

PREDICTED ENERGY ASSESSMENT

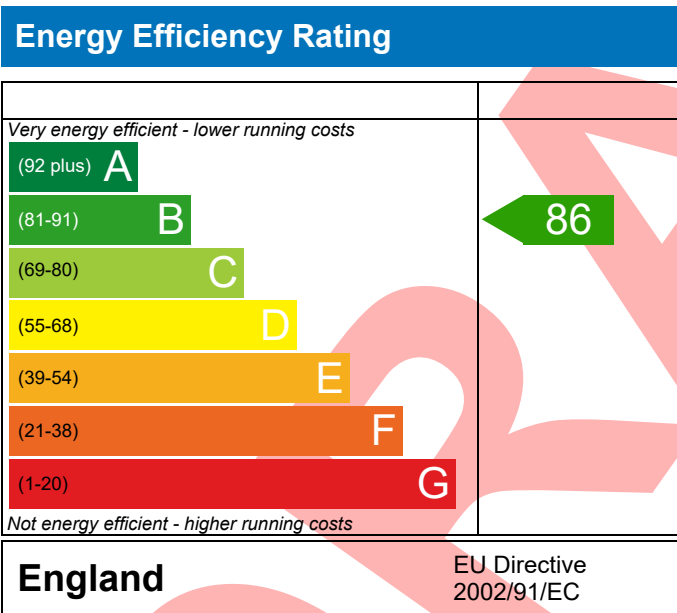


Plot 13

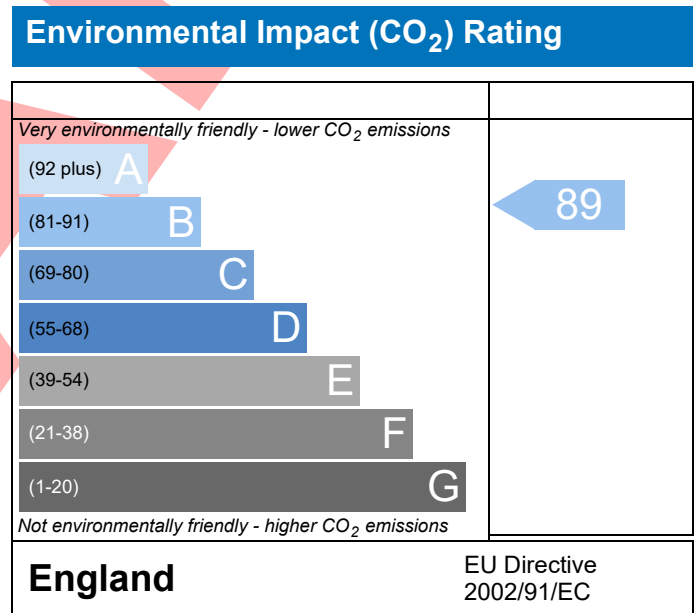
Dwelling type: House, Semi-Detached
 Date of assessment: 15/12/2021
 Produced by: Sebastian Ingham
 Total floor area: 72.69 m²

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

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



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



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

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)



Property Reference	Plot 13	Issued on Date	15/12/2021
Assessment Reference	As Designed + PV	Prop Type Ref	Kynnersley a.k.a Stretton
Property	Plot 13		

SAP Rating	86 B	DER	15.23	TER	19.41
Environmental	89 B	% DER<TER	21.53		
CO ₂ Emissions (t/year)	0.92	DFEE	48.88	TFEE	54.06
General Requirements Compliance	Pass	% DFEE<TFEE	9.58		

Assessor Details	Mr. Sebastian Ingham, Sebastian Ingham, Tel: 07817728156, sebastian@idea-ingham.co.uk	Assessor ID	T245-0001
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Client	
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SUMMARY FOR INPUT DATA FOR New Build (As Designed)

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)	19.41	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.23	kgCO ₂ /m ²	Pass
	-4.18 (-21.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.06	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.88	kWh/m ² /yr	
	-5.2 (-9.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	Pass
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	Pass
Openings	1.48 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)



Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB)
Combi boiler
Efficiency: 89.3% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Midlands)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North East

5.94 m², No overhang

Windows facing South West

2.60 m², No overhang

Windows facing North West

1.43 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.01 (design value) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.09

W/m²K

Photovoltaic array

0.85

kW

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RECOMMENDATIONS



	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£28	B 88	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£28	B 88	B 91	

DRAFT

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)



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Assessment Reference	As Designed + PV	Prop Type Ref	Kynnersley a.k.a Stretton	
Property	Plot 13			

SAP Rating	86 B	DER	15.23	TER	19.41
Environmental	89 B	% DER<TER	21.53		
CO ₂ Emissions (t/year)	0.92	DFEE	48.88	TFEE	54.06
General Requirements Compliance	Pass	% DFEE<TFEE	9.58		

Assessor Details	Mr. Sebastian Ingham, Sebastian Ingham, Tel: 07817728156, sebastian@idea-ingham.co.uk	Assessor ID	T245-0001
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.209	8.93	1.87	
External wall	E3 Sill	Independently assessed	0.013	7.92	0.10	
External wall	E4 Jamb	Independently assessed	0.018	23.10	0.42	
External wall	E5 Ground floor (normal)	Independently assessed	0.107	17.80	1.90	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	15.44	0.00	
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.060	9.80	0.59	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.240	1.46	0.35	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.091	9.46	0.86	
External wall	E16 Corner (normal)	Independently assessed	0.067	12.24	0.82	
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.117	2.40	-0.28	
External wall	E18 Party wall between dwellings	Independently assessed	0.043	4.92	0.21	
Party wall	P1 Party wall - Ground floor	Independently assessed	0.100	9.46	0.95	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Independently assessed	0.000	8.56	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.079	9.46	0.75	
External wall	E25 Staggered party wall between dwellings	Table K1 - Default	0.120	4.92	0.59	

Total: **9.12** W/mK:
 Y-Value: **0.057** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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Property	Plot 13				
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CO₂ Emissions (t/year)	0.92	DFEE	48.88	TFEE	54.06
General Requirements Compliance	Pass	% DFEE<TFEE	9.58		
Assessor Details	Mr. Sebastian Ingham, Sebastian Ingham, Tel: 07817728156, sebastian@idea-ingham.co.uk			Assessor ID	T245-0001
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 73 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.41 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.23 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 48.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.48 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Data from database

Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB)

Combi boiler

Efficiency: 89.3% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading:

Average

Windows facing North East: 5.94 m², No overhang

Windows facing South West: 2.60 m², No overhang

Windows facing North West: 1.43 m², No overhang

Air change rate: 8.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.09 W/m²K

Photovoltaic array 0.85 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.0000 (1b)	2.4000 (2b)	88.8000 (1b) - (3b)
First floor	35.6900 (1c)	2.5200 (2c)	89.9388 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 178.7388 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.2238 (8)
Pressure test				Yes	
Measured/design AP50					5.0100
Infiltration rate					0.4743 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4031 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5140	0.5039	0.4939	0.4435	0.4334	0.3830	0.3830	0.3729	0.4031	0.4334	0.4535	0.4737 (22b)
	0.6321	0.6270	0.6219	0.5983	0.5939	0.5733	0.5733	0.5695	0.5813	0.5939	0.6028	0.6122 (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
Windows (Uw = 1.50)			9.9700	1.4151	14.1085		(27)
Doors			2.1200	1.4000	2.9680		(26)
Heat Loss Floor			37.0000	0.1300	4.8100	110.0000	4070.0000 (28a)
External Wall	85.3000	12.0900	73.2100	0.2500	18.3025	60.0000	4392.6000 (29a)
External Roof	37.0000		37.0000	0.0900	3.3300	9.0000	333.0000 (30)
Total net area of external elements Aum(A, m2)			159.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5190		(33)
Party Wall			44.2700	0.0000	0.0000	45.0000	1992.1500 (32)
Internal Wall - studs			131.4800			9.0000	1183.3200 (32c)
Internal Floor 1			35.6900			18.0000	642.4200 (32d)
Internal Ceiling 1			35.6900			18.0000	642.4200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13255.9100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 182.3622 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1236 (36)
 Total fabric heat loss (33) + (36) = 52.6426 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	37.2839	36.9813	36.6848	35.2917	35.0311	33.8178	33.8178	33.5931	34.2851	35.0311	35.5583	36.1096 (38)
Average = Sum(39)m / 12 =	89.9265	89.6239	89.3273	87.9343	87.6736	86.4604	86.4604	86.2357	86.9277	87.6736	88.2009	88.7521 (39)
												87.9330 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2371	1.2330	1.2289	1.2097	1.2061	1.1894	1.1894	1.1863	1.1959	1.2061	1.2134	1.2210 (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 2.3096 (42)
 Average daily hot water use (litres/day) 89.0535 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	97.9588	94.3967	90.8346	87.2724	83.7103	80.1481	80.1481	83.7103	87.2724	90.8346	94.3967	97.9588 (44)
Energy content (annual)	145.2701	127.0542	131.1085	114.3036	109.6770	94.6429	87.7006	100.6377	101.8396	118.6843	129.5532	140.6864 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1401.1582 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:	21.7905	19.0581	19.6663	17.1455	16.4516	14.1964	13.1551	15.0957	15.2759	17.8026	19.4330	21.1030 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6404	0.5397	0.5359	0.4489	0.4131	0.3413	0.3163	0.3791	0.4000	0.4851	0.5503	0.6202 (61)
Total heat required for water heating calculated for each month	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065 (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	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065 (64)
Heat gains from water heating, kWh/month	48.4624	42.3804	43.7276	38.1182	36.5709	31.5541	29.2395	33.5568	33.9617	39.5838	43.2140	46.9333 (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	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.5498	17.3640	14.1213	10.6908	7.9915	6.7467	7.2901	9.4759	12.7186	16.1491	18.8484	20.0932 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.4922	205.6038	200.2826	188.9544	174.6546	161.2148	152.2362	150.1246	155.4458	166.7739	181.0738	194.5136 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481 (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)	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848 (71)
Water heating gains (Table 5)	65.1377	63.0661	58.7736	52.9419	49.1544	43.8252	39.3004	45.1032	47.1690	53.2040	60.0195	63.0823 (72)
Total internal gains	348.8239	346.6782	333.8218	313.2314	292.4448	272.4310	259.4710	265.3480	275.9776	296.7714	320.5860	338.3334 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
Northeast	5.9400	11.2829	0.7300	0.7000	0.7700	23.7336 (75)						
Southwest	2.6000	36.7938	0.7300	0.7000	0.7700	33.8768 (79)						
Northwest	1.4300	11.2829	0.7300	0.7000	0.7700	5.7136 (81)						
Solar gains	63.3240	117.6454	186.9481	275.1851	347.9782	362.9456	342.6424	285.6624	217.0829	137.0282	77.6288	53.0396 (83)
Total gains	412.1480	464.3236	520.7699	588.4164	640.4230	635.3766	602.1134	551.0105	493.0605	433.7997	398.2148	391.3729 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	40.9468	41.0850	41.2214	41.8744	41.9989	42.5883	42.5883	42.6992	42.3593	41.9989	41.7478	41.4886
tau	3.7298	3.7390	3.7481	3.7916	3.7999	3.8392	3.8392	3.8466	3.8240	3.7999	3.7832	3.7659
alpha	0.9941	0.9902	0.9801	0.9498	0.8751	0.7353	0.5871	0.6484	0.8624	0.9679	0.9904	0.9952 (86)
util living area	19.2407	19.4146	19.7332	20.1811	20.5864	20.8597	20.9561	20.9358	20.7161	20.2019	19.6530	19.2189 (87)
MIT	19.8904	19.8937	19.8970	19.9122	19.9151	19.9285	19.9285	19.9309	19.9233	19.9151	19.9093	19.9033 (88)
Th 2	0.9926	0.9876	0.9745	0.9347	0.8354	0.6515	0.4629	0.5258	0.8030	0.9555	0.9874	0.9940 (89)
util rest of house	17.5477	17.8030	18.2677	18.9188	19.4750	19.8170	19.9068	19.8957	19.6606	18.9594	18.1618	17.5239 (90)
Living area fraction	17.9359	18.1726	18.6038	19.2083	19.7299	20.0561	20.1474	20.1343	19.9027	19.2443	18.5038	17.9126 (92)
MIT	17.7859	18.0226	18.4538	19.0583	19.5799	19.9061	19.9974	19.9843	19.7527	19.0943	18.3538	17.7626 (93)
Temperature adjustment												-0.1500
adjusted MIT												17.7626 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	407.2599	455.5148	502.0653	540.7163	525.5029	412.7239	283.8730	293.4587	390.1794	408.6923	390.5883	387.5149 (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	1212.7425	1176.0977	1067.7993	893.2642	690.8556	458.7688	293.7431	309.0903	491.3750	744.7289	992.5957	1203.7116 (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	599.2791	484.2317	420.9061	253.8344	123.0224	0.0000	0.0000	0.0000	0.0000	250.0112	433.4453	607.2503 (98)
Space heating												3171.9805 (98)
Space heating per m2												(98) / (4) = 43.6371 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3516.6081 (211)
Space heating requirement	599.2791	484.2317	420.9061	253.8344	123.0224	0.0000	0.0000	0.0000	0.0000	250.0112	433.4453	607.2503	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	664.3892	536.8423	466.6365	281.4129	136.3884	0.0000	0.0000	0.0000	0.0000	277.1743	480.5381	673.2265	(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	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065	(64)
Efficiency of water heater (217)m	87.1188	86.9256	86.4784	85.3976	83.1104	76.4000	76.4000	76.4000	76.4000	85.2306	86.5892	87.2258	(216)
Fuel for water heating, kWh/month	167.4845	146.7852	152.2280	134.3743	132.4626	124.3250	115.2054	132.2210	133.8215	139.8200	150.2538	162.0008	(219)
Water heating fuel used													1690.9821 (219)
Annual totals kWh/year													
Space heating fuel - main system													3516.6081 (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)													345.2559 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.85 * 1029 * 0.65) =										-454.9005			-454.9005 (233)
Total delivered energy for all uses													5172.9455 (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	3516.6081	0.2160	759.5873	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1690.9821	0.2160	365.2521	(264)
Space and water heating			1124.8395	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	345.2559	0.5190	179.1878	(268)
Energy saving/generation technologies				
PV Unit	-454.9005	0.5190	-236.0934	(269)
Total CO2, kg/year			1106.8589	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.2300	(273)

