



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 3 Fred Woolley Walk
West End, Southampton, SO30 3LF

Contact: Tobias Whiting
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Report Issue Date: 22/03/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 65			Issued on Date	22/03/2022
Assessment Reference	As Built	Prop Type Ref	L		
Property	3 Fred Woolley Walk, West End, Southampton, SO30 3LF				
SAP Rating	88 B	DER	13.62	TER	17.35
Environmental	88 B	% DER<TER	21.48		
CO ₂ Emissions (t/year)	1.15	DFEE	46.64	TFEE	58.20
General Requirements Compliance	Pass	% DFEE<TFEE	19.86		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.35	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.62	kgCO ₂ /m ²	Pass
	-3.73 (-21.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.20	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.64	kWh/m ² /yr	
	-11.6 (-19.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (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	3.99 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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 Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

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

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

11.48 m², No overhang

Windows facing South

5.76 m², No overhang

Windows facing West

9.46 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

3.99 (measured in this dwelling)

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 Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.024	W/m ² K
Air permeability	4.0	m ³ /m ² h
Photovoltaic array	0.76	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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SAP Rating	88 B	DER	13.62
Environmental	88 B	TER	17.35
CO ₂ Emissions (t/year)	1.15	% DER<TER	21.48
General Requirements Compliance	Pass	DFEE	46.64
		TFEE	58.20
		% DFEE<TFEE	19.86
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	1.83	0.13	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.01	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	8.40	0.56	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	3.02	0.21	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	7.08	0.45	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	17.30	0.36	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	42.90	0.69	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.060	33.58	2.01	CBA - 302
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	33.58	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	18.70	1.12	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	14.88	0.65	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	25.25	0.98	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	5.05	-0.46	Knauf P24

Total: **6.79** W/mK:
Y-Value: **0.024** W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Detached House, total floor area 117 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) 17.35 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.62 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (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: 3.99 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs 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 (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing East: 11.48 m², No overhang
Windows facing South: 5.76 m², No overhang
Windows facing West: 9.46 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.024 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 0.76 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6700 (2c)	= 156.5955 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.7690 (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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					3.9900
Infiltration rate					0.3343 (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) =	0.3343 (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	0.4262	0.4179	0.4095	0.3677	0.3594	0.3176	0.3176	0.3092	0.3343	0.3594	0.3761	0.3928 (22b)
Effective ac	0.5908	0.5873	0.5838	0.5676	0.5646	0.5504	0.5504	0.5478	0.5559	0.5646	0.5707	0.5771 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000 (28a)
Brick and Block	169.9100	28.8200	141.0900	0.2400	33.8616	42.2200	5956.8198 (29a)
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150 (30)
Total net area of external elements Aum(A, m ²)			287.2100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.6691		(33)
GF Block			58.4300			75.0000	4382.2500 (32c)
GF Stud			34.6800			9.0000	312.1200 (32c)
FF Stud			127.5000			9.0000	1147.5000 (32c)
Internal Floor 1			58.6500			18.0000	1055.7000 (32d)
Internal Ceiling 1			58.6500			18.0000	1055.7000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19370.4048 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.1356 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7936 (36)
Total fabric heat loss (33) + (36) = 86.4627 (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	57.8621	57.5167	57.1781	55.5879	55.2903	53.9053	53.9053	53.6488	54.4388	55.2903	55.8922	56.5215 (38)
Heat transfer coeff	144.3248	143.9794	143.6408	142.0505	141.7530	140.3679	140.3679	140.1114	140.9014	141.7530	142.3549	142.9842 (39)
Average = Sum(39)m / 12 =												142.0491 (39)
HLP	1.2304	1.2274	1.2246	1.2110	1.2085	1.1967	1.1967	1.1945	1.2012	1.2085	1.2136	1.2190 (40)
HLP (average)												1.2110 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	112.1350	108.0574	103.9798	99.9021	95.8245	91.7468	91.7468	95.8245	99.9021	103.9798	108.0574	112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1928.0048 (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	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1098	22.3023	18.1374	13.7312	10.2642	8.6655	9.3634	12.1709	16.3357	20.7420	24.2089	25.8077	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.6553	284.5780	277.2129	261.5335	241.7410	223.1388	210.7114	207.7887	215.1539	230.8333	250.6258	269.2279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327	(72)
Total internal gains	459.1293	456.8891	440.4652	413.7250	386.1410	359.8528	342.9517	349.4654	363.3526	390.3262	421.3628	445.0521	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				11.4800	19.6403	0.6300	0.7000	0.7700	68.9066 (76)			
South				5.7600	46.7521	0.6300	0.7000	0.7700	82.2991 (78)			
West				9.4600	19.6403	0.6300	0.7000	0.7700	56.7819 (80)			
Solar gains	207.9877	380.6582	576.6105	784.5988	925.9520	935.4782	895.4824	790.5306	650.2896	437.1276	254.2714	174.4742 (83)
Total gains	667.1170	837.5474	1017.0757	1198.3237	1312.0930	1295.3310	1238.4341	1139.9959	1013.6421	827.4538	675.6342	619.5262 (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	37.2817	37.3711	37.4592	37.8786	37.9581	38.3326	38.3326	38.4028	38.1875	37.9581	37.7976	37.6312
alpha	3.4854	3.4914	3.4973	3.5252	3.5305	3.5555	3.5555	3.5602	3.5458	3.5305	3.5198	3.5087
util living area	0.9918	0.9815	0.9566	0.8945	0.7811	0.6222	0.4767	0.5305	0.7635	0.9384	0.9849	0.9936 (86)
MIT	19.1240	19.3939	19.8076	20.3026	20.6835	20.9001	20.9705	20.9570	20.7857	20.2474	19.5852	19.0779 (87)
Th 2	19.8958	19.8981	19.9004	19.9112	19.9132	19.9227	19.9227	19.9244	19.9190	19.9132	19.9091	19.9049 (88)
util rest of house	0.9898	0.9773	0.9463	0.8695	0.7306	0.5392	0.3692	0.4204	0.6911	0.9185	0.9807	0.9921 (89)
MIT 2	18.1894	18.4585	18.8664	19.3483	19.6914	19.8700	19.9128	19.9087	19.7900	19.3090	18.6586	18.1502 (90)
Living area fraction	18.3216	18.5909	18.9996	19.4833	19.8318	20.0158	20.0625	20.0570	19.9309	19.4418	18.7897	18.2815 (91)
MIT	18.3216	18.5909	18.9996	19.4833	19.8318	20.0158	20.0625	20.0570	19.9309	19.4418	18.7897	18.2815 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3216	18.5909	18.9996	19.4833	19.8318	20.0158	20.0625	20.0570	19.9309	19.4418	18.7897	18.2815 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9859	0.9704	0.9356	0.8578	0.7263	0.5469	0.3838	0.4347	0.6920	0.9074	0.9747	0.9889 (94)
Useful gains	657.7038	812.7547	951.5733	1027.9635	953.0086	708.4205	475.2544	495.5876	701.4394	750.8709	658.5321	612.6326 (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	2023.6699	1971.2002	1795.4549	1503.3663	1152.7043	760.2049	486.0215	512.3911	821.5873	1253.3508	1664.0891	2013.4350 (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	1016.2787	778.4754	627.8479	342.2900	148.5736	0.0000	0.0000	0.0000	0.0000	373.8451	724.0010	1042.1970 (98)
Space heating												5053.5089 (98)
Space heating per m2												(98) / (4) = 43.0819 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5571.6746 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1016.2787	778.4754	627.8479	342.2900	148.5736	0.0000	0.0000	0.0000	0.0000	373.8451	724.0010	1042.1970	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1120.4837	858.2970	692.2248	377.3870	163.8078	0.0000	0.0000	0.0000	0.0000	412.1776	798.2371	1149.0596	(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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034	(64)
Efficiency of water heater (217)m	90.2395	90.1843	90.0673	89.7986	89.2573	87.9000	87.9000	87.9000	87.9000	89.8297	90.1411	87.9000	(216)
Fuel for water heating, kWh/month	214.8269	188.8772	197.2241	175.3808	171.4779	153.5045	145.4514	162.3347	162.9097	181.8869	194.1003	208.9570	(219)
Water heating fuel used												2156.9314	(219)
Annual totals kWh/year													
Space heating fuel - main system												5571.6746	(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)												443.4465	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.76 * 1080 * 1.00) =									-656.3510			-656.3510	(233)
Total delivered energy for all uses												7590.7015	(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	5571.6746	0.2160	1203.4817 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2156.9314	0.2160	465.8972 (264)
Space and water heating			1669.3789 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.4465	0.5190	230.1487 (268)
Energy saving/generation technologies			
PV Unit	-656.3510	0.5190	-340.6462 (269)
Total CO2, kg/year			1597.8065 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6200 (273)

