Appendix J – SAP Worksheets

SAP worksheets can be found on the following page

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	2BF Detached PV	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	Representice
Property	Alverton RL DS01 (Rooflights -, Detached, Part L2013 Masonry		

SAP Rating	90 B	**DER**	12.06	**TER**	24.58
Environmental	92 A	**% DER<TER**	50.93		
CO_2 Emissions (t/year)	0.50	**DFEE**	67.43	**TFEE**	76.63
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.01		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Detached House, total floor area 60 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) 24.58 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.06 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)76.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)67.4 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.37 (max. 0.70)	OK
Floor	0.17 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.48 (max. 2.00)	1.90 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing South: 4.40 m², Overhang width less than twice window, ratio 0.28
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 1.93 kW

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	2.4700	(1b)	x 2.5900	(2b) =	6.3973	(1b) - (3b)
First floor	57.4700	(1c)	x 2.3100	(2c) =	132.7557	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	139.1530	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2156	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4661	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4661	(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	0.5943	0.5826	0.5710	0.5127	0.5010	0.4428	0.4428	0.4311	0.4661	0.5010	0.5244	0.5477	(22b)
Effective ac	0.6766	0.6697	0.6630	0.6314	0.6255	0.5980	0.5980	0.5929	0.6086	0.6255	0.6375	0.6500	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			4.4000	1.3347	5.8728			(27)
Opening Type 5 (Uw = 1.90)			2.9200	1.7658	5.1561			(27a)
150mm TE Platinum GF			2.4900	0.1800	0.4482			(28a)
Over Garages			52.1900	0.1700	8.8723			(28b)
Over Store			2.8000	0.1700	0.4760			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.2700	0.1269			(29a)
50mm AP to Garage	13.7700		13.7700	0.2200	3.0294			(29a)
50mm AP with Acousti	73.2600	4.4000	68.8600	0.2500	17.2150			(29a)
Sheltered to Store	2.4400		2.4400	0.3700	0.9028			(29a)
Wall to Rooflights	7.0300		7.0300	0.3000	2.1090			(29a)
400mm mineral wool	53.9600		53.9600	0.1100	5.9356			(30)
Rooflights (for SAP	2.9200	2.9200	0.0000	0.1600	0.0000			(30)
Total net area of external elements Aum(A, m2)			213.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.1141			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	110.2000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	20.8115	(36)
Total fabric heat loss (33) + (36) =	72.9256	(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	31.0687	30.7538	30.4452	28.9956	28.7244	27.4618	27.4618	27.2280	27.9481	28.7244	29.2730	29.8466	(38)
Heat transfer coeff	103.9943	103.6794	103.3708	101.9212	101.6500	100.3874	100.3874	100.1536	100.8737	101.6500	102.1986	102.7722	(39)
Average = Sum(39)m / 12 =												101.9199	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.7350	1.7297	1.7246	1.7004	1.6959	1.6748	1.6748	1.6709	1.6829	1.6959	1.7050	1.7146	(40)
HLP (average)												1.7004	(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	1.9799	(42)
Average daily hot water use (litres/day)	81.2235	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)
Energy content (annual)										Total = Sum(45)m =		1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	19.8746	17.3825	17.9371	15.6380	15.0051	12.9482	11.9984	13.7684	13.9328	16.2374	17.7243	19.2475	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0407	12.6647	13.9943	13.5120	13.9399	13.4642	13.8969	13.9248	13.4902	13.9718	13.5570	14.0317	(61)
Total heat required for water heating calculated for each month													
	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(64)
									Total per year (kWh/year) = Sum(64)m =			1442.4503	(64)
Heat gains from water heating, kWh/month													
	47.5655	41.6973	43.2592	38.0423	36.7462	32.0680	30.0708	34.0011	34.2570	39.4858	42.6782	46.1732	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.7386	14.8671	12.0907	9.1535	6.8423	5.7766	6.2418	8.1133	10.8897	13.8269	16.1381	17.2038	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	63.9322	62.0495	58.1441	52.8365	49.3900	44.5388	40.4177	45.7004	47.5791	53.0723	59.2753	62.0607	(72)
Total internal gains													
	309.1654	307.2043	296.0041	278.1398	260.2395	242.9102	231.6300	236.9912	246.1648	264.2145	284.8714	300.1350	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	4.4000	46.7521	0.7100	0.7000	0.7700	70.8505	(78)
North	2.9200	16.1759	0.7200	0.7000	1.0000	21.4252	(82)

Solar gains	92.2757	156.6111	221.5883	301.2066	372.1234	387.5000	365.8673	308.3567	247.4649	174.2070	110.2078	79.2897	(83)
Total gains	401.4411	463.8155	517.5924	579.3464	632.3630	630.4102	597.4974	545.3479	493.6297	438.4215	395.0792	379.4247	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	17.6436	17.6972	17.7500	18.0024	18.0505	18.2775	18.2775	18.3202	18.1894	18.0505	17.9536	17.8534	
alpha	2.1762	2.1798	2.1833	2.2002	2.2034	2.2185	2.2185	2.2213	2.2126	2.2034	2.1969	2.1902	
util living area													
	0.9680	0.9549	0.9335	0.8896	0.8115	0.6958	0.5807	0.6297	0.7966	0.9105	0.9559	0.9715	(86)
MIT	17.8211	18.1042	18.5981	19.2910	19.9699	20.5113	20.7728	20.7185	20.2757	19.4317	18.5204	17.7800	(87)
Th 2	19.5159	19.5196	19.5233	19.5406	19.5438	19.5589	19.5589	19.5618	19.5531	19.5438	19.5372	19.5304	(88)
util rest of house													
	0.9618	0.9462	0.9198	0.8645	0.7631	0.6049	0.4379	0.4926	0.7251	0.8851	0.9458	0.9661	(89)
MIT 2	15.3943	15.8036	16.5161	17.5091	18.4468	19.1504	19.4347	19.3931	18.8809	17.7276	16.4179	15.3399	(90)
Living area fraction										fLA = Living area / (4) =		0.3315	(91)
MIT	16.1988	16.5663	17.2063	18.0998	18.9517	19.6016	19.8783	19.8325	19.3432	18.2925	17.1149	16.1488	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.0488	16.4163	17.0563	17.9498	18.8017	19.4516	19.7283	19.6825	19.1932	18.1425	16.9649	15.9988	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9386	0.9181	0.8863	0.8273	0.7320	0.5969	0.4571	0.5061	0.7024	0.8500	0.9183	0.9447	(94)
Useful gains	376.8078	425.8279	458.7210	479.3164	462.8987	376.2720	273.1180	275.9990	346.7192	372.6585	362.7828	358.4457	(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													
	1221.8082	1193.9993	1091.2139	922.3683	721.8855	487.0353	314.0408	328.7519	513.7750	766.6943	1008.1808	1212.5839	(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													
	628.6803	516.2112	470.5747	318.9974	192.6861	0.0000	0.0000	0.0000	0.0000	293.1626	464.6865	635.4788	(98)
Space heating												3520.4777	(98)
Space heating per m2											(98) / (4) =	58.7334	(99)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3890.0307	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	628.6803	516.2112	470.5747	318.9974	192.6861	0.0000	0.0000	0.0000	0.0000	293.1626	464.6865	635.4788	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	694.6744	570.3991	519.9721	352.4833	212.9128	0.0000	0.0000	0.0000	0.0000	323.9366	513.4658	702.1865	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8773	89.8434	89.7725	89.6143	89.2837	87.3000	87.3000	87.3000	87.3000	89.5343	89.7732	89.8970	(217)
Fuel for water heating, kWh/month	163.0424	143.0798	148.7931	131.4137	127.6534	114.3021	107.5446	121.0927	121.8507	136.5072	146.7244	158.3461	(219)
Water heating fuel used												1620.3502	(219)
Annual totals kWh/year													
Space heating fuel - main system												3890.0307	(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)												295.6090	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.93 * 1029 * 0.80) =											-1271.2514	-1271.2514	(233)
Total delivered energy for all uses												4609.7384	(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	3890.0307	0.2160	840.2466	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1620.3502	0.2160	349.9956	(264)
Space and water heating			1190.2423	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	295.6090	0.5190	153.4211	(268)
Energy saving/generation technologies				
PV Unit	-1271.2514	0.5190	-659.7795	(269)
Total CO2, kg/year			722.8088	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.0600	(273)

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

DER		12.0600	ZC1
Total Floor Area	TFA	59.9400	
Assumed number of occupants	N	1.9799	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0829	ZC2
CO2 emissions from cooking, equation (L16)		2.7781	ZC3
Total CO2 emissions		31.9210	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.9210	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.3100 (2c)	=	132.7557	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.1530	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1437	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3937	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3937	(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	0.5020	0.4922	0.4823	0.4331	0.4233	0.3740	0.3740	0.3642	0.3937	0.4233	0.4429	0.4626	(22b)
Effective ac	0.6260	0.6211	0.6163	0.5938	0.5896	0.5700	0.5700	0.5663	0.5775	0.5896	0.5981	0.6070	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			4.4000	1.3258	5.8333			(27)
TER Room Window (Uw = 1.70)			2.9200	1.5918	4.6479			(27a)
150mm TE Platinum GF			2.4900	0.1300	0.3237			(28a)
Over Garages			52.1900	0.1300	6.7847			(28b)
Over Store			2.8000	0.1300	0.3640			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.1800	0.0846			(29a)
50mm AP to Garage	13.7700		13.7700	0.1800	2.4786			(29a)
50mm AP with Acousti	73.2600	4.4000	68.8600	0.1800	12.3948			(29a)
Sheltered to Store	2.4400		2.4400	0.1800	0.4392			(29a)
Wall to Rooflights	7.0300		7.0300	0.1800	1.2654			(29a)
400mm mineral wool	53.9600		53.9600	0.1300	7.0148			(30)
Rooflights (for SAP	2.9200	2.9200	0.0000	0.1300	0.0000			(30)
Total net area of external elements Aum(A, m2)			213.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.6011			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	21.8390	(36)
Total fabric heat loss (33) + (36) =	65.4401	(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	28.7464	28.5217	28.3014	27.2670	27.0735	26.1725	26.1725	26.0057	26.5196	27.0735	27.4650	27.8743	(38)
Heat transfer coeff	94.1864	93.9617	93.7415	92.7071	92.5135	91.6126	91.6126	91.4458	91.9596	92.5135	92.9051	93.3144	(39)
Average = Sum(39)m / 12 =												92.7062	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5713	1.5676	1.5639	1.5467	1.5434	1.5284	1.5284	1.5256	1.5342	1.5434	1.5500	1.5568	(40)
HLP (average)												1.5466	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)
Energy content (annual)										Total = Sum(45)m =		1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	19.8746	17.3825	17.9371	15.6380	15.0051	12.9482	11.9984	13.7684	13.9328	16.2374	17.7243	19.2475	(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	45.5297	39.6282	42.2184	39.2543	38.9072	36.0499	37.2516	38.9072	39.2543	42.2184	42.4588	45.5297	(61)
Total heat required for water heating calculated for each month													
	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463	(64)
									Total per year (kWh/year) = Sum(64)m =			1765.1697	(64)
Heat gains from water heating, kWh/month													
	55.4378	48.4381	50.3153	44.4779	42.9880	37.7144	35.9094	40.2467	40.6980	46.5474	49.9037	54.0477	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.7386	14.8671	12.0907	9.1535	6.8423	5.7766	6.2418	8.1133	10.8897	13.8269	16.1381	17.2038	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	74.5131	72.0806	67.6280	61.7748	57.7796	52.3811	48.2653	54.0950	56.5250	62.5637	69.3106	72.6447	(72)
Total internal gains													
	319.7464	317.2354	305.4880	287.0782	268.6291	250.7524	239.4777	245.3858	255.1106	273.7060	294.9067	310.7190	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)
North	2.9200	16.1759	0.6300	0.7000	1.0000	18.7470	(82)