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

DER		15.2300	ZC1
Total Floor Area		72.6900	TFA
Assumed number of occupants		2.3096	N
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	EF
CO2 emissions from appliances, equation (L14)		16.5890	ZC2
CO2 emissions from cooking, equation (L16)		2.3997	ZC3
Total CO2 emissions		34.2186	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.2186	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.0000 (1b)	2.4000 (2b)	88.8000 (1b) - (3b)
First floor	35.6900 (1c)	2.5200 (2c)	89.9388 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 178.7388 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1678 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4178 (18)							
Number of sides sheltered					2 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3552 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4528	0.4440	0.4351	0.3907	0.3818	0.3374	0.3374	0.3285	0.3552	0.3818	0.3996	0.4173 (22b)
Effective ac	0.6025	0.5985	0.5946	0.5763	0.5729	0.5569	0.5569	0.5540	0.5631	0.5729	0.5798	0.5871 (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)			9.9700	1.3258	13.2178		(27)					
Heat Loss Floor			37.0000	0.1300	4.8100		(28a)					
External Wall	85.3000	12.0900	73.2100	0.1800	13.1778		(29a)					
External Roof	37.0000		37.0000	0.1300	4.8100		(30)					
Total net area of external elements Aum(A, m2)			159.3000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		38.1356 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7195 (36)					
Total fabric heat loss							(33) + (36) = 47.8551 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.5396	Feb 35.3047	Mar 35.0745	Apr 33.9933	May 33.7911	Jun 32.8494	Jul 32.8494	Aug 32.6750	Sep 33.2121	Oct 33.7911	Nov 34.2003	Dec 34.6281 (38)
Heat transfer coeff	83.3947	83.1598	82.9296	81.8484	81.6462	80.7045	80.7045	80.5301	81.0672	81.6462	82.0554	82.4832 (39)
Average = Sum(39)m / 12 =												81.8475 (39)
HLP	Jan 1.1473	Feb 1.1440	Mar 1.1409	Apr 1.1260	May 1.1232	Jun 1.1103	Jul 1.1103	Aug 1.1079	Sep 1.1152	Oct 1.1232	Nov 1.1288	Dec 1.1347 (40)
HLP (average)												1.1260 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.3096 (42)
Average daily hot water use (litres/day)												89.0535 (43)
Daily hot water use	97.9588	94.3967	90.8346	87.2724	83.7103	80.1481	80.1481	83.7103	87.2724	90.8346	94.3967	97.9588 (44)
Energy conte	145.2701	127.0542	131.1085	114.3036	109.6770	94.6429	87.7006	100.6377	101.8396	118.6843	129.5532	140.6864 (45)
Energy content (annual)												Total = Sum(45)m = 1401.1582 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	21.7905	19.0581	19.6663	17.1455	16.4516	14.1964	13.1551	15.0957	15.2759	17.8026	19.4330	21.1030 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Total heat required for water heating calculated for each month	49.9188	43.4483	46.2883	43.0385	42.6578	39.5251	40.8426	42.6578	43.0385	46.2883	46.5518	49.9188	61											
Solar input	195.1889	170.5025	177.3968	157.3421	152.3349	134.1680	128.5432	143.2956	144.8781	164.9726	176.1050	190.6051	62											
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	63											
Heat gains from water heating, kWh/month	195.1889	170.5025	177.3968	157.3421	152.3349	134.1680	128.5432	143.2956	144.8781	164.9726	176.1050	190.6051	64											
	60.7820	53.1076	55.1657	48.7656	47.1321	41.3501	39.3711	44.1265	44.6213	51.0346	54.7144	59.2579	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	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.5498	17.3640	14.1213	10.6908	7.9915	6.7467	7.2901	9.4759	12.7186	16.1491	18.8484	20.0932	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.4922	205.6038	200.2826	188.9544	174.6546	161.2148	152.2362	150.1246	155.4458	166.7739	181.0738	194.5136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	(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)	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	(71)
Water heating gains (Table 5)	81.6962	79.0292	74.1474	67.7299	63.3496	57.4306	52.9181	59.3098	61.9740	68.5949	75.9922	79.6477	(72)
Total internal gains	365.3825	362.6412	349.1956	328.0194	306.6399	286.0365	273.0887	279.5546	290.7827	312.1623	336.5587	354.8988	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	5.9400	11.2829	0.6300	0.7000	0.7700	20.4824 (75)							
Southwest	2.6000	36.7938	0.6300	0.7000	0.7700	29.2362 (79)							
Northwest	1.4300	11.2829	0.6300	0.7000	0.7700	4.9309 (81)							
Solar gains	54.6495	101.5296	161.3388	237.4885	300.3100	313.2271	295.7050	246.5306	187.3455	118.2572	66.9947	45.7739	(83)
Total gains	420.0320	464.1708	510.5344	565.5079	606.9499	599.2635	568.7938	526.0852	478.1282	430.4195	403.5534	400.6726	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5305	60.7014	60.8699	61.6739	61.8267	62.5482	62.5482	62.6836	62.2683	61.8267	61.5184	61.1993	
alpha	5.0354	5.0468	5.0580	5.1116	5.1218	5.1699	5.1699	5.1789	5.1512	5.1218	5.1012	5.0800	
util living area	0.9983	0.9969	0.9924	0.9747	0.9146	0.7699	0.6026	0.6659	0.8955	0.9846	0.9968	0.9987	(86)
MIT	19.7418	19.8668	20.0995	20.4301	20.7349	20.9283	20.9839	20.9738	20.8294	20.4478	20.0424	19.7231	(87)
Th 2	19.9624	19.9650	19.9676	19.9797	19.9819	19.9925	19.9925	19.9944	19.9884	19.9819	19.9773	19.9726	(88)
util rest of house	0.9978	0.9958	0.9896	0.9643	0.8783	0.6820	0.4756	0.5387	0.8368	0.9764	0.9954	0.9983	(89)
MIT 2	18.2829	18.4674	18.8082	19.2926	19.7098	19.9420	19.9862	19.9829	19.8412	19.3245	18.7332	18.2628	(90)
Living area fraction	fLA = Living area / (4) =												0.2293 (91)
MIT	18.6175	18.7883	19.1043	19.5534	19.9449	20.1682	20.2150	20.2101	20.0678	19.5821	19.0334	18.5977	(92)
Temperature adjustment													0.0000
adjusted MIT	18.6175	18.7883	19.1043	19.5534	19.9449	20.1682	20.2150	20.2101	20.0678	19.5821	19.0334	18.5977	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	418.6158	461.3700	503.4784	542.1219	532.1214	418.8245	287.1700	298.7035	402.7393	418.3525	400.9633	399.6071	(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	1194.0031	1154.9470	1045.2727	871.9668	673.1626	449.3777	291.7486	306.8303	483.7965	733.3532	979.2014	1187.5691	(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	576.8881	466.0837	403.0950	237.4883	104.9346	0.0000	0.0000	0.0000	0.0000	234.3606	416.3314	586.2437	(98)
Space heating													3025.4254 (98)
Space heating per m2													(98) / (4) = 41.6209 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3239.2135 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	576.8881	466.0837	403.0950	237.4883	104.9346	0.0000	0.0000	0.0000	0.0000	234.3606	416.3314	586.2437 (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)	617.6532	499.0190	431.5792	254.2701	112.3497	0.0000	0.0000	0.0000	0.0000	250.9214	445.7509	627.6699 (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	195.1889	170.5025	177.3968	157.3421	152.3349	134.1680	128.5432	143.2956	144.8781	164.9726	176.1050	190.6051 (64)
Efficiency of water heater (217)m	87.6140	87.4538	87.0539	86.0851	84.1340	80.3000	80.3000	80.3000	80.3000	85.9347	87.1419	80.3000 (216)
Fuel for water heating, kWh/month	222.7826	194.9629	203.7782	182.7750	181.0621	167.0835	160.0787	178.4503	180.4210	191.9744	202.0899	217.3532 (219)
Water heating fuel used												2282.8118 (219)
Annual totals kWh/year												
Space heating fuel - main system												3239.2135 (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)												345.2559 (232)
Total delivered energy for all uses												5942.2812 (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	3239.2135	0.2160	699.6701 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2282.8118	0.2160	493.0874 (264)
Space and water heating			1192.7575 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	345.2559	0.5190	179.1878 (268)
Total CO2, kg/m2/year			1410.8703 (272)
Emissions per m2 for space and water heating			16.4088 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4651 (272b)
Emissions per m2 for pumps and fans			0.5355 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4088 * 1.00) + 2.4651 + 0.5355, rounded to 2 d.p.			19.4100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.0000 (1b)	x 2.4000 (2b)	= 88.8000 (1b) - (3b)
First floor	35.6900 (1c)	x 2.5200 (2c)	= 89.9388 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 178.7388 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1678 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4183 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3556 (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	0.4534	0.4445	0.4356	0.3912	0.3823	0.3378	0.3378	0.3289	0.3556	0.3823	0.4000	0.4178 (22b)
Effective ac	0.6028	0.5988	0.5949	0.5765	0.5731	0.5571	0.5571	0.5541	0.5632	0.5731	0.5800	0.5873 (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
Windows (Uw = 1.50)			9.9700	1.4151	14.1085		(27)
Doors			2.1200	1.4000	2.9680		(26)
Heat Loss Floor			37.0000	0.1300	4.8100	110.0000	4070.0000 (28a)
External Wall	85.3000	12.0900	73.2100	0.2500	18.3025	60.0000	4392.6000 (29a)
External Roof	37.0000		37.0000	0.0900	3.3300	9.0000	333.0000 (30)
Total net area of external elements Aum(A, m ²)			159.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5190		(33)
Party Wall			44.2700	0.0000	0.0000	45.0000	1992.1500 (32)
Internal Wall - studs			131.4800			9.0000	1183.3200 (32c)
Internal Floor 1			35.6900			18.0000	642.4200 (32d)
Internal Ceiling 1			35.6900			9.0000	321.2100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12934.7000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 177.9433 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1236 (36)
 Total fabric heat loss (33) + (36) = 52.6426 (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	35.5540	35.3186	35.0879	34.0041	33.8014	32.8574	32.8574	32.6826	33.2210	33.8014	34.2116	34.6404 (38)
Heat transfer coeff	88.1966	87.9612	87.7305	86.6467	86.4439	85.5000	85.5000	85.3252	85.8636	86.4439	86.8541	87.2830 (39)
Average = Sum(39)m / 12 =												86.6457 (39)
HLP	1.2133	1.2101	1.2069	1.1920	1.1892	1.1762	1.1762	1.1738	1.1812	1.1892	1.1949	1.2008 (40)
HLP (average)												1.1920 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.3096 (42)
Average daily hot water use (litres/day)												89.0535 (43)
Daily hot water use	97.9588	94.3967	90.8346	87.2724	83.7103	80.1481	80.1481	83.7103	87.2724	90.8346	94.3967	97.9588 (44)
Energy conte	145.2701	127.0542	131.1085	114.3036	109.6770	94.6429	87.7006	100.6377	101.8396	118.6843	129.5532	140.6864 (45)
Energy content (annual)												Total = Sum(45)m = 1401.1582 (45)
Distribution loss (46)m = 0.15 x (45)m												