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

DER			13.6200 ZC1
Total Floor Area		TFA	117.3000
Assumed number of occupants		N	2.8522
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.2287 ZC2
CO2 emissions from cooking, equation (L16)			1.5981 ZC3
Total CO2 emissions			29.4468 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			29.4468 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6700 (2c)	= 156.5955 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.7690 (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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3848 (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) =	0.3848 (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	0.4906	0.4810	0.4714	0.4233	0.4136	0.3655	0.3655	0.3559	0.3848	0.4136	0.4329	0.4521 (22b)
Effective ac	0.6203	0.6157	0.6111	0.5896	0.5856	0.5668	0.5668	0.5633	0.5740	0.5856	0.5937	0.6022 (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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			26.7000	1.3258	35.3977		(27)					
Ground Floor			58.6500	0.1300	7.6245		(28a)					
Brick and Block	169.9100	28.8200	141.0900	0.1800	25.3962		(29a)					
Pitched Roof	58.6500		58.6500	0.1300	7.6245		(30)					
Total net area of external elements Aum(A, m2)			287.2100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		78.1629		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2826 (36)					
Total fabric heat loss						(33) + (36) =	91.4455 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.7527	60.2950	59.8464	57.7394	57.3452	55.5100	55.5100	55.1702	56.2169	57.3452	58.1427	58.9764 (38)
Heat transfer coeff	152.1982	151.7406	151.2920	149.1849	148.7907	146.9555	146.9555	146.6157	147.6624	148.7907	149.5882	150.4220 (39)
Average = Sum(39)m / 12 =												149.1830 (39)
HLP	Jan 1.2975	Feb 1.2936	Mar 1.2898	Apr 1.2718	May 1.2685	Jun 1.2528	Jul 1.2528	Aug 1.2499	Sep 1.2588	Oct 1.2685	Nov 1.2753	Dec 1.2824 (40)
HLP (average)												1.2718 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1350	108.0574	103.9798	99.9021	95.8245	91.7468	91.7468	95.8245	99.9021	103.9798	108.0574	112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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 Built)

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)
	50.9589	46.0274	50.9589	49.2668	48.8311	45.2450	46.7532	48.8311	49.2668	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
Solar input	217.2519	191.4683	201.0409	180.1119	174.3801	153.5843	147.1454	164.0327	165.8442	186.8187	197.6166	212.0048 (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)
Output from w/h								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
	217.2519	191.4683	201.0409	180.1119	174.3801	153.5843	147.1454	164.0327	165.8442	186.8187	197.6166	212.0048 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum (64)m =				2191.2999 (64)
	68.0321	59.8660	62.6420	55.8227	53.9528	47.3341	45.0687	50.5123	51.0787	57.9131	61.6390	66.2875 (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	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.1098	22.3023	18.1374	13.7312	10.2642	8.6655	9.3634	12.1709	16.3357	20.7420	24.2089	25.8077 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	281.6553	284.5780	277.2129	261.5335	241.7410	223.1388	210.7114	207.7887	215.1539	230.8333	250.6258	269.2279 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612 (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)												
	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900 (71)
Water heating gains (Table 5)												
	91.4411	89.0862	84.1962	77.5315	72.5172	65.7417	60.5762	67.8929	70.9426	77.8402	85.6098	89.0961 (72)
Total internal gains												
	466.9899	464.7503	448.3303	421.5799	393.3062	366.3298	349.4348	356.6362	371.2160	398.1992	429.2282	452.9154 (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
East		11.4800		19.6403		0.6300		0.7000		0.7700		68.9066 (76)
South		5.7600		46.7521		0.6300		0.7000		0.7700		82.2991 (78)
West		9.4600		19.6403		0.6300		0.7000		0.7700		56.7819 (80)
Solar gains	207.9877	380.6582	576.6105	784.5988	925.9520	935.4782	895.4824	790.5306	650.2896	437.1276	254.2714	174.4742 (83)
Total gains	674.9776	845.4085	1024.9408	1206.1787	1319.2582	1301.8081	1244.9172	1147.1668	1021.5055	835.3268	683.4996	627.3896 (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	53.5212	53.6826	53.8418	54.6023	54.7469	55.4306	55.4306	55.5591	55.1652	54.7469	54.4551	54.1532
alpha	4.5681	4.5788	4.5895	4.6402	4.6498	4.6954	4.6954	4.7039	4.6777	4.6498	4.6303	4.6102
util living area												
	0.9983	0.9949	0.9836	0.9430	0.8421	0.6708	0.5076	0.5670	0.8228	0.9730	0.9961	0.9988 (86)
MIT	19.5436	19.7501	20.0743	20.4770	20.7861	20.9471	20.9885	20.9811	20.8600	20.4242	19.9053	19.5142 (87)
Th 2	19.8428	19.8458	19.8488	19.8630	19.8656	19.8780	19.8780	19.8803	19.8732	19.8656	19.8603	19.8547 (88)
util rest of house												
	0.9977	0.9931	0.9776	0.9221	0.7875	0.5735	0.3842	0.4393	0.7422	0.9592	0.9945	0.9983 (89)
MIT 2	17.9103	18.2136	18.6852	19.2627	19.6636	19.8445	19.8740	19.8730	19.7648	19.2029	18.4511	17.8755 (90)
Living area fraction												
									fLA = Living area / (4) =			0.1415 (91)
MIT	18.1415	18.4311	18.8817	19.4345	19.8224	20.0005	20.0317	20.0298	19.9198	19.3757	18.6569	18.1074 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1415	18.4311	18.8817	19.4345	19.8224	20.0005	20.0317	20.0298	19.9198	19.3757	18.6569	18.1074 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9962	0.9898	0.9705	0.9121	0.7851	0.5849	0.4016	0.4571	0.7461	0.9509	0.9917	0.9973 (94)
Useful gains	672.4407	836.7950	994.7501	1100.2152	1035.7846	761.3790	499.9769	524.3927	762.1565	794.3349	677.8432	625.6836 (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												
	2106.6485	2053.2121	1873.2591	1571.5916	1208.5404	793.6392	504.3123	532.1858	859.3625	1305.7446	1728.7782	2091.9782 (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												
	1067.0506	817.4323	653.6107	339.3910	128.5303	0.0000	0.0000	0.0000	0.0000	380.4889	756.6732	1090.9231 (98)
Space heating												5234.1001 (98)
Space heating per m2												(98) / (4) = 44.6215 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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												5603.9615 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1067.0506	817.4323	653.6107	339.3910	128.5303	0.0000	0.0000	0.0000	0.0000	380.4889	756.6732	1090.9231 (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)	1142.4525	875.1951	699.7973	363.3737	137.6128	0.0000	0.0000	0.0000	0.0000	407.3756	810.1426	1168.0119 (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	217.2519	191.4683	201.0409	180.1119	174.3801	153.5843	147.1454	164.0327	165.8442	186.8187	197.6166	212.0048 (64)
Efficiency of water heater (217)m	88.5167	88.2924	87.8022	86.6226	84.2962	80.3000	80.3000	80.3000	80.3000	86.8046	88.1052	80.3000 (216)
Fuel for water heating, kWh/month	245.4362	216.8570	228.9703	207.9271	206.8658	191.2631	183.2446	204.2748	206.5308	215.2175	224.2963	239.3182 (219)
Water heating fuel used												2570.2017 (219)
Annual totals kWh/year												
Space heating fuel - main system												5603.9615 (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)												443.4465 (232)
Total delivered energy for all uses												8692.6097 (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	5603.9615	0.2160	1210.4557 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2570.2017	0.2160	555.1636 (264)
Space and water heating			1765.6193 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.4465	0.5190	230.1487 (268)
Total CO2, kg/m2/year			2034.6930 (272)
Emissions per m2 for space and water heating			15.0522 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9621 (272b)
Emissions per m2 for pumps and fans			0.3318 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0522 * 1.00) + 1.9621 + 0.3318, rounded to 2 d.p.			17.3500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6700 (2c)	= 156.5955 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.7690 (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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					3.9900
Infiltration rate					0.3343 (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) =	0.3343 (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	0.4262	0.4179	0.4095	0.3677	0.3594	0.3176	0.3176	0.3092	0.3343	0.3594	0.3761	0.3928 (22b)
Effective ac	0.5908	0.5873	0.5838	0.5676	0.5646	0.5504	0.5504	0.5478	0.5559	0.5646	0.5707	0.5771 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000 (28a)
Brick and Block	169.9100	28.8200	141.0900	0.2400	33.8616	42.2200	5956.8198 (29a)
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150 (30)
Total net area of external elements Aum(A, m ²)			287.2100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.6691		(33)
GF Block			58.4300			75.0000	4382.2500 (32c)
GF Stud			34.6800			9.0000	312.1200 (32c)
FF Stud			127.5000			9.0000	1147.5000 (32c)
Internal Floor 1			58.6500			18.0000	1055.7000 (32d)
Internal Ceiling 1			58.6500			9.0000	527.8500 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	18842.5548 (34)
	160.6356 (35)
	6.7936 (36)
(33) + (36) =	86.4627 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 57.8621 Feb 57.5167 Mar 57.1781 Apr 55.5879 May 55.2903 Jun 53.9053 Jul 53.9053 Aug 53.6488 Sep 54.4388 Oct 55.2903 Nov 55.8922 Dec 56.5215 (38)
Heat transfer coeff	144.3248 143.9794 143.6408 142.0505 141.7530 140.3679 140.3679 140.1114 140.9014 141.7530 142.3549 142.9842 (39)
Average = Sum(39)m / 12 =	142.0491 (39)