Solar gains	81.6144	138.4647	195.7113	265.6145	327.7534	341.1272	322.1512	271.7711	218.4347	153.9735	97.4668	70.1330	(83)
Total gains	401.3608	455.7001	501.1993	552.6927	596.3825	591.8796	561.6289	517.1570	473.5453	427.6795	392.3735	380.8520	(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	44.1943	44.2999	44.4040	44.8995	44.9934	45.4359	45.4359	45.5188	45.2644	44.9934	44.8038	44.6073	
alpha	3.9463	3.9533	3.9603	3.9933	3.9996	4.0291	4.0291	4.0346	4.0176	3.9996	3.9869	3.9738	
util living area													
	0.9966	0.9939	0.9878	0.9691	0.9157	0.7974	0.6521	0.7114	0.8983	0.9779	0.9940	0.9973	(86)
MIT	19.2932	19.4568	19.7409	20.1435	20.5405	20.8323	20.9460	20.9226	20.6937	20.2048	19.6836	19.2672	(87)
Th 2	19.6344	19.6372	19.6399	19.6527	19.6551	19.6663	19.6663	19.6683	19.6620	19.6551	19.6502	19.6452	(88)
util rest of house													
	0.9954	0.9917	0.9830	0.9554	0.8743	0.6941	0.4843	0.5494	0.8303	0.9655	0.9913	0.9963	(89)
MIT 2	17.4077	17.6478	18.0627	18.6493	19.1956	19.5518	19.6472	19.6367	19.4082	18.7455	17.9882	17.3765	(90)
Living area fraction									fLA = Living area / (4) =			0.3315	(91)
MIT	18.0327	18.2475	18.6190	19.1446	19.6415	19.9763	20.0777	20.0630	19.8344	19.2292	18.5502	18.0033	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0327	18.2475	18.6190	19.1446	19.6415	19.9763	20.0777	20.0630	19.8344	19.2292	18.5502	18.0033	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9932	0.9883	0.9777	0.9484	0.8738	0.7217	0.5407	0.6031	0.8413	0.9600	0.9881	0.9944	(94)
Useful gains	398.6193	450.3630	490.0457	524.1883	521.0923	427.1531	303.6984	311.9157	398.3906	410.5642	387.6972	378.7302	(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													
	1293.4361	1254.1510	1136.0541	949.7486	734.6920	492.5377	318.6043	334.9625	527.3315	798.3203	1063.7828	1288.0451	(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													
	665.7437	540.1456	480.6303	306.4034	158.9182	0.0000	0.0000	0.0000	0.0000	288.4906	486.7816	676.5303	(98)
Space heating												3603.6436	(98)
Space heating per m2											(98) / (4) =	60.1208	(99)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3858.2908	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	665.7437	540.1456	480.6303	306.4034	158.9182	0.0000	0.0000	0.0000	0.0000	288.4906	486.7816	676.5303	(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)													
	712.7877	578.3143	514.5934	328.0551	170.1480	0.0000	0.0000	0.0000	0.0000	308.8764	521.1795	724.3365	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0630	87.9277	87.6242	86.9131	85.3901	80.3000	80.3000	80.3000	80.3000	86.6635	87.6644	88.1338	(217)
Fuel for water heating, kWh/month													
	202.1587	176.8625	184.6513	165.1165	162.7132	152.3928	146.0039	162.7601	164.5576	173.6226	183.2227	197.2527	(219)
Water heating fuel used												2071.3147	(219)
Annual totals kWh/year													
Space heating fuel - main system												3858.2908	(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)												295.6090	(232)
Total delivered energy for all uses												6300.2144	(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	3858.2908	0.2160	833.3908	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2071.3147	0.2160	447.4040	(264)
Space and water heating			1280.7948	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	295.6090	0.5190	153.4211	(268)
Total CO2, kg/m2/year			1473.1408	(272)
Emissions per m2 for space and water heating			21.3679	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5596	(272b)
Emissions per m2 for pumps and fans			0.6494	(272c)
Target Carbon Dioxide Emission Rate (TER) = (21.3679 * 1.00) + 2.5596 + 0.6494, rounded to 2 d.p.			24.5800	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.3100 (2c)	=	132.7557	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.1530	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1437	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3942	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3942	(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	0.5026	0.4928	0.4829	0.4336	0.4238	0.3745	0.3745	0.3647	0.3942	0.4238	0.4435	0.4632	(22b)
Effective ac	0.6263	0.6214	0.6166	0.5940	0.5898	0.5701	0.5701	0.5665	0.5777	0.5898	0.5983	0.6073	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			4.4000	1.3347	5.8728			(27)
Opening Type 5 (Uw = 1.90)			2.9200	1.7658	5.1561			(27a)
150mm TE Platinum GF			2.4900	0.1800	0.4482			(28a)
Over Garages			52.1900	0.1700	8.8723			(28b)
Over Store			2.8000	0.1700	0.4760			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.2700	0.1269			(29a)
50mm AP to Garage	13.7700		13.7700	0.2200	3.0294			(29a)
50mm AP with Acousti	73.2600	4.4000	68.8600	0.2500	17.2150			(29a)
Sheltered to Store	2.4400		2.4400	0.3700	0.9028			(29a)
Wall to Rooflights	7.0300		7.0300	0.3000	2.1090			(29a)
400mm mineral wool	53.9600		53.9600	0.1100	5.9356			(30)
Rooflights (for SAP	2.9200	2.9200	0.0000	0.1600	0.0000			(30)
Total net area of external elements Aum(A, m2)			213.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.1141			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	110.2000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	20.8115	(36)
Total fabric heat loss (33) + (36) =	72.9256	(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	28.7611	28.5358	28.3150	27.2780	27.0839	26.1807	26.1807	26.0134	26.5286	27.0839	27.4764	27.8868	(38)
Heat transfer coeff	101.6866	101.4614	101.2406	100.2035	100.0095	99.1063	99.1063	98.9390	99.4542	100.0095	100.4020	100.8124	(39)
Average = Sum(39)m / 12 =												100.2026	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6965	1.6927	1.6890	1.6717	1.6685	1.6534	1.6534	1.6506	1.6592	1.6685	1.6750	1.6819	(40)
HLP (average)												1.6717	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)
Energy content (annual)										Total = Sum(45)m =		1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.1557	24.6251	25.4109	22.1539	21.2572	18.3433	16.9978	19.5052	19.7382	23.0029	25.1095	27.2673	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.7386	14.8671	12.0907	9.1535	6.8423	5.7766	6.2418	8.1133	10.8897	13.8269	16.1381	17.2038	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	37.8437	36.6446	34.1545	30.7693	28.5715	25.4768	22.8465	26.2167	27.4141	30.9179	34.8743	36.6496	(72)
Total internal gains													
	280.0769	278.7994	269.0144	253.0726	236.4210	220.8482	211.0588	214.5075	222.9998	239.0602	257.4704	271.7238	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	4.4000	46.7521	0.7100	0.7000	0.7700	70.8505	(78)
North	2.9200	16.1759	0.7200	0.7000	1.0000	21.4252	(82)

Solar gains	92.2757	156.6111	221.5883	301.2066	372.1234	387.5000	365.8673	308.3567	247.4649	174.2070	110.2078	79.2897	(83)
Total gains	372.3526	435.4105	490.6027	554.2792	608.5444	608.3482	576.9262	522.8641	470.4647	413.2672	367.6782	351.0135	(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	18.0440	18.0840	18.1235	18.3110	18.3466	18.5138	18.5138	18.5451	18.4490	18.3466	18.2748	18.2004	
alpha	2.2029	2.2056	2.2082	2.2207	2.2231	2.2343	2.2343	2.2363	2.2299	2.2231	2.2183	2.2134	
util living area													
	0.9722	0.9597	0.9390	0.8962	0.8193	0.7051	0.5901	0.6419	0.8077	0.9184	0.9613	0.9755	(86)
MIT	17.8157	18.0999	18.5945	19.2826	19.9637	20.5048	20.7693	20.7115	20.2626	19.4135	18.5016	17.7668	(87)
Th 2	19.5434	19.5461	19.5487	19.5612	19.5635	19.5744	19.5744	19.5764	19.5702	19.5635	19.5588	19.5538	(88)
util rest of house													
	0.9668	0.9519	0.9264	0.8725	0.7726	0.6157	0.4480	0.5059	0.7389	0.8950	0.9524	0.9708	(89)
MIT 2	16.7073	16.9898	17.4793	18.1582	18.8039	19.2887	19.4869	19.4564	19.0972	18.2988	17.3994	16.6655	(90)
Living area fraction										fLA = Living area / (4) =		0.3315	(91)
MIT	17.0748	17.3578	17.8490	18.5309	19.1883	19.6918	19.9120	19.8725	19.4835	18.6683	17.7648	17.0305	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0748	17.3578	17.8490	18.5309	19.1883	19.6918	19.9120	19.8725	19.4835	18.6683	17.7648	17.0305	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9537	0.9354	0.9064	0.8507	0.7578	0.6242	0.4860	0.5385	0.7337	0.8754	0.9367	0.9588	(94)
Useful gains	355.1011	407.2823	444.6770	471.5490	461.1299	379.7342	280.3845	281.5778	345.1898	361.7566	344.3902	336.5350	(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													
	1299.0216	1263.9824	1148.9762	965.0547	748.9057	504.6318	328.2385	343.5608	535.4139	806.9081	1070.7654	1293.4784	(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													
	702.2769	575.7025	523.9986	355.3241	214.1052	0.0000	0.0000	0.0000	0.0000	331.1927	522.9901	711.9659	(98)
Space heating												3937.5559	(98)
Space heating per m2											(98) / (4) =	65.6916	(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	931.5990	733.3865	751.9365	0.0000	0.0000	0.0000	0.0000	(100)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6125	0.6812	0.6451	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	570.6278	499.5759	485.0870	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	748.4828	713.3546	660.4191	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	128.0556	159.0513	130.4471	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												417.5540 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	32.0139	39.7628	32.6118	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												104.3885 (107)
Space cooling per m2												1.7415 (108)
Energy for space heating												65.6916 (99)
Energy for space cooling												1.7415 (108)
Total												67.4332 (109)
Dwelling Fabric Energy Efficiency (DFEE)												67.4 (109)

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	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.3100 (2c)	=	132.7557	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.1530	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1437	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3937	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3937	(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	0.5020	0.4922	0.4823	0.4331	0.4233	0.3740	0.3740	0.3642	0.3937	0.4233	0.4429	0.4626	(22b)
Effective ac	0.6260	0.6211	0.6163	0.5938	0.5896	0.5700	0.5700	0.5663	0.5775	0.5896	0.5981	0.6070	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			4.4000	1.3258	5.8333			(27)
TER Room Window (Uw = 1.70)			2.9200	1.5918	4.6479			(27a)
150mm TE Platinum GF			2.4900	0.1300	0.3237			(28a)
Over Garages			52.1900	0.1300	6.7847			(28b)
Over Store			2.8000	0.1300	0.3640			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.1800	0.0846			(29a)
50mm AP to Garage	13.7700		13.7700	0.1800	2.4786			(29a)
50mm AP with Acousti	73.2600	4.4000	68.8600	0.1800	12.3948			(29a)
Sheltered to Store	2.4400		2.4400	0.1800	0.4392			(29a)
Wall to Rooflights	7.0300		7.0300	0.1800	1.2654			(29a)
400mm mineral wool	53.9600		53.9600	0.1300	7.0148			(30)
Rooflights (for SAP	2.9200	2.9200	0.0000	0.1300	0.0000			(30)
Total net area of external elements Aum(A, m2)			213.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.6011			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	21.8390	(36)
Total fabric heat loss (33) + (36) =	65.4401	(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	28.7464	28.5217	28.3014	27.2670	27.0735	26.1725	26.1725	26.0057	26.5196	27.0735	27.4650	27.8743	(38)
Heat transfer coeff	94.1864	93.9617	93.7415	92.7071	92.5135	91.6126	91.6126	91.4458	91.9596	92.5135	92.9051	93.3144	(39)
Average = Sum(39)m / 12 =												92.7062	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5713	1.5676	1.5639	1.5467	1.5434	1.5284	1.5284	1.5256	1.5342	1.5434	1.5500	1.5568	(40)
HLP (average)												1.5466	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)
Energy content (annual)										Total = Sum(45)m =		1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.1557	24.6251	25.4109	22.1539	21.2572	18.3433	16.9978	19.5052	19.7382	23.0029	25.1095	27.2673	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.7386	14.8671	12.0907	9.1535	6.8423	5.7766	6.2418	8.1133	10.8897	13.8269	16.1381	17.2038	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	37.8437	36.6446	34.1545	30.7693	28.5715	25.4768	22.8465	26.2167	27.4141	30.9179	34.8743	36.6496	(72)
Total internal gains													
	280.0769	278.7994	269.0144	253.0726	236.4210	220.8482	211.0588	214.5075	222.9998	239.0602	257.4704	271.7238	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)
North	2.9200	16.1759	0.6300	0.7000	1.0000	18.7470	(82)

Solar gains	81.6144	138.4647	195.7113	265.6145	327.7534	341.1272	322.1512	271.7711	218.4347	153.9735	97.4668	70.1330	(83)
Total gains	361.6913	417.2641	464.7258	518.6871	564.1743	561.9753	533.2100	486.2786	441.4344	393.0337	354.9372	341.8568	(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	44.1943	44.2999	44.4040	44.8995	44.9934	45.4359	45.4359	45.5188	45.2644	44.9934	44.8038	44.6073	
alpha	3.9463	3.9533	3.9603	3.9933	3.9996	4.0291	4.0291	4.0346	4.0176	3.9996	3.9869	3.9738	
util living area													
	0.9977	0.9955	0.9906	0.9748	0.9276	0.8178	0.6768	0.7395	0.9155	0.9833	0.9958	0.9982	(86)
MIT	19.2363	19.4021	19.6903	20.0996	20.5072	20.8142	20.9381	20.9105	20.6626	20.1584	19.6302	19.2109	(87)
Th 2	19.6344	19.6372	19.6399	19.6527	19.6551	19.6663	19.6663	19.6683	19.6620	19.6551	19.6502	19.6452	(88)
util rest of house													
	0.9968	0.9939	0.9868	0.9633	0.8904	0.7182	0.5072	0.5782	0.8549	0.9737	0.9939	0.9975	(89)
MIT 2	18.0574	18.2248	18.5134	18.9261	19.3135	19.5776	19.6509	19.6424	19.4656	18.9898	18.4626	18.0402	(90)
Living area fraction										fLA = Living area / (4) =		0.3315	(91)
MIT	18.4482	18.6151	18.9035	19.3151	19.7092	19.9875	20.0776	20.0628	19.8624	19.3772	18.8497	18.4283	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4482	18.6151	18.9035	19.3151	19.7092	19.9875	20.0776	20.0628	19.8624	19.3772	18.8497	18.4283	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9921	0.9839	0.9595	0.8922	0.7461	0.5649	0.6326	0.8665	0.9709	0.9923	0.9966	(94)
Useful gains	360.1548	413.9829	457.2631	497.6693	503.3625	419.2771	301.1875	307.5965	382.4819	381.5951	352.2101	340.6995	(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													
	1332.5661	1288.6904	1162.7263	965.5576	740.9588	493.5636	318.5948	334.9439	529.9097	812.0072	1091.6026	1327.7023	(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													
	723.4740	587.8034	524.8647	336.8796	176.7716	0.0000	0.0000	0.0000	0.0000	320.2266	532.3626	734.3301	(98)
Space heating												3936.7126	(98)
Space heating per m2											(98) / (4) =	65.6776	(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	861.1584	677.9332	694.9877	0.0000	0.0000	0.0000	0.0000	(100)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7102	0.7943	0.7538	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	611.5565	538.4821	523.8675	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	698.9230	666.5246	620.8096	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	62.9039	95.2636	72.1249	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												230.2924 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	15.7260	23.8159	18.0312	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												57.5731 (107)
Space cooling per m2												0.9605 (108)
Energy for space heating												65.6776 (99)
Energy for space cooling												0.9605 (108)
Total												66.6381 (109)
Target Fabric Energy Efficiency (TFEE)												76.6 (109)

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	2BF End-Terrace PV	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	Representive
Property	Alverton DS01 (Hipped), EOT, Part L2013, Masonry		

SAP Rating	90 B	**DER**	12.05	**TER**	23.84
Environmental	92 A	**% DER<TER**	49.45		
CO_2 Emissions (t/year)	0.49	**DFEE**	66.35	**TFEE**	72.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.20		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 60 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) 23.84 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)72.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)66.4 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.37 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 3.26 m², Overhang width less than twice window, ratio 0.28
Windows facing South: 4.40 m², Overhang width less than twice window, ratio 0.24
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 1.93 kW

ARUN DISTRICT COUNCIL A/45/22/PL

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	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.2800 (2c)	=	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.4289	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2183	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4688	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4688	(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	0.5977	0.5860	0.5743	0.5157	0.5040	0.4454	0.4454	0.4336	0.4688	0.5040	0.5274	0.5508	(22b)
Effective ac	0.6786	0.6717	0.6649	0.6330	0.6270	0.5992	0.5992	0.5940	0.6099	0.6270	0.6391	0.6517	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			7.6600	1.3347	10.2240			(27)
150mm TE Platinum GF			2.4900	0.1800	0.4482			(28a)
Over Access			18.6300	0.1800	3.3534			(28b)
Over Garages			33.5600	0.1700	5.7052			(28b)
Over Store			2.8000	0.1700	0.4760			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.2700	0.1269			(29a)
50mm AP to Access	6.8900		6.8900	0.2700	1.8603			(29a)
50mm AP to Garage	6.8900		6.8900	0.2200	1.5158			(29a)
50mm AP with Acousti	60.9300	7.6600	53.2700	0.2500	13.3175			(29a)
Sheltered to Store	2.4400		2.4400	0.3700	0.9028			(29a)
400mm mineral wool	57.4700		57.4700	0.1100	6.3217			(30)
Total net area of external elements Aum(A, m2)			194.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.2218			(33)
E-WM-20/22			12.3300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	122.3100	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	23.1147	(36)
Total fabric heat loss (33) + (36) =	69.3365	(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	30.7769	30.4624	30.1540	28.7057	28.4347	27.1733	27.1733	26.9397	27.6592	28.4347	28.9829	29.5560	(38)
Heat transfer coeff	100.1134	99.7988	99.4905	98.0422	97.7712	96.5098	96.5098	96.2762	96.9957	97.7712	98.3194	98.8925	(39)
Average = Sum(39)m / 12 =												98.0409	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6702	1.6650	1.6598	1.6357	1.6312	1.6101	1.6101	1.6062	1.6182	1.6312	1.6403	1.6499	(40)
HLP (average)												1.6357	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)
Energy content (annual)										Total = Sum(45)m =		1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	19.8746	17.3825	17.9371	15.6380	15.0051	12.9482	11.9984	13.7684	13.9328	16.2374	17.7243	19.2475	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0407	12.6647	13.9943	13.5120	13.9399	13.4642	13.8969	13.9248	13.4902	13.9718	13.5570	14.0317	(61)
Total heat required for water heating calculated for each month													
	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.4503	(64)
Heat gains from water heating, kWh/month													
	47.5655	41.6973	43.2592	38.0423	36.7462	32.0680	30.0708	34.0011	34.2570	39.4858	42.6782	46.1732	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	63.9322	62.0495	58.1441	52.8365	49.3900	44.5388	40.4177	45.7004	47.5791	53.0723	59.2753	62.0607	(72)
Total internal gains													
	309.2887	307.3138	296.0931	278.2072	260.2899	242.9527	231.6760	237.0509	246.2450	264.3163	284.9902	300.2617	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.7100	0.7000	0.7700	11.9393	(74)
South	4.4000	46.7521	0.7100	0.7000	0.7700	70.8505	(78)

