



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Asprey Homes

Project: Plot 13, Darvel Down
Netherfield, East Sussex, TN33

Contact: Stuart Searle
SRS Surveyors Ltd T/A SRS Partnership
stuart@srssurveyors.co.uk

Report Issue Date: 13/12/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

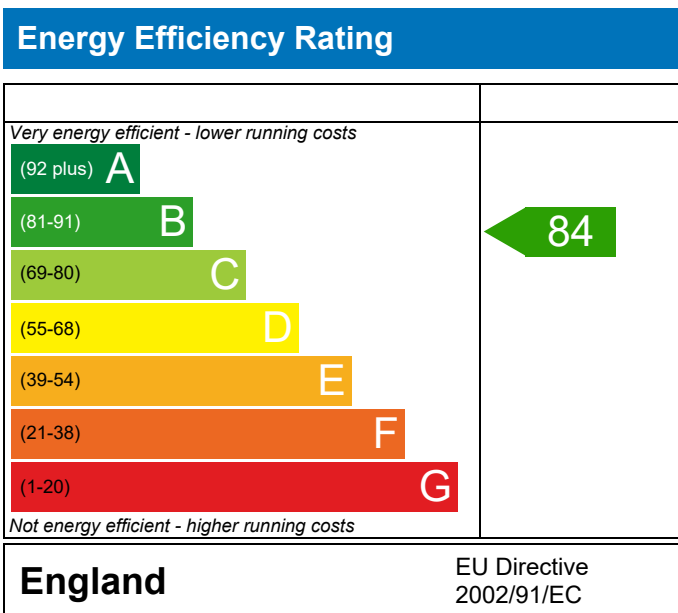
PREDICTED ENERGY ASSESSMENT

Plot 13, Darvel Down,
Netherfield,
East Sussex,
TN33

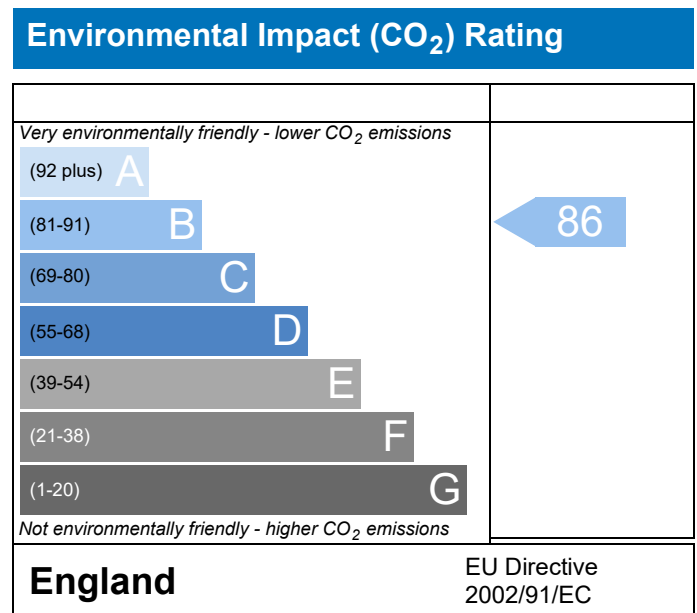
Dwelling type: House, Semi-Detached
Date of assessment: 13/12/2021
Produced by: SRS Surveyors Ltd T/A SRS Partnership
Total floor area: 102.49 m²
DRRN: 5299-4624-7971

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.



BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	19-104-00-P13	Issued on Date	13/12/2021
Assessment Reference	001	Prop Type Ref	Darvel Down
Property	Plot 13, Darvel Down, Netherfield, East Sussex, TN33		
SAP Rating	84 B	DER	16.66
Environmental	86 B	TER	17.05
CO ₂ Emissions (t/year)	1.43	% DER<TER	2.29
General Requirements Compliance	Pass	DFEE	44.86
		TREE	51.58
		% DFEE<TFEE	13.03
Assessor Details	Mr. Stuart Searle, SRS Surveyors Ltd (Consult Construct), Tel: 01227 767770, stuart.searle@consultconstruct.co.uk	Assessor ID	L603-0001
Client	Asprey Homes, Asprey Homes		

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.05	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.66	kgCO ₂ /m ²	Pass
	-0.39 (-2.3%)	kgCO ₂ /m ²	

1b TFE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.58	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.86	kWh/m ² /yr	
	-6.7 (-13.0%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	Pass
Roof	0.09 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.24 (max. 2.00)	1.60 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar CDi 30 CDi
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1600

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

6.31 m², No overhang

Windows facing South East

1.10 m², Overhang width less than twice window, ratio 1.39

Windows facing South West

8.92 m², No overhang

Windows facing North West

1.10 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

Light-coloured curtain or roller blind, closed 50% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.09	W/m ² K
Floor U-value	0.10	W/m ² K