HLP	Jan 1.2304 Feb 1.2274 Mar 1.2246 Apr 1.2110 May 1.2085 Jun 1.1967 Jul 1.1967 Aug 1.1945 Sep 1.2012 Oct 1.2085 Nov 1.2136 Dec 1.2190 (40)
HLP (average)	1.2110 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1350	108.0574	103.9798	99.9021	95.8245	91.7468	91.7468	95.8245	99.9021	103.9798	108.0574	112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)												Total = Sum(45)m = 1603.9278 (45)

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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	35.3373	30.9062	31.8924	27.8046	26.6792	23.0221	21.3334	24.4803	24.7727	28.8702	31.5141	34.2223 (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	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1098	22.3023	18.1374	13.7312	10.2642	8.6655	9.3634	12.1709	16.3357	20.7420	24.2089	25.8077	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.6553	284.5780	277.2129	261.5335	241.7410	223.1388	210.7114	207.7887	215.1539	230.8333	250.6258	269.2279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	47.4963	45.9914	42.8662	38.6175	35.8591	31.9751	28.6739	32.9037	34.4065	38.8040	43.7696	45.9977	(72)
Total internal gains	420.0452	418.6554	404.0003	379.6659	353.6480	329.5632	314.5324	318.6470	331.6799	356.1630	384.3880	406.8170	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East			11.4800		19.6403		0.6300		0.7000		0.7700		68.9066 (76)
South			5.7600		46.7521		0.6300		0.7000		0.7700		82.2991 (78)
West			9.4600		19.6403		0.6300		0.7000		0.7700		56.7819 (80)
Solar gains	207.9877	380.6582	576.6105	784.5988	925.9520	935.4782	895.4824	790.5306	650.2896	437.1276	254.2714	174.4742	(83)
Total gains	628.0329	799.3137	980.6108	1164.2647	1279.6000	1265.0414	1210.0148	1109.1776	981.9694	793.2907	638.6594	581.2912	(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	36.2657	36.3527	36.4384	36.8463	36.9237	37.2880	37.2880	37.3563	37.1468	36.9237	36.7676	36.6058	
alpha	3.4177	3.4235	3.4292	3.4564	3.4616	3.4859	3.4859	3.4904	3.4765	3.4616	3.4512	3.4404	
util living area	0.9925	0.9827	0.9586	0.8981	0.7873	0.6306	0.4852	0.5410	0.7727	0.9423	0.9862	0.9942	(86)
MIT	19.0457	19.3226	19.7483	20.2602	20.6581	20.8890	20.9664	20.9509	20.7649	20.2008	19.5186	18.9992	(87)
Th 2	19.8958	19.8981	19.9004	19.9112	19.9132	19.9227	19.9227	19.9244	19.9190	19.9132	19.9091	19.9049	(88)
util rest of house	0.9908	0.9788	0.9489	0.8741	0.7379	0.5480	0.3768	0.4302	0.7021	0.9237	0.9824	0.9929	(89)
MIT 2	18.1146	18.3909	18.8113	19.3106	19.6713	19.8633	19.9111	19.9060	19.7753	19.2672	18.5956	18.0750	(90)
Living area fraction	18.2463	18.5228	18.9439	19.4450	19.8109	20.0084	20.0605	20.0539	19.9153	19.3994	18.7262	18.2057	(91)
Temperature adjustment	18.2463	18.5228	18.9439	19.4450	19.8109	20.0084	20.0605	20.0539	19.9153	19.3994	18.7262	18.2057	(92)
adjusted MIT	18.2463	18.5228	18.9439	19.4450	19.8109	20.0084	20.0605	20.0539	19.9153	19.3994	18.7262	18.2057	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	619.9166	776.9776	919.8752	1003.3863	937.5342	702.2104	473.4614	492.8034	689.1637	723.7830	623.7785	575.4149	(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	2012.8009	1961.3960	1787.4485	1497.9225	1149.7464	759.1698	485.7373	511.9494	819.3887	1247.3358	1655.0482	2002.6003	(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	1036.3059	795.9291	645.4746	356.0661	157.8859	0.0000	0.0000	0.0000	0.0000	389.5233	742.5142	1061.8260	(98)
Space heating												5185.5250	(98)
Space heating per m2												44.2074	(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	1319.4585	1038.7226	1064.8468	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8437	0.8982	0.8717	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	1113.2857	933.0280	928.2016	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1592.1088	1525.2554	1409.4708	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	344.7526	440.6172	358.0643	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1143.4341 (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	86.1882	110.1543	89.5161	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												285.8585 (107)
Space cooling per m2												2.4370 (108)
Energy for space heating												44.2074 (99)
Energy for space cooling												2.4370 (108)
Total												46.6444 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6700 (2c)	= 156.5955 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.7690 (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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3848 (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) =	0.3848 (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	0.4906	0.4810	0.4714	0.4233	0.4136	0.3655	0.3655	0.3559	0.3848	0.4136	0.4329	0.4521 (22b)
Effective ac	0.6203	0.6157	0.6111	0.5896	0.5856	0.5668	0.5668	0.5633	0.5740	0.5856	0.5937	0.6022 (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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			26.7000	1.3258	35.3977		(27)					
Ground Floor			58.6500	0.1300	7.6245		(28a)					
Brick and Block	169.9100	28.8200	141.0900	0.1800	25.3962		(29a)					
Pitched Roof	58.6500		58.6500	0.1300	7.6245		(30)					
Total net area of external elements Aum(A, m2)			287.2100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.1629		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2826 (36)					
Total fabric heat loss						(33) + (36) =	91.4455 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 60.7527	Feb 60.2950	Mar 59.8464	Apr 57.7394	May 57.3452	Jun 55.5100	Jul 55.5100	Aug 55.1702	Sep 56.2169	Oct 57.3452	Nov 58.1427	Dec 58.9764 (38)
Heat transfer coeff	152.1982	151.7406	151.2920	149.1849	148.7907	146.9555	146.9555	146.6157	147.6624	148.7907	149.5882	150.4220 (39)
Average = Sum(39)m / 12 =												149.1830 (39)
HLP	Jan 1.2975	Feb 1.2936	Mar 1.2898	Apr 1.2718	May 1.2685	Jun 1.2528	Jul 1.2528	Aug 1.2499	Sep 1.2588	Oct 1.2685	Nov 1.2753	Dec 1.2824 (40)
HLP (average)												1.2718 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1350	108.0574	103.9798	99.9021	95.8245	91.7468	91.7468	95.8245	99.9021	103.9798	108.0574	112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)											Total = Sum(45)m =	1603.9278 (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 Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
	35.3373	30.9062	31.8924	27.8046	26.6792	23.0221	21.3334	24.4803	24.7727	28.8702	31.5141	34.2223 (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	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1098	22.3023	18.1374	13.7312	10.2642	8.6655	9.3634	12.1709	16.3357	20.7420	24.2089	25.8077	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.6553	284.5780	277.2129	261.5335	241.7410	223.1388	210.7114	207.7887	215.1539	230.8333	250.6258	269.2279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	47.4963	45.9914	42.8662	38.6175	35.8591	31.9751	28.6739	32.9037	34.4065	38.8040	43.7696	45.9977	(72)
Total internal gains	420.0452	418.6554	404.0003	379.6659	353.6480	329.5632	314.5324	318.6470	331.6799	356.1630	384.3880	406.8170	(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	
East	11.4800	19.6403	0.6300		0.7000	0.7700	68.9066	(76)
South	5.7600	46.7521	0.6300		0.7000	0.7700	82.2991	(78)
West	9.4600	19.6403	0.6300		0.7000	0.7700	56.7819	(80)