Solar gains	82.7898	138.8515	186.5789	229.3312	257.9734	257.3385	247.5347	225.4852	201.0181	152.3147	98.7107	71.1746	(83)
Total gains	392.0785	446.1653	482.6720	507.5385	518.2633	500.2912	479.2107	462.5361	447.2631	416.6311	383.7009	371.4363	(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	20.3415	20.4057	20.4689	20.7713	20.8288	21.1011	21.1011	21.1523	20.9954	20.8288	20.7127	20.5927	
alpha	2.3561	2.3604	2.3646	2.3848	2.3886	2.4067	2.4067	2.4102	2.3997	2.3886	2.3808	2.3728	
util living area													
	0.9747	0.9644	0.9487	0.9199	0.8681	0.7766	0.6627	0.6913	0.8309	0.9264	0.9646	0.9777	(86)
MIT	18.0754	18.3286	18.7610	19.3537	19.9475	20.4721	20.7533	20.7160	20.3158	19.5546	18.7223	18.0402	(87)
Th 2	19.5622	19.5660	19.5698	19.5873	19.5906	19.6059	19.6059	19.6088	19.6000	19.5906	19.5839	19.5770	(88)
util rest of house													
	0.9695	0.9571	0.9374	0.8999	0.8286	0.6940	0.5182	0.5557	0.7651	0.9039	0.9560	0.9731	(89)
MIT 2	15.7501	16.1185	16.7461	17.6061	18.4427	19.1473	19.4650	19.4335	18.9560	17.9046	16.7030	15.7062	(90)
Living area fraction									fLA = Living area / (4) =			0.3315	(91)
MIT	16.5210	16.8511	17.4141	18.1854	18.9415	19.5865	19.8921	19.8586	19.4067	18.4516	17.3724	16.4800	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.3710	16.7011	17.2641	18.0354	18.7915	19.4365	19.7421	19.7086	19.2567	18.3016	17.2224	16.3300	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9513	0.9347	0.9104	0.8690	0.7990	0.6816	0.5350	0.5674	0.7442	0.8744	0.9338	0.9564	(94)
Useful gains	372.9678	417.0146	439.4347	441.0566	414.1175	340.9930	256.3638	262.4611	332.8524	364.3212	358.3118	355.2458	(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													
	1208.4651	1177.7374	1070.9229	895.6581	693.3491	466.7661	303.2397	318.5436	500.1822	752.9917	995.2291	1199.5607	(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													
	621.6100	511.2058	469.8272	327.3130	207.7483	0.0000	0.0000	0.0000	0.0000	289.1708	458.5804	628.1703	(98)
Space heating												3513.6259	(98)
Space heating per m2											(98) / (4) =	58.6190	(99)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3882.4595	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	621.6100	511.2058	469.8272	327.3130	207.7483	0.0000	0.0000	0.0000	0.0000	289.1708	458.5804	628.1703	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	686.8619	564.8682	519.1461	361.6719	229.5561	0.0000	0.0000	0.0000	0.0000	319.5258	506.7187	694.1109	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8716	89.8383	89.7716	89.6307	89.3399	87.3000	87.3000	87.3000	87.3000	89.5251	89.7658	89.8913	(217)
Fuel for water heating, kWh/month													
	163.0527	143.0879	148.7946	131.3897	127.5730	114.3021	107.5446	121.0927	121.8507	136.5213	146.7366	158.3561	(219)
Water heating fuel used												1620.3021	(219)
Annual totals kWh/year													
Space heating fuel - main system												3882.4595	(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)												297.7858	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.93 * 1029 * 0.80) =											-1271.2514	-1271.2514	(233)
Total delivered energy for all uses												4604.2960	(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	3882.4595	0.2160	838.6113	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1620.3021	0.2160	349.9853	(264)
Space and water heating			1188.5965	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	297.7858	0.5190	154.5508	(268)
Energy saving/generation technologies				
PV Unit	-1271.2514	0.5190	-659.7795	(269)
Total CO2, kg/year			722.2929	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.0500	(273)

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

DER		12.0500	ZC1
Total Floor Area	TFA	59.9400	
Assumed number of occupants	N	1.9799	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0829	ZC2
CO2 emissions from cooking, equation (L16)		2.7781	ZC3
Total CO2 emissions		31.9110	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.9110	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.2800 (2c)	=	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.4289	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1455	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3955	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3955	(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	0.5043	0.4944	0.4845	0.4351	0.4252	0.3758	0.3758	0.3659	0.3955	0.4252	0.4450	0.4647	(22b)
Effective ac	0.6272	0.6222	0.6174	0.5946	0.5904	0.5706	0.5706	0.5669	0.5782	0.5904	0.5990	0.6080	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			7.6600	1.3258	10.1553			(27)
150mm TE Platinum GF			2.4900	0.1300	0.3237			(28a)
Over Access			18.6300	0.1300	2.4219			(28b)
Over Garages			33.5600	0.1300	4.3628			(28b)
Over Store			2.8000	0.1300	0.3640			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.1800	0.0846			(29a)
50mm AP to Access	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP to Garage	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP with Acousti	60.9300	7.6600	53.2700	0.1800	9.5886			(29a)
Sheltered to Store	2.4400		2.4400	0.1800	0.4392			(29a)
400mm mineral wool	57.4700		57.4700	0.1300	7.4711			(30)
Total net area of external elements Aum(A, m2)			194.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6616			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	19.9967	(36)
Total fabric heat loss (33) + (36) =	59.6583	(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	28.4426	28.2187	27.9992	26.9682	26.7753	25.8774	25.8774	25.7111	26.2233	26.7753	27.1656	27.5735	(38)
Heat transfer coeff	88.1009	87.8770	87.6575	86.6265	86.4336	85.5357	85.5357	85.3694	85.8816	86.4336	86.8239	87.2318	(39)
Average = Sum(39)m / 12 =												86.6256	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4698	1.4661	1.4624	1.4452	1.4420	1.4270	1.4270	1.4242	1.4328	1.4420	1.4485	1.4553	(40)
HLP (average)												1.4452	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)
Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1277.9621 (45)

Distribution loss (46)m = 0.15 x (45)m

	19.8746	17.3825	17.9371	15.6380	15.0051	12.9482	11.9984	13.7684	13.9328	16.2374	17.7243	19.2475 (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	45.5297	39.6282	42.2184	39.2543	38.9072	36.0499	37.2516	38.9072	39.2543	42.2184	42.4588	45.5297 (61)

Total heat required for water heating calculated for each month

	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463 (64)

Total per year (kWh/year) = Sum(64)m = 1765.1697 (64)

Heat gains from water heating, kWh/month

	55.4378	48.4381	50.3153	44.4779	42.9880	37.7144	35.9094	40.2467	40.6980	46.5474	49.9037	54.0477 (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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997 (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)

	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975 (71)

Water heating gains (Table 5)

	74.5131	72.0806	67.6280	61.7748	57.7796	52.3811	48.2653	54.0950	56.5250	62.5637	69.3106	72.6447 (72)

Total internal gains

	319.8697	317.3449	305.5770	287.1456	268.6795	250.7949	239.5237	245.4456	255.1908	273.8078	295.0256	310.8457 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.6300	0.7000	0.7700	10.5940	(74)
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)

Solar gains	73.4614	123.2063	165.5559	203.4911	228.9060	228.3426	219.6435	200.0784	178.3682	135.1525	87.5884	63.1549 (83)
Total gains	393.3311	440.5511	471.1329	490.6366	497.5854	479.1376	459.1671	445.5240	433.5590	408.9603	382.6139	374.0006 (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	47.2469	47.3673	47.4859	48.0511	48.1583	48.6639	48.6639	48.7587	48.4679	48.1583	47.9419	47.7177	
alpha	4.1498	4.1578	4.1657	4.2034	4.2106	4.2443	4.2443	4.2506	4.2312	4.2106	4.1961	4.1812	
util living area	0.9969	0.9946	0.9899	0.9777	0.9449	0.8591	0.7215	0.7553	0.9111	0.9799	0.9945	0.9975	(86)
MIT	19.4022	19.5531	19.8071	20.1547	20.5036	20.7974	20.9328	20.9161	20.7056	20.2589	19.7720	19.3785	(87)
Th 2	19.7102	19.7130	19.7158	19.7288	19.7313	19.7427	19.7427	19.7448	19.7383	19.7313	19.7263	19.7212	(88)
util rest of house	0.9958	0.9927	0.9859	0.9676	0.9154	0.7732	0.5588	0.6025	0.8507	0.9687	0.9921	0.9967	(89)
MIT 2	17.6155	17.8373	18.2090	18.7198	19.2112	19.5911	19.7160	19.7073	19.4864	18.8748	18.1665	17.5881	(90)

Living area fraction fLA = Living area / (4) = 0.3315 (91)

MIT	18.2078	18.4061	18.7387	19.1955	19.6396	19.9910	20.1193	20.1081	19.8906	19.3336	18.6987	18.1816	(92)

Temperature adjustment 0.0000

adjusted MIT	18.2078	18.4061	18.7387	19.1955	19.6396	19.9910	20.1193	20.1081	19.8906	19.3336	18.6987	18.1816	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9897	0.9815	0.9618	0.9126	0.7935	0.6134	0.6528	0.8599	0.9638	0.9892	0.9950	(94)
Useful gains	390.9321	436.0265	462.4341	471.8983	454.1054	380.1917	281.6349	290.8426	372.8194	394.1646	378.4980	372.1457	(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	1225.2889	1186.8747	1072.8170	891.8629	686.2489	461.1197	301.0295	316.5545	497.3058	754.8769	1007.0452	1219.6431	(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	620.7615	504.5700	454.1249	302.3745	172.7148	0.0000	0.0000	0.0000	0.0000	268.3700	452.5540	630.5381	(98)

Space heating 3406.0076 (98)

Space heating per m2 (98) / (4) = 56.8236 (99)

8c. Space cooling requirement

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3646.6891	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	620.7615	504.5700	454.1249	302.3745	172.7148	0.0000	0.0000	0.0000	0.0000	268.3700	452.5540	630.5381	(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)													
	664.6268	540.2248	486.2151	323.7414	184.9195	0.0000	0.0000	0.0000	0.0000	287.3340	484.5332	675.0943	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement													
	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9350	87.7983	87.5086	86.8828	85.6001	80.3000	80.3000	80.3000	80.3000	86.4918	87.5165	88.0076	(217)
Fuel for water heating, kWh/month													
	202.4530	177.1232	184.8953	165.1740	162.3140	152.3928	146.0039	162.7601	164.5576	173.9673	183.5322	197.5354	(219)
Water heating fuel used												2072.7090	(219)
Annual totals kWh/year													
Space heating fuel - main system												3646.6891	(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)	297.7858	(232)
Total delivered energy for all uses	6092.1839	(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	3646.6891	0.2160	787.6849	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2072.7090	0.2160	447.7051	(264)
Space and water heating			1235.3900	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	297.7858	0.5190	154.5508	(268)
Total CO2, kg/m2/year			1428.8658	(272)
Emissions per m2 for space and water heating			20.6104	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5784	(272b)
Emissions per m2 for pumps and fans			0.6494	(272c)
Target Carbon Dioxide Emission Rate (TER) = (20.6104 * 1.00) + 2.5784 + 0.6494, rounded to 2 d.p.			23.8400	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.2800 (2c)	=	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.4289	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1455	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3960	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3960	(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	0.5049	0.4950	0.4851	0.4356	0.4257	0.3762	0.3762	0.3663	0.3960	0.4257	0.4455	0.4653	(22b)
Effective ac	0.6275	0.6225	0.6177	0.5949	0.5906	0.5708	0.5708	0.5671	0.5784	0.5906	0.5993	0.6083	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			7.6600	1.3347	10.2240			(27)
150mm TE Platinum GF			2.4900	0.1800	0.4482			(28a)
Over Access			18.6300	0.1800	3.3534			(28b)
Over Garages			33.5600	0.1700	5.7052			(28b)
Over Store			2.8000	0.1700	0.4760			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.2700	0.1269			(29a)
50mm AP to Access	6.8900		6.8900	0.2700	1.8603			(29a)
50mm AP to Garage	6.8900		6.8900	0.2200	1.5158			(29a)
50mm AP with Acousti	60.9300	7.6600	53.2700	0.2500	13.3175			(29a)
Sheltered to Store	2.4400		2.4400	0.3700	0.9028			(29a)
400mm mineral wool	57.4700		57.4700	0.1100	6.3217			(30)
Total net area of external elements Aum(A, m2)			194.5400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2218			(33)
E-WM-20/22			12.3300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	122.3100	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	23.1147	(36)
Total fabric heat loss	(33) + (36) = 69.3365	(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	28.4572	28.2327	28.0127	26.9791	26.7857	25.8855	25.8855	25.7188	26.2322	26.7857	27.1769	27.5859	(38)
Heat transfer coeff	97.7937	97.5692	97.3491	96.3156	96.1222	95.2219	95.2219	95.0552	95.5687	96.1222	96.5134	96.9224	(39)
Average = Sum(39)m / 12 =												96.3146	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6315	1.6278	1.6241	1.6069	1.6036	1.5886	1.5886	1.5858	1.5944	1.6036	1.6102	1.6170	(40)
HLP (average)												1.6069	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)
Energy content (annual)										Total = Sum(45)m =		1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.1557	24.6251	25.4109	22.1539	21.2572	18.3433	16.9978	19.5052	19.7382	23.0029	25.1095	27.2673	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	37.8437	36.6446	34.1545	30.7693	28.5715	25.4768	22.8465	26.2167	27.4141	30.9179	34.8743	36.6496	(72)
Total internal gains													
	280.2002	278.9088	269.1035	253.1400	236.4713	220.8907	211.1048	214.5672	223.0800	239.1620	257.5892	271.8505	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.7100	0.7000	0.7700	11.9393	(74)
South	4.4000	46.7521	0.7100	0.7000	0.7700	70.8505	(78)