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Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	30.8699	26.9990	27.8606	24.2895	23.3064	20.1116	18.6364	21.3855	21.6409	25.2204	27.5301	29.8959		(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	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.5498	17.3640	14.1213	10.6908	7.9915	6.7467	7.2901	9.4759	12.7186	16.1491	18.8484	20.0932	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.4922	205.6038	200.2826	188.9544	174.6546	161.2148	152.2362	150.1246	155.4458	166.7739	181.0738	194.5136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	(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)	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	(71)
Water heating gains (Table 5)	41.4918	40.1771	37.4470	33.7354	31.3258	27.9328	25.0489	28.7440	30.0568	33.8984	38.2362	40.1826	(72)
Total internal gains	322.1781	320.7892	309.4952	291.0249	271.6161	253.5386	242.2195	245.9888	255.8655	274.4658	295.8027	312.4336	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W
Northeast	5.9400	11.2829	0.7300	0.7000	0.7700	23.7336 (75)
Southwest	2.6000	36.7938	0.7300	0.7000	0.7700	33.8768 (79)
Northwest	1.4300	11.2829	0.7300	0.7000	0.7700	5.7136 (81)

Solar gains	63.3240	117.6454	186.9481	275.1851	347.9782	362.9456	342.6424	285.6624	217.0829	137.0282	77.6288	53.0396	(83)
Total gains	385.5021	438.4345	496.4433	566.2100	619.5943	616.4843	584.8618	531.6512	472.9484	411.4940	373.4315	365.4732	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	40.7382	40.8472	40.9547	41.4669	41.5642	42.0231	42.0231	42.1092	41.8451	41.5642	41.3679	41.1646	(85)
alpha	3.7159	3.7231	3.7303	3.7645	3.7709	3.8015	3.8015	3.8073	3.7897	3.7709	3.7579	3.7443	
util living area	0.9949	0.9912	0.9816	0.9522	0.8793	0.7421	0.5945	0.6590	0.8699	0.9708	0.9916	0.9959	(86)
MIT	19.2041	19.3805	19.7042	20.1562	20.5704	20.8509	20.9526	20.9299	20.6993	20.1718	19.6142	19.1772	(87)
Th 2	19.9094	19.9119	19.9145	19.9264	19.9286	19.9391	19.9391	19.9410	19.9350	19.9286	19.9241	19.9194	(88)
util rest of house	0.9936	0.9889	0.9765	0.9380	0.8412	0.6602	0.4712	0.5377	0.8134	0.9596	0.9890	0.9948	(89)
MIT 2	18.2712	18.4487	18.7718	19.2234	19.6134	19.8567	19.9226	19.9140	19.7418	19.2464	18.6914	18.2519	(90)
Living area fraction									fLA = Living area / (4) =			0.2293	(91)
MIT	18.4851	18.6624	18.9856	19.4374	19.8329	20.0847	20.1588	20.1469	19.9614	19.4586	18.9030	18.4641	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4851	18.6624	18.9856	19.4374	19.8329	20.0847	20.1588	20.1469	19.9614	19.4586	18.9030	18.4641	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9913	0.9853	0.9707	0.9299	0.8372	0.6727	0.4985	0.5635	0.8151	0.9531	0.9856	0.9928	(94)
Useful gains	382.1295	432.0076	481.9217	526.5381	518.7210	414.6816	291.5527	299.5794	385.4861	392.1974	368.0493	362.8425	(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	1251.0798	1210.5538	1095.3682	913.0268	703.0390	468.9440	304.2803	319.7086	503.2804	765.7721	1025.1407	1245.0157	(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	646.4990	523.1830	456.4042	278.2719	137.1326	0.0000	0.0000	0.0000	0.0000	277.9396	473.1058	656.3369	(98)
Space heating												3448.8729	(98)
Space heating per m2												(98) / (4) =	47.4463 (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	803.6998	632.6999	648.4714	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7934	0.8609	0.8251	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	637.6175	544.6907	535.0706	0.0000	0.0000	0.0000	0.0000	(102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	807.0006	768.3431	707.7512	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	121.9559	166.3974	128.4744	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												416.8276 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	30.4890	41.5994	32.1186	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												104.2069 (107)
Space cooling per m2												1.4336 (108)
Energy for space heating												47.4463 (99)
Energy for space cooling												1.4336 (108)
Total												48.8799 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.9 (109)

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.0000 (1b)	x 2.4000 (2b)	= 88.8000 (1b) - (3b)
First floor	35.6900 (1c)	x 2.5200 (2c)	= 89.9388 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.7388 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					3 * 10 = 30.0000 (7a)							
Number of passive vents					0 * 10 = 0.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1678 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4178 (18)							
Number of sides sheltered					2 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3552 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4528	0.4440	0.4351	0.3907	0.3818	0.3374	0.3374	0.3285	0.3552	0.3818	0.3996	0.4173 (22b)
Effective ac	0.6025	0.5985	0.5946	0.5763	0.5729	0.5569	0.5569	0.5540	0.5631	0.5729	0.5798	0.5871 (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)			9.9700	1.3258	13.2178		(27)					
Heat Loss Floor			37.0000	0.1300	4.8100		(28a)					
External Wall	85.3000	12.0900	73.2100	0.1800	13.1778		(29a)					
External Roof	37.0000		37.0000	0.1300	4.8100		(30)					
Total net area of external elements Aum(A, m2)			159.3000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		38.1356 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7195 (36)					
Total fabric heat loss							(33) + (36) = 47.8551 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.5396	Feb 35.3047	Mar 35.0745	Apr 33.9933	May 33.7911	Jun 32.8494	Jul 32.8494	Aug 32.6750	Sep 33.2121	Oct 33.7911	Nov 34.2003	Dec 34.6281 (38)
Heat transfer coeff	83.3947	83.1598	82.9296	81.8484	81.6462	80.7045	80.7045	80.5301	81.0672	81.6462	82.0554	82.4832 (39)
Average = Sum(39)m / 12 =												81.8475 (39)
HLP	Jan 1.1473	Feb 1.1440	Mar 1.1409	Apr 1.1260	May 1.1232	Jun 1.1103	Jul 1.1103	Aug 1.1079	Sep 1.1152	Oct 1.1232	Nov 1.1288	Dec 1.1347 (40)
HLP (average)												1.1260 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.3096 (42)
Average daily hot water use (litres/day)												89.0535 (43)
Daily hot water use	97.9588	94.3967	90.8346	87.2724	83.7103	80.1481	80.1481	83.7103	87.2724	90.8346	94.3967	97.9588 (44)
Energy conte	145.2701	127.0542	131.1085	114.3036	109.6770	94.6429	87.7006	100.6377	101.8396	118.6843	129.5532	140.6864 (45)
Energy content (annual)												Total = Sum(45)m = 1401.1582 (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 (46)
If cylinder contains dedicated solar storage												

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Calculation Type: New Build (As Designed)