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	19-104-00-P13			Issued on Date	13/12/2021
Assessment Reference	001	Prop Type Ref	Darvel Down		
Property	Plot 13, Darvel Down, Netherfield, East Sussex, TN33				
SAP Rating	84 B	DER	16.66	TER	17.05
Environmental	86 B	% DER<TER	2.29		
CO₂ Emissions (t/year)	1.43	DFEE	44.86	TFEE	51.58
General Requirements Compliance	Pass	% DFEE<TFEE	13.03		
Assessor Details	Mr. Stuart Searle, SRS Surveyors Ltd (Consult Construct), Tel: 01227 767770, stuart.searle@consultconstruct.co.uk			Assessor ID	L603-0001
Client	Asprey Homes, Asprey Homes				

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

Semi-Detached House, total floor area 102 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) 17.05 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.66 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.24 (max. 2.00)	1.60 (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: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar CDi 30 CDi
Combi boiler
Efficiency: 89.4% 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

Continuous extract system (decentralised)
Specific fan power: 0.1600 0.1600
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North East: 6.31 m², No overhang
Windows facing South East: 1.10 m², Overhang width less than twice window, ratio 1.39
Windows facing South West: 8.92 m², No overhang
Windows facing North West: 1.10 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 50% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K
Floor U-value 0.10 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	52.1200 (1b)	2.3900 (2b)	124.5668 (1b) - (3b)
First floor	50.3700 (1c)	2.6900 (2c)	135.4953 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.4900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.0621 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (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) =				0.0000 / (5) =	0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (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) =	0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5209	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Glazed Entrance Door			2.1000	1.6000	3.3600		(26a)
Windows - Double (Uw = 1.20)			17.4300	1.1450	19.9580		(27)
FT1 - Ground BB			52.1200	0.1000	5.2120		(28a)
EWT1 - Brick/Block	107.4000	19.5300	87.8700	0.1900	16.6953		(29a)
RT1 - Ins Ceiling	50.3700		50.3700	0.0900	4.5333		(30)
RT5 - Bay	1.7500		1.7500	0.1600	0.2800		(30)
Total net area of external elements Aum(A, m ²)			211.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	50.0386	(33)
PWT1: Party Wall			44.1500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.6977 (36)
Total fabric heat loss						(33) + (36) =	65.7364 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	44.7071	44.2512	43.7953	42.9102	42.9102	42.9102	42.9102	42.9102	42.9102	42.9102	42.9102	42.9102 (38)
Heat transfer coeff	110.4435	109.9875	109.5316	108.6466	108.6466	108.6466	108.6466	108.6466	108.6466	108.6466	108.6466	108.6466 (39)
Average = Sum(39)m / 12 =												108.9818 (39)
HLP	1.0776	1.0732	1.0687	1.0601	1.0601	1.0601	1.0601	1.0601	1.0601	1.0601	1.0601	1.0601 (40)
HLP (average)												1.0633 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7614 (42)
Average daily hot water use (litres/day)												99.7835 (43)
Daily hot water use	109.7619	105.7705	101.7792	97.7879	93.7965	89.8052	89.8052	93.7965	97.7879	101.7792	105.7705	109.7619 (44)
Energy conte	162.7737	142.3629	146.9058	128.0760	122.8920	106.0464	98.2676	112.7635	114.1103	132.9845	145.1630	157.6376 (45)
Energy content (annual)												Total = Sum(45)m = 1569.9834 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:	24.4161	21.3544	22.0359	19.2114	18.4338	15.9070	14.7401	16.9145	17.1165	19.9477	21.7745	23.6456 (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)
Combi loss	50.9589	46.0274	50.9589	48.2241	47.7977	44.2875	45.7637	47.7977	48.2241	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	213.7326	188.3903	197.8647	176.3002	170.6897	150.3339	144.0313	160.5612	162.3344	183.9434	194.4781	208.5965 (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	213.7326	188.3903	197.8647	176.3002	170.6897	150.3339	144.0313	160.5612	162.3344	183.9434	194.4781	208.5965 (64)
Heat gains from water heating, kWh/month	66.8620	58.8425	61.5859	54.6413	52.8110	46.3323	44.1149	49.4433	49.9977	56.9571	60.5955	65.1542 (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	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9314	21.2556	17.2862	13.0868	9.7825	8.2588	8.9240	11.5997	15.5691	19.7685	23.0728	24.5965 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.2915	262.9925	256.1860	241.6959	223.4047	206.2135	194.7288	192.0277	198.8342	213.3244	231.6156	248.8067 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071 (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)	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565 (71)