Solar gains	207.9877	380.6582	576.6105	784.5988	925.9520	935.4782	895.4824	790.5306	650.2896	437.1276	254.2714	174.4742	(83)
Total gains	628.0329	799.3137	980.6108	1164.2647	1279.6000	1265.0414	1210.0148	1109.1776	981.9694	793.2907	638.6594	581.2912	(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 (see Table 9a)														
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	53.5212	53.6826	53.8418	54.6023	54.7469	55.4306	55.4306	55.5591	55.1652	54.7469	54.4551	54.1532		
alpha	4.5681	4.5788	4.5895	4.6402	4.6498	4.6954	4.6954	4.7039	4.6777	4.6498	4.6303	4.6102		
util living area	0.9987	0.9960	0.9861	0.9493	0.8536	0.6853	0.5209	0.5837	0.8387	0.9777	0.9971	0.9991	(86)	
MIT	19.5073	19.7150	20.0422	20.4518	20.7716	20.9422	20.9872	20.9787	20.8467	20.3951	19.8708	19.4784	(87)	
Th 2	19.8428	19.8458	19.8488	19.8630	19.8656	19.8780	19.8780	19.8803	19.8732	19.8656	19.8603	19.8547	(88)	
util rest of house	0.9983	0.9945	0.9810	0.9302	0.8010	0.5877	0.3949	0.4535	0.7611	0.9660	0.9958	0.9988	(89)	
MIT 2	18.4872	18.6966	19.0231	19.4302	19.7167	19.8527	19.8749	19.8746	19.7907	19.3857	18.8639	18.4676	(90)	
Living area fraction									fLA = Living area / (4) =			0.1415	(91)	
MIT	18.6315	18.8407	19.1673	19.5748	19.8660	20.0069	20.0323	20.0308	19.9401	19.5286	19.0064	18.6106	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6315	18.8407	19.1673	19.5748	19.8660	20.0069	20.0323	20.0308	19.9401	19.5286	19.0064	18.6106	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9976	0.9927	0.9769	0.9242	0.8010	0.5998	0.4128	0.4719	0.7665	0.9613	0.9944	0.9983	(94)	
Useful gains	626.5162	793.5170	957.9622	1075.9867	1025.0187	758.7539	499.5352	523.4422	752.6932	762.5557	635.1001	580.3052	(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	2181.2344	2115.3704	1916.4631	1592.5180	1215.0256	794.5711	504.4018	532.3385	862.3684	1328.4873	1781.0604	2167.6766	(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	1156.7103	888.2855	713.1247	371.9025	141.3651	0.0000	0.0000	0.0000	0.0000	421.0532	825.0914	1181.0043	(98)	
Space heating												5698.5370	(98)	
Space heating per m2										(98) / (4) =		48.5809	(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	1381.3821	1087.4710	1114.2793	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8774	0.9314	0.9061	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1212.0915	1012.8580	1009.6316	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1592.1088	1525.2554	1409.4708	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	273.6124	381.2237	297.4804	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												952.3165	(104)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	68.4031	95.3059	74.3701	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												238.0791 (107)
Space cooling per m2												2.0297 (108)
Energy for space heating												48.5809 (99)
Energy for space cooling												2.0297 (108)
Total												50.6105 (109)
Target Fabric Energy Efficiency (TFEE)												58.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6700 (2c)	= 156.5955 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.7690 (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) =	0.1348 (8)
Pressure test																	Yes	
Measured/design AP50																		3.9900
Infiltration rate																		0.3343 (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) =	0.3343 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)						
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)						
Adj infilt rate																		
	0.3928	0.3677	0.3677	0.3343	0.3426	0.3259	0.3259	0.3176	0.3176	0.3426	0.3343	0.3426 (22b)						
Effective ac	0.5771	0.5676	0.5676	0.5559	0.5587	0.5531	0.5531	0.5504	0.5504	0.5587	0.5559	0.5587 (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						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			26.7000	1.1450	30.5725			(27)					
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000	(28a)					
Brick and Block	169.9100	28.8200	141.0900	0.2400	33.8616	42.2200	5956.8198	(29a)					
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150	(30)					
Total net area of external elements Aum(A, m2)			287.2100					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.6691			(33)					
GF Block			58.4300			75.0000	4382.2500	(32c)					
GF Stud			34.6800			9.0000	312.1200	(32c)					
FF Stud			127.5000			9.0000	1147.5000	(32c)					
Internal Floor 1			58.6500			18.0000	1055.7000	(32d)					
Internal Ceiling 1			58.6500			18.0000	1055.7000	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		19370.4048	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							165.1356	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7936	(36)					
Total fabric heat loss						(33) + (36) =	86.4627	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 56.5215	Feb 55.5879	Mar 55.5879	Apr 54.4388	May 54.7158	Jun 54.1686	Jul 54.1686	Aug 53.9053	Sep 53.9053	Oct 54.7158	Nov 54.4388	Dec 54.7158	(38)
Heat transfer coeff	142.9842	142.0505	142.0505	140.9014	141.1784	140.6313	140.6313	140.3679	140.3679	141.1784	140.9014	141.1784	(39)
Average = Sum(39)m / 12 =												141.2018	(39)
HLP	Jan 1.2190	Feb 1.2110	Mar 1.2110	Apr 1.2012	May 1.2036	Jun 1.1989	Jul 1.1989	Aug 1.1967	Sep 1.1967	Oct 1.2036	Nov 1.2012	Dec 1.2036	(40)
HLP (average)												1.2038	(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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	Jan 112.1350	Feb 108.0574	Mar 103.9798	Apr 99.9021	May 95.8245	Jun 91.7468	Jul 91.7468	Aug 95.8245	Sep 99.9021	Oct 103.9798	Nov 108.0574	Dec 112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (64)
RHI water heating demand												1928 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (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	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7744	55.7557	45.3436	34.3280	25.6606	21.6638	23.4084	30.4272	40.8393	51.8549	60.5223	64.5191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3811	424.7433	413.7506	390.3485	360.8074	333.0430	314.4947	310.1324	321.1252	344.5273	374.0684	401.8328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327	(72)
Total internal gains	681.7467	676.7348	650.4361	609.3637	566.8308	528.9822	507.0070	516.2924	540.0544	581.3601	627.3457	662.5953	(73)

6. Solar gains

[Jan]												
					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W
East					11.4800	25.1733		0.6300	0.7000		0.7700	88.3188 (76)
South					5.7600	56.5862		0.6300	0.7000		0.7700	99.6105 (78)
West					9.4600	25.1733		0.6300	0.7000		0.7700	72.7784 (80)
Solar gains	260.7076	406.4263	626.9646	856.3038	951.0036	1063.3081	977.8493	900.5579	740.1430	503.7219	317.7676	206.9682 (83)
Total gains	942.4544	1083.1612	1277.4007	1465.6675	1517.8344	1592.2904	1484.8563	1416.8503	1280.1974	1085.0820	945.1133	869.5635 (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	37.6312	37.8786	37.8786	38.1875	38.1125	38.2608	38.2608	38.3326	38.3326	38.1125	38.1875	38.1125	
alpha	3.5087	3.5252	3.5252	3.5458	3.5408	3.5507	3.5507	3.5555	3.5555	3.5408	3.5458	3.5408	
util living area	0.9702	0.9525	0.9035	0.7979	0.6479	0.4355	0.3091	0.3134	0.5671	0.8331	0.9447	0.9758	(86)
MIT	19.6148	19.8153	20.1923	20.6041	20.8576	20.9742	20.9944	20.9944	20.9350	20.6193	20.0768	19.5837	(87)
Th 2	19.9049	19.9112	19.9112	19.9190	19.9171	19.9209	19.9209	19.9227	19.9227	19.9171	19.9190	19.9171	(88)
util rest of house	0.9633	0.9419	0.8826	0.7570	0.5812	0.3493	0.2097	0.2096	0.4744	0.7863	0.9298	0.9700	(89)
MIT 2	18.6811	18.8809	19.2414	19.6230	19.8304	19.9108	19.9198	19.9217	19.8929	19.6468	19.1452	18.6605	(90)
Living area fraction									fLA = Living area / (4) =			0.1415	(91)
MIT	18.8132	19.0131	19.3759	19.7618	19.9758	20.0613	20.0719	20.0735	20.0403	19.7844	19.2771	18.7911	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8132	19.0131	19.3759	19.7618	19.9758	20.0613	20.0719	20.0735	20.0403	19.7844	19.2771	18.7911	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	899.4250	1008.3586	1111.8391	1099.7966	887.9708	574.5077	332.2735	317.8887	621.0054	846.0387	868.2255	836.5923	(94)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	1889.2840	1848.5170	1672.7788	1361.3616	970.7101	585.2082	333.5633	319.1244	651.3553	1084.8706	1504.4142	1848.1864	(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	736.4551	564.5864	417.3391	188.3268	61.5581	0.0000	0.0000	0.0000	0.0000	177.6909	458.0558	752.6260	(98)
Space heating												3356.6383	(98)
RHI space heating demand												3357	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6700 (2c)	= 156.5955 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.7690 (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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					3.9900
Infiltration rate					0.3343 (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) =	0.3343 (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	0.4262	0.4179	0.4095	0.3677	0.3594	0.3176	0.3176	0.3092	0.3343	0.3594	0.3761	0.3928 (22b)
Effective ac	0.5908	0.5873	0.5838	0.5676	0.5646	0.5504	0.5504	0.5478	0.5559	0.5646	0.5707	0.5771 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000 (28a)
Brick and Block	169.9100	28.8200	141.0900	0.2400	33.8616	42.2200	5956.8198 (29a)
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150 (30)
Total net area of external elements Aum(A, m ²)			287.2100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.6691		(33)
GF Block			58.4300			75.0000	4382.2500 (32c)
GF Stud			34.6800			9.0000	312.1200 (32c)
FF Stud			127.5000			9.0000	1147.5000 (32c)
Internal Floor 1			58.6500			18.0000	1055.7000 (32d)
Internal Ceiling 1			58.6500			18.0000	1055.7000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19370.4048 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.1356 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7936 (36)
Total fabric heat loss (33) + (36) = 86.4627 (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	57.8621	57.5167	57.1781	55.5879	55.2903	53.9053	53.9053	53.6488	54.4388	55.2903	55.8922	56.5215 (38)
Heat transfer coeff	144.3248	143.9794	143.6408	142.0505	141.7530	140.3679	140.3679	140.1114	140.9014	141.7530	142.3549	142.9842 (39)
Average = Sum(39)m / 12 =												142.0491 (39)
HLP	1.2304	1.2274	1.2246	1.2110	1.2085	1.1967	1.1967	1.1945	1.2012	1.2085	1.2136	1.2190 (40)
HLP (average)												1.2110 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	112.1350	108.0574	103.9798	99.9021	95.8245	91.7468	91.7468	95.8245	99.9021	103.9798	108.0574	112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1928.0048 (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	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7744	55.7557	45.3436	34.3280	25.6606	21.6638	23.4084	30.4272	40.8393	51.8549	60.5223	64.5191 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3811	424.7433	413.7506	390.3485	360.8074	333.0430	314.4947	310.1324	321.1252	344.5273	374.0684	401.8328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657 (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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900 (71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327 (72)
Total internal gains	681.7467	676.7348	650.4361	609.3637	566.8308	528.9822	507.0070	516.2924	540.0544	581.3601	627.3457	662.5953 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				11.4800	19.6403		0.6300	0.7000		0.7700		68.9066 (76)	
South				5.7600	46.7521		0.6300	0.7000		0.7700		82.2991 (78)	
West				9.4600	19.6403		0.6300	0.7000		0.7700		56.7819 (80)	