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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	30.8699	26.9990	27.8606	24.2895	23.3064	20.1116	18.6364	21.3855	21.6409	25.2204	27.5301	29.8959	(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	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	115.4810	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.5498	17.3640	14.1213	10.6908	7.9915	6.7467	7.2901	9.4759	12.7186	16.1491	18.8484	20.0932	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	203.4922	205.6038	200.2826	188.9544	174.6546	161.2148	152.2362	150.1246	155.4458	166.7739	181.0738	194.5136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	34.5481	(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)													
	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	(71)
Water heating gains (Table 5)													
	41.4918	40.1771	37.4470	33.7354	31.3258	27.9328	25.0489	28.7440	30.0568	33.8984	38.2362	40.1826	(72)
Total internal gains	322.1781	320.7892	309.4952	291.0249	271.1611	253.5386	242.2195	245.9888	255.8655	274.4658	295.8027	312.4336	(73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains						
		m2	Table 6a	Specific data	Specific data	factor	W						
			W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast		5.9400	11.2829	0.6300	0.7000	0.7700	20.4824 (75)						
Southwest		2.6000	36.7938	0.6300	0.7000	0.7700	29.2362 (79)						
Northwest		1.4300	11.2829	0.6300	0.7000	0.7700	4.9309 (81)						
Solar gains	54.6495	101.5296	161.3388	237.4885	300.3100	313.2271	295.7050	246.5306	187.3455	118.2572	66.9947	45.7739	(83)
Total gains	376.8276	422.3187	470.8340	528.5134	571.9261	566.7657	537.9245	492.5194	443.2110	392.7230	362.7974	358.2075	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5305	60.7014	60.8699	61.6739	61.8267	62.5482	62.5482	62.6836	62.2683	61.8267	61.5184	61.1993	21.0000 (85)
alpha	5.0354	5.0468	5.0580	5.1116	5.1218	5.1699	5.1699	5.1789	5.1512	5.1218	5.1012	5.0800	
util living area													
	0.9990	0.9980	0.9947	0.9808	0.9298	0.7967	0.6317	0.7006	0.9177	0.9896	0.9980	0.9992	(86)
MIT													
Th 2	19.6864	19.8134	20.0499	20.3875	20.7046	20.9154	20.9801	20.9670	20.8016	20.4021	19.9903	19.6684	(87)
util rest of house	19.9624	19.9650	19.9676	19.9797	19.9819	19.9925	19.9925	19.9944	19.9884	19.9819	19.9773	19.9726	(88)
MIT 2													
	0.9986	0.9973	0.9926	0.9726	0.8980	0.7113	0.5012	0.5717	0.8668	0.9838	0.9972	0.9990	(89)
Living area fraction													
MIT 2	18.7605	18.8894	19.1270	19.4699	19.7708	19.9507	19.9871	19.9841	19.8673	19.4890	19.0761	18.7506	(90)
Temperature adjustment													
MIT	18.9728	19.1013	19.3387	19.6803	19.9850	20.1720	20.2148	20.2095	20.0815	19.6984	19.2857	18.9611	(92)
Temperature adjustment													
adjusted MIT	18.9728	19.1013	19.3387	19.6803	19.9850	20.1720	20.2148	20.2095	20.0815	19.6984	19.2857	18.9611	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9982	0.9964	0.9909	0.9695	0.8981	0.7282	0.5316	0.6015	0.8726	0.9816	0.9964	0.9986	(94)
Useful gains	376.1342	420.8037	466.5674	512.3766	513.6647	412.7390	285.9522	296.2496	386.7558	385.5039	361.4829	357.7019	(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													
	1223.6321	1180.9759	1064.7071	882.3524	676.4360	449.6826	291.7301	306.7815	484.9062	742.8518	999.9057	1217.5433	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	630.5385	510.8358	445.0159	266.3826	121.1018	0.0000	0.0000	0.0000	0.0000	265.8668	459.6644	639.7220	(98)
Space heating													
Space heating per m2										(98) / (4) =		45.9365	(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	758.6222	597.2132	612.0288	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8325	0.9025	0.8692	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	631.5252	538.9830	531.9650	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	748.8880	713.4813	662.0127	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	84.5012	129.8268	96.7555	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
												311.0835	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	21.1253	32.4567	24.1889	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											77.7709 (107)	
Space cooling per m2											1.0699 (108)	
Energy for space heating											45.9365 (99)	
Energy for space cooling											1.0699 (108)	
Total											47.0064 (109)	
Target Fabric Energy Efficiency (TFEE)											54.1 (109)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.0000 (1b)	2.4000 (2b)	88.8000 (1b) - (3b)
First floor	35.6900 (1c)	2.5200 (2c)	89.9388 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 178.7388 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.2238 (8)
Pressure test				Yes	
Measured/design AP50					5.0100
Infiltration rate					0.4743 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4031 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000 (22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250 (22a)
Adj inflt rate												
Effective ac	0.4535	0.4535	0.4435	0.3931	0.3830	0.3427	0.3326	0.3326	0.3528	0.3830	0.3931	0.4132 (22b)
	0.6028	0.6028	0.5983	0.5773	0.5733	0.5587	0.5553	0.5553	0.5622	0.5733	0.5773	0.5854 (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
Windows (Uw = 1.50)			9.9700	1.4151	14.1085		(27)
Doors			2.1200	1.4000	2.9680		(26)
Heat Loss Floor			37.0000	0.1300	4.8100	110.0000	4070.0000 (28a)
External Wall	85.3000	12.0900	73.2100	0.2500	18.3025	60.0000	4392.6000 (29a)
External Roof	37.0000		37.0000	0.0900	3.3300	9.0000	333.0000 (30)
Total net area of external elements Aum(A, m2)			159.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5190		(33)
Party Wall			44.2700	0.0000	0.0000	45.0000	1992.1500 (32)
Internal Wall - studs			131.4800			9.0000	1183.3200 (32c)
Internal Floor 1			35.6900			18.0000	642.4200 (32d)
Internal Ceiling 1			35.6900			18.0000	642.4200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13255.9100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 182.3622 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1236 (36)
 Total fabric heat loss (33) + (36) = 52.6426 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.5583	35.5583	35.2917	34.0485	33.8178	32.9550	32.7543	32.7543	33.1617	33.8178	34.0485	34.5278 (38)
Average = Sum(39)m / 12 =	88.2009	88.2009	87.9343	86.6910	86.4604	85.5976	85.3969	85.3969	85.8043	86.4604	86.6910	87.1704 (39)
												86.6671 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2134	1.2134	1.2097	1.1926	1.1894	1.1776	1.1748	1.1748	1.1804	1.1894	1.1926	1.1992 (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 2.3096 (42)
 Average daily hot water use (litres/day) 89.0535 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	97.9588	94.3967	90.8346	87.2724	83.7103	80.1481	80.1481	83.7103	87.2724	90.8346	94.3967	97.9588 (44)
Energy content (annual)	145.2701	127.0542	131.1085	114.3036	109.6770	94.6429	87.7006	100.6377	101.8396	118.6843	129.5532	140.6864 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1401.1582 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:	21.7905	19.0581	19.6663	17.1455	16.4516	14.1964	13.1551	15.0957	15.2759	17.8026	19.4330	21.1030 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6404	0.5397	0.5359	0.4489	0.4131	0.3413	0.3163	0.3791	0.4000	0.4851	0.5503	0.6202 (61)
Total heat required for water heating calculated for each month	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065 (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	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065 (64)
RHI water heating demand	48.4624	42.3804	43.7276	38.1182	36.5709	31.5541	29.2395	33.5568	33.9617	39.5838	43.2140	46.9333 (65)
Heat gains from water heating, kWh/month												1407 (64)
												1407 (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	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.8745	43.4099	35.3033	26.7269	19.9787	16.8668	18.2252	23.6898	31.7964	40.3729	47.1211	50.2329 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.7197	306.8713	298.9292	282.0215	260.6785	240.6191	227.2182	224.0665	232.0086	248.9163	270.2593	290.3187 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673 (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)	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848 (71)
Water heating gains (Table 5)	65.1377	63.0661	58.7736	52.9419	49.1544	43.8252	39.3004	45.1032	47.1690	53.2040	60.0195	63.0823 (72)
Total internal gains	518.0916	513.7071	493.3659	462.0500	430.1713	401.6708	385.1036	393.2193	411.3337	442.8530	477.7596	503.9938 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	5.9400	12.1063	0.7300	0.7000	0.7700	25.4654 (75)						
Southwest	2.6000	38.7358	0.7300	0.7000	0.7700	35.6648 (79)						
Northwest	1.4300	12.1063	0.7300	0.7000	0.7700	6.1306 (81)						
Solar gains	67.2608	127.1087	203.1012	305.6500	364.2797	410.4038	373.6099	318.0287	244.2134	152.1718	92.8696	62.2394 (83)
Total gains	585.3524	640.8158	696.4672	767.7000	794.4510	812.0746	758.7134	711.2480	655.5472	595.0248	570.6292	566.2332 (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	41.7478	41.7478	41.8744	42.4749	42.5883	43.0175	43.1186	43.1186	42.9139	42.5883	42.4749	42.2414
alpha	3.7832	3.7832	3.7916	3.8317	3.8392	3.8678	3.8746	3.8746	3.8609	3.8392	3.8317	3.8161
util living area	0.9814	0.9729	0.9505	0.8937	0.7938	0.6035	0.4783	0.5162	0.7582	0.9218	0.9691	0.9835 (86)
MIT	19.5447	19.6954	20.0205	20.4236	20.7317	20.9337	20.9790	20.9720	20.8309	20.4148	19.9389	19.5252 (87)
Th 2	19.9093	19.9093	19.9122	19.9259	19.9285	19.9380	19.9402	19.9402	19.9357	19.9285	19.9259	19.9206 (88)
util rest of house	0.9770	0.9665	0.9383	0.8671	0.7422	0.5172	0.3706	0.4051	0.6844	0.8969	0.9607	0.9796 (89)
MIT 2	17.9999	18.2170	18.6845	19.2550	19.6585	19.8906	19.9305	19.9266	19.7907	19.2569	18.5822	17.9792 (90)
Living area fraction									fLA = Living area / (4) =			0.2293 (91)
MIT	18.3542	18.5561	18.9909	19.5230	19.9046	20.1298	20.1709	20.1663	20.0293	19.5225	18.8933	18.3338 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2042	18.4061	18.8409	19.3730	19.7546	19.9798	20.0209	20.0163	19.8793	19.3725	18.7433	18.1838 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	566.1517	611.5421	642.5993	653.0321	582.0682	422.9271	287.6439	294.0497	445.7486	523.8814	540.8482	549.5629 (95)
Ext temp.	4.3000	4.8000	6.6000	9.0000	11.8000	14.8000	16.6000	16.5000	14.0000	10.5000	7.1000	4.2000 (96)
Heat loss rate W	1226.3598	1200.0680	1076.3923	899.2431	687.7569	443.3797	292.1378	300.2852	504.4655	767.1152	1009.3737	1218.9700 (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	491.1949	395.4894	322.7420	177.2719	78.6324	0.0000	0.0000	0.0000	0.0000	180.9660	337.3384	498.0389 (98)
Space heating												2481.6738 (98)
RHI space heating demand												2482 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.0000 (1b)	2.4000 (2b)	88.8000 (1b) - (3b)
First floor	35.6900 (1c)	2.5200 (2c)	89.9388 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 178.7388 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.2238 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4743 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4031 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5140	0.5039	0.4939	0.4435	0.4334	0.3830	0.3830	0.3729	0.4031	0.4334	0.4535	0.4737 (22b)
	0.6321	0.6270	0.6219	0.5983	0.5939	0.5733	0.5733	0.5695	0.5813	0.5939	0.6028	0.6122 (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
Windows (Uw = 1.50)			9.9700	1.4151	14.1085		(27)
Doors			2.1200	1.4000	2.9680		(26)
Heat Loss Floor			37.0000	0.1300	4.8100	110.0000	4070.0000 (28a)
External Wall	85.3000	12.0900	73.2100	0.2500	18.3025	60.0000	4392.6000 (29a)
External Roof	37.0000		37.0000	0.0900	3.3300	9.0000	333.0000 (30)
Total net area of external elements Aum(A, m2)			159.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5190		(33)
Party Wall			44.2700	0.0000	0.0000	45.0000	1992.1500 (32)
Internal Wall - studs			131.4800			9.0000	1183.3200 (32c)
Internal Floor 1			35.6900			18.0000	642.4200 (32d)
Internal Ceiling 1			35.6900			18.0000	642.4200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13255.9100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							182.3622 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1236 (36)
Total fabric heat loss						(33) + (36) =	52.6426 (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	37.2839	36.9813	36.6848	35.2917	35.0311	33.8178	33.8178	33.5931	34.2851	35.0311	35.5583	36.1096 (38)
Heat transfer coeff	89.9265	89.6239	89.3273	87.9343	87.6736	86.4604	86.4604	86.2357	86.9277	87.6736	88.2009	88.7521 (39)
Average = Sum(39)m / 12 =												87.9330 (39)
HLP	1.2371	1.2330	1.2289	1.2097	1.2061	1.1894	1.1894	1.1863	1.1959	1.2061	1.2134	1.2210 (40)
HLP (average)												1.2097 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.3096 (42)
Average daily hot water use (litres/day)												89.0535 (43)
Daily hot water use	97.9588	94.3967	90.8346	87.2724	83.7103	80.1481	80.1481	83.7103	87.2724	90.8346	94.3967	97.9588 (44)
Energy conte	145.2701	127.0542	131.1085	114.3036	109.6770	94.6429	87.7006	100.6377	101.8396	118.6843	129.5532	140.6864 (45)
Energy content (annual)												Total = Sum(45)m = 1401.1582 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:	21.7905	19.0581	19.6663	17.1455	16.4516	14.1964	13.1551	15.0957	15.2759	17.8026	19.4330	21.1030 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6404	0.5397	0.5359	0.4489	0.4131	0.3413	0.3163	0.3791	0.4000	0.4851	0.5503	0.6202 (61)
Total heat required for water heating calculated for each month	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065 (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	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065 (64)
Heat gains from water heating, kWh/month	48.4624	42.3804	43.7276	38.1182	36.5709	31.5541	29.2395	33.5568	33.9617	39.5838	43.2140	46.9333 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.8745	43.4099	35.3033	26.7269	19.9787	16.8668	18.2252	23.6898	31.7964	40.3729	47.1211	50.2329 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.7197	306.8713	298.9292	282.0215	260.6785	240.6191	227.2182	224.0665	232.0086	248.9163	270.2593	290.3187 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673 (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)	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848 (71)
Water heating gains (Table 5)	65.1377	63.0661	58.7736	52.9419	49.1544	43.8252	39.3004	45.1032	47.1690	53.2040	60.0195	63.0823 (72)
Total internal gains	518.0916	513.7071	493.3659	462.0500	430.1713	401.6708	385.1036	393.2193	411.3337	442.8530	477.7596	503.9938 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	5.9400	11.2829	0.7300	0.7000	0.7700	23.7336 (75)						
Southwest	2.6000	36.7938	0.7300	0.7000	0.7700	33.8768 (79)						
Northwest	1.4300	11.2829	0.7300	0.7000	0.7700	5.7136 (81)						
Solar gains	63.3240	117.6454	186.9481	275.1851	347.9782	362.9456	342.6424	285.6624	217.0829	137.0282	77.6288	53.0396 (83)
Total gains	581.4156	631.3525	680.3140	737.2351	778.1496	764.6165	727.7459	678.8818	628.4167	579.8812	555.3884	557.0333 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	40.9468	41.0850	41.2214	41.8744	41.9989	42.5883	42.5883	42.6992	42.3593	41.9989	41.7478	41.4886
alpha	3.7298	3.7390	3.7481	3.7916	3.7999	3.8392	3.8392	3.8466	3.8240	3.7999	3.7832	3.7659
util living area	0.9820	0.9739	0.9554	0.9077	0.8097	0.6506	0.5011	0.5511	0.7738	0.9264	0.9720	0.9845 (86)
MIT	19.5004	19.6647	19.9585	20.3599	20.6994	20.9090	20.9744	20.9633	20.8154	20.3923	19.8886	19.4758 (87)
Th 2	19.8904	19.8937	19.8970	19.9122	19.9151	19.9285	19.9285	19.9309	19.9233	19.9151	19.9093	19.9033 (88)
util rest of house	0.9777	0.9676	0.9442	0.8836	0.7600	0.5651	0.3886	0.4370	0.6997	0.9022	0.9642	0.9808 (89)
MIT 2	17.9236	18.1628	18.5865	19.1598	19.6089	19.8601	19.9165	19.9122	19.7650	19.2176	18.4994	17.8965 (90)
Living area fraction	18.2852	18.5073	18.9011	19.4350	19.8590	20.1007	20.1591	20.1532	20.0059	19.4870	18.8180	18.2587 (92)
Temperature adjustment	18.1352	18.3573	18.7511	19.2850	19.7090	19.9507	20.0091	20.0032	19.8559	19.3370	18.6680	-0.1500
adjusted MIT	18.1352	18.3573	18.7511	19.2850	19.7090	19.9507	20.0091	20.0032	19.8559	19.3370	18.6680	18.1087 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9679	0.9556	0.9289	0.8666	0.7492	0.5670	0.3974	0.4451	0.6944	0.8855	0.9517	0.9720 (94)
Ext temp.	562.7632	603.2984	631.9182	638.8684	582.9875	433.5165	289.2281	302.1979	436.3847	513.5096	528.5768	541.4117 (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	1244.1537	1206.0912	1094.3619	913.1976	702.1793	462.6203	294.7553	310.7283	500.3438	766.0008	1020.3080	1234.4229 (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 per m2	506.9545	405.0768	344.0581	197.5171	88.6787	0.0000	0.0000	0.0000	0.0000	187.8534	354.0464	515.6003 (98)
												2599.7854 (98)
												(98) / (4) = 35.7654 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2882.2454 (211)
Space heating requirement	506.9545	405.0768	344.0581	197.5171	88.6787	0.0000	0.0000	0.0000	0.0000	187.8534	354.0464	515.6003	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	562.0339	449.0873	381.4391	218.9768	98.3134	0.0000	0.0000	0.0000	0.0000	208.2632	392.5127	571.6190	(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	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065	(64)
Efficiency of water heater (217)m	86.7000	86.4592	85.9059	84.5855	81.9968	76.4000	76.4000	76.4000	76.4000	84.2904	86.0244	86.8264	(216)
Fuel for water heating, kWh/month	168.2935	147.5770	153.2427	135.6646	134.2615	124.3250	115.2054	132.2210	133.8215	141.3796	151.2402	162.7461	(219)
Water heating fuel used													1699.9780 (219)
Annual totals kWh/year													
Space heating fuel - main system													2882.2454 (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)													345.2559 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.85 * 1029 * 0.65) =										-454.9005			-454.9005 (233)
Total delivered energy for all uses													4547.5788 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2882.2454	3.4800	100.3021 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1699.9780	3.4800	59.1592 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	345.2559	13.1900	45.5393 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-454.9005	13.1900	-60.0014 (252)
Total energy cost			274.8917 (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] =	0.9810 (257)
SAP value		86.3150
SAP rating (Section 12)		86 (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	2882.2454	0.2160	622.5650 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1699.9780	0.2160	367.1952 (264)
Space and water heating			989.7603 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	345.2559	0.5190	179.1878 (268)
Energy saving/generation technologies			
PV Unit	-454.9005	0.5190	-236.0934 (269)
Total kg/year			971.7797 (272)
CO2 emissions per m2			13.3700 (273)
EI value			88.9355
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4