Water heating gains (Table 5)	89.8683	87.5633	82.7767	75.8907	70.9825	64.3504	59.2942	66.4560	69.4413	76.5552	84.1604	87.5729 (72)
Total internal gains	441.5123	439.2326	423.6702	398.0946	371.5909	346.2439	330.3681	337.5046	351.2657	377.0693	406.2699	428.3973 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	6.3100	11.2829	0.6300	0.7000	0.7700	21.7582 (75)						
Southeast	1.1000	36.7938	0.6300	0.7000	0.7700	12.3691 (77)						
Southwest	8.9200	36.7938	0.6300	0.7000	0.7700	100.3025 (79)						
Northwest	1.1000	11.2829	0.6300	0.7000	0.7700	3.7930 (81)						
Solar gains	138.2229	243.9318	356.3014	479.2606	571.3011	582.3404	555.1250	484.1393	398.5175	275.6749	167.1047	117.2899 (83)
Total gains	579.7352	683.1644	779.9716	877.3552	942.8920	928.5844	885.4931	821.6440	749.7832	652.7441	573.3746	545.6872 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.4435	64.7106	64.9800	65.5093	65.5093	65.5093	65.5093	65.5093	65.5093	65.5093	65.5093	65.5093
alpha	5.2962	5.3140	5.3320	5.3673	5.3673	5.3673	5.3673	5.3673	5.3673	5.3673	5.3673	5.3673
util living area	0.9985	0.9961	0.9884	0.9589	0.8706	0.7015	0.5306	0.5910	0.8429	0.9771	0.9966	0.9989 (86)
MIT	19.8248	19.9867	20.2398	20.5591	20.8234	20.9591	20.9924	20.9868	20.8904	20.5415	20.1254	19.8074 (87)
Th 2	20.0192	20.0228	20.0265	20.0336	20.0336	20.0336	20.0336	20.0336	20.0336	20.0336	20.0336	20.0336 (88)
util rest of house	0.9980	0.9948	0.9843	0.9437	0.8254	0.6142	0.4189	0.4755	0.7731	0.9658	0.9952	0.9986 (89)
MIT 2	18.4449	18.6838	19.0540	19.5128	19.8600	20.0062	20.0307	20.0280	19.9448	19.4953	18.8948	18.4298 (90)
Living area fraction	fLA = Living area / (4) = 0.1940 (91)											
MIT	18.7126	18.9365	19.2840	19.7158	20.0469	20.1911	20.2172	20.2140	20.1282	19.6982	19.1335	18.6970 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.5626	18.7865	19.1340	19.5658	19.8969	20.0411	20.0672	20.0640	19.9782	19.5482	18.9835	18.5470 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9968	0.9923	0.9789	0.9343	0.8179	0.6149	0.4229	0.4793	0.7684	0.9579	0.9928	0.9977 (94)
Useful gains	577.8919	677.8806	763.5308	819.6820	771.2111	570.9866	374.4916	393.8427	576.1224	625.2904	569.2648	544.4173 (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	1575.2073	1527.3449	1383.8199	1158.7984	890.5651	591.1532	376.7046	398.0829	638.6514	972.1967	1291.1032	1558.7568 (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	742.0027	570.8400	461.4951	244.1638	88.7994	0.0000	0.0000	0.0000	0.0000	258.0982	519.7237	754.6686 (98)
Space heating	3639.7915 (98)											
Space heating per m2	(98) / (4) = 35.5136 (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 %)													90.3000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4030.7769 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	742.0027	570.8400	461.4951	244.1638	88.7994	0.0000	0.0000	0.0000	0.0000	258.0982	519.7237	754.6686	(98)
Space heating efficiency (main heating system 1)	90.3000	90.3000	90.3000	90.3000	90.3000	0.0000	0.0000	0.0000	0.0000	90.3000	90.3000	90.3000	(210)
Space heating fuel (main heating system)	821.7084	632.1595	511.0687	270.3918	98.3382	0.0000	0.0000	0.0000	0.0000	285.8231	575.5523	835.7349	(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	213.7326	188.3903	197.8647	176.3002	170.6897	150.3339	144.0313	160.5612	162.3344	183.9434	194.4781	208.5965	(64)
Efficiency of water heater (217)m	87.8265	87.5637	87.0117	85.7709	83.3919	80.2000	80.2000	80.2000	80.2000	85.8035	87.3061	80.2000	(216)
Fuel for water heating, kWh/month	243.3577	215.1465	227.4001	205.5477	204.6838	187.4488	179.5902	200.2010	202.4120	214.3775	222.7543	237.3037	(219)
Water heating fuel used													2540.2232 (219)
Annual totals kWh/year													
Space heating fuel - main system													4030.7769 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840													
mechanical ventilation fans (SFP = 0.1840)													58.3787 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													133.3787 (231)
Electricity for lighting (calculated in Appendix L)													422.6356 (232)
Total delivered energy for all uses													7127.0143 (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	4030.7769	0.2160	870.6478	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2540.2232	0.2160	548.6882	(264)
Space and water heating			1419.3360	(265)
Pumps and fans	133.3787	0.5190	69.2236	(267)
Energy for lighting	422.6356	0.5190	219.3479	(268)
Total CO2, kg/year			1707.9074	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.6600	(273)