Solar gains	207.9877	380.6582		576.6105	784.5988	925.9520	935.4782	895.4824	790.5306	650.2896	437.1276	254.2714	174.4742 (83)
Total gains	889.7344	1057.3931		1227.0466	1393.9625	1492.7828	1464.4605	1402.4894	1306.8230	1190.3440	1018.4877	881.6171	837.0695 (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	37.2817	37.3711	37.4592	37.8786	37.9581	38.3326	38.3326	38.4028	38.1875	37.9581	37.7976	37.6312
alpha	3.4854	3.4914	3.4973	3.5252	3.5305	3.5555	3.5555	3.5602	3.5458	3.5305	3.5198	3.5087
util living area	0.9802	0.9638	0.9288	0.8525	0.7285	0.5667	0.4267	0.4722	0.6954	0.8969	0.9669	0.9837 (86)
MIT	19.3499	19.6055	19.9868	20.4283	20.7511	20.9259	20.9793	20.9703	20.8439	20.3952	19.7867	19.3016 (87)
Th 2	19.8958	19.8981	19.9004	19.9112	19.9132	19.9227	19.9227	19.9244	19.9190	19.9132	19.9091	19.9049 (88)
util rest of house	0.9758	0.9560	0.9135	0.8216	0.6743	0.4862	0.3281	0.3704	0.6188	0.8677	0.9584	0.9801 (89)
MIT 2	18.4124	18.6650	19.0367	19.4596	19.7432	19.8847	19.9159	19.9139	19.8290	19.4425	18.8551	18.3716 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.5451	18.7981	19.1711	19.5967	19.8858	20.0321	20.0664	20.0634	19.9726	19.5773	18.9869	18.5032 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5451	18.7981	19.1711	19.5967	19.8858	20.0321	20.0664	20.0634	19.9726	19.5773	18.9869	18.5032 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9687	0.9461	0.9012	0.8113	0.6728	0.4948	0.3416	0.3841	0.6230	0.8569	0.9491	0.9738 (94)
Ext temp.	861.8429	1000.3656	1105.7575	1130.9367	1004.3551	724.6551	479.1411	501.9350	741.5249	872.7107	836.7061	815.1576 (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	2055.9186	2001.0444	1820.0929	1519.4718	1160.3635	762.4896	486.5705	513.2836	827.4593	1272.5657	1692.1608	2045.1378 (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	888.3923	672.4562	531.4655	279.7453	116.0702	0.0000	0.0000	0.0000	0.0000	297.4921	615.9273	915.1052 (98)
Space heating per m2												4316.6541 (98)
(98) / (4) =												36.8001 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4759.2658 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	888.3923	672.4562	531.4655	279.7453	116.0702	0.0000	0.0000	0.0000	0.0000	297.4921	615.9273	915.1052	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	979.4844	741.4070	585.9598	308.4292	127.9716	0.0000	0.0000	0.0000	0.0000	327.9957	679.0819	1008.9363	(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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034	(64)
Efficiency of water heater (217)m	90.1854	90.1198	89.9820	89.6711	89.0861	87.9000	87.9000	87.9000	87.9000	89.6872	90.0653	87.9000	(216)
Fuel for water heating, kWh/month	214.9558	189.0123	197.4111	175.6301	171.8073	153.5045	145.4514	162.3347	162.9097	182.1760	194.2637	209.0739	(219)
Water heating fuel used												2158.5306	(219)
Annual totals kWh/year													
Space heating fuel - main system												4759.2658	(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)												443.4465	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.76 * 1080 * 1.00) =										-656.3510		-656.3510	(233)
Total delivered energy for all uses												6779.8919	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4759.2658	3.4800	165.6225 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2158.5306	3.4800	75.1169 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	443.4465	13.1900	58.4906 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-656.3510	13.1900	-86.5727 (252)
Total energy cost			342.5497 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8865 (257)
SAP value		87.6340
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4759.2658	0.2160	1028.0014 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2158.5306	0.2160	466.2426 (264)
Space and water heating			1494.2440 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.4465	0.5190	230.1487 (268)
Energy saving/generation technologies			
PV Unit	-656.3510	0.5190	-340.6462 (269)
Total kg/year			1422.6716 (272)
CO2 emissions per m2			12.1300 (273)
EI value			88.2540
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8922 = 3.901$, stars = 4
Water heating environmental impact	$0.216 / 0.8922 = 0.2421$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6700 (2c)	= 156.5955 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.7690 (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) =							0.1348 (8)
Pressure test										Yes							
Measured/design AP50																	3.9900
Infiltration rate																	0.3343 (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) =							0.3343 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000	(22)				
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250	(22a)				
Adj infilt rate	0.3928	0.3677	0.3677	0.3343	0.3426	0.3259	0.3259	0.3176	0.3176	0.3426	0.3343	0.3426	(22b)				
Effective ac	0.5771	0.5676	0.5676	0.5559	0.5587	0.5531	0.5531	0.5504	0.5504	0.5587	0.5559	0.5587	(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						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			26.7000	1.1450	30.5725			(27)					
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000	(28a)					
Brick and Block	169.9100	28.8200	141.0900	0.2400	33.8616	42.2200	5956.8198	(29a)					
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150	(30)					
Total net area of external elements Aum(A, m2)			287.2100					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.6691			(33)					
GF Block			58.4300			75.0000	4382.2500	(32c)					
GF Stud			34.6800			9.0000	312.1200	(32c)					
FF Stud			127.5000			9.0000	1147.5000	(32c)					
Internal Floor 1			58.6500			18.0000	1055.7000	(32d)					
Internal Ceiling 1			58.6500			18.0000	1055.7000	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		19370.4048	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							165.1356	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7936	(36)					
Total fabric heat loss						(33) + (36) =	86.4627	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 56.5215	Feb 55.5879	Mar 55.5879	Apr 54.4388	May 54.7158	Jun 54.1686	Jul 54.1686	Aug 53.9053	Sep 53.9053	Oct 54.7158	Nov 54.4388	Dec 54.7158	(38)
Heat transfer coeff	142.9842	142.0505	142.0505	140.9014	141.1784	140.6313	140.6313	140.3679	140.3679	141.1784	140.9014	141.1784	(39)
Average = Sum(39)m / 12 =												141.2018	(39)
HLP	Jan 1.2190	Feb 1.2110	Mar 1.2110	Apr 1.2012	May 1.2036	Jun 1.1989	Jul 1.1989	Aug 1.1967	Sep 1.1967	Oct 1.2036	Nov 1.2012	Dec 1.2036	(40)
HLP (average)												1.2038	(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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	Jan 112.1350	Feb 108.0574	Mar 103.9798	Apr 99.9021	May 95.8245	Jun 91.7468	Jul 91.7468	Aug 95.8245	Sep 99.9021	Oct 103.9798	Nov 108.0574	Dec 112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1928.0048 (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	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7744	55.7557	45.3436	34.3280	25.6606	21.6638	23.4084	30.4272	40.8393	51.8549	60.5223	64.5191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3811	424.7433	413.7506	390.3485	360.8074	333.0430	314.4947	310.1324	321.1252	344.5273	374.0684	401.8328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327	(72)
Total internal gains	681.7467	676.7348	650.4361	609.3637	566.8308	528.9822	507.0070	516.2924	540.0544	581.3601	627.3457	662.5953	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
East					11.4800	25.1733		0.6300	0.7000	0.7700		88.3188 (76)
South					5.7600	56.5862		0.6300	0.7000	0.7700		99.6105 (78)
West					9.4600	25.1733		0.6300	0.7000	0.7700		72.7784 (80)