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Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency $3.48 / 0.8237 = 4.225$, stars = 4
Water heating environmental impact $0.216 / 0.8237 = 0.2622$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.0000 (1b)	x 2.4000 (2b)	= 88.8000 (1b) - (3b)
First floor	35.6900 (1c)	x 2.5200 (2c)	= 89.9388 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 178.7388 (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) = 0.2238 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4743 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4031 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000 (22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250 (22a)
Adj infilt rate												
Effective ac	0.4535	0.4535	0.4435	0.3931	0.3830	0.3427	0.3326	0.3326	0.3528	0.3830	0.3931	0.4132 (22b)
	0.6028	0.6028	0.5983	0.5773	0.5733	0.5587	0.5553	0.5553	0.5622	0.5733	0.5773	0.5854 (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
Windows (Uw = 1.50)			9.9700	1.4151	14.1085		(27)
Doors			2.1200	1.4000	2.9680		(26)
Heat Loss Floor			37.0000	0.1300	4.8100	110.0000	4070.0000 (28a)
External Wall	85.3000	12.0900	73.2100	0.2500	18.3025	60.0000	4392.6000 (29a)
External Roof	37.0000		37.0000	0.0900	3.3300	9.0000	333.0000 (30)
Total net area of external elements Aum(A, m2)			159.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5190		(33)
Party Wall			44.2700	0.0000	0.0000	45.0000	1992.1500 (32)
Internal Wall - studs			131.4800			9.0000	1183.3200 (32c)
Internal Floor 1			35.6900			18.0000	642.4200 (32d)
Internal Ceiling 1			35.6900			18.0000	642.4200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13255.9100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 182.3622 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1236 (36)
 Total fabric heat loss (33) + (36) = 52.6426 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.5583	35.5583	35.2917	34.0485	33.8178	32.9550	32.7543	32.7543	33.1617	33.8178	34.0485	34.5278 (38)
Average = Sum(39)m / 12 =	88.2009	88.2009	87.9343	86.6910	86.4604	85.5976	85.3969	85.3969	85.8043	86.4604	86.6910	87.1704 (39)
												86.6671 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2134	1.2134	1.2097	1.1926	1.1894	1.1776	1.1748	1.1748	1.1804	1.1894	1.1926	1.1992 (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 2.3096 (42)
 Average daily hot water use (litres/day) 89.0535 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	97.9588	94.3967	90.8346	87.2724	83.7103	80.1481	80.1481	83.7103	87.2724	90.8346	94.3967	97.9588 (44)
Energy content (annual)	145.2701	127.0542	131.1085	114.3036	109.6770	94.6429	87.7006	100.6377	101.8396	118.6843	129.5532	140.6864 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1401.1582 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Water storage loss:	21.7905	19.0581	19.6663	17.1455	16.4516	14.1964	13.1551	15.0957	15.2759	17.8026	19.4330	21.1030 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6404	0.5397	0.5359	0.4489	0.4131	0.3413	0.3163	0.3791	0.4000	0.4851	0.5503	0.6202 (61)
Total heat required for water heating calculated for each month	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065 (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	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065 (64)
Heat gains from water heating, kWh/month	48.4624	42.3804	43.7276	38.1182	36.5709	31.5541	29.2395	33.5568	33.9617	39.5838	43.2140	46.9333 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.8745	43.4099	35.3033	26.7269	19.9787	16.8668	18.2252	23.6898	31.7964	40.3729	47.1211	50.2329 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.7197	306.8713	298.9292	282.0215	260.6785	240.6191	227.2182	224.0665	232.0086	248.9163	270.2593	290.3187 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673 (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)	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848 (71)
Water heating gains (Table 5)	65.1377	63.0661	58.7736	52.9419	49.1544	43.8252	39.3004	45.1032	47.1690	53.2040	60.0195	63.0823 (72)
Total internal gains	518.0916	513.7071	493.3659	462.0500	430.1713	401.6708	385.1036	393.2193	411.3337	442.8530	477.7596	503.9938 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	5.9400	12.1063	0.7300	0.7000	0.7700	25.4654 (75)						
Southwest	2.6000	38.7358	0.7300	0.7000	0.7700	35.6648 (79)						
Northwest	1.4300	12.1063	0.7300	0.7000	0.7700	6.1306 (81)						
Solar gains	67.2608	127.1087	203.1012	305.6500	364.2797	410.4038	373.6099	318.0287	244.2134	152.1718	92.8696	62.2394 (83)
Total gains	585.3524	640.8158	696.4672	767.7000	794.4510	812.0746	758.7134	711.2480	655.5472	595.0248	570.6292	566.2332 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	41.7478	41.7478	41.8744	42.4749	42.5883	43.0175	43.1186	43.1186	42.9139	42.5883	42.4749	42.2414
tau	3.7832	3.7832	3.7916	3.8317	3.8392	3.8678	3.8746	3.8746	3.8609	3.8392	3.8317	3.8161
alpha	0.9814	0.9729	0.9505	0.8937	0.7938	0.6035	0.4783	0.5162	0.7582	0.9218	0.9691	0.9835 (86)
util living area	19.5447	19.6954	20.0205	20.4236	20.7317	20.9337	20.9790	20.9720	20.8309	20.4148	19.9389	19.5252 (87)
MIT	19.9093	19.9093	19.9122	19.9259	19.9285	19.9380	19.9402	19.9402	19.9357	19.9285	19.9259	19.9206 (88)
Th 2	0.9770	0.9665	0.9383	0.8671	0.7422	0.5172	0.3706	0.4051	0.6844	0.8969	0.9607	0.9796 (89)
util rest of house	17.9999	18.2170	18.6845	19.2550	19.6585	19.8906	19.9305	19.9266	19.7907	19.2569	18.5822	17.9792 (90)
Living area fraction	18.3542	18.5561	18.9909	19.5230	19.9046	20.1298	20.1709	20.1663	20.0293	19.5225	18.8933	18.3338 (91)
MIT	18.3542	18.5561	18.9909	19.5230	19.9046	20.1298	20.1709	20.1663	20.0293	19.5225	18.8933	18.3338 (92)
Temperature adjustment	18.2042	18.4061	18.8409	19.3730	19.7546	19.9798	20.0209	20.0163	19.8793	19.3725	18.7433	-0.1500 (93)
adjusted MIT	18.2042	18.4061	18.8409	19.3730	19.7546	19.9798	20.0209	20.0163	19.8793	19.3725	18.7433	18.1838 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9672	0.9543	0.9227	0.8506	0.7327	0.5208	0.3791	0.4134	0.6800	0.8804	0.9478	0.9706 (94)
Ext temp.	566.1517	611.5421	642.5993	653.0321	582.0682	422.9271	287.6439	294.0497	445.7486	523.8814	540.8482	549.5629 (95)
Heat loss rate W	4.3000	4.8000	6.6000	9.0000	11.8000	14.8000	16.6000	16.5000	14.0000	10.5000	7.1000	4.2000 (96)
Month fracti	1226.3598	1200.0680	1076.3923	899.2431	687.7569	443.3797	292.1378	300.2852	504.4655	767.1152	1009.3737	1218.9700 (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 per m2	491.1949	395.4894	322.7420	177.2719	78.6324	0.0000	0.0000	0.0000	0.0000	180.9660	337.3384	498.0389 (98)
												2481.6738 (98)
												(98) / (4) = 34.1405 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2751.3013 (211)
Space heating requirement	491.1949	395.4894	322.7420	177.2719	78.6324	0.0000	0.0000	0.0000	0.0000	180.9660	337.3384	498.0389	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	544.5619	438.4583	357.8070	196.5321	87.1757	0.0000	0.0000	0.0000	0.0000	200.6275	373.9893	552.1495	(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	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065	(64)
Efficiency of water heater (217)m	86.6169	86.3935	85.7144	84.2220	81.6018	76.4000	76.4000	76.4000	76.4000	84.1639	85.8823	86.7373	(216)
Fuel for water heating, kWh/month	168.4551	147.6892	153.5849	136.2500	134.9115	124.3250	115.2054	132.2210	133.8215	141.5921	151.4904	162.9133	(219)
Water heating fuel used													1702.4594 (219)
Annual totals kWh/year													
Space heating fuel - main system													2751.3013 (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)													345.2559 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.85 * 1132 * 0.65) =										-500.3210			-500.3210 (233)
Total delivered energy for all uses													4373.6955 (238)