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

	DER		
Total Floor Area		TFA	16.6600 ZC1
Assumed number of occupants		N	102.4900
CO2 emission factor in Table 12 for electricity displaced from grid		EF	2.7614
CO2 emissions from appliances, equation (L14)			0.5190
CO2 emissions from cooking, equation (L16)			15.0496 ZC2
Total CO2 emissions			1.8077 ZC3
Residual CO2 emissions offset from biofuel CHP			33.5173 ZC4
Additional allowable electricity generation, kWh/m ² /year			0.0000 ZC5
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC6
Net CO2 emissions			0.0000 ZC7
			33.5173 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	52.1200 (1b)	2.3900 (2b)	124.5668 (1b) - (3b)
First floor	50.3700 (1c)	2.6900 (2c)	135.4953 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.4900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.0621 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1538 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate				0.4038 (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) =		0.3432 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4376	0.4290	0.4205	0.3776	0.3690	0.3261	0.3261	0.3175	0.3432	0.3690	0.3861	0.4033 (22b)
Effective ac	0.5958	0.5920	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5813 (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			2.1000	1.2000	2.5200		(26a)					
TER Opening Type (Uw = 1.40)			17.4300	1.3258	23.1080		(27)					
FT1 - Ground BB			52.1200	0.1300	6.7756		(28a)					
EWT1 - Brick/Block	107.4000	19.5300	87.8700	0.1800	15.8166		(29a)					
RT1 - Ins Ceiling	50.3700		50.3700	0.1300	6.5481		(30)					
RT5 - Bay	1.7500		1.7500	0.1300	0.2275		(30)					
Total net area of external elements Aum(A, m ²)			211.6400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	54.9958	(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)							10.7268 (36)					
Total fabric heat loss							(33) + (36) = 65.7226 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.1284	Feb 50.8092	Mar 50.4964	Apr 49.0272	May 48.7523	Jun 47.4727	Jul 47.4727	Aug 47.2357	Sep 47.9656	Oct 48.7523	Nov 49.3084	Dec 49.8898 (38)
Heat transfer coeff	116.8509	116.5318	116.2190	114.7498	114.4749	113.1953	113.1953	112.9583	113.6882	114.4749	115.0310	115.6124 (39)
Average = Sum(39)m / 12 =												114.7485 (39)
HLP	Jan 1.1401	Feb 1.1370	Mar 1.1340	Apr 1.1196	May 1.1169	Jun 1.1045	Jul 1.1045	Aug 1.1021	Sep 1.1093	Oct 1.1169	Nov 1.1224	Dec 1.1280 (40)
HLP (average)												1.1196 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7614 (42)
Average daily hot water use (litres/day)												99.7835 (43)
Daily hot water use	109.7619	105.7705	101.7792	97.7879	93.7965	89.8052	89.8052	93.7965	97.7879	101.7792	105.7705	109.7619 (44)
Energy conte	162.7737	142.3629	146.9058	128.0760	122.8920	106.0464	98.2676	112.7635	114.1103	132.9845	145.1630	157.6376 (45)
Energy content (annual)												Total = Sum(45)m = 1569.9834 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4161	21.3544	22.0359	19.2114	18.4338	15.9070	14.7401	16.9145	17.1165	19.9477	21.7745	23.6456 (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 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	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.2241	47.7977	44.2875	45.7637	47.7977	48.2241	50.9589	49.3151	50.9589	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	213.7326	188.3903	197.8647	176.3002	170.6897	150.3339	144.0313	160.5612	162.3344	183.9434	194.4781	208.5965	208.5965	208.5965	(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	0.0000	(63)
Output from w/h	213.7326	188.3903	197.8647	176.3002	170.6897	150.3339	144.0313	160.5612	162.3344	183.9434	194.4781	208.5965	208.5965	208.5965	(64)
Heat gains from water heating, kWh/month	66.8620	58.8425	61.8859	54.6413	52.8110	46.3323	44.1149	49.4433	49.9977	56.9571	60.5955	65.1542	65.1542	65.1542	(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	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9314	21.2556	17.2862	13.0868	9.7825	8.2588	8.9240	11.5997	15.5691	19.7685	23.0728	24.5965	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.2915	262.9925	256.1860	241.6959	223.4047	206.2135	194.7288	192.0277	198.8342	213.3244	231.6156	248.8067	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	(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)	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	(71)