Solar gains	82.7898	138.8515	186.5789	229.3312	257.9734	257.3385	247.5347	225.4852	201.0181	152.3147	98.7107	71.1746	(83)
Total gains	362.9900	417.7604	455.6824	482.4712	494.4447	478.2292	458.6395	440.0524	424.0981	391.4767	356.2999	343.0251	(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	20.8241	20.8720	20.9192	21.1436	21.1862	21.3865	21.3865	21.4240	21.3089	21.1862	21.1003	21.0113	
alpha	2.3883	2.3915	2.3946	2.4096	2.4124	2.4258	2.4258	2.4283	2.4206	2.4124	2.4067	2.4008	
util living area													
	0.9784	0.9687	0.9538	0.9264	0.8765	0.7881	0.6754	0.7060	0.8426	0.9339	0.9695	0.9811	(86)
MIT	18.0722	18.3257	18.7575	19.3432	19.9371	20.4611	20.7470	20.7065	20.3011	19.5365	18.7049	18.0292	(87)
Th 2	19.5903	19.5930	19.5957	19.6083	19.6107	19.6217	19.6217	19.6237	19.6174	19.6107	19.6059	19.6009	(88)
util rest of house													
	0.9740	0.9623	0.9436	0.9078	0.8391	0.7081	0.5328	0.5728	0.7801	0.9136	0.9620	0.9773	(89)
MIT 2	16.9747	17.2274	17.6563	18.2399	18.8133	19.2983	19.5211	19.4977	19.1629	18.4370	17.6147	16.9389	(90)
Living area fraction									fLA = Living area / (4) =			0.3315	(91)
MIT	17.3385	17.5915	18.0214	18.6056	19.1858	19.6837	19.9275	19.8984	19.5402	18.8015	17.9761	17.3004	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3385	17.5915	18.0214	18.6056	19.1858	19.6837	19.9275	19.8984	19.5402	18.8015	17.9761	17.3004	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9639	0.9494	0.9279	0.8902	0.8247	0.7124	0.5696	0.6042	0.7757	0.8976	0.9497	0.9681	(94)
Useful gains	349.8847	396.6396	422.8394	429.4840	407.7906	340.6856	261.2486	265.8726	328.9717	351.3875	338.3736	332.0828	(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													
	1275.0838	1238.2985	1121.5944	934.8005	719.5511	484.0838	316.8509	332.5399	519.9102	788.3482	1049.6888	1269.7183	(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													
	688.3481	565.5948	519.8737	363.8279	231.9498	0.0000	0.0000	0.0000	0.0000	325.0987	512.1469	697.6009	(98)
Space heating												3904.4408	(98)
Space heating per m2											(98) / (4) =	65.1392	(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	895.0862	704.6424	722.4198	0.0000	0.0000	0.0000	0.0000	(100)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5789	0.6551	0.6331	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	518.2063	461.5909	457.3526	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	633.5901	609.2930	588.9281	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	83.0763	109.8904	97.8922	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												290.8588 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	20.7691	27.4726	24.4730	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												72.7147 (107)
Space cooling per m2												1.2131 (108)
Energy for space heating												65.1392 (99)
Energy for space cooling												1.2131 (108)
Total												66.3523 (109)
Dwelling Fabric Energy Efficiency (DFEE)												66.4 (109)

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	2.4700	(1b)	x 2.5900	(2b) =	6.3973	(1b) - (3b)
First floor	57.4700	(1c)	x 2.2800	(2c) =	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		137.4289	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1455	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3955	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3955	(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	0.5043	0.4944	0.4845	0.4351	0.4252	0.3758	0.3758	0.3659	0.3955	0.4252	0.4450	0.4647	(22b)
Effective ac	0.6272	0.6222	0.6174	0.5946	0.5904	0.5706	0.5706	0.5669	0.5782	0.5904	0.5990	0.6080	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			7.6600	1.3258	10.1553			(27)
150mm TE Platinum GF			2.4900	0.1300	0.3237			(28a)
Over Access			18.6300	0.1300	2.4219			(28b)
Over Garages			33.5600	0.1300	4.3628			(28b)
Over Store			2.8000	0.1300	0.3640			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.1800	0.0846			(29a)
50mm AP to Access	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP to Garage	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP with Acousti	60.9300	7.6600	53.2700	0.1800	9.5886			(29a)
Sheltered to Store	2.4400		2.4400	0.1800	0.4392			(29a)
400mm mineral wool	57.4700		57.4700	0.1300	7.4711			(30)
Total net area of external elements Aum(A, m2)			194.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6616			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	19.9967	(36)
Total fabric heat loss (33) + (36) =	59.6583	(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	28.4426	28.2187	27.9992	26.9682	26.7753	25.8774	25.8774	25.7111	26.2233	26.7753	27.1656	27.5735	(38)
Heat transfer coeff	88.1009	87.8770	87.6575	86.6265	86.4336	85.5357	85.5357	85.3694	85.8816	86.4336	86.8239	87.2318	(39)
Average = Sum(39)m / 12 =												86.6256	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4698	1.4661	1.4624	1.4452	1.4420	1.4270	1.4270	1.4242	1.4328	1.4420	1.4485	1.4553	(40)
HLP (average)												1.4452	(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	1.9799	(42)
Average daily hot water use (litres/day)	81.2235	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)
Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.1557	24.6251	25.4109	22.1539	21.2572	18.3433	16.9978	19.5052	19.7382	23.0029	25.1095	27.2673	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	37.8437	36.6446	34.1545	30.7693	28.5715	25.4768	22.8465	26.2167	27.4141	30.9179	34.8743	36.6496	(72)
Total internal gains													
	280.2002	278.9088	269.1035	253.1400	236.4713	220.8907	211.1048	214.5672	223.0800	239.1620	257.5892	271.8505	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.6300	0.7000	0.7700	10.5940	(74)
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)

Solar gains	73.4614	123.2063	165.5559	203.4911	228.9060	228.3426	219.6435	200.0784	178.3682	135.1525	87.5884	63.1549	(83)
Total gains	353.6616	402.1151	434.6594	456.6311	465.3773	449.2333	430.7483	414.6456	401.4481	374.3145	345.1776	335.0054	(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	47.2469	47.3673	47.4859	48.0511	48.1583	48.6639	48.6639	48.7587	48.4679	48.1583	47.9419	47.7177	
alpha	4.1498	4.1578	4.1657	4.2034	4.2106	4.2443	4.2443	4.2506	4.2312	4.2106	4.1961	4.1812	
util living area													
	0.9980	0.9962	0.9924	0.9826	0.9552	0.8799	0.7511	0.7869	0.9286	0.9853	0.9963	0.9984	(86)
MIT	19.3442	19.4974	19.7552	20.1086	20.4655	20.7731	20.9212	20.9009	20.6725	20.2113	19.7176	19.3212	(87)
Th 2	19.7102	19.7130	19.7158	19.7288	19.7313	19.7427	19.7427	19.7448	19.7383	19.7313	19.7263	19.7212	(88)
util rest of house													
	0.9972	0.9948	0.9894	0.9745	0.9301	0.8007	0.5894	0.6375	0.8763	0.9768	0.9946	0.9978	(89)
MIT 2	18.2223	18.3771	18.6360	18.9957	19.3425	19.6231	19.7204	19.7132	19.5409	19.1011	18.6074	18.2077	(90)
Living area fraction									fLA = Living area / (4) =			0.3315	(91)
MIT	18.5942	18.7485	19.0070	19.3646	19.7148	20.0043	20.1185	20.1069	19.9160	19.4691	18.9754	18.5768	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5942	18.7485	19.0070	19.3646	19.7148	20.0043	20.1185	20.1069	19.9160	19.4691	18.9754	18.5768	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9933	0.9871	0.9714	0.9297	0.8207	0.6444	0.6876	0.8857	0.9744	0.9932	0.9971	(94)
Useful gains	352.3517	399.4113	429.0521	443.5722	432.6498	368.6862	277.5952	285.1112	355.5561	364.7227	342.8426	334.0202	(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													
	1259.3302	1216.9617	1096.3316	906.5143	692.7456	462.2605	300.9560	316.4549	499.4896	766.5895	1031.0723	1254.1166	(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													
	674.7920	549.3939	496.4560	333.3183	193.5113	0.0000	0.0000	0.0000	0.0000	298.9889	495.5254	684.5517	(98)
Space heating												3726.5374	(98)
Space heating per m2											(98) / (4) =	62.1711	(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	804.0354	632.9640	648.8073	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6763	0.7699	0.7451	0.0000	0.0000	0.0000	0.0000	(101)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	543.7755	487.2996	483.4272	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	599.6988	576.6928	559.2318	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	40.2648	66.5086	56.3986	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												163.1719 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	10.0662	16.6271	14.0997	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												40.7930 (107)
Space cooling per m2												0.6806 (108)
Energy for space heating												62.1711 (99)
Energy for space cooling												0.6806 (108)
Total												62.8517 (109)
Target Fabric Energy Efficiency (TFEE)												72.3 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	2BF Mid-Terrace PV	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	Representive
Property	Alverton DS02, Mid Terr, Part L2013		

SAP Rating	90 B	**DER**	11.60	**TER**	23.11
Environmental	92 A	**% DER<TER**	49.80		
CO_2 Emissions (t/year)	0.46	**DFEE**	63.92	**TFEE**	68.40
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.55		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 60 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) 23.11 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.60 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)68.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)63.9 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.37 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 3.26 m², Overhang width less than twice window, ratio 0.28
Windows facing South: 4.40 m², Overhang width less than twice window, ratio 0.24
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 1.93 kW

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	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.2800 (2c)	=	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.4289	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2183	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4688	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4336	(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	0.5529	0.5420	0.5312	0.4770	0.4662	0.4120	0.4120	0.4011	0.4336	0.4662	0.4878	0.5095	(22b)
Effective ac	0.6528	0.6469	0.6411	0.6138	0.6087	0.5849	0.5849	0.5804	0.5940	0.6087	0.6190	0.6298	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			7.6600	1.3347	10.2240			(27)
150mm TE Platinum GF			2.4900	0.1800	0.4482			(28a)
Over Access			18.6300	0.1800	3.3534			(28b)
Over Garages			33.5600	0.1700	5.7052			(28b)
Over Store			2.8000	0.1700	0.4760			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.2700	0.1269			(29a)
50mm AP to Access	6.8900		6.8900	0.2700	1.8603			(29a)
50mm AP to Garage	6.8900		6.8900	0.2200	1.5158			(29a)
50mm AP with Acousti	48.6100	7.6600	40.9500	0.2500	10.2375			(29a)
Sheltered to Store	2.4400		2.4400	0.3700	0.9028			(29a)
400mm mineral wool	57.4700		57.4700	0.1100	6.3217			(30)
Total net area of external elements Aum(A, m2)			182.2200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.1418			(33)
E-WM-20/22			24.6500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	135.3200	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	23.1201	(36)
Total fabric heat loss (33) + (36) =	66.2619	(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	29.6073	29.3382	29.0743	27.8351	27.6033	26.5240	26.5240	26.3241	26.9397	27.6033	28.0723	28.5627	(38)
Heat transfer coeff	95.8692	95.6000	95.3362	94.0970	93.8651	92.7858	92.7858	92.5860	93.2016	93.8651	94.3342	94.8245	(39)
Average = Sum(39)m / 12 =												94.0959	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5994	1.5949	1.5905	1.5699	1.5660	1.5480	1.5480	1.5446	1.5549	1.5660	1.5738	1.5820	(40)
HLP (average)												1.5698	(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	1.9799	(42)
Average daily hot water use (litres/day)	81.2235	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)
Energy content (annual)										Total = Sum(45)m =		1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	19.8746	17.3825	17.9371	15.6380	15.0051	12.9482	11.9984	13.7684	13.9328	16.2374	17.7243	19.2475	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0407	12.6647	13.9943	13.5120	13.9399	13.4642	13.8969	13.9248	13.4902	13.9718	13.5570	14.0317	(61)
Total heat required for water heating calculated for each month													
	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(64)
									Total per year (kWh/year) = Sum(64)m =			1442.4503	(64)
Heat gains from water heating, kWh/month													
	47.5655	41.6973	43.2592	38.0423	36.7462	32.0680	30.0708	34.0011	34.2570	39.4858	42.6782	46.1732	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	63.9322	62.0495	58.1441	52.8365	49.3900	44.5388	40.4177	45.7004	47.5791	53.0723	59.2753	62.0607	(72)
Total internal gains													
	309.2887	307.3138	296.0931	278.2072	260.2899	242.9527	231.6760	237.0509	246.2450	264.3163	284.9902	300.2617	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.7100	0.7000	0.7700	11.9393	(74)
South	4.4000	46.7521	0.7100	0.7000	0.7700	70.8505	(78)

Solar gains	82.7898	138.8515	186.5789	229.3312	257.9734	257.3385	247.5347	225.4852	201.0181	152.3147	98.7107	71.1746	(83)
Total gains	392.0785	446.1653	482.6720	507.5385	518.2633	500.2912	479.2107	462.5361	447.2631	416.6311	383.7009	371.4363	(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	23.5016	23.5678	23.6330	23.9442	24.0033	24.2826	24.2826	24.3350	24.1742	24.0033	23.8840	23.7605	
alpha	2.5668	2.5712	2.5755	2.5963	2.6002	2.6188	2.6188	2.6223	2.6116	2.6002	2.5923	2.5840	
util living area													
	0.9795	0.9702	0.9557	0.9280	0.8763	0.7825	0.6635	0.6934	0.8385	0.9343	0.9704	0.9821	(86)
MIT	18.3488	18.5872	18.9888	19.5347	20.0799	20.5533	20.8007	20.7677	20.4094	19.7104	18.9412	18.3123	(87)
Th 2	19.6138	19.6171	19.6203	19.6355	19.6384	19.6517	19.6517	19.6542	19.6466	19.6384	19.6326	19.6266	(88)
util rest of house													
	0.9750	0.9638	0.9453	0.9090	0.8376	0.6997	0.5193	0.5578	0.7732	0.9132	0.9628	0.9782	(89)
MIT 2	16.1492	16.4963	17.0793	17.8712	18.6375	19.2680	19.5408	19.5141	19.0943	18.1326	17.0222	16.1029	(90)
Living area fraction										fLA = Living area / (4) =		0.3315	(91)
MIT	16.8783	17.1894	17.7123	18.4226	19.1156	19.6941	19.9584	19.9297	19.5303	18.6557	17.6583	16.8353	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.7283	17.0394	17.5623	18.2726	18.9656	19.5441	19.8084	19.7797	19.3803	18.5057	17.5083	16.6853	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9606	0.9455	0.9228	0.8828	0.8127	0.6916	0.5389	0.5728	0.7567	0.8883	0.9448	0.9651	(94)
Useful gains	376.6137	421.8522	445.4289	448.0581	421.2036	346.0097	258.2391	264.9389	338.4558	370.0733	362.5132	358.4839	(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													
	1191.4937	1160.5298	1054.6403	881.9376	681.9904	458.7431	297.6970	312.9091	492.1307	742.0652	981.8609	1183.9149	(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													
	606.2708	496.3913	453.2532	312.3933	194.0254	0.0000	0.0000	0.0000	0.0000	276.7620	445.9304	614.1207	(98)
Space heating												3399.1469	(98)
Space heating per m2											(98) / (4) =	56.7092	(99)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3755.9635	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	606.2708	496.3913	453.2532	312.3933	194.0254	0.0000	0.0000	0.0000	0.0000	276.7620	445.9304	614.1207	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	669.9124	548.4987	500.8323	345.1859	214.3927	0.0000	0.0000	0.0000	0.0000	305.8143	492.7407	678.5864	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8588	89.8228	89.7512	89.6008	89.2889	87.3000	87.3000	87.3000	87.3000	89.4951	89.7498	89.8800	(217)
Fuel for water heating, kWh/month	163.0758	143.1127	148.8284	131.4335	127.6459	114.3021	107.5446	121.0927	121.8507	136.5671	146.7627	158.3759	(219)
Water heating fuel used												1620.5921	(219)
Annual totals kWh/year													
Space heating fuel - main system												3755.9635	(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)												297.7858	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.93 * 1029 * 0.80) =											-1271.2514	-1271.2514	(233)
Total delivered energy for all uses												4478.0899	(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	3755.9635	0.2160	811.2881	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1620.5921	0.2160	350.0479	(264)
Space and water heating			1161.3360	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	297.7858	0.5190	154.5508	(268)
Energy saving/generation technologies				
PV Unit	-1271.2514	0.5190	-659.7795	(269)
Total CO2, kg/year			695.0323	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.6000	(273)