10a. Fuel costs - using BEDF prices (486)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2751.3013	3.7400	102.8987 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1702.4594	3.7400	63.6720 (247)
Pumps and fans for heating	75.0000	19.1200	14.3400 (249)
Energy for lighting	345.2559	19.1200	66.0129 (250)
Additional standing charges			94.0000 (251)
Energy saving/generation technologies			
PV Unit	-500.3210	19.1200	-95.6614 (252)
Total energy cost			245.2622 (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	2751.3013	0.2160	594.2811 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1702.4594	0.2160	367.7312 (264)
Space and water heating			962.0123 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	345.2559	0.5190	179.1878 (268)
Energy saving/generation technologies			
PV Unit	-500.3210	0.5190	-259.6666 (269)
Total kg/year			920.4585 (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	2751.3013	1.2200	3356.5876 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1702.4594	1.2200	2077.0004 (264)
Space and water heating			5433.5880 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	345.2559	3.0700	1059.9356 (268)
Energy saving/generation technologies			
PV Unit	-500.3210	3.0700	-1535.9855 (269)
Primary energy kWh/year			5187.7881 (272)
Primary energy kWh/m2/year			71.3687 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
 Current environmental impact rating: B 89

(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	+ 1.4	-£ 28	-192 kg (20.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£28	2.65 kg/m ²	B 88 B 91
Total Savings	£28	2.65 kg/m²	

Potential energy efficiency rating: B 88
 Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 486 TEST (30 Nov 2021)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£80	£90	-£10
Mains gas	£261	£223	£38
Space heating	£211	£211	£0
Water heating	£64	£35	£28
Lighting	£66	£66	£0
Generated (PV)	-£96	-£96	£0
Total cost of fuels	£245	£217	£28
Total cost of uses	£245	£216	£28
Delivered energy	60 kWh/m ²	47 kWh/m ²	13 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m ²	13 kg/m ²	10 kg/m ²	3 kg/m ²
Primary energy	71 kWh/m ²	57 kWh/m ²	15 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.0000 (1b)	2.4000 (2b)	88.8000 (1b) - (3b)
First floor	35.6900 (1c)	2.5200 (2c)	89.9388 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 178.7388 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.2238 (8)
Pressure test				Yes	
Measured/design AP50					5.0100
Infiltration rate					0.4743 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4031 (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 infiltr rate												
Effective ac	0.5140	0.5039	0.4939	0.4435	0.4334	0.3830	0.3830	0.3729	0.4031	0.4334	0.4535	0.4737 (22b)
	0.6321	0.6270	0.6219	0.5983	0.5939	0.5733	0.5733	0.5695	0.5813	0.5939	0.6028	0.6122 (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
Windows (Uw = 1.50)			9.9700	1.4151	14.1085		(27)
Doors			2.1200	1.4000	2.9680		(26)
Heat Loss Floor			37.0000	0.1300	4.8100	110.0000	4070.0000 (28a)
External Wall	85.3000	12.0900	73.2100	0.2500	18.3025	60.0000	4392.6000 (29a)
External Roof	37.0000		37.0000	0.0900	3.3300	9.0000	333.0000 (30)
Total net area of external elements Aum(A, m2)			159.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5190		(33)
Party Wall			44.2700	0.0000	0.0000	45.0000	1992.1500 (32)
Internal Wall - studs			131.4800			9.0000	1183.3200 (32c)
Internal Floor 1			35.6900			18.0000	642.4200 (32d)
Internal Ceiling 1			35.6900			18.0000	642.4200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13255.9100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 182.3622 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1236 (36)
 Total fabric heat loss (33) + (36) = 52.6426 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	37.2839	36.9813	36.6848	35.2917	35.0311	33.8178	33.8178	33.5931	34.2851	35.0311	35.5583	36.1096 (38)
Average = Sum(39)m / 12 =	89.9265	89.6239	89.3273	87.9343	87.6736	86.4604	86.4604	86.2357	86.9277	87.6736	88.2009	88.7521 (39)
												87.9330 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2371	1.2330	1.2289	1.2097	1.2061	1.1894	1.1894	1.1863	1.1959	1.2061	1.2134	1.2210 (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 2.3096 (42)
 Average daily hot water use (litres/day) 89.0535 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	97.9588	94.3967	90.8346	87.2724	83.7103	80.1481	80.1481	83.7103	87.2724	90.8346	94.3967	97.9588 (44)
Energy content (annual)	145.2701	127.0542	131.1085	114.3036	109.6770	94.6429	87.7006	100.6377	101.8396	118.6843	129.5532	140.6864 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1401.1582 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Water storage loss:	21.7905	19.0581	19.6663	17.1455	16.4516	14.1964	13.1551	15.0957	15.2759	17.8026	19.4330	21.1030 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6404	0.5397	0.5359	0.4489	0.4131	0.3413	0.3163	0.3791	0.4000	0.4851	0.5503	0.6202 (61)
Total heat required for water heating calculated for each month	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065 (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												1.2944 (H8)
Utilisation factor												0.5382 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												89.0535 (H14)
Volume ratio Veff/V												0.8422 (H15)
Solar storage volume factor												0.9657 (H16)
Solar input												-828.7514 (H17)
Solar input	-24.0321	-40.1027	-68.2995	-91.5348	-113.0836	-111.1792	-109.7099	-95.8541	-75.0730	-51.2660	-28.5056	-20.1108 (63)
Solar input (sum of months) = Sum(63)m =												-828.7514 (63)
Output from w/h	121.8784	87.4912	63.3449	23.2177	0.0000	0.0000	0.0000	5.1627	27.1666	67.9034	101.5979	121.1957 (64)
Total per year (kWh/year) = Sum(64)m =												618.9585 (64)
Heat gains from water heating, kWh/month	48.4624	42.3804	43.7276	38.1182	36.5709	31.5541	29.2395	33.5568	33.9617	39.5838	43.2140	46.9333 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.8745	43.4099	35.3033	26.7269	19.9787	16.8668	18.2252	23.6898	31.7964	40.3729	47.1211	50.2329 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.7197	306.8713	298.9292	282.0215	260.6785	240.6191	227.2182	224.0665	232.0086	248.9163	270.2593	290.3187 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673 (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)	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848 (71)
Water heating gains (Table 5)	65.1377	63.0661	58.7736	52.9419	49.1544	43.8252	39.3004	45.1032	47.1690	53.2040	60.0195	63.0823 (72)
Total internal gains	518.0916	513.7071	493.3659	462.0500	430.1713	401.6708	385.1036	393.2193	411.3337	442.8530	477.7596	503.9938 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
Northeast	5.9400	11.2829	0.7300	0.7000	0.7700	23.7336 (75)						
Southwest	2.6000	36.7938	0.7300	0.7000	0.7700	33.8768 (79)						
Northwest	1.4300	11.2829	0.7300	0.7000	0.7700	5.7136 (81)						
Solar gains	63.3240	117.6454	186.9481	275.1851	347.9782	362.9456	342.6424	285.6624	217.0829	137.0282	77.6288	53.0396 (83)
Total gains	581.4156	631.3525	680.3140	737.2351	778.1496	764.6165	727.7459	678.8818	628.4167	579.8812	555.3884	557.0333 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil _m (see Table 9a)												21.0000 (85)
tau	40.9468	41.0850	41.2214	41.8744	41.9989	42.5883	42.5883	42.6992	42.3593	41.9989	41.7478	41.4886
alpha	3.7298	3.7390	3.7481	3.7916	3.7999	3.8392	3.8392	3.8466	3.8240	3.7999	3.7832	3.7659
util living area	0.9820	0.9739	0.9554	0.9077	0.8097	0.6506	0.5011	0.5511	0.7738	0.9264	0.9720	0.9845 (86)
MIT	19.5004	19.6647	19.9585	20.3599	20.6994	20.9090	20.9744	20.9633	20.8154	20.3923	19.8886	19.4758 (87)
Th 2	19.8904	19.8937	19.8970	19.9122	19.9151	19.9285	19.9285	19.9309	19.9233	19.9151	19.9093	19.9033 (88)
util rest of house	0.9777	0.9676	0.9442	0.8836	0.7600	0.5651	0.3886	0.4370	0.6997	0.9022	0.9642	0.9808 (89)
MIT 2	17.9236	18.1628	18.5865	19.1598	19.6089	19.8601	19.9165	19.9122	19.7650	19.2176	18.4994	17.8965 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.2293 (91)
MIT	18.2852	18.5073	18.9011	19.4350	19.8590	20.1007	20.1591	20.1532	20.0059	19.4870	18.8180	18.2587 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1352	18.3573	18.7511	19.2850	19.7090	19.9507	20.0091	20.0032	19.8559	19.3370	18.6680	18.1087 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9679	0.9556	0.9289	0.8666	0.7492	0.5670	0.3974	0.4451	0.6944	0.8855	0.9517	0.9720	(94)
Useful gains	562.7632	603.2984	631.9182	638.8684	582.9875	433.5165	289.2281	302.1979	436.3847	513.5096	528.5768	541.4117	(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	1244.1537	1206.0912	1094.3619	913.1976	702.1793	462.6203	294.7553	310.7283	500.3438	766.0008	1020.3080	1234.4229	(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	506.9545	405.0768	344.0581	197.5171	88.6787	0.0000	0.0000	0.0000	0.0000	187.8534	354.0464	515.6003	(98)
Space heating per m2											(98) / (4) =	35.7654	(99)