Solar gains	260.7076	406.4263	626.9646	856.3038	951.0036	1063.3081	977.8493	900.5579	740.1430	503.7219	317.7676	206.9682 (83)
Total gains	942.4544	1083.1612	1277.4007	1465.6675	1517.8344	1592.2904	1484.8563	1416.8503	1280.1974	1085.0820	945.1133	869.5635 (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	37.6312	37.8786	37.8786	38.1875	38.1125	38.2608	38.2608	38.3326	38.3326	38.1125	38.1875	38.1125
alpha	3.5087	3.5252	3.5252	3.5458	3.5408	3.5507	3.5507	3.5555	3.5555	3.5408	3.5458	3.5408
util living area												
	0.9702	0.9525	0.9035	0.7979	0.6479	0.4355	0.3091	0.3134	0.5671	0.8331	0.9447	0.9758 (86)
MIT	19.6148	19.8153	20.1923	20.6041	20.8576	20.9742	20.9944	20.9944	20.9350	20.6193	20.0768	19.5837 (87)
Th 2	19.9049	19.9112	19.9112	19.9190	19.9171	19.9209	19.9209	19.9227	19.9227	19.9171	19.9190	19.9171 (88)
util rest of house												
	0.9633	0.9419	0.8826	0.7570	0.5812	0.3493	0.2097	0.2096	0.4744	0.7863	0.9298	0.9700 (89)
MIT 2	18.6811	18.8809	19.2414	19.6230	19.8304	19.9108	19.9198	19.9217	19.8929	19.6468	19.1452	18.6605 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.8132	19.0131	19.3759	19.7618	19.9758	20.0613	20.0719	20.0735	20.0403	19.7844	19.2771	18.7911 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8132	19.0131	19.3759	19.7618	19.9758	20.0613	20.0719	20.0735	20.0403	19.7844	19.2771	18.7911 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9543	0.9309	0.8704	0.7504	0.5850	0.3608	0.2238	0.2244	0.4851	0.7797	0.9186	0.9621 (94)
Useful gains	899.4250	1008.3586	1111.8391	1099.7966	887.9708	574.5077	332.2735	317.8887	621.0054	846.0387	868.2255	836.5923 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W	1889.2840	1848.5170	1672.7788	1361.3616	970.7101	585.2082	333.5633	319.1244	651.3553	1084.8706	1504.4142	1848.1864 (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	736.4551	564.5864	417.3391	188.3268	61.5581	0.0000	0.0000	0.0000	0.0000	177.6909	458.0558	752.6260 (98)
Space heating												3356.6383 (98)
Space heating per m2												(98) / (4) = 28.6158 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3700.8140 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	736.4551	564.5864	417.3391	188.3268	61.5581	0.0000	0.0000	0.0000	0.0000	177.6909	458.0558	752.6260	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	811.9682	622.4768	460.1313	207.6370	67.8700	0.0000	0.0000	0.0000	0.0000	195.9106	505.0230	829.7971	(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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034	(64)
Efficiency of water heater (217)m	90.1019	90.0353	89.8455	89.4030	88.6853	87.9000	87.9000	87.9000	87.9000	89.3368	89.9084	87.9000	(216)
Fuel for water heating, kWh/month	215.1550	189.1897	197.7109	176.1568	172.5838	153.5045	145.4514	162.3347	162.9097	182.8906	194.6027	209.2693	(219)
Water heating fuel used												2161.7591	(219)
Annual totals kWh/year													
Space heating fuel - main system												3700.8140	(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)												443.4465	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.76 * 1206 * 1.00) =										-733.2542		-733.2542	(233)
Total delivered energy for all uses												5647.7654	(238)

10a. Fuel costs - using BEDF prices (491)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3700.8140	3.6300	134.3395 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2161.7591	3.6300	78.4719 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	443.4465	19.4400	86.2060 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-733.2542	19.4400	-142.5446 (252)
Total energy cost			266.0528 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3700.8140	0.2160	799.3758 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2161.7591	0.2160	466.9400 (264)
Space and water heating			1266.3158 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.4465	0.5190	230.1487 (268)
Energy saving/generation technologies			
PV Unit	-733.2542	0.5190	-380.5589 (269)
Total kg/year			1154.8306 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3700.8140	1.2200	4514.9931 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2161.7591	1.2200	2637.3461 (264)
Space and water heating			7152.3392 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	443.4465	3.0700	1361.3808 (268)
Energy saving/generation technologies			
PV Unit	-733.2542	3.0700	-2251.0905 (269)
Primary energy kWh/year			6492.8795 (272)
Primary energy kWh/m2/year			55.3528 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 88

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 28	-197 kg (17.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£28 1.68 kg/m²	B 89	B 90
Total Savings	£28 1.68 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 491 TEST (28 Feb 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£101	£111	-£10
Mains gas	£308	£270	£38
Space heating	£244	£244	£0
Water heating	£78	£51	£28
Lighting	£86	£86	£0
Generated (PV)	-£143	-£143	£0
Total cost of fuels	£266	£238	£28
Total cost of uses	£265	£238	£28
Delivered energy	48 kWh/m²	40 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	46 kWh/m²	9 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6700 (2c)	= 156.5955 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.7690 (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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					3.9900
Infiltration rate					0.3343 (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) =	0.3343 (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	0.4262	0.4179	0.4095	0.3677	0.3594	0.3176	0.3176	0.3092	0.3343	0.3594	0.3761	0.3928 (22b)
Effective ac	0.5908	0.5873	0.5838	0.5676	0.5646	0.5504	0.5504	0.5478	0.5559	0.5646	0.5707	0.5771 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000 (28a)
Brick and Block	169.9100	28.8200	141.0900	0.2400	33.8616	42.2200	5956.8198 (29a)
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150 (30)
Total net area of external elements Aum(A, m ²)			287.2100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.6691		(33)
GF Block			58.4300			75.0000	4382.2500 (32c)
GF Stud			34.6800			9.0000	312.1200 (32c)
FF Stud			127.5000			9.0000	1147.5000 (32c)
Internal Floor 1			58.6500			18.0000	1055.7000 (32d)
Internal Ceiling 1			58.6500			18.0000	1055.7000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19370.4048 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.1356 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7936 (36)
Total fabric heat loss (33) + (36) = 86.4627 (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	57.8621	57.5167	57.1781	55.5879	55.2903	53.9053	53.9053	53.6488	54.4388	55.2903	55.8922	56.5215 (38)
Heat transfer coeff	144.3248	143.9794	143.6408	142.0505	141.7530	140.3679	140.3679	140.1114	140.9014	141.7530	142.3549	142.9842 (39)
Average = Sum(39)m / 12 =												142.0491 (39)
HLP	1.2304	1.2274	1.2246	1.2110	1.2085	1.1967	1.1967	1.1945	1.2012	1.2085	1.2136	1.2190 (40)
HLP (average)												1.2110 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	112.1350	108.0574	103.9798	99.9021	95.8245	91.7468	91.7468	95.8245	99.9021	103.9798	108.0574	112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1307 (H8)
Utilisation factor												0.5870 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.9409 (H14)
Volume ratio Veff/V												0.7357 (H15)
Solar storage volume factor												0.9386 (H16)
Solar input	-25.4798	-42.5184	-72.4138	-97.0487	-119.8955	-117.8764	-116.3186	-101.6282	-79.5952	-54.3542	-30.2227	-878.6738 (H17)
Solar input (sum of months) = Sum (63)m =												-878.6738 (63)
Output from w/h	168.3790	127.8190	105.2206	60.4408	33.1609	17.0540	11.5331	41.0640	63.6024	109.0344	144.7415	167.2812 (64)
Total per year (kWh/year) = Sum (64)m =												1049.3310 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (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	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7744	55.7557	45.3436	34.3280	25.6606	21.6638	23.4084	30.4272	40.8393	51.8549	60.5223	64.5191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3811	424.7433	413.7506	390.3485	360.8074	333.0430	314.4947	310.1324	321.1252	344.5273	374.0684	401.8328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327	(72)
Total internal gains	681.7467	676.7348	650.4361	609.3637	566.8308	528.9822	507.0070	516.2924	540.0544	581.3601	627.3457	662.5953	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
East					11.4800	19.6403		0.6300	0.7000	0.7700		68.9066 (76)
South					5.7600	46.7521		0.6300	0.7000	0.7700		82.2991 (78)
West					9.4600	19.6403		0.6300	0.7000	0.7700		56.7819 (80)