Water heating gains (Table 5)	89.8683	87.5633	82.7767	75.8907	70.9825	64.3504	59.2942	66.4560	69.4413	76.5552	84.1604	87.5729	(72)
Total internal gains	441.5123	439.2326	423.6702	398.0946	371.5909	346.2439	330.3681	337.5046	351.2657	377.0693	406.2699	428.3973	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	6.3100	11.2829	0.6300	0.6300	0.7000	0.7700	21.7582	(75)					
Southeast	1.1000	36.7938	0.6300	0.6300	0.7000	0.7700	12.3691	(77)					
Southwest	8.9200	36.7938	0.6300	0.6300	0.7000	0.7700	100.3025	(79)					
Northwest	1.1000	11.2829	0.6300	0.6300	0.7000	0.7700	3.7930	(81)					
Solar gains	138.2229	243.9318	356.3014	479.2606	571.3011	582.3404	555.1250	484.1393	398.5175	275.6749	167.1047	117.2899	(83)
Total gains	579.7352	683.1644	779.9716	877.3552	942.8920	928.5844	885.4931	821.6440	749.7832	652.7441	573.3746	545.6872	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9985	0.9962	0.9892	0.9629	0.8836	0.7200	0.5497	0.6096	0.8563	0.9790	0.9966	0.9989	(86)
MIT	19.7400	19.9018	20.1603	20.4991	20.7866	20.9483	20.9896	20.9827	20.8686	20.4916	20.0537	19.7145	(87)
Th 2	19.9682	19.9707	19.9732	19.9848	19.9870	19.9972	19.9972	19.9991	19.9933	19.9870	19.9826	19.9780	(88)
util rest of house	0.9980	0.9949	0.9853	0.9487	0.8398	0.6302	0.4310	0.4883	0.7875	0.9683	0.9953	0.9985	(89)
MIT 2	18.2845	18.5225	18.8999	19.3915	19.7753	19.9624	19.9933	19.9918	19.8857	19.3895	18.7534	18.2542	(90)
Living area fraction	18.5668	18.7900	19.1444	19.6063	19.9714	20.1537	20.1865	20.1840	20.0764	19.6033	19.0056	18.5375	(92)
MIT	18.5668	18.7900	19.1444	19.6063	19.9714	20.1537	20.1865	20.1840	20.0764	19.6033	19.0056	18.5375	(92)
Temperature adjustment	18.5668	18.7900	19.1444	19.6063	19.9714	20.1537	20.1865	20.1840	20.0764	19.6033	19.0056	18.5375	(93)
adjusted MIT	18.5668	18.7900	19.1444	19.6063	19.9714	20.1537	20.1865	20.1840	20.0764	19.6033	19.0056	18.5375	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9927	0.9808	0.9419	0.8390	0.6453	0.4541	0.5117	0.7941	0.9628	0.9933	0.9977	(94)
Useful gains	577.9284	678.1672	765.0250	826.3789	791.1082	599.2243	402.1140	420.4626	595.4094	628.4511	569.5102	544.4250	(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	1667.0873	1618.6280	1469.5183	1228.5483	946.8734	628.6479	405.9799	427.4377	679.4404	1030.6495	1369.5184	1657.5875	(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	810.3342	631.9896	524.1430	289.5620	115.8893	0.0000	0.0000	0.0000	0.0000	299.2356	576.0059	828.1928	(98)
Space heating												4075.3525	(98)
Space heating per m2												39.7634	(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													4363.3324 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	810.3342	631.9896	524.1430	289.5620	115.8893	0.0000	0.0000	0.0000	0.0000	299.2356	576.0059	828.1928	(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)	867.5955	676.6484	561.1809	310.0235	124.0785	0.0000	0.0000	0.0000	0.0000	320.3807	616.7087	886.7161	(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	213.7326	188.3903	197.8647	176.3002	170.6897	150.3339	144.0313	160.5612	162.3344	183.9434	194.4781	208.5965	(64)
Efficiency of water heater (217)m	88.0876	87.8622	87.3878	86.2925	84.0997	80.3000	80.3000	80.3000	80.3000	86.2692	87.6183	88.1688	(216)
Fuel for water heating, kWh/month	242.6364	214.4156	226.4214	204.3052	202.9611	187.2153	179.3666	199.9517	202.1599	213.2204	221.9605	236.5877	(219)
Water heating fuel used													2531.2018 (219)
Annual totals kWh/year													
Space heating fuel - main system													4363.3324 (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)													422.6356 (232)
Total delivered energy for all uses													7392.1698 (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	4363.3324	0.2160	942.4798 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2531.2018	0.2160	546.7396 (264)
Space and water heating			1489.2194 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	422.6356	0.5190	219.3479 (268)
Total CO2, kg/m2/year			1747.4922 (272)
Emissions per m2 for space and water heating			14.5304 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1402 (272b)
Emissions per m2 for pumps and fans			0.3798 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5304 * 1.00) + 2.1402 + 0.3798, rounded to 2 d.p.			17.0500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	19-104-00-P13	Issued on Date	13/12/2021
Assessment Reference	001	Prop Type Ref	Darvel Down
Property	Plot 13, Darvel Down, Netherfield, East Sussex, TN33		