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
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 %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2882.2454	(211)
Space heating requirement	506.9545	405.0768	344.0581	197.5171	88.6787	0.0000	0.0000	0.0000	0.0000	187.8534	354.0464	515.6003	(98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)	
Space heating fuel (main heating system)	562.0339	449.0873	381.4391	218.9768	98.3134	0.0000	0.0000	0.0000	0.0000	208.2632	392.5127	571.6190	(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	121.8784	87.4912	63.3449	23.2177	0.0000	0.0000	0.0000	5.1627	27.1666	67.9034	101.5979	121.1957	(64)	
Efficiency of water heater (217)m	87.1490	87.3960	87.7359	88.5182	90.2000	76.4000	76.4000	76.4000	76.4000	86.0723	86.7078	76.4000	(216)	
Fuel for water heating, kWh/month	139.8505	100.1089	72.1995	26.2292	0.0000	0.0000	0.0000	6.7575	35.5584	78.8912	117.1728	138.9824	(219)	
Water heating fuel used												715.7504	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2882.2454	(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)													345.2559	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.85 * 1029 * 0.65) =										-454.9005			-454.9005	(233)
Total delivered energy for all uses													3613.3512	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2882.2454	3.4800	100.3021	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	715.7504	3.4800	24.9081	(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	345.2559	13.1900	45.5393	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-454.9005	13.1900	-60.0014	(252)
Total energy cost			247.2356	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.8823	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	87.6918	
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
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	2882.2454	0.2160	622.5650 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	715.7504	0.2160	154.6021 (264)
Space and water heating			777.1671 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	345.2559	0.5190	179.1878 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-454.9005	0.5190	-236.0934 (269)
CO2 emissions per m2			785.1365 (272)
EI value			10.8000 (273)
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.0000 (1b)	2.4000 (2b)	88.8000 (1b) - (3b)
First floor	35.6900 (1c)	2.5200 (2c)	89.9388 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 178.7388 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.2238 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4743 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4031 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000 (22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250 (22a)
Adj infilt rate												
Effective ac	0.4535	0.4535	0.4435	0.3931	0.3830	0.3427	0.3326	0.3326	0.3528	0.3830	0.3931	0.4132 (22b)
	0.6028	0.6028	0.5983	0.5773	0.5733	0.5587	0.5553	0.5553	0.5622	0.5733	0.5773	0.5854 (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
Windows (Uw = 1.50)			9.9700	1.4151	14.1085		(27)
Doors			2.1200	1.4000	2.9680		(26)
Heat Loss Floor			37.0000	0.1300	4.8100	110.0000	4070.0000 (28a)
External Wall	85.3000	12.0900	73.2100	0.2500	18.3025	60.0000	4392.6000 (29a)
External Roof	37.0000		37.0000	0.0900	3.3300	9.0000	333.0000 (30)
Total net area of external elements Aum(A, m2)			159.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5190		(33)
Party Wall			44.2700	0.0000	0.0000	45.0000	1992.1500 (32)
Internal Wall - studs			131.4800			9.0000	1183.3200 (32c)
Internal Floor 1			35.6900			18.0000	642.4200 (32d)
Internal Ceiling 1			35.6900			18.0000	642.4200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13255.9100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 182.3622 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1236 (36)
 Total fabric heat loss (33) + (36) = 52.6426 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.5583	35.5583	35.2917	34.0485	33.8178	32.9550	32.7543	32.7543	33.1617	33.8178	34.0485	34.5278 (38)
Average = Sum(39)m / 12 =	88.2009	88.2009	87.9343	86.6910	86.4604	85.5976	85.3969	85.3969	85.8043	86.4604	86.6910	87.1704 (39)
												86.6671 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2134	1.2134	1.2097	1.1926	1.1894	1.1776	1.1748	1.1748	1.1804	1.1894	1.1926	1.1992 (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 2.3096 (42)
 Average daily hot water use (litres/day) 89.0535 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	97.9588	94.3967	90.8346	87.2724	83.7103	80.1481	80.1481	83.7103	87.2724	90.8346	94.3967	97.9588 (44)
Energy content (annual)	145.2701	127.0542	131.1085	114.3036	109.6770	94.6429	87.7006	100.6377	101.8396	118.6843	129.5532	140.6864 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1401.1582 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	21.7905	19.0581	19.6663	17.1455	16.4516	14.1964	13.1551	15.0957	15.2759	17.8026	19.4330	21.1030 (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	0.6404	0.5397	0.5359	0.4489	0.4131	0.3413	0.3163	0.3791	0.4000	0.4851	0.5503	0.6202 (61)
Total heat required for water heating calculated for each month	145.9105	127.5939	131.6445	114.7525	110.0902	94.9843	88.0169	101.0168	102.2396	119.1694	130.1035	141.3065 (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												1185.6484 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1991.8893 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.4216 (H8)
Utilisation factor												0.5051 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												89.0535 (H14)
Volume ratio Veff/V												0.8422 (H15)
Solar storage volume factor												0.9657 (H16)
Solar input												-854.2991 (H17)
Solar input	-23.9594	-40.6031	-69.3715	-94.9019	-110.4875	-117.3662	-111.6631	-99.5942	-78.8952	-53.3024	-31.9946	-22.1598 (63)
Solar input (sum of months) = Sum (63)m =												-854.2991 (63)
Output from w/h	121.9511	86.9908	62.2729	19.8506	0.0000	0.0000	0.0000	1.4226	23.3444	65.8670	98.1089	119.1467 (64)
Total per year (kWh/year) = Sum (64)m =												598.9550 (64)
Heat gains from water heating, kWh/month	48.4624	42.3804	43.7276	38.1182	36.5709	31.5541	29.2395	33.5568	33.9617	39.5838	43.2140	46.9333 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772	138.5772 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.8745	43.4099	35.3033	26.7269	19.9787	16.8668	18.2252	23.6898	31.7964	40.3729	47.1211	50.2329 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.7197	306.8713	298.9292	282.0215	260.6785	240.6191	227.2182	224.0665	232.0086	248.9163	270.2593	290.3187 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673	51.1673 (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)	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848	-92.3848 (71)
Water heating gains (Table 5)	65.1377	63.0661	58.7736	52.9419	49.1544	43.8252	39.3004	45.1032	47.1690	53.2040	60.0195	63.0823 (72)
Total internal gains	518.0916	513.7071	493.3659	462.0500	430.1713	401.6708	385.1036	393.2193	411.3337	442.8530	477.7596	503.9938 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	5.9400	12.1063	0.7300	0.7000	0.7700	25.4654 (75)						
Southwest	2.6000	38.7358	0.7300	0.7000	0.7700	35.6648 (79)						
Northwest	1.4300	12.1063	0.7300	0.7000	0.7700	6.1306 (81)						
Solar gains	67.2608	127.1087	203.1012	305.6500	364.2797	410.4038	373.6099	318.0287	244.2134	152.1718	92.8696	62.2394 (83)
Total gains	585.3524	640.8158	696.4672	767.7000	794.4510	812.0746	758.7134	711.2480	655.5472	595.0248	570.6292	566.2332 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (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	41.7478	41.7478	41.8744	42.4749	42.5883	43.0175	43.1186	43.1186	42.9139	42.5883	42.4749	42.2414
alpha	3.7832	3.7832	3.7916	3.8317	3.8392	3.8678	3.8746	3.8746	3.8609	3.8392	3.8317	3.8161
util living area	0.9814	0.9729	0.9505	0.8937	0.7938	0.6035	0.4783	0.5162	0.7582	0.9218	0.9691	0.9835 (86)
MIT	19.5447	19.6954	20.0205	20.4236	20.7317	20.9337	20.9790	20.9720	20.8309	20.4148	19.9389	19.5252 (87)
Th 2	19.9093	19.9093	19.9122	19.9259	19.9285	19.9380	19.9402	19.9402	19.9357	19.9285	19.9259	19.9206 (88)
util rest of house	0.9770	0.9665	0.9383	0.8671	0.7422	0.5172	0.3706	0.4051	0.6844	0.8969	0.9607	0.9796 (89)
MIT 2	17.9999	18.2170	18.6845	19.2550	19.6585	19.8906	19.9305	19.9266	19.7907	19.2569	18.5822	17.9792 (90)
Living area fraction									fLA = Living area / (4) =			0.2293 (91)
MIT	18.3542	18.5561	18.9909	19.5230	19.9046	20.1298	20.1709	20.1663	20.0293	19.5225	18.8933	18.3338 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2042	18.4061	18.8409	19.3730	19.7546	19.9798	20.0209	20.0163	19.8793	19.3725	18.7433	18.1838 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9672	0.9543	0.9227	0.8506	0.7327	0.5208	0.3791	0.4134	0.6800	0.8804	0.9478	0.9706	(94)
Useful gains	566.1517	611.5421	642.5993	653.0321	582.0682	422.9271	287.6439	294.0497	445.7486	523.8814	540.8482	549.5629	(95)
Ext temp.	4.3000	4.8000	6.6000	9.0000	11.8000	14.8000	16.6000	16.5000	14.0000	10.5000	7.1000	4.2000	(96)
Heat loss rate W	1226.3598	1200.0680	1076.3923	899.2431	687.7569	443.3797	292.1378	300.2852	504.4655	767.1152	1009.3737	1218.9700	(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	491.1949	395.4894	322.7420	177.2719	78.6324	0.0000	0.0000	0.0000	0.0000	180.9660	337.3384	498.0389	(98)
Space heating per m2										(98) / (4) =		34.1405	(99)

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
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 %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2751.3013	(211)
Space heating requirement	491.1949	395.4894	322.7420	177.2719	78.6324	0.0000	0.0000	0.0000	0.0000	180.9660	337.3384	498.0389	(98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)	
Space heating fuel (main heating system)	544.5619	438.4583	357.8070	196.5321	87.1757	0.0000	0.0000	0.0000	0.0000	200.6275	373.9893	552.1495	(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	121.9511	86.9908	62.2729	19.8506	0.0000	0.0000	0.0000	1.4226	23.3444	65.8670	98.1089	119.1467	(64)	
Efficiency of water heater (217)m	87.0719	87.3551	87.6396	88.5886	90.2000	76.4000	76.4000	76.4000	76.4000	86.0522	86.6727	76.1607	(216)	
Fuel for water heating, kWh/month	140.0580	99.5830	71.0557	22.4076	0.0000	0.0000	0.0000	1.8621	30.5555	76.5430	113.1946	136.6978	(219)	
Water heating fuel used												691.9573	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2751.3013	(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)													345.2559	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.85 * 1132 * 0.65) =										-500.3210			-500.3210	(233)
Total delivered energy for all uses													3413.1934	(238)