Solar gains	207.9877	380.6582	576.6105	784.5988	925.9520	935.4782	895.4824	790.5306	650.2896	437.1276	254.2714	174.4742 (83)
Total gains	889.7344	1057.3931	1227.0466	1393.9625	1492.7828	1464.4605	1402.4894	1306.8230	1190.3440	1018.4877	881.6171	837.0695 (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	37.2817	37.3711	37.4592	37.8786	37.9581	38.3326	38.3326	38.4028	38.1875	37.9581	37.7976	37.6312	
alpha	3.4854	3.4914	3.4973	3.5252	3.5305	3.5555	3.5555	3.5602	3.5458	3.5305	3.5198	3.5087	
util living area	0.9802	0.9638	0.9288	0.8525	0.7285	0.5667	0.4267	0.4722	0.6954	0.8969	0.9669	0.9837 (86)	
MIT	19.3499	19.6055	19.9868	20.4283	20.7511	20.9259	20.9793	20.9703	20.8439	20.3952	19.7867	19.3016 (87)	
Th 2	19.8958	19.8981	19.9004	19.9112	19.9132	19.9227	19.9227	19.9244	19.9190	19.9132	19.9091	19.9049 (88)	
util rest of house	0.9758	0.9560	0.9135	0.8216	0.6743	0.4862	0.3281	0.3704	0.6188	0.8677	0.9584	0.9801 (89)	
MIT 2	18.4124	18.6650	19.0367	19.4596	19.7432	19.8847	19.9159	19.9139	19.8290	19.4425	18.8551	18.3716 (90)	
Living area fraction													0.1415 (91)
MIT	18.5451	18.7981	19.1711	19.5967	19.8858	20.0321	20.0664	20.0634	19.9726	19.5773	18.9869	18.5032 (92)	
Temperature adjustment													0.0000
adjusted MIT	18.5451	18.7981	19.1711	19.5967	19.8858	20.0321	20.0664	20.0634	19.9726	19.5773	18.9869	18.5032 (93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9687	0.9461	0.9012	0.8113	0.6728	0.4948	0.3416	0.3841	0.6230	0.8569	0.9491	0.9738	(94)
Useful gains	861.8429	1000.3656	1105.7575	1130.9367	1004.3551	724.6551	479.1411	501.9350	741.5249	872.7107	836.7061	815.1576	(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	2055.9186	2001.0444	1820.0929	1519.4718	1160.3635	762.4896	486.5705	513.2836	827.4593	1272.5657	1692.1608	2045.1378	(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	888.3923	672.4562	531.4655	279.7453	116.0702	0.0000	0.0000	0.0000	0.0000	297.4921	615.9273	915.1052	(98)
Space heating												4316.6541	(98)
Space heating per m2											(98) / (4) =	36.8001	(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 %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4759.2658	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	888.3923	672.4562	531.4655	279.7453	116.0702	0.0000	0.0000	0.0000	0.0000	297.4921	615.9273	915.1052	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	979.4844	741.4070	585.9598	308.4292	127.9716	0.0000	0.0000	0.0000	0.0000	327.9957	679.0819	1008.9363	(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	168.3790	127.8190	105.2206	60.4408	33.1609	17.0540	11.5331	41.0640	63.6024	109.0344	144.7415	167.2812	(64)	
Efficiency of water heater	(217)m	90.2420	90.2409	90.2250	90.1896	90.0625	87.9000	87.9000	87.9000	89.9317	90.1536	90.2557	(217)	
Fuel for water heating, kWh/month	186.5861	141.6420	116.6202	67.0153	36.8199	19.4016	13.1208	46.7167	72.3577	121.2414	160.5500	185.3414	(219)	
Water heating fuel used												1167.4132	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4759.2658	(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)	
pump for solar water heating												50.0000	(230g)	
Total electricity for the above, kWh/year												125.0000	(231)	
Electricity for lighting (calculated in Appendix L)												443.4465	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.76 * 1080 * 1.00) =										-656.3510		-656.3510	(233)	
Total delivered energy for all uses												5838.7746	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4759.2658	3.4800	165.6225	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1167.4132	3.4800	40.6260	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	443.4465	13.1900	58.4906	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-656.3510	13.1900	-86.5727	(252)
Total energy cost			314.6538	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.8143	(257)
SAP value			88.6411	
SAP rating (Section 12)			89	(258)
SAP band			B	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	4759.2658	0.2160	1028.0014 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1167.4132	0.2160	252.1612 (264)
Space and water heating			1280.1627 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	443.4465	0.5190	230.1487 (268)
Energy saving/generation technologies			
PV Unit	-656.3510	0.5190	-340.6462 (269)
Total kg/year			1234.5403 (272)
CO2 emissions per m2			10.5200 (273)
EI value			89.8072
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6700 (2c)	= 156.5955 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.7690 (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) =							
Pressure test										40.0000 / (5) =							0.1348 (8)
Measured/design AP50										Yes							3.9900
Infiltration rate																	0.3343 (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) =							0.3343 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000	(22)				
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250	(22a)				
Adj infilt rate	0.3928	0.3677	0.3677	0.3343	0.3426	0.3259	0.3259	0.3176	0.3176	0.3426	0.3343	0.3426	(22b)				
Effective ac	0.5771	0.5676	0.5676	0.5559	0.5587	0.5531	0.5531	0.5504	0.5504	0.5587	0.5559	0.5587	(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						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			26.7000	1.1450	30.5725			(27)					
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000	(28a)					
Brick and Block	169.9100	28.8200	141.0900	0.2400	33.8616	42.2200	5956.8198	(29a)					
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150	(30)					
Total net area of external elements Aum(A, m2)			287.2100					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.6691			(33)					
GF Block			58.4300			75.0000	4382.2500	(32c)					
GF Stud			34.6800			9.0000	312.1200	(32c)					
FF Stud			127.5000			9.0000	1147.5000	(32c)					
Internal Floor 1			58.6500			18.0000	1055.7000	(32d)					
Internal Ceiling 1			58.6500			18.0000	1055.7000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19370.4048	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							165.1356	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7936	(36)					
Total fabric heat loss						(33) + (36) =	86.4627	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 56.5215	Feb 55.5879	Mar 55.5879	Apr 54.4388	May 54.7158	Jun 54.1686	Jul 54.1686	Aug 53.9053	Sep 53.9053	Oct 54.7158	Nov 54.4388	Dec 54.7158	(38)
Heat transfer coeff	142.9842	142.0505	142.0505	140.9014	141.1784	140.6313	140.6313	140.3679	140.3679	141.1784	140.9014	141.1784	(39)
Average = Sum(39)m / 12 =												141.2018	(39)
HLP	Jan 1.2190	Feb 1.2110	Mar 1.2110	Apr 1.2012	May 1.2036	Jun 1.1989	Jul 1.1989	Aug 1.1967	Sep 1.1967	Oct 1.2036	Nov 1.2012	Dec 1.2036	(40)
HLP (average)												1.2038	(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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	Jan 112.1350	Feb 108.0574	Mar 103.9798	Apr 99.9021	May 95.8245	Jun 91.7468	Jul 91.7468	Aug 95.8245	Sep 99.9021	Oct 103.9798	Nov 108.0574	Dec 112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2632 (H8)
Utilisation factor												0.5469 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.9409 (H14)
Volume ratio Veff/V												0.7357 (H15)
Solar storage volume factor												0.9386 (H16)
Solar input												-914.5098 (H17)
Solar input	-29.8416	-42.4381	-73.6411	-99.0597	-115.1141	-125.2107	-118.7188	-108.2601	-84.7349	-58.5657	-35.2959	-23.6291 (63)
Solar input (sum of months) = Sum (63)m =												-914.5098 (63)
Output from w/h												
	164.0172	127.8993	103.9933	58.4298	37.9424	9.7197	9.1329	34.4321	58.4627	104.8228	139.6684	164.9743 (64)
Total per year (kWh/year) = Sum (64)m =												1013.4950 (64)
Heat gains from water heating, kWh/month												
	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7744	55.7557	45.3436	34.3280	25.6606	21.6638	23.4084	30.4272	40.8393	51.8549	60.5223	64.5191 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3811	424.7433	413.7506	390.3485	360.8074	333.0430	314.4947	310.1324	321.1252	344.5273	374.0684	401.8328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657 (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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900 (71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327 (72)
Total internal gains	681.7467	676.7348	650.4361	609.3637	566.8308	528.9822	507.0070	516.2924	540.0544	581.3601	627.3457	662.5953 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
East					11.4800	25.1733		0.6300	0.7000	0.7700		88.3188 (76)
South					5.7600	56.5862		0.6300	0.7000	0.7700		99.6105 (78)
West					9.4600	25.1733		0.6300	0.7000	0.7700		72.7784 (80)
Solar gains	260.7076	406.4263	626.9646	856.3038	951.0036	1063.3081	977.8493	900.5579	740.1430	503.7219	317.7676	206.9682 (83)
Total gains	942.4544	1083.1612	1277.4007	1465.6675	1517.8344	1592.2904	1484.8563	1416.8503	1280.1974	1085.0820	945.1133	869.5635 (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	37.6312	37.8786	37.8786	38.1875	38.1125	38.2608	38.2608	38.3326	38.3326	38.1125	38.1875	38.1125
alpha	3.5087	3.5252	3.5252	3.5458	3.5408	3.5507	3.5507	3.5555	3.5555	3.5408	3.5458	3.5408
util living area	0.9702	0.9525	0.9035	0.7979	0.6479	0.4355	0.3091	0.3134	0.5671	0.8331	0.9447	0.9758 (86)
MIT	19.6148	19.8153	20.1923	20.6041	20.8576	20.9742	20.9944	20.9944	20.9350	20.6193	20.0768	19.5837 (87)
Th 2	19.9049	19.9112	19.9112	19.9190	19.9171	19.9209	19.9209	19.9227	19.9227	19.9171	19.9190	19.9171 (88)
util rest of house	0.9633	0.9419	0.8826	0.7570	0.5812	0.3493	0.2097	0.2096	0.4744	0.7863	0.9298	0.9700 (89)
MIT 2	18.6811	18.8809	19.2414	19.6230	19.8304	19.9108	19.9198	19.9217	19.8929	19.6468	19.1452	18.6605 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.8132	19.0131	19.3759	19.7618	19.9758	20.0613	20.0719	20.0735	20.0403	19.7844	19.2771	18.7911 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8132	19.0131	19.3759	19.7618	19.9758	20.0613	20.0719	20.0735	20.0403	19.7844	19.2771	18.7911 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9543	0.9309	0.8704	0.7504	0.5850	0.3608	0.2238	0.2244	0.4851	0.7797	0.9186	0.9621	(94)
Useful gains	899.4250	1008.3586	1111.8391	1099.7966	887.9708	574.5077	332.2735	317.8887	621.0054	846.0387	868.2255	836.5923	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	1889.2840	1848.5170	1672.7788	1361.3616	970.7101	585.2082	333.5633	319.1244	651.3553	1084.8706	1504.4142	1848.1864	(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	736.4551	564.5864	417.3391	188.3268	61.5581	0.0000	0.0000	0.0000	0.0000	177.6909	458.0558	752.6260	(98)
Space heating												3356.6383	(98)
Space heating per m2											(98) / (4) =	28.6158	(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 %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3700.8140	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	736.4551	564.5864	417.3391	188.3268	61.5581	0.0000	0.0000	0.0000	0.0000	177.6909	458.0558	752.6260	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	811.9682	622.4768	460.1313	207.6370	67.8700	0.0000	0.0000	0.0000	0.0000	195.9106	505.0230	829.7971	(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	164.0172	127.8993	103.9933	58.4298	37.9424	9.7197	9.1329	34.4321	58.4627	104.8228	139.6684	164.9743	(64)	
Efficiency of water heater	90.1768	90.1695	90.1273	90.0210	89.6115	87.9000	87.9000	87.9000	87.9000	89.6405	90.0299	90.1835	(216)	
Fuel for water heating, kWh/month	181.8840	141.8432	115.3849	64.9069	42.3410	11.0577	10.3901	39.1719	66.5105	116.9368	155.1356	182.9318	(219)	
Water heating fuel used												1128.4945	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3700.8140	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													443.4465	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.76 * 1206 * 1.00) =										-733.2542			-733.2542	(233)
Total delivered energy for all uses													4664.5008	(238)