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

DER		11.6000	ZC1
Total Floor Area	TFA	59.9400	
Assumed number of occupants	N	1.9799	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0829	ZC2
CO2 emissions from cooking, equation (L16)		2.7781	ZC3
Total CO2 emissions		31.4610	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.4610	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	2.4700	(1b)	x 2.5900	(2b) =	6.3973	(1b) - (3b)
First floor	57.4700	(1c)	x 2.2800	(2c) =	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		137.4289	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1455	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3955	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3659	(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	0.4665	0.4573	0.4482	0.4025	0.3933	0.3476	0.3476	0.3384	0.3659	0.3933	0.4116	0.4299	(22b)
Effective ac	0.6088	0.6046	0.6004	0.5810	0.5773	0.5604	0.5604	0.5573	0.5669	0.5773	0.5847	0.5924	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			7.6600	1.3258	10.1553			(27)
150mm TE Platinum GF			2.4900	0.1300	0.3237			(28a)
Over Access			18.6300	0.1300	2.4219			(28b)
Over Garages			33.5600	0.1300	4.3628			(28b)
Over Store			2.8000	0.1300	0.3640			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.1800	0.0846			(29a)
50mm AP to Access	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP to Garage	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP with Acousti	48.6100	7.6600	40.9500	0.1800	7.3710			(29a)
Sheltered to Store	2.4400		2.4400	0.1800	0.4392			(29a)
400mm mineral wool	57.4700		57.4700	0.1300	7.4711			(30)
Total net area of external elements Aum(A, m2)			182.2200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.4440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	19.3190	(36)
Total fabric heat loss (33) + (36) =	56.7630	(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	27.6101	27.4184	27.2306	26.3485	26.1835	25.4151	25.4151	25.2729	25.7111	26.1835	26.5173	26.8664	(38)
Heat transfer coeff	84.3731	84.1815	83.9936	83.1115	82.9465	82.1781	82.1781	82.0359	82.4741	82.9465	83.2803	83.6294	(39)
Average = Sum(39)m / 12 =												83.1107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4076	1.4044	1.4013	1.3866	1.3838	1.3710	1.3710	1.3686	1.3759	1.3838	1.3894	1.3952	(40)
HLP (average)												1.3866	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)
Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1277.9621 (45)

Distribution loss (46)m = 0.15 x (45)m

	19.8746	17.3825	17.9371	15.6380	15.0051	12.9482	11.9984	13.7684	13.9328	16.2374	17.7243	19.2475 (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	45.5297	39.6282	42.2184	39.2543	38.9072	36.0499	37.2516	38.9072	39.2543	42.2184	42.4588	45.5297 (61)

Total heat required for water heating calculated for each month

	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463 (64)

Total per year (kWh/year) = Sum(64)m = 1765.1697 (64)

Heat gains from water heating, kWh/month

	55.4378	48.4381	50.3153	44.4779	42.9880	37.7144	35.9094	40.2467	40.6980	46.5474	49.9037	54.0477 (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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997 (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)

	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975 (71)

Water heating gains (Table 5)

	74.5131	72.0806	67.6280	61.7748	57.7796	52.3811	48.2653	54.0950	56.5250	62.5637	69.3106	72.6447 (72)

Total internal gains

	319.8697	317.3449	305.5770	287.1456	268.6795	250.7949	239.5237	245.4456	255.1908	273.8078	295.0256	310.8457 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.6300	0.7000	0.7700	10.5940	(74)
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)

Solar gains	73.4614	123.2063	165.5559	203.4911	228.9060	228.3426	219.6435	200.0784	178.3682	135.1525	87.5884	63.1549 (83)
Total gains	393.3311	440.5511	471.1329	490.6366	497.5854	479.1376	459.1671	445.5240	433.5590	408.9603	382.6139	374.0006 (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	49.3345	49.4468	49.5573	50.0833	50.1830	50.6522	50.6522	50.7400	50.4704	50.1830	49.9818	49.7732	
alpha	4.2890	4.2965	4.3038	4.3389	4.3455	4.3768	4.3768	4.3827	4.3647	4.3455	4.3321	4.3182	
util living area	0.9970	0.9946	0.9896	0.9767	0.9416	0.8499	0.7062	0.7411	0.9053	0.9791	0.9945	0.9976	(86)
MIT	19.4781	19.6266	19.8738	20.2093	20.5448	20.8211	20.9438	20.9289	20.7343	20.3053	19.8333	19.4523	(87)
Th 2	19.7575	19.7599	19.7623	19.7736	19.7758	19.7856	19.7856	19.7875	19.7818	19.7758	19.7715	19.7670	(88)
util rest of house	0.9959	0.9927	0.9856	0.9664	0.9112	0.7634	0.5481	0.5916	0.8438	0.9677	0.9921	0.9967	(89)
MIT 2	17.7573	17.9755	18.3369	18.8286	19.2993	19.6525	19.7633	19.7558	19.5553	18.9716	18.2856	17.7261	(90)
Living area fraction									fLA = Living area / (4) =			0.3315	(91)
MIT	18.3278	18.5228	18.8464	19.2863	19.7122	20.0399	20.1546	20.1447	19.9461	19.4137	18.7987	18.2983	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3278	18.5228	18.8464	19.2863	19.7122	20.0399	20.1546	20.1447	19.9461	19.4137	18.7987	18.2983	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9898	0.9814	0.9609	0.9092	0.7847	0.6011	0.6410	0.8541	0.9630	0.9893	0.9952	(94)
Useful gains	390.9943	436.0731	462.3815	471.4464	452.4165	376.0014	276.0179	285.5742	370.2950	393.8469	378.5341	372.2024	(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	1183.5665	1146.7907	1037.0168	863.2188	664.5846	447.0402	292.1130	307.1984	482.1543	731.0679	974.2701	1179.0335	(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	589.6737	477.6022	427.5286	282.0761	157.8531	0.0000	0.0000	0.0000	0.0000	250.8924	428.9299	600.2823	(98)
Space heating												3214.8385	(98)
Space heating per m2										(98) / (4) =		53.6343	(99)

8c. Space cooling requirement

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3442.0112	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	589.6737	477.6022	427.5286	282.0761	157.8531	0.0000	0.0000	0.0000	0.0000	250.8924	428.9299	600.2823	(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)													
	631.3423	511.3514	457.7394	302.0087	169.0076	0.0000	0.0000	0.0000	0.0000	268.6214	459.2398	642.7006	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement													
	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8380	87.6908	87.3825	86.7219	85.3731	80.3000	80.3000	80.3000	80.3000	86.3293	87.4048	87.9167	(217)
Fuel for water heating, kWh/month													
	202.6766	177.3404	185.1622	165.4805	162.7456	152.3928	146.0039	162.7601	164.5576	174.2948	183.7668	197.7398	(219)
Water heating fuel used												2074.9210	(219)
Annual totals kWh/year													
Space heating fuel - main system												3442.0112	(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)	297.7858	(232)
Total delivered energy for all uses	5889.7180	(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	3442.0112	0.2160	743.4744	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2074.9210	0.2160	448.1829	(264)
Space and water heating			1191.6574	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	297.7858	0.5190	154.5508	(268)
Total CO2, kg/m2/year			1385.1332	(272)
Emissions per m2 for space and water heating			19.8808	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5784	(272b)
Emissions per m2 for pumps and fans			0.6494	(272c)
Target Carbon Dioxide Emission Rate (TER) = (19.8808 * 1.00) + 2.5784 + 0.6494, rounded to 2 d.p.			23.1100	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.2800 (2c)	=	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.4289	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1455	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3960	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3663	(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	0.4671	0.4579	0.4488	0.4030	0.3938	0.3480	0.3480	0.3389	0.3663	0.3938	0.4121	0.4304	(22b)
Effective ac	0.6091	0.6048	0.6007	0.5812	0.5775	0.5606	0.5606	0.5574	0.5671	0.5775	0.5849	0.5926	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			7.6600	1.3347	10.2240			(27)
150mm TE Platinum GF			2.4900	0.1800	0.4482			(28a)
Over Access			18.6300	0.1800	3.3534			(28b)
Over Garages			33.5600	0.1700	5.7052			(28b)
Over Store			2.8000	0.1700	0.4760			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.2700	0.1269			(29a)
50mm AP to Access	6.8900		6.8900	0.2700	1.8603			(29a)
50mm AP to Garage	6.8900		6.8900	0.2200	1.5158			(29a)
50mm AP with Acousti	48.6100	7.6600	40.9500	0.2500	10.2375			(29a)
Sheltered to Store	2.4400		2.4400	0.3700	0.9028			(29a)
400mm mineral wool	57.4700		57.4700	0.1100	6.3217			(30)
Total net area of external elements Aum(A, m2)			182.2200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.1418			(33)
E-WM-20/22			24.6500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	135.3200	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	23.1201	(36)
Total fabric heat loss	(33) + (36) = 66.2619	(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	27.6225	27.4304	27.2422	26.3578	26.1923	25.4221	25.4221	25.2794	25.7188	26.1923	26.5271	26.8770	(38)
Heat transfer coeff	93.8844	93.6923	93.5040	92.6197	92.4542	91.6839	91.6839	91.5413	91.9806	92.4542	92.7889	93.1389	(39)
Average = Sum(39)m / 12 =												92.6189	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5663	1.5631	1.5600	1.5452	1.5424	1.5296	1.5296	1.5272	1.5345	1.5424	1.5480	1.5539	(40)
HLP (average)												1.5452	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)
Energy content (annual)										Total = Sum(45)m =		1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.1557	24.6251	25.4109	22.1539	21.2572	18.3433	16.9978	19.5052	19.7382	23.0029	25.1095	27.2673	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	37.8437	36.6446	34.1545	30.7693	28.5715	25.4768	22.8465	26.2167	27.4141	30.9179	34.8743	36.6496	(72)
Total internal gains													
	280.2002	278.9088	269.1035	253.1400	236.4713	220.8907	211.1048	214.5672	223.0800	239.1620	257.5892	271.8505	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.7100	0.7000	0.7700	11.9393	(74)
South	4.4000	46.7521	0.7100	0.7000	0.7700	70.8505	(78)

Solar gains	82.7898	138.8515	186.5789	229.3312	257.9734	257.3385	247.5347	225.4852	201.0181	152.3147	98.7107	71.1746	(83)
Total gains	362.9900	417.7604	455.6824	482.4712	494.4447	478.2292	458.6395	440.0524	424.0981	391.4767	356.2999	343.0251	(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	23.9984	24.0476	24.0961	24.3261	24.3697	24.5744	24.5744	24.6127	24.4951	24.3697	24.2818	24.1905	
alpha	2.5999	2.6032	2.6064	2.6217	2.6246	2.6383	2.6383	2.6408	2.6330	2.6246	2.6188	2.6127	
util living area													
	0.9828	0.9742	0.9605	0.9344	0.8851	0.7946	0.6772	0.7092	0.8507	0.9417	0.9748	0.9851	(86)
MIT	18.3392	18.5782	18.9797	19.5203	20.0668	20.5414	20.7941	20.7581	20.3934	19.6895	18.9198	18.2962	(87)
Th 2	19.6381	19.6405	19.6428	19.6538	19.6558	19.6654	19.6654	19.6672	19.6617	19.6558	19.6517	19.6473	(88)
util rest of house													
	0.9791	0.9685	0.9512	0.9169	0.8485	0.7144	0.5344	0.5756	0.7888	0.9227	0.9684	0.9819	(89)
MIT 2	17.2553	17.4935	17.8924	18.4309	18.9573	19.3931	19.5857	19.5656	19.2695	18.6036	17.8425	17.2188	(90)
Living area fraction									fLA = Living area / (4) =			0.3315	(91)
MIT	17.6146	17.8531	18.2529	18.7920	19.3251	19.7738	19.9863	19.9609	19.6421	18.9636	18.1997	17.5759	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6146	17.8531	18.2529	18.7920	19.3251	19.7738	19.9863	19.9609	19.6421	18.9636	18.1997	17.5759	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9712	0.9583	0.9384	0.9023	0.8373	0.7222	0.5739	0.6099	0.7876	0.9096	0.9585	0.9748	(94)
Useful gains	352.5236	400.3251	427.6177	435.3413	414.0098	345.3717	263.2104	268.4084	334.0312	356.0927	341.5218	334.3925	(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													
	1250.0346	1213.6053	1098.9398	916.1965	704.9725	474.3531	310.4661	325.9685	509.7638	773.2464	1029.9259	1245.8188	(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													
	667.7482	546.5243	499.4637	346.2157	216.4763	0.0000	0.0000	0.0000	0.0000	310.3624	495.6509	678.1012	(98)
Space heating												3760.5427	(98)
Space heating per m2											(98) / (4) =	62.7384	(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	861.8290	678.4612	695.7139	0.0000	0.0000	0.0000	0.0000	(100)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6068	0.6851	0.6625	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	522.9463	464.8259	460.9413	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	633.5901	609.2930	588.9281	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	79.6635	107.4835	95.2222	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												282.3693 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	19.9159	26.8709	23.8055	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												70.5923 (107)
Space cooling per m2												1.1777 (108)
Energy for space heating												62.7384 (99)
Energy for space cooling												1.1777 (108)
Total												63.9162 (109)
Dwelling Fabric Energy Efficiency (DFEE)												63.9 (109)