SAP Rating	84 B	DER	16.66	TER	17.05
Environmental	86 B	% DER<TER	2.29		
CO ₂ Emissions (t/year)	1.43	DFEE	44.86	TREE	51.58
General Requirements Compliance	Pass	% DFEE<TFEE	13.03		

Assessor Details	Mr. Stuart Searle, SRS Surveyors Ltd (Consult Construct), Tel: 01227 767770, stuart.searle@consultconstruct.co.uk	Assessor ID	L603-0001
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Client	Asprey Homes, Asprey Homes
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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	52.1200 (1b)	x 2.3900 (2b)	= 124.5668 (1b) - (3b)
First floor	50.3700 (1c)	x 2.6900 (2c)	= 135.4953 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	102.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 260.0621 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour								
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)								
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)								
Number of intermittent fans				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) =	0.1538 (8)								
Pressure test				Yes									
Measured/design AP50				5.0000									
Infiltration rate				0.4038	(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) =		0.3432 (21)								
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4376	0.4290	0.4205	0.3776	0.3690	0.3261	0.3261	0.3175	0.3432	0.3690	0.3861	0.4033	(22b)
Effective ac	0.5958	0.5920	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5813	(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						
Glazed Entrance Door			2.1000	1.6000	3.3600		(26a)						
Windows - Double (Uw = 1.20)			17.4300	1.1450	19.9580		(27)						
FT1 - Ground BB			52.1200	0.1000	5.2120		(28a)						
EWT1 - Brick/Block	107.4000	19.5300	87.8700	0.1900	16.6953		(29a)						
RT1 - Ins Ceiling	50.3700		50.3700	0.0900	4.5333		(30)						
RT5 - Bay	1.7500		1.7500	0.1600	0.2800		(30)						
Total net area of external elements Aum(A, m ²)			211.6400				(31)						
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.0386		(33)						
PWT1: Party Wall			44.1500	0.0000	0.0000		(32)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.6977 (36)						
Total fabric heat loss					(33) + (36) =		65.7364 (37)						
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 51.1284	Feb 50.8092	Mar 50.4964	Apr 49.0272	May 48.7523	Jun 47.4727	Jul 47.4727	Aug 47.2357	Sep 47.9656	Oct 48.7523	Nov 49.3084	Dec 49.8898	(38)
Heat transfer coeff													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average =	Sum(39)m / 12 =	116.8647	116.5456	116.2328	114.7636	114.4887	113.2091	113.2091	112.9721	113.7020	114.4887	115.0448	115.6262 (39)	114.7623 (39)
HLP		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)		1.1403	1.1371	1.1341	1.1198	1.1171	1.1046	1.1046	1.1023	1.1094	1.1171	1.1225	1.1282 (40)	1.1197 (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														2.7614 (42)
Average daily hot water use (litres/day)														99.7835 (43)
Daily hot water use		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte		109.7619	105.7705	101.7792	97.7879	93.7965	89.8052	89.8052	93.7965	97.7879	101.7792	105.7705	109.7619	144.0000 (44)
Energy content (annual)		162.7737	142.3629	146.9058	128.0760	122.8920	106.0464	98.2676	112.7635	114.1103	132.9845	145.1630	157.6376	1569.9834 (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	0.0000 (56)
If cylinder contains dedicated solar storage														
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		34.5894	30.2521	31.2175	27.2162	26.1145	22.5349	20.8819	23.9622	24.2484	28.2592	30.8471	33.4980	1569.9834 (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		138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5		23.9314	21.2556	17.2862	13.0868	9.7825	8.2588	8.9240	11.5997	15.5691	19.7685	23.0728	24.5965	1569.9834 (67)
Appliances gains (calculated in Appendix L13 or L13a), also see Table 5		260.2915	262.9925	256.1860	241.6959	223.4047	206.2135	194.7288	192.0277	198.8342	213.3244	231.6156	248.8067	1569.9834 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5		36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071 (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	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)		-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565 (71)
Water heating gains (Table 5)		46.4911	45.0180	41.9590	37.8002	35.1002	31.2984	28.0670	32.2073	33.6784	37.9828	42.8432	45.0242	1569.9834 (72)
Total internal gains		395.1352	393.6873	379.8524	357.0041	332.7086	310.1919	296.1409	300.2559	312.5028	335.4969	361.9528	382.8486	1569.9834 (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								
Northeast		6.3100	11.2829	0.6300	0.7000	0.7700	21.7582 (75)							
Southeast		1.1000	36.7938	0.6300	0.7000	0.7700	12.3691 (77)							
Southwest		8.9200	36.7938	0.6300	0.7000	0.7700	100.3025 (79)							
Northwest		1.1000	11.2829	0.6300	0.7000	0.7700	3.7930 (81)							
Solar gains		138.2229	243.9318	356.3014	479.2606	571.3011	582.3404	555.1250	484.1393	398.5175	275.6749	167.1047	117.2899	83
Total gains		533.3581	637.6191	736.1538	836.2647	904.0097	892.5323	851.2659	784.3953	711.0204	611.1717	529.0575	500.1385	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		60.9026	61.0693	61.2337	62.0176	62.1665	62.8692	62.8692	63.0011	62.5966	62.1665	61.8660	61.5549	61.5549 (86)
alpha		5.0602	5.0713	5.0822	5.1345	5.1444	5.1913	5.1913	5.2001	5.1731	5.1444	5.1244	5.1037	5.1037 (87)
util living area		0.9990	0.9972	0.9916	0.9692	0.8974	0.7404	0.5696	0.6340	0.8763	0.9840	0.9977	0.9993	0.9993 (88)
MIT		19.6976	19.8606	20.1220	20.4673	20.7663	20.9411	20.9877	20.9793	20.8509	20.4567	20.0134	19.6727	19.6727 (89)
Th 2		19.9681	19.9706	19.9731	19.9847	19.9869	19.9971	19.9971	19.9990	19.9932	19.9869	19.9825	19.9779	19.9779 (90)
util rest of house		0.9986	0.9963	0.9885	0.9570	0.8568	0.6512	0.4477	0.5100	0.8122	0.9756	0.9967	0.9990	0.9990 (91)
MIT 2		18.7762	18.9408	19.2026	19.5500	19.8263	19.9696	19.9939	19.9929	19.9077	19.5459	19.1032	18.7592	18.7592 (92)
Living area fraction														0.1940 (91)
MIT		18.9549	19.1192	19.3810	19.7279	20.0086	20.1580	20.1867	20.1843	20.0906	19.7225	19.2798	18.9364	18.9364 (92)
Temperature adjustment														0.0000
adjusted MIT		18.9549	19.1192	19.3810	19.7279	20.0086	20.1580	20.1867	20.1843	20.0906	19.7225	19.2798	18.9364	18.9364 (93)