10a. Fuel costs - using BEDF prices (491)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3700.8140	3.6300	134.3395	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1128.4945	3.6300	40.9644	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	443.4465	19.4400	86.2060	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-733.2542	19.4400	-142.5446	(252)
Total energy cost			238.2653	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3700.8140	0.2160	799.3758	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1128.4945	0.2160	243.7548	(264)
Space and water heating			1043.1306	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	443.4465	0.5190	230.1487	(268)
Energy saving/generation technologies				
PV Unit	-733.2542	0.5190	-380.5589	(269)
Total kg/year			957.5954	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3700.8140	1.2200	4514.9931	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1128.4945	1.2200	1376.7633	(264)
Space and water heating			5891.7564	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	443.4465	3.0700	1361.3808	(268)
Energy saving/generation technologies				
PV Unit	-733.2542	3.0700	-2251.0905	(269)
Primary energy kWh/year			5385.7968	(272)
Primary energy kWh/m2/year			45.9147	(273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 65	Issued on Date	22/03/2022
Assessment Reference	As Built	Prop Type Ref	L
Project	3 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.62	TER	17.35
Environmental	88 B	% DER<TER	21.48		
CO ₂ Emissions (t/year)	1.15	DFEE	46.64	TFEE	58.20
General Requirements Compliance	Pass	% DFEE<TFEE	19.86		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Earthwool Loft Roll 40						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Earthwool Loft Roll 40						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Earthwool Loft Roll 40						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance:	Upper limit = 11.200 m ² K/W	Lower limit = 10.901 m ² K/W	Average = 11.050 m ² K/W
	Total correction = 0.0065 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 65	Issued on Date	22/03/2022
Assessment Reference	As Built	Prop Type Ref	L
Project	3 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.62	TER	17.35
Environmental	88 B	% DER<TER	21.48		
CO ₂ Emissions (t/year)	1.15	DFEE	46.64	TFEE	58.20
General Requirements Compliance	Pass	% DFEE<TFEE	19.86		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Wall 000001

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Brick, outer leaf						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.321 m ² K/W	Lower limit = 4.110 m ² K/W	Average = 4.215 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None		
Total thickness: 330 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 65	Issued on Date	22/03/2022
Assessment Reference	As Built	Prop Type Ref	L
Project	3 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.62	TER	17.35
Environmental	88 B	% DER<TER	21.48		
CO ₂ Emissions (t/year)	1.15	DFEE	46.64	TFEE	58.20
General Requirements Compliance	Pass	% DFEE<TFEE	19.86		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 35.11 m², Perimeter = 16.79 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Concrete, medium density						
	Main construction	100	1.3500	0.0741	100.00		
Layer 2	Polythene,1000 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Celotex XR4000						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Polythene, 500 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 5	Screed						
	Main construction	70	1.1500	0.0609	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.953 m² K/W Lower limit = 6.953 m² K/W Average = 6.953 m² K/W

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 65	Issued on Date	22/03/2022
Assessment Reference	As Built	Prop Type Ref	L
Property	3 Fred Woolley Walk, West End, Southampton, SO30 3LF		
SAP Rating	88 B	DER	13.62
Environmental	88 B	TER	17.35
CO ₂ Emissions (t/year)	1.15	% DER<TER	21.48
General Requirements Compliance	Pass	DLEE	46.64
		TFEE	58.20
		% DLEE<TFEE	19.86
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	33.58 m	58.65 m ²
	1st Storey:	33.58 m	58.65 m ²
			2.39 m
			2.67 m

7.0 Living Area	16.60	m ²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	165.14	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	169.91	141.09

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
		Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill		70.00	

9.2 Internal Walls				
Description	Construction	Kappa (kJ/m ² K)	Area (m ²)	
GF Block	Dense block, plasterboard on dabs	75.00	58.43	
GF Stud	Plasterboard on timber frame	9.00	34.68	
FF Stud	Plasterboard on timber frame	9.00	127.50	

10.0 External Roofs					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	58.65
					58.65

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	58.65

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	58.65

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	58.65

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Solid Door							1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	West							2.12	
Front Elevation	Window	[1] Brick and Block	West	None	0.00					9.46	
Rear Elevation	Window	[1] Brick and Block	East	None	0.00					11.48	
Side Elevation	Window	[1] Brick and Block	South	None	0.00					5.76	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.83	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.01	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	8.40	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.02	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	7.08	0.064	No	Birtley Supatherm
Independently assessed	E3 Sill	17.30	0.021	No	Knauf P5
Independently assessed	E4 Jamb	42.90	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	33.58	0.060	No	CBA - 302
Independently assessed	E6 Intermediate floor within a dwelling	33.58	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	18.70	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	14.88	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	25.25	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	5.05	-0.091	No	Knauf P24

Y-value	0.024	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	3.99	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
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20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	23	
Total number of L.E.L. fittings	23	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	17515	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.7	
In Summer	87.9	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	Gas/Oil, time clock	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.76	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£28	B 89	