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	2.4700	(1b)	x 2.5900	(2b) =	6.3973	(1b) - (3b)
First floor	57.4700	(1c)	x 2.2800	(2c) =	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		137.4289	(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							2 * 10 =		20.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1455	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3955	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3659	(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	0.4665	0.4573	0.4482	0.4025	0.3933	0.3476	0.3476	0.3384	0.3659	0.3933	0.4116	0.4299	(22b)
Effective ac	0.6088	0.6046	0.6004	0.5810	0.5773	0.5604	0.5604	0.5573	0.5669	0.5773	0.5847	0.5924	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			7.6600	1.3258	10.1553			(27)
150mm TE Platinum GF			2.4900	0.1300	0.3237			(28a)
Over Access			18.6300	0.1300	2.4219			(28b)
Over Garages			33.5600	0.1300	4.3628			(28b)
Over Store			2.8000	0.1300	0.3640			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.1800	0.0846			(29a)
50mm AP to Access	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP to Garage	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP with Acousti	48.6100	7.6600	40.9500	0.1800	7.3710			(29a)
Sheltered to Store	2.4400		2.4400	0.1800	0.4392			(29a)
400mm mineral wool	57.4700		57.4700	0.1300	7.4711			(30)
Total net area of external elements Aum(A, m2)			182.2200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.4440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	19.3190	(36)
Total fabric heat loss (33) + (36) =	56.7630	(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	27.6101	27.4184	27.2306	26.3485	26.1835	25.4151	25.4151	25.2729	25.7111	26.1835	26.5173	26.8664	(38)
Heat transfer coeff	84.3731	84.1815	83.9936	83.1115	82.9465	82.1781	82.1781	82.0359	82.4741	82.9465	83.2803	83.6294	(39)
Average = Sum(39)m / 12 =												83.1107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4076	1.4044	1.4013	1.3866	1.3838	1.3710	1.3710	1.3686	1.3759	1.3838	1.3894	1.3952	(40)
HLP (average)												1.3866	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)
Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.1557	24.6251	25.4109	22.1539	21.2572	18.3433	16.9978	19.5052	19.7382	23.0029	25.1095	27.2673	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	37.8437	36.6446	34.1545	30.7693	28.5715	25.4768	22.8465	26.2167	27.4141	30.9179	34.8743	36.6496	(72)
Total internal gains													
	280.2002	278.9088	269.1035	253.1400	236.4713	220.8907	211.1048	214.5672	223.0800	239.1620	257.5892	271.8505	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.6300	0.7000	0.7700	10.5940	(74)
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)

Solar gains	73.4614	123.2063	165.5559	203.4911	228.9060	228.3426	219.6435	200.0784	178.3682	135.1525	87.5884	63.1549	(83)
Total gains	353.6616	402.1151	434.6594	456.6311	465.3773	449.2333	430.7483	414.6456	401.4481	374.3145	345.1776	335.0054	(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	49.3345	49.4468	49.5573	50.0833	50.1830	50.6522	50.6522	50.7400	50.4704	50.1830	49.9818	49.7732	
alpha	4.2890	4.2965	4.3038	4.3389	4.3455	4.3768	4.3768	4.3827	4.3647	4.3455	4.3321	4.3182	
util living area													
	0.9980	0.9962	0.9923	0.9820	0.9527	0.8720	0.7367	0.7740	0.9241	0.9848	0.9963	0.9984	(86)
MIT	19.4195	19.5703	19.8215	20.1630	20.5070	20.7979	20.9333	20.9149	20.7019	20.2576	19.7783	19.3944	(87)
Th 2	19.7575	19.7599	19.7623	19.7736	19.7758	19.7856	19.7856	19.7875	19.7818	19.7758	19.7715	19.7670	(88)
util rest of house													
	0.9973	0.9948	0.9893	0.9737	0.9269	0.7919	0.5788	0.6269	0.8706	0.9762	0.9947	0.9979	(89)
MIT 2	18.3335	18.4858	18.7376	19.0840	19.4173	19.6796	19.7668	19.7604	19.6026	19.1811	18.7026	18.3158	(90)
Living area fraction									fLA = Living area / (4) =			0.3315	(91)
MIT	18.6935	18.8453	19.0969	19.4417	19.7785	20.0503	20.1535	20.1431	19.9670	19.5379	19.0592	18.6734	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6935	18.8453	19.0969	19.4417	19.7785	20.0503	20.1535	20.1431	19.9670	19.5379	19.0592	18.6734	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9934	0.9871	0.9708	0.9269	0.8128	0.6325	0.6763	0.8809	0.9739	0.9933	0.9972	(94)
Useful gains	352.3975	399.4568	429.0429	443.2835	431.3722	365.1374	272.4410	280.4195	353.6178	364.5515	342.8808	334.0597	(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													
	1214.4225	1173.9355	1058.0617	876.1361	670.0863	447.8966	292.0233	307.0721	483.8760	741.3710	995.9654	1210.3992	(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													
	641.3466	520.4497	467.9900	311.6538	177.6033	0.0000	0.0000	0.0000	0.0000	280.3537	470.2209	651.9966	(98)
Space heating												3521.6147	(98)
Space heating per m2											(98) / (4) =	58.7523	(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	772.4746	608.1183	623.4726	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6992	0.7918	0.7674	0.0000	0.0000	0.0000	0.0000	(101)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	540.1433	481.5074	478.4823	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	599.6988	576.6928	559.2318	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	42.8800	70.8180	60.0776	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												173.7756 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	10.7200	17.7045	15.0194	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												43.4439 (107)
Space cooling per m2												0.7248 (108)
Energy for space heating												58.7523 (99)
Energy for space cooling												0.7248 (108)
Total												59.4771 (109)
Target Fabric Energy Efficiency (TFEE)												68.4 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Alderney Detached PV	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	DS07 Alderney , Detached, Part L2013 Masonry , Barratt Developments		

SAP Rating	91 B	**DER**	10.59	**TER**	16.93
Environmental	91 B	**% DER<TER**	37.45		
CO_2 Emissions (t/year)	0.93	**DFEE**	49.48	**TFEE**	53.52
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.55		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Detached House, total floor area 112 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.93 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.59 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.5 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.68 m², No overhang
Windows facing East: 5.27 m², No overhang
Windows facing South: 6.75 m², No overhang
Windows facing West: 3.15 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 1.93 kW

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	56.0900 (1b)	x	2.3100 (2b)	=	129.5679	(1b) - (3b)
First floor	56.0900 (1c)	x	2.5600 (2c)	=	143.5904	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	273.1583	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1464	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3969	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2779	(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	0.3543	0.3473	0.3404	0.3056	0.2987	0.2640	0.2640	0.2570	0.2779	0.2987	0.3126	0.3265	(22b)
Effective ac	0.5628	0.5603	0.5579	0.5467	0.5446	0.5348	0.5348	0.5330	0.5386	0.5446	0.5489	0.5533	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			19.8500	1.3347	26.4942			(27)
Opening Type 12			1.9700	1.0000	1.9700			(26)
150mm TE Platinum GF			56.0900	0.1500	8.4135			(28a)
50mm Alreflex Plat	159.0800	21.8200	137.2600	0.2700	37.0602			(29a)
400mm	56.0900		56.0900	0.1100	6.1699			(30)
Total net area of external elements Aum(A, m2)			271.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.1078			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							153.7100	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9313	(36)
Total fabric heat loss					(33) + (36) =		91.0391	(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	50.7277	50.5080	50.2927	49.2815	49.0923	48.2115	48.2115	48.0484	48.5508	49.0923	49.4750	49.8752	(38)
Heat transfer coeff	141.7668	141.5472	141.3319	140.3206	140.1314	139.2506	139.2506	139.0875	139.5899	140.1314	140.5142	140.9143	(39)
Average = Sum(39)m / 12 =												140.3197	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2637	1.2618	1.2599	1.2509	1.2492	1.2413	1.2413	1.2399	1.2443	1.2492	1.2526	1.2561	(40)
HLP (average)												1.2508	(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	2.8273	(42)
Average daily hot water use (litres/day)	101.3483	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.4831	107.4292	103.3753	99.3213	95.2674	91.2135	91.2135	95.2674	99.3213	103.3753	107.4292	111.4831	(44)
Energy conte	165.3263	144.5954	149.2095	130.0845	124.8192	107.7094	99.8086	114.5319	115.8997	135.0700	147.4394	160.1097	(45)
Energy content (annual)										Total = Sum(45)m =		1594.6036	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7989	21.6893	22.3814	19.5127	18.7229	16.1564	14.9713	17.1798	17.3850	20.2605	22.1159	24.0165	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1533	12.7723	14.1147	13.6229	14.0419	13.5486	13.9751	14.0184	13.5891	14.0807	13.6667	14.1408	(61)
Total heat required for water heating calculated for each month													
	179.4796	157.3677	163.3242	143.7074	138.8611	121.2580	113.7837	128.5503	129.4888	149.1507	161.1061	174.2505	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.4796	157.3677	163.3242	143.7074	138.8611	121.2580	113.7837	128.5503	129.4888	149.1507	161.1061	174.2505	(64)
								Total per year (kWh/year) = Sum(64)m =				1760.3281	(64)
Heat gains from water heating, kWh/month													
	58.5093	51.2711	53.1408	46.6588	45.0129	39.2005	36.6801	41.5865	41.9339	48.4309	52.4403	56.7717	(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	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.0782	22.2742	18.1146	13.7139	10.2513	8.6546	9.3516	12.1556	16.3152	20.7158	24.1784	25.7752	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	274.6516	277.5016	270.3196	255.0301	235.7298	217.5902	205.4718	202.6218	209.8038	225.0933	244.3937	262.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	(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)													
	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	(71)
Water heating gains (Table 5)													
	78.6416	76.2962	71.4258	64.8039	60.5011	54.4452	49.3013	55.8958	58.2416	65.0954	72.8337	76.3060	(72)
Total internal gains													
	446.7808	444.4815	428.2696	401.9574	374.8917	349.0994	332.5341	339.0826	352.7700	379.3140	409.8153	433.0239	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.6800	10.6334	0.7100	0.7000	0.7700	17.1399	(74)
East	5.2700	19.6403	0.7100	0.7000	0.7700	35.6490	(76)
South	6.7500	46.7521	0.7100	0.7000	0.7700	108.6912	(78)
West	3.1500	19.6403	0.7100	0.7000	0.7700	21.3082	(80)

Solar gains	182.7883	322.1837	465.9034	613.2947	715.4623	721.6711	691.1167	613.9241	517.1988	363.1989	220.9993	155.0467	(83)
Total gains	629.5691	766.6652	894.1730	1015.2521	1090.3540	1070.7706	1023.6508	953.0067	869.9687	742.5129	630.8146	588.0705	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.7863	33.8387	33.8903	34.1345	34.1806	34.3968	34.3968	34.4371	34.3132	34.1806	34.0875	33.9907	
alpha	3.2524	3.2559	3.2594	3.2756	3.2787	3.2931	3.2931	3.2958	3.2875	3.2787	3.2725	3.2660	
util living area													
	0.9901	0.9807	0.9611	0.9161	0.8295	0.6924	0.5487	0.5989	0.8042	0.9431	0.9831	0.9920	(86)
MIT	18.9613	19.2142	19.6078	20.0996	20.5321	20.8240	20.9400	20.9188	20.6904	20.1117	19.4375	18.9107	(87)
Th 2	19.8693	19.8709	19.8724	19.8795	19.8809	19.8871	19.8871	19.8882	19.8847	19.8809	19.8782	19.8753	(88)
util rest of house													
	0.9879	0.9764	0.9521	0.8954	0.7851	0.6093	0.4291	0.4805	0.7374	0.9249	0.9786	0.9902	(89)
MIT 2	17.1553	17.5234	18.0925	18.7947	19.3819	19.7429	19.8553	19.8413	19.5992	18.8261	17.8554	17.0853	(90)
Living area fraction									fLA = Living area / (4) =			0.1688	(91)
MIT	17.4602	17.8089	18.3483	19.0150	19.5761	19.9254	20.0385	20.0233	19.7834	19.0432	18.1225	17.3935	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.3102	17.6589	18.1983	18.8650	19.4261	19.7754	19.8885	19.8733	19.6334	18.8932	17.9725	17.2435	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9637	0.9332	0.8712	0.7636	0.5999	0.4293	0.4788	0.7193	0.9025	0.9668	0.9834	(94)
Useful gains	616.8650	738.8317	834.4373	884.5328	832.5604	642.4082	439.4392	456.2598	625.7573	670.1493	609.8482	578.3226	(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													
	1844.4202	1805.9803	1653.3485	1398.3012	1082.6738	720.6756	457.9198	483.0864	772.4092	1162.1336	1527.7364	1838.0151	(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													
	913.3011	717.1239	609.2699	369.9132	186.0843	0.0000	0.0000	0.0000	0.0000	366.0363	660.8795	937.2112	(98)
Space heating												4759.8195	(98)
Space heating per m2											(98) / (4) =	42.4302	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5259.4691	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	913.3011	717.1239	609.2699	369.9132	186.0843	0.0000	0.0000	0.0000	0.0000	366.0363	660.8795	937.2112	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	1009.1725	792.4021	673.2265	408.7439	205.6181	0.0000	0.0000	0.0000	0.0000	404.4600	730.2536	1035.5925	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement													
	179.4796	157.3677	163.3242	143.7074	138.8611	121.2580	113.7837	128.5503	129.4888	149.1507	161.1061	174.2505	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.9584	89.9070	89.8041	89.5813	89.1043	87.3000	87.3000	87.3000	87.3000	89.5497	89.8545	89.9829	(217)
Fuel for water heating, kWh/month													
	199.5140	175.0340	181.8671	160.4212	155.8411	138.8981	130.3364	147.2512	148.3262	166.5563	179.2967	193.6485	(219)
Water heating fuel used												1976.9909	(219)
Annual totals kWh/year													
Space heating fuel - main system												5259.4691	(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)	442.8883	(232)

Energy saving/generation technologies (Appendices M ,N and Q)			
PV Unit 0 (0.80 * 1.93 * 1004 * 0.80) =	-1240.1361	-1240.1361	(233)
Total delivered energy for all uses		6514.2121	(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	5259.4691	0.2160	1136.0453	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1976.9909	0.2160	427.0300	(264)
Space and water heating			1563.0753	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	442.8883	0.5190	229.8590	(268)
Energy saving/generation technologies				
PV Unit	-1240.1361	0.5190	-643.6306	(269)
Total CO2, kg/year			1188.2287	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.5900	(273)