8. Space heating requirement

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	
Utilisation	0.9981	0.9951	0.9860	0.9531	0.8578	0.6667	0.4716	0.5342	0.8195	0.9726	0.9958	0.9986	(94)
Useful gains	532.3543	634.5196	725.8730	797.0171	775.4602	595.0613	401.4472	419.0346	582.6818	594.4497	526.8133	499.4601	(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													
	1712.6401	1657.1878	1497.1892	1242.6483	951.2461	629.2170	406.0455	427.5165	681.1475	1044.4276	1401.2189	1703.9095	(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													
	878.1326	687.2331	573.8592	320.8545	130.7847	0.0000	0.0000	0.0000	0.0000	334.7836	629.5720	896.1104	(98)
Space heating												4451.3301	(98)
Space heating per m2												(98) / (4) =	43.4318 (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	1064.1652	837.7470	858.5879	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8691	0.9287	0.9025	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	924.9171	778.0221	774.9074	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1149.9426	1099.4223	1023.2504	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	162.0184	239.1217	184.7672	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												585.9073	(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	40.5046	59.7804	46.1918	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												146.4768	(107)
Space cooling per m2												1.4292	(108)
Energy for space heating												43.4318	(99)
Energy for space cooling												1.4292	(108)
Total												44.8610	(109)
Dwelling Fabric Energy Efficiency (DFEE)												44.9	(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 (m2)	Storey height (m)	Volume (m3)
Ground floor	52.1200 (1b)	x 2.3900 (2b)	= 124.5668 (1b) - (3b)
First floor	50.3700 (1c)	x 2.6900 (2c)	= 135.4953 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.0621 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				40.0000 / (5) =	0.1538 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4038 (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) =		0.3432 (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	0.4376	0.4290	0.4205	0.3776	0.3690	0.3261	0.3261	0.3175	0.3432	0.3690	0.3861	0.4033 (22b)
	0.5958	0.5920	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5813 (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			2.1000	1.2000	2.5200		(26a)
TER Opening Type (Uw = 1.40)			17.4300	1.3258	23.1080		(27)
FT1 - Ground BB			52.1200	0.1300	6.7756		(28a)
EWT1 - Brick/Block	107.4000	19.5300	87.8700	0.1800	15.8166		(29a)
RT1 - Ins Ceiling	50.3700		50.3700	0.1300	6.5481		(30)
RT5 - Bay	1.7500		1.7500	0.1300	0.2275		(30)
Total net area of external elements Aum(A, m2)			211.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	54.9958	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7268 (36)
Total fabric heat loss							(33) + (36) = 65.7226 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	51.1284	50.8092	50.4964	49.0272	48.7523	47.4727	47.4727	47.2357	47.9656	48.7523	49.3084	49.8898 (38)
Heat transfer coeff	116.8509	116.5318	116.2190	114.7498	114.4749	113.1953	113.1953	112.9583	113.6882	114.4749	115.0310	115.6124 (39)
Average = Sum(39)m / 12 =												114.7485 (39)
HLP	1.1401	1.1370	1.1340	1.1196	1.1169	1.1045	1.1045	1.1021	1.1093	1.1169	1.1224	1.1280 (40)
HLP (average)												1.1196 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7614 (42)
Average daily hot water use (litres/day)												99.7835 (43)
Daily hot water use	109.7619	105.7705	101.7792	97.7879	93.7965	89.8052	89.8052	93.7965	97.7879	101.7792	105.7705	109.7619 (44)
Energy conte	162.7737	142.3629	146.9058	128.0760	122.8920	106.0464	98.2676	112.7635	114.1103	132.9845	145.1630	157.6376 (45)
Energy content (annual)												Total = Sum(45)m = 1569.9834 (45)
Distribution loss (46)m = 0.15 x (45)m												
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	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	0.0000	(59)
Heat gains from water heating, kWh/month	34.5894	30.2521	31.2175	27.2162	26.1145	22.5349	20.8819	23.9622	24.2484	28.2592	30.8471	33.4980	33.4980	(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	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	138.0706	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9314	21.2556	17.2862	13.0868	9.7825	8.2588	8.9240	11.5997	15.5691	19.7685	23.0728	24.5965	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.2915	262.9925	256.1860	241.6959	223.4047	206.2135	194.7288	192.0277	198.8342	213.3244	231.6156	248.8067	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	36.8071	(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)	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	-110.4565	(71)
Water heating gains (Table 5)	46.4911	45.0180	41.9590	37.8002	35.1002	31.2984	28.0670	32.2073	33.6784	37.9828	42.8432	45.0242	(72)
Total internal gains	395.1352	393.6873	379.8524	357.0041	332.7086	310.1919	296.1409	300.2559	312.5028	335.4969	361.9528	382.8486	(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	6.3100	11.2829	0.6300	0.7000	0.7700	21.7582 (75)							
Southeast	1.1000	36.7938	0.6300	0.7000	0.7700	12.3691 (77)							
Southwest	8.9200	36.7938	0.6300	0.7000	0.7700	100.3025 (79)							
Northwest	1.1000	11.2829	0.6300	0.7000	0.7700	3.7930 (81)							
Solar gains	138.2229	243.9318	356.3014	479.2606	571.3011	582.3404	555.1250	484.1393	398.5175	275.6749	167.1047	117.2899	(83)
Total gains	533.3581	637.6191	736.1538	836.2647	904.0097	892.5323	851.2659	784.3953	711.0204	611.1717	529.0575	500.1385	(84)