10a. Fuel costs - using BEDF prices (486)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost f/year	
Space heating - main system 1	2751.3013	3.7400	102.8987	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	691.9573	3.7400	25.8792	(247)
Pumps and fans for heating	75.0000	19.1200	14.3400	(249)
Pump for solar water heating	50.0000	19.1200	9.5600	(249)
Energy for lighting	345.2559	19.1200	66.0129	(250)
Additional standing charges			94.0000	(251)
Energy saving/generation technologies				
PV Unit	-500.3210	19.1200	-95.6614	(252)
Total energy cost			217.0294	(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	2751.3013	0.2160	594.2811	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	691.9573	0.2160	149.4628	(264)
Space and water heating			743.7439	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	345.2559	0.5190	179.1878	(268)
Energy saving/generation technologies				
PV Unit	-500.3210	0.5190	-259.6666	(269)
Total kg/year			728.1400	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	2751.3013	1.2200	3356.5876 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	691.9573	1.2200	844.1879 (264)
Space and water heating			4200.7755 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	345.2559	3.0700	1059.9356 (268)
Energy saving/generation technologies			
PV Unit	-500.3210	3.0700	-1535.9855 (269)
Primary energy kWh/year			4108.4755 (272)
Primary energy kWh/m2/year			56.5205 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Midlands
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	182.4 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	471.87 (P1)
Transmission heat loss coefficient	52.64 (37)
Summer heat loss coefficient	524.51 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	5.9400	99.7758	0.7300	0.7000	0.9000	245.3114
South West	2.6000	122.9541	0.7300	0.7000	0.9000	132.3190
North West	1.4300	99.7758	0.7300	0.7000	0.9000	59.0564

total: 436.6869

Solar gains	480	437	372	(P3)
Internal gains	399	382	390	
Total summer gains	878	819	762	(P5)

Summer gain/loss ratio	1.67	1.56	1.45	(P6)
Summer external temperature	14.80	16.60	16.50	
Thermal mass temperature increment (TMP = 182.4)	0.72	0.72	0.72	
Threshold temperature	17.20	18.88	18.68	(P7)

Likelihood of high internal temperature Not significant Not significant Not significant
 Assessment of likelihood of high internal temperature: Not significant

U-VALUE CALCULATOR REPORT



Property Reference	Plot 13		Issued on Date	15/12/2021
Assessment Reference	As Designed + PV	Prop Type Ref	Kynnersley a.k.a Stretton	
Project	Plot 13			
Calculation Type	New Build (As Designed)			

SAP Rating	86 B	DER	15.23	TER	19.41
Environmental	89 B	% DER<TER	21.53		
CO ₂ Emissions (t/year)	0.92	DFEE	48.88	TFEE	54.06
General Requirements Compliance	Pass	% DFEE<TFEE	9.58		

Assessor Details	Mr. Sebastian Ingham, Sebastian Ingham, Tel: 07817728156, sebastian@idea-ingham.co.uk	Assessor ID	T245-0001
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Client	
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Building Elements

Roof 000002

Roof Type: Pitched Roof, insulated flat ceiling

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

Total resistance: Upper limit = 11.200 m² K/W Lower limit = 10.901 m² K/W Average = 11.050 m² K/W
 Total correction = 0.0035 m² K/W U-value (unrounded) = 0.09 W/m² K

Unheated space: None

Total thickness: 463 mm

U-value: 0.09 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT



Property Reference	Plot 13		Issued on Date	15/12/2021
Assessment Reference	As Designed + PV	Prop Type Ref	Kynnersley a.k.a Stretton	
Project	Plot 13			
Calculation Type	New Build (As Designed)			

SAP Rating	86 B	DER	15.23	TER	19.41
Environmental	89 B	% DER<TER	21.53		
CO ₂ Emissions (t/year)	0.92	DFEE	48.88	TFEE	54.06
General Requirements Compliance	Pass	% DFEE<TFEE	9.58		

Assessor Details	Mr. Sebastian Ingham, Sebastian Ingham, Tel: 07817728156, sebastian@idea-ingham.co.uk	Assessor ID	T245-0001
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Client	
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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 (%)
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	Earthwool Dritherm 37 Standard				
	Main construction	125	0.0370	3.3784	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Blockwork, medium				
	Main construction	100	0.5700	0.1754	93.43
	Main construction	100	0.8803	0.1136	6.57
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
Int surface				0.1300	

Total resistance: Upper limit = 4.078 m² K/W Lower limit = 4.075 m² K/W Average = 4.076 m² K/W
 Total correction = 0.0069 m² K/W U-value (unrounded) = 0.25 W/m² K

Unheated space:	None
Total thickness: 355 mm	U-value: 0.25 W/m² K
	Kappa: n/a

U-VALUE CALCULATOR REPORT



Property Reference	Plot 13	Issued on Date	15/12/2021
Assessment Reference	As Designed + PV	Prop Type Ref	Kynnersley a.k.a Stretton
Project	Plot 13		
Calculation Type	New Build (As Designed)		

SAP Rating	86 B	DER	15.23	TER	19.41
Environmental	89 B	% DER<TER	21.53		
CO ₂ Emissions (t/year)	0.92	DFEE	48.88	TFEE	54.06
General Requirements Compliance	Pass	% DFEE<TFEE	9.58		

Assessor Details	Mr. Sebastian Ingham, Sebastian Ingham, Tel: 07817728156, sebastian@idea-ingham.co.uk	Assessor ID	T245-0001
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Client	
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Building Elements

Floor 000003

Floor Type: Slab On Ground Floor
 Area = 37.00 m², Perimeter = 17.80 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 (%)
Ext surface				0.0400	
Layer 1	Concrete, reinforced (2% steel)				
	Main construction	100	2.5000	0.0400	100.00
Layer 2	Expanded polystyrene				
	Main construction	200	0.0310	6.4516	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

Total resistance: Upper limit = 6.557 m² K/W Lower limit = 6.557 m² K/W Average = 6.557 m² K/W
 Total correction = 0.0097 m² K/W U-value (unrounded) = 0.13 W/m² K

Unheated space: None
Total thickness: 375 mm U-value: 0.13 W/m ² K Kappa: n/a

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)



Property Reference	Plot 13	Issued on Date	15/12/2021
Assessment Reference	As Designed + PV	Prop Type Ref	Kynnersley a.k.a Stretton
Property	Plot 13		

SAP Rating	86 B	DER	15.23	TER	19.41
Environmental	89 B	% DER<TER	21.53		
CO₂ Emissions (t/year)	0.92	DFEE	48.88	TFEE	54.06
General Requirements Compliance	Pass	% DFEE<TFEE	9.58		

Assessor Details	Mr. Sebastian Ingham, Sebastian Ingham, Tel: 07817728156, sebastian@idea-ingham.co.uk	Assessor ID	T245-0001
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Client	
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SUMMARY FOR INPUT DATA FOR New Build (As Designed)

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)	19.41	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.23	kgCO ₂ /m ²	Pass
	-4.18 (-21.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.06	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.88	kWh/m ² /yr	
	-5.2 (-9.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	Pass
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	Pass
Openings	1.48 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)



Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB) Combi boiler Efficiency: 89.3% SEDBUK2009 Minimum: 88.0%	Pass
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Secondary heating system	None	
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5 Cylinder insulation

Hot water storage	No cylinder	
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6 Controls

Space heating controls	Time and temperature zone control	Pass
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Hot water controls	No cylinder	
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Boiler interlock	Yes	Pass
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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 (Midlands)	Not significant	Pass
-----------------------------	-----------------	------

Based on:

Overshading	Average
-------------	---------

Windows facing North East	5.94 m ² , No overhang
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Windows facing South West	2.60 m ² , No overhang
---------------------------	-----------------------------------

Windows facing North West	1.43 m ² , No overhang
---------------------------	-----------------------------------

Air change rate	8.00 ach
-----------------	----------

Blinds/curtains	None
-----------------	------

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value	W/m ² K	
Filled Cavity with Edge Sealing	0.00	W/m ² K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)
--------------------------------	---------------------

Maximum	10.0	Pass
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10 Key features

Party wall U-value	0.00	W/m ² K
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Roof U-value	0.09	W/m ² K
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Photovoltaic array	0.85	kW
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This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)



Property Reference	Plot 13	Issued on Date	15/12/2021
Assessment Reference	As Designed + PV	Prop Type Ref	Kynnersley a.k.a Stretton
Property	Plot 13		

SAP Rating	86 B	DER	15.23	TER	19.41
Environmental	89 B	% DER<TER	21.53		
CO ₂ Emissions (t/year)	0.92	DFEE	48.88	TREE	54.06
General Requirements Compliance	Pass	% DFEE<TFEE	9.58		

Assessor Details	Mr. Sebastian Ingham, Sebastian Ingham, Tel: 07817728156, sebastian@idea-ingham.co.uk	Assessor ID	T245-0001
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Client	
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SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.80 m	37.00 m ²	2.40 m
1st Storey:	16.90 m	35.69 m ²	2.52 m

7.0 Living Area	16.67	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	182.36	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)
External Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.25	60.00	85.30	73.21

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	44.27

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall - studs	Plasterboard on timber frame	9.00	131.48

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.09	9.00	37.00	37.00

10.2 Internal Ceilings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)



Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor		9.00	35.69

11.0 Heat Loss Floors						
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Heat Loss Floor	Ground Floor - Solid	Slab on ground, screed over insulation		0.13	110.00	37.00

11.2 Internal Floors					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor		18.00	35.69	

12.0 Opening Types										
Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)	
Windows	Manufacturer	Window	Double glazed			0.73		0.70	1.50	
Doors	Manufacturer	Solid Door							1.40	

13.0 Openings											
Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
SW windows	Window	[1] External Wall	South West	None	0.00					2.60	
SW door	Solid Door	[1] External Wall	South West							2.12	
NW windows	Window	[1] External Wall	North West	None	0.00					1.43	
NE windows	Window	[1] External Wall	North East	None	0.00					5.94	

14.0 Conservatory	<input type="text" value="None"/>	
15.0 Draught Proofing	<input type="text" value="100"/>	%
16.0 Draught Lobby	<input type="text" value="No"/>	
17.0 Thermal Bridging	<input type="text" value="Calculate Bridges"/>	

17.1 List of Bridges					
Source Type	Bridge Type	Length	Psi	Imported	
Independently assessed	E2 Other lintels (including other steel lintels)	8.93	0.209	Yes	
Independently assessed	E3 Sill	7.92	0.013	Yes	
Independently assessed	E4 Jamb	23.10	0.018	Yes	
Independently assessed	E5 Ground floor (normal)	17.80	0.107	Yes	
Independently assessed	E6 Intermediate floor within a dwelling	15.44	0.000	No	
Independently assessed	E10 Eaves (insulation at ceiling level)	9.80	0.060	No	
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	1.46	0.240	No	
Independently assessed	E12 Gable (insulation at ceiling level)	9.46	0.091	No	
Independently assessed	E16 Corner (normal)	12.24	0.067	No	
Independently assessed	E17 Corner (inverted – internal area greater than external area)	2.40	-0.117	No	
Independently assessed	E18 Party wall between dwellings	4.92	0.043	No	
Independently assessed	P1 Party wall - Ground floor	9.46	0.100	No	
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.56	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.46	0.079	No	
Table K1 - Default	E25 Staggered party wall between dwellings	4.92	0.120	No	

Y-value	<input type="text" value="0.057"/>	W/m ² K
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18.0 Pressure Testing		
Designed AP ₅₀	<input type="text" value="5.01"/>	m ³ /(h.m ²) @ 50 Pa
Property Tested ?	<input type="text"/>	
As Built AP ₅₀	<input type="text"/>	m ³ /(h.m ²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)



19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
---------------------------------------	----

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	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
------------------------	----

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Percentage of Heat	100	%
Database Ref. No.	17960	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.2	
In Summer	76.4	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2110	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)



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
0.85	South West	30°	Significant	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 88	