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

DER		10.5900	ZC1
Total Floor Area	TFA	112.1800	
Assumed number of occupants	N	2.8273	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.5082	ZC2
CO2 emissions from cooking, equation (L16)		1.6657	ZC3
Total CO2 emissions		26.7639	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.7639	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	56.0900 (1b)	x	2.3100 (2b)	=	129.5679	(1b) - (3b)
First floor	56.0900 (1c)	x	2.5600 (2c)	=	143.5904	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	273.1583	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1464	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3964	(18)
Number of sides sheltered			4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.2775	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3538	0.3469	0.3399	0.3053	0.2983	0.2636	0.2636	0.2567	0.2775	0.2983	0.3122	0.3261	(22b)
Effective ac	0.5626	0.5602	0.5578	0.5466	0.5445	0.5348	0.5348	0.5329	0.5385	0.5445	0.5487	0.5532	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			19.8500	1.3258	26.3163			(27)
150mm TE Platinum GF			56.0900	0.1300	7.2917			(28a)
50mm Alreflex Plat	159.0800	21.8200	137.2600	0.1800	24.7068			(29a)
400mm	56.0900		56.0900	0.1300	7.2917			(30)
Total net area of external elements Aum(A, m2)			271.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.5765			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6786	(36)
Total fabric heat loss					(33) + (36) =		80.2551	(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	50.7135	50.4944	50.2796	49.2709	49.0821	48.2036	48.2036	48.0409	48.5420	49.0821	49.4639	49.8631	(38)
Heat transfer coeff	130.9685	130.7494	130.5347	129.5260	129.3372	128.4587	128.4587	128.2960	128.7971	129.3372	129.7190	130.1182	(39)
Average = Sum(39)m / 12 =												129.5251	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1675	1.1655	1.1636	1.1546	1.1529	1.1451	1.1451	1.1437	1.1481	1.1529	1.1563	1.1599	(40)
HLP (average)												1.1546	(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												2.8273	(42)
Average daily hot water use (litres/day)												101.3483	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.4831	107.4292	103.3753	99.3213	95.2674	91.2135	91.2135	95.2674	99.3213	103.3753	107.4292	111.4831	(44)
Energy conte	165.3263	144.5954	149.2095	130.0845	124.8192	107.7094	99.8086	114.5319	115.8997	135.0700	147.4394	160.1097	(45)
Energy content (annual)										Total = Sum(45)m =		1594.6036	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7989	21.6893	22.3814	19.5127	18.7229	16.1564	14.9713	17.1798	17.3850	20.2605	22.1159	24.0165	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.9804	48.5472	44.9820	46.4814	48.5472	48.9804	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.2852	190.6228	200.1684	179.0649	173.3664	152.6914	146.2900	163.0791	164.8801	186.0289	196.7545	211.0686	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.2852	190.6228	200.1684	179.0649	173.3664	152.6914	146.2900	163.0791	164.8801	186.0289	196.7545	211.0686	(64)
								Total per year (kWh/year) = Sum(64)m =				2180.3003	(64)
Heat gains from water heating, kWh/month													
	67.7107	59.5848	62.3519	55.4982	53.6392	47.0589	44.8067	50.2187	50.7818	57.6505	61.3524	65.9762	(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	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.0782	22.2742	18.1146	13.7139	10.2513	8.6546	9.3516	12.1556	16.3152	20.7158	24.1784	25.7752	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	274.6516	277.5016	270.3196	255.0301	235.7298	217.5902	205.4718	202.6218	209.8038	225.0933	244.3937	262.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	(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)													
	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	(71)
Water heating gains (Table 5)													
	91.0090	88.6679	83.8063	77.0808	72.0957	65.3596	60.2241	67.4982	70.5302	77.4872	85.2116	88.6777	(72)
Total internal gains													
	459.1482	456.8532	440.6500	414.2343	386.4862	360.0138	343.4570	350.6850	365.0586	391.7058	422.1932	445.3955	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.6800	10.6334	0.6300	0.7000	0.7700	15.2086	(74)
East	5.2700	19.6403	0.6300	0.7000	0.7700	31.6322	(76)
South	6.7500	46.7521	0.6300	0.7000	0.7700	96.4443	(78)
West	3.1500	19.6403	0.6300	0.7000	0.7700	18.9073	(80)

Solar gains	162.1924	285.8813	413.4072	544.1911	634.8468	640.3561	613.2444	544.7495	458.9229	322.2751	196.0980	137.5766	(83)
Total gains	621.3407	742.7345	854.0573	958.4254	1021.3330	1000.3699	956.7014	895.4345	823.9815	713.9810	618.2912	582.9722	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4821	59.5817	59.6798	60.1445	60.2323	60.6442	60.6442	60.7211	60.4849	60.2323	60.0550	59.8708	
alpha	4.9655	4.9721	4.9787	5.0096	5.0155	5.0429	5.0429	5.0481	5.0323	5.0155	5.0037	4.9914	
util living area													
	0.9986	0.9963	0.9895	0.9651	0.8939	0.7435	0.5730	0.6293	0.8641	0.9800	0.9969	0.9990	(86)
MIT	19.6925	19.8604	20.1251	20.4628	20.7575	20.9343	20.9858	20.9776	20.8520	20.4599	20.0076	19.6599	(87)
Th 2	19.9461	19.9477	19.9492	19.9565	19.9578	19.9642	19.9642	19.9653	19.9617	19.9578	19.9551	19.9522	(88)
util rest of house													
	0.9981	0.9951	0.9856	0.9514	0.8518	0.6523	0.4472	0.5023	0.7957	0.9697	0.9956	0.9987	(89)
MIT 2	18.1995	18.4457	18.8315	19.3191	19.7151	19.9193	19.9588	19.9559	19.8399	19.3230	18.6666	18.1561	(90)
Living area fraction									fLA = Living area / (4) =			0.1688	(91)
MIT	18.4516	18.6845	19.0499	19.5122	19.8911	20.0907	20.1322	20.1284	20.0108	19.5150	18.8931	18.4100	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4516	18.6845	19.0499	19.5122	19.8911	20.0907	20.1322	20.1284	20.0108	19.5150	18.8931	18.4100	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9928	0.9809	0.9438	0.8486	0.6645	0.4684	0.5235	0.7996	0.9636	0.9936	0.9978	(94)
Useful gains	619.5217	737.3880	837.7607	904.6086	866.7459	664.7008	448.1380	468.7198	658.8231	687.9577	614.3139	581.7147	(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													
	1853.4101	1802.3210	1638.1925	1374.5540	1059.4155	705.3222	453.7438	478.3420	761.2926	1153.0382	1529.7832	1848.9751	(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													
	918.0129	715.6349	595.5212	338.3607	143.3462	0.0000	0.0000	0.0000	0.0000	346.0199	659.1378	942.8417	(98)
Space heating												4658.8755	(98)
Space heating per m2											(98) / (4) =	41.5304	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												4988.0894	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	918.0129	715.6349	595.5212	338.3607	143.3462	0.0000	0.0000	0.0000	0.0000	346.0199	659.1378	942.8417	(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)													
	982.8832	766.2044	637.6030	362.2705	153.4755	0.0000	0.0000	0.0000	0.0000	370.4710	705.7150	1009.4665	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.2852	190.6228	200.1684	179.0649	173.3664	152.6914	146.2900	163.0791	164.8801	186.0289	196.7545	211.0686	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2827	88.0700	87.6273	86.6292	84.5769	80.3000	80.3000	80.3000	80.3000	86.5919	87.8596	88.3670	(217)
Fuel for water heating, kWh/month													
	244.9916	216.4447	228.4315	206.7026	204.9809	190.1512	182.1793	203.0873	205.3302	214.8341	223.9419	238.8546	(219)
Water heating fuel used												2559.9299	(219)
Annual totals kWh/year													
Space heating fuel - main system												4988.0894	(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)												442.8883	(232)
Total delivered energy for all uses												8065.9076	(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	4988.0894	0.2160	1077.4273	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2559.9299	0.2160	552.9449	(264)
Space and water heating			1630.3722	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	442.8883	0.5190	229.8590	(268)
Total CO2, kg/m2/year			1899.1562	(272)
Emissions per m2 for space and water heating			14.5335	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0490	(272b)
Emissions per m2 for pumps and fans			0.3470	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5335 * 1.00) + 2.0490 + 0.3470, rounded to 2 d.p.			16.9300	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	56.0900 (1b)	x	2.3100 (2b)	=	129.5679	(1b) - (3b)
First floor	56.0900 (1c)	x	2.5600 (2c)	=	143.5904	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	273.1583	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1464	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3969	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2779	(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	0.3543	0.3473	0.3404	0.3056	0.2987	0.2640	0.2640	0.2570	0.2779	0.2987	0.3126	0.3265	(22b)
Effective ac	0.5628	0.5603	0.5579	0.5467	0.5446	0.5348	0.5348	0.5330	0.5386	0.5446	0.5489	0.5533	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			19.8500	1.3347	26.4942			(27)
Opening Type 12			1.9700	1.0000	1.9700			(26)
150mm TE Platinum GF			56.0900	0.1500	8.4135			(28a)
50mm Alreflex Plat	159.0800	21.8200	137.2600	0.2700	37.0602			(29a)
400mm	56.0900		56.0900	0.1100	6.1699			(30)
Total net area of external elements Aum(A, m2)			271.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.1078			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	153.7100	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.9313	(36)
Total fabric heat loss (33) + (36) =	91.0391	(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	50.7277	50.5080	50.2927	49.2815	49.0923	48.2115	48.2115	48.0484	48.5508	49.0923	49.4750	49.8752	(38)
Heat transfer coeff	141.7668	141.5472	141.3319	140.3206	140.1314	139.2506	139.2506	139.0875	139.5899	140.1314	140.5142	140.9143	(39)
Average = Sum(39)m / 12 =												140.3197	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2637	1.2618	1.2599	1.2509	1.2492	1.2413	1.2413	1.2399	1.2443	1.2492	1.2526	1.2561	(40)
HLP (average)												1.2508	(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	2.8273	(42)
Average daily hot water use (litres/day)	101.3483	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.4831	107.4292	103.3753	99.3213	95.2674	91.2135	91.2135	95.2674	99.3213	103.3753	107.4292	111.4831	(44)
Energy conte	165.3263	144.5954	149.2095	130.0845	124.8192	107.7094	99.8086	114.5319	115.8997	135.0700	147.4394	160.1097	(45)
Energy content (annual)										Total = Sum(45)m =		1594.6036	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1318	30.7265	31.7070	27.6430	26.5241	22.8883	21.2093	24.3380	24.6287	28.7024	31.3309	34.0233	(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	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.0782	22.2742	18.1146	13.7139	10.2513	8.6546	9.3516	12.1556	16.3152	20.7158	24.1784	25.7752	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	274.6516	277.5016	270.3196	255.0301	235.7298	217.5902	205.4718	202.6218	209.8038	225.0933	244.3937	262.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	(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)													
	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	(71)
Water heating gains (Table 5)													
	47.2202	45.7240	42.6170	38.3930	35.6506	31.7892	28.5072	32.7124	34.2065	38.5785	43.5151	45.7302	(72)
Total internal gains													
	412.3594	410.9093	396.4607	372.5465	347.0412	323.4435	308.7400	312.8992	325.7349	349.7971	377.4967	399.4481	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.6800	10.6334	0.7100	0.7000	0.7700	17.1399	(74)
East	5.2700	19.6403	0.7100	0.7000	0.7700	35.6490	(76)
South	6.7500	46.7521	0.7100	0.7000	0.7700	108.6912	(78)
West	3.1500	19.6403	0.7100	0.7000	0.7700	21.3082	(80)

Solar gains	182.7883	322.1837	465.9034	613.2947	715.4623	721.6711	691.1167	613.9241	517.1988	363.1989	220.9993	155.0467	(83)
Total gains	595.1477	733.0930	862.3641	985.8412	1062.5034	1045.1146	999.8568	926.8233	842.9337	712.9960	598.4960	554.4948	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.7863	33.8387	33.8903	34.1345	34.1806	34.3968	34.3968	34.4371	34.3132	34.1806	34.0875	33.9907	
alpha	3.2524	3.2559	3.2594	3.2756	3.2787	3.2931	3.2931	3.2958	3.2875	3.2787	3.2725	3.2660	
util living area													
	0.9916	0.9830	0.9646	0.9217	0.8377	0.7027	0.5589	0.6112	0.8151	0.9486	0.9854	0.9933	(86)
MIT	18.9225	19.1776	19.5755	20.0744	20.5153	20.8157	20.9367	20.9138	20.6756	20.0837	19.4019	18.8725	(87)
Th 2	19.8693	19.8709	19.8724	19.8795	19.8809	19.8871	19.8871	19.8882	19.8847	19.8809	19.8782	19.8753	(88)
util rest of house													
	0.9897	0.9791	0.9563	0.9021	0.7945	0.6200	0.4382	0.4920	0.7500	0.9318	0.9815	0.9918	(89)
MIT 2	17.9778	18.2321	18.6260	19.1157	19.5263	19.7833	19.8640	19.8539	19.6788	19.1345	18.4621	17.9325	(90)
Living area fraction										fLA = Living area / (4) =		0.1688	(91)
MIT	18.1373	18.3918	18.7863	19.2775	19.6933	19.9576	20.0451	20.0328	19.8471	19.2948	18.6207	18.0912	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1373	18.3918	18.7863	19.2775	19.6933	19.9576	20.0451	20.0328	19.8471	19.2948	18.6207	18.0912	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9722	0.9458	0.8891	0.7861	0.6258	0.4566	0.5089	0.7475	0.9204	0.9754	0.9883	(94)
Useful gains	586.5261	712.7494	815.6505	876.4761	835.2264	654.0621	456.5167	471.6819	630.0522	656.2148	583.7505	548.0066	(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													
	1961.6752	1909.7217	1736.4507	1456.1811	1120.1082	746.0541	479.7356	505.2840	802.2402	1218.4108	1618.8256	1957.4687	(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													
	1023.1109	804.3654	685.0754	417.3876	211.9521	0.0000	0.0000	0.0000	0.0000	418.2738	745.2541	1048.6398	(98)
Space heating												5354.0590	(98)
Space heating per m2											(98) / (4) =	47.7274	(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	1308.9560	1030.4547	1057.0652	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7740	0.8419	0.8117	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1013.1467	867.5293	858.0362	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1333.0359	1277.6963	1194.4325	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	230.3202	305.1643	250.2788	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												785.7633 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	57.5801	76.2911	62.5697	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												196.4408 (107)
Space cooling per m2												1.7511 (108)
Energy for space heating												47.7274 (99)
Energy for space cooling												1.7511 (108)
Total												49.4785 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.5 (109)

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	56.0900 (1b)	x	2.3100 (2b)	=	129.5679	(1b) - (3b)
First floor	56.0900 (1c)	x	2.5600 (2c)	=	143.5904	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	273.1583	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1464	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3964	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2775	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3538	0.3469	0.3399	0.3053	0.2983	0.2636	0.2636	0.2567	0.2775	0.2983	0.3122	0.3261	(22b)
Effective ac	0.5626	0.5602	0.5578	0.5466	0.5445	0.5348	0.5348	0.5329	0.5385	0.5445	0.5487	0.5532	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			19.8500	1.3258	26.3163			(27)
150mm TE Platinum GF			56.0900	0.1300	7.2917			(28a)
50mm Alreflex Plat	159.0800	21.8200	137.2600	0.1800	24.7068			(29a)
400mm	56.0900		56.0900	0.1300	7.2917			(30)
Total net area of external elements Aum(A, m2)			271.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.5765			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6786	(36)
Total fabric heat loss					(33) + (36) =		80.2551	(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	50.7135	50.4944	50.2796	49.2709	49.0821	48.2036	48.2036	48.0409	48.5420	49.0821	49.4639	49.8631	(38)
Heat transfer coeff	130.9685	130.7494	130.5347	129.5260	129.3372	128.4587	128.4587	128.2960	128.7971	129.3372	129.7190	130.1182	(39)
Average = Sum(39)m / 12 =												129.5251	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1675	1.1655	1.1636	1.1546	1.1529	1.1451	1.1451	1.1437	1.1481	1.1529	1.1563	1.1599	(40)
HLP (average)												1.1546	(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	2.8273	(42)
Average daily hot water use (litres/day)	101.3483	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.4831	107.4292	103.3753	99.3213	95.2674	91.2135	91.2135	95.2674	99.3213	103.3753	107.4292	111.4831	(44)
Energy conte	165.3263	144.5954	149.2095	130.0845	124.8192	107.7094	99.8086	114.5319	115.8997	135.0700	147.4394	160.1097	(45)
Energy content (annual)										Total = Sum(45)m =		1594.6036	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1318	30.7265	31.7070	27.6430	26.5241	22.8883	21.2093	24.3380	24.6287	28.7024	31.3309	34.0233	(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	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.0782	22.2742	18.1146	13.7139	10.2513	8.6546	9.3516	12.1556	16.3152	20.7158	24.1784	25.7752	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	274.6516	277.5016	270.3196	255.0301	235.7298	217.5902	205.4718	202.6218	209.8038	225.0933	244.3937	262.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	(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)													
	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	(71)
Water heating gains (Table 5)													
	47.2202	45.7240	42.6170	38.3930	35.6506	31.7892	28.5072	32.7124	34.2065	38.5785	43.5151	45.7302	(72)
Total internal gains													
	412.3594	410.9093	396.4607	372.5465	347.0412	323.4435	308.7400	312.8992	325.7349	349.7971	377.4967	399.4481	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.6800	10.6334	0.6300	0.7000	0.7700	15.2086	(74)
East	5.2700	19.6403	0.6300	0.7000	0.7700	31.6322	(76)
South	6.7500	46.7521	0.6300	0.7000	0.7700	96.4443	(78)
West	3.1500	19.6403	0.6300	0.7000	0.7700	18.9073	(80)