7. Mean internal temperature (heating season)

Utilisation during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	60.9098	61.0766	61.2409	62.0251	62.1740	62.8768	62.8768	63.0088	62.6042	62.1740	61.8734	61.5623	(85)
tau	5.0607	5.0718	5.0827	5.1350	5.1449	5.1918	5.1918	5.2006	5.1736	5.1449	5.1249	5.1042	
alpha	0.9990	0.9972	0.9916	0.9692	0.8974	0.7403	0.5695	0.6340	0.8762	0.9840	0.9977	0.9993	(86)
util living area	19.6977	19.8608	20.1221	20.4674	20.7664	20.9412	20.9877	20.9794	20.8510	20.4569	20.0135	19.6729	(87)
MIT	19.9682	19.9707	19.9732	19.9848	19.9870	19.9972	19.9972	19.9991	19.9933	19.9870	19.9826	19.9780	(88)
Th 2	0.9986	0.9963	0.9885	0.9570	0.8568	0.6511	0.4477	0.5100	0.8121	0.9756	0.9967	0.9990	(89)
util rest of house	18.7764	18.9411	19.2029	19.5502	19.8265	19.9697	19.9940	19.9930	19.9078	19.5461	19.1035	18.7594	(90)
Living area fraction	18.9551	19.1195	19.3812	19.7281	20.0088	20.1581	20.1868	20.1844	20.0908	19.7227	19.2800	18.9366	(92)
MIT	18.9551	19.1195	19.3812	19.7281	20.0088	20.1581	20.1868	20.1844	20.0908	19.7227	19.2800	18.9366	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9551	19.1195	19.3812	19.7281	20.0088	20.1581	20.1868	20.1844	20.0908	19.7227	19.2800	18.9366	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9951	0.9860	0.9531	0.8578	0.6667	0.4715	0.5342	0.8195	0.9726	0.9958	0.9986	(94)
Useful gains	532.3544	634.5196	725.8723	797.0110	775.4368	595.0201	401.4123	419.0001	582.6597	594.4477	526.8133	499.4602	(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	1712.4670	1657.0203	1497.0384	1242.5225	951.1497	629.1528	406.0065	427.4751	681.0799	1044.3232	1401.0764	1703.7352	(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	878.0038	687.1204	573.7476	320.7683	130.7304	0.0000	0.0000	0.0000	0.0000	334.7073	629.4694	895.9806	(98)
Space heating												4450.5278	(98)
Space heating per m2												43.4240	(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	1064.0354	837.6449	858.4830	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8692	0.9287	0.9026	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	924.8669	777.9623	774.8562	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1149.9426	1099.4223	1023.2504	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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	162.0545	239.1663	184.8053	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												586.0261 (104)
Intermittency factor (Table 10b)												1.0000 (105)
									FC = cooled area / (4) =			
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	40.5136	59.7916	46.2013	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												146.5065 (107)
Energy for space heating												1.4295 (108)
Energy for space cooling												43.4240 (99)
Total												1.4295 (108)
Target Fabric Energy Efficiency (TFEE)												44.8535 (109)
												51.6 (109)