Solar gains	162.1924	285.8813	413.4072	544.1911	634.8468	640.3561	613.2444	544.7495	458.9229	322.2751	196.0980	137.5766	(83)
Total gains	574.5518	696.7906	809.8679	916.7376	981.8880	963.7996	921.9845	857.6487	784.6578	672.0722	573.5946	537.0247	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4821	59.5817	59.6798	60.1445	60.2323	60.6442	60.6442	60.7211	60.4849	60.2323	60.0550	59.8708	
alpha	4.9655	4.9721	4.9787	5.0096	5.0155	5.0429	5.0429	5.0481	5.0323	5.0155	5.0037	4.9914	
util living area													
	0.9990	0.9973	0.9916	0.9706	0.9059	0.7619	0.5918	0.6518	0.8815	0.9843	0.9978	0.9993	(86)
MIT	19.6538	19.8227	20.0900	20.4333	20.7378	20.9264	20.9836	20.9739	20.8350	20.4280	19.9708	19.6217	(87)
Th 2	19.9461	19.9477	19.9492	19.9565	19.9578	19.9642	19.9642	19.9653	19.9617	19.9578	19.9551	19.9522	(88)
util rest of house													
	0.9987	0.9963	0.9884	0.9587	0.8668	0.6717	0.4632	0.5227	0.8177	0.9760	0.9968	0.9991	(89)
MIT 2	18.7149	18.8847	19.1516	19.4937	19.7763	19.9293	19.9599	19.9577	19.8668	19.4940	19.0388	18.6877	(90)
Living area fraction									fLA = Living area / (4) =			0.1688	(91)
MIT	18.8734	19.0431	19.3100	19.6523	19.9386	20.0976	20.1327	20.1292	20.0303	19.6517	19.1961	18.8454	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8734	19.0431	19.3100	19.6523	19.9386	20.0976	20.1327	20.1292	20.0303	19.6517	19.1961	18.8454	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9951	0.9859	0.9542	0.8659	0.6846	0.4851	0.5445	0.8228	0.9727	0.9959	0.9987	(94)
Useful gains	573.5164	693.3911	798.4146	874.7775	850.2205	659.7867	447.2631	466.9990	645.6087	653.7267	571.2222	536.3314	(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													
	1908.6560	1849.2002	1672.1547	1392.7029	1065.5587	706.2168	453.8114	478.4476	763.8025	1170.7201	1569.0993	1905.6340	(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													
	993.3439	776.7037	650.0626	372.9064	160.2116	0.0000	0.0000	0.0000	0.0000	384.6431	718.4715	1018.7611	(98)
Space heating												5075.1039	(98)
Space heating per m2											(98) / (4) =	45.2407	(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	1207.5115	950.5942	975.0494	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8447	0.9120	0.8848	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1020.0363	866.9025	862.7219	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1237.9924	1186.6767	1113.5791	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	156.9283	237.9120	186.6378	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											581.4782	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	39.2321	59.4780	46.6594	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											145.3695	(107)
Space cooling per m2											1.2959	(108)
Energy for space heating											45.2407	(99)
Energy for space cooling											1.2959	(108)
Total											46.5366	(109)
Target Fabric Energy Efficiency (TFEE)											53.5	(109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Alverton End-Terrace PV	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Alverton DS01 (Hipped), EOT, Part L2013, Masonry		

SAP Rating	81 B	**DER**	23.06	**TER**	23.84
Environmental	84 B	**% DER<TER**	3.26		
CO_2 Emissions (t/year)	1.19	**DFEE**	66.35	**TFEE**	72.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.20		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 60 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) 23.84 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 23.06 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)72.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)66.4 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.25 (max. 0.30)        0.37 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)         -                        OK
Floor           0.17 (max. 0.25)        0.18 (max. 0.70)          OK
Roof            0.11 (max. 0.20)        0.11 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.41 (max. 3.30)          OK
-------------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
-------------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         5.01 (design value)
Maximum                                 10.0                                            OK
-------------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
-------------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
-------------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
-------------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
-------------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
-------------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Thames Valley):       Slight                                          OK
Based on:
Overshading:                            Average
Windows facing North:                   3.26 m², Overhang width less than twice window, ratio 0.28
Windows facing South:                   4.40 m², Overhang width less than twice window, ratio 0.24
Air change rate:                        4.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
-------------------------------------------------------------------------------------------------------
10 Key features
Party wall U-value                      0.00 W/m²K
Roof U-value                            0.11 W/m²K
Door U-value                            1.00 W/m²K




-------------------------------------------------------------------------------------------------------
```

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	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.2800 (2c)	=	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.4289	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2183	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4688	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4688	(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	0.5977	0.5860	0.5743	0.5157	0.5040	0.4454	0.4454	0.4336	0.4688	0.5040	0.5274	0.5508	(22b)
Effective ac	0.6786	0.6717	0.6649	0.6330	0.6270	0.5992	0.5992	0.5940	0.6099	0.6270	0.6391	0.6517	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			7.6600	1.3347	10.2240			(27)
150mm TE Platinum GF			2.4900	0.1800	0.4482			(28a)
Over Access			18.6300	0.1800	3.3534			(28b)
Over Garages			33.5600	0.1700	5.7052			(28b)
Over Store			2.8000	0.1700	0.4760			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.2700	0.1269			(29a)
50mm AP to Access	6.8900		6.8900	0.2700	1.8603			(29a)
50mm AP to Garage	6.8900		6.8900	0.2200	1.5158			(29a)
50mm AP with Acousti	60.9300	7.6600	53.2700	0.2500	13.3175			(29a)
Sheltered to Store	2.4400		2.4400	0.3700	0.9028			(29a)
400mm mineral wool	57.4700		57.4700	0.1100	6.3217			(30)
Total net area of external elements Aum(A, m2)			194.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.2218			(33)
E-WM-20/22			12.3300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	122.3100	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	23.1147	(36)
Total fabric heat loss (33) + (36) =	69.3365	(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	30.7769	30.4624	30.1540	28.7057	28.4347	27.1733	27.1733	26.9397	27.6592	28.4347	28.9829	29.5560	(38)
Heat transfer coeff	100.1134	99.7988	99.4905	98.0422	97.7712	96.5098	96.5098	96.2762	96.9957	97.7712	98.3194	98.8925	(39)
Average = Sum(39)m / 12 =												98.0409	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6702	1.6650	1.6598	1.6357	1.6312	1.6101	1.6101	1.6062	1.6182	1.6312	1.6403	1.6499	(40)
HLP (average)												1.6357	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)
Energy content (annual)										Total = Sum(45)m =		1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	19.8746	17.3825	17.9371	15.6380	15.0051	12.9482	11.9984	13.7684	13.9328	16.2374	17.7243	19.2475	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0407	12.6647	13.9943	13.5120	13.9399	13.4642	13.8969	13.9248	13.4902	13.9718	13.5570	14.0317	(61)
Total heat required for water heating calculated for each month													
	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.4503	(64)
Heat gains from water heating, kWh/month													
	47.5655	41.6973	43.2592	38.0423	36.7462	32.0680	30.0708	34.0011	34.2570	39.4858	42.6782	46.1732	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	63.9322	62.0495	58.1441	52.8365	49.3900	44.5388	40.4177	45.7004	47.5791	53.0723	59.2753	62.0607	(72)
Total internal gains													
	309.2887	307.3138	296.0931	278.2072	260.2899	242.9527	231.6760	237.0509	246.2450	264.3163	284.9902	300.2617	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.7100	0.7000	0.7700	11.9393	(74)
South	4.4000	46.7521	0.7100	0.7000	0.7700	70.8505	(78)

Solar gains	82.7898	138.8515	186.5789	229.3312	257.9734	257.3385	247.5347	225.4852	201.0181	152.3147	98.7107	71.1746	(83)
Total gains	392.0785	446.1653	482.6720	507.5385	518.2633	500.2912	479.2107	462.5361	447.2631	416.6311	383.7009	371.4363	(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	20.3415	20.4057	20.4689	20.7713	20.8288	21.1011	21.1011	21.1523	20.9954	20.8288	20.7127	20.5927	
alpha	2.3561	2.3604	2.3646	2.3848	2.3886	2.4067	2.4067	2.4102	2.3997	2.3886	2.3808	2.3728	
util living area													
	0.9747	0.9644	0.9487	0.9199	0.8681	0.7766	0.6627	0.6913	0.8309	0.9264	0.9646	0.9777	(86)
MIT	18.0754	18.3286	18.7610	19.3537	19.9475	20.4721	20.7533	20.7160	20.3158	19.5546	18.7223	18.0402	(87)
Th 2	19.5622	19.5660	19.5698	19.5873	19.5906	19.6059	19.6059	19.6088	19.6000	19.5906	19.5839	19.5770	(88)
util rest of house													
	0.9695	0.9571	0.9374	0.8999	0.8286	0.6940	0.5182	0.5557	0.7651	0.9039	0.9560	0.9731	(89)
MIT 2	15.7501	16.1185	16.7461	17.6061	18.4427	19.1473	19.4650	19.4335	18.9560	17.9046	16.7030	15.7062	(90)
Living area fraction									fLA = Living area / (4) =			0.3315	(91)
MIT	16.5210	16.8511	17.4141	18.1854	18.9415	19.5865	19.8921	19.8586	19.4067	18.4516	17.3724	16.4800	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.3710	16.7011	17.2641	18.0354	18.7915	19.4365	19.7421	19.7086	19.2567	18.3016	17.2224	16.3300	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9513	0.9347	0.9104	0.8690	0.7990	0.6816	0.5350	0.5674	0.7442	0.8744	0.9338	0.9564	(94)
Useful gains	372.9678	417.0146	439.4347	441.0566	414.1175	340.9930	256.3638	262.4611	332.8524	364.3212	358.3118	355.2458	(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													
	1208.4651	1177.7374	1070.9229	895.6581	693.3491	466.7661	303.2397	318.5436	500.1822	752.9917	995.2291	1199.5607	(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													
	621.6100	511.2058	469.8272	327.3130	207.7483	0.0000	0.0000	0.0000	0.0000	289.1708	458.5804	628.1703	(98)
Space heating												3513.6259	(98)
Space heating per m2											(98) / (4) =	58.6190	(99)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3882.4595	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	621.6100	511.2058	469.8272	327.3130	207.7483	0.0000	0.0000	0.0000	0.0000	289.1708	458.5804	628.1703	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	686.8619	564.8682	519.1461	361.6719	229.5561	0.0000	0.0000	0.0000	0.0000	319.5258	506.7187	694.1109	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	146.5380	128.5477	133.5752	117.7655	113.9736	99.7858	93.8865	105.7140	106.3757	122.2208	131.7193	142.3483	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8716	89.8383	89.7716	89.6307	89.3399	87.3000	87.3000	87.3000	87.3000	89.5251	89.7658	89.8913	(217)
Fuel for water heating, kWh/month													
	163.0527	143.0879	148.7946	131.3897	127.5730	114.3021	107.5446	121.0927	121.8507	136.5213	146.7366	158.3561	(219)
Water heating fuel used												1620.3021	(219)
Annual totals kWh/year													
Space heating fuel - main system												3882.4595	(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)												297.7858	(232)
Total delivered energy for all uses												5875.5475	(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	3882.4595	0.2160	838.6113	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1620.3021	0.2160	349.9853	(264)
Space and water heating			1188.5965	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	297.7858	0.5190	154.5508	(268)
Total CO2, kg/year			1382.0723	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			23.0600	(273)

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

DER		23.0600	ZC1
Total Floor Area	TFA	59.9400	
Assumed number of occupants	N	1.9799	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0829	ZC2
CO2 emissions from cooking, equation (L16)		2.7781	ZC3
Total CO2 emissions		42.9210	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		42.9210	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.2800 (2c)	=	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.4289	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1455	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3955	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3955	(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	0.5043	0.4944	0.4845	0.4351	0.4252	0.3758	0.3758	0.3659	0.3955	0.4252	0.4450	0.4647	(22b)
Effective ac	0.6272	0.6222	0.6174	0.5946	0.5904	0.5706	0.5706	0.5669	0.5782	0.5904	0.5990	0.6080	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			7.6600	1.3258	10.1553			(27)
150mm TE Platinum GF			2.4900	0.1300	0.3237			(28a)
Over Access			18.6300	0.1300	2.4219			(28b)
Over Garages			33.5600	0.1300	4.3628			(28b)
Over Store			2.8000	0.1300	0.3640			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.1800	0.0846			(29a)
50mm AP to Access	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP to Garage	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP with Acousti	60.9300	7.6600	53.2700	0.1800	9.5886			(29a)
Sheltered to Store	2.4400		2.4400	0.1800	0.4392			(29a)
400mm mineral wool	57.4700		57.4700	0.1300	7.4711			(30)
Total net area of external elements Aum(A, m2)			194.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6616			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	19.9967	(36)
Total fabric heat loss (33) + (36) =	59.6583	(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	28.4426	28.2187	27.9992	26.9682	26.7753	25.8774	25.8774	25.7111	26.2233	26.7753	27.1656	27.5735	(38)
Heat transfer coeff	88.1009	87.8770	87.6575	86.6265	86.4336	85.5357	85.5357	85.3694	85.8816	86.4336	86.8239	87.2318	(39)
Average = Sum(39)m / 12 =												86.6256	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4698	1.4661	1.4624	1.4452	1.4420	1.4270	1.4270	1.4242	1.4328	1.4420	1.4485	1.4553	(40)
HLP (average)												1.4452	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)
Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1277.9621 (45)

Distribution loss (46)m = 0.15 x (45)m

	19.8746	17.3825	17.9371	15.6380	15.0051	12.9482	11.9984	13.7684	13.9328	16.2374	17.7243	19.2475 (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	45.5297	39.6282	42.2184	39.2543	38.9072	36.0499	37.2516	38.9072	39.2543	42.2184	42.4588	45.5297 (61)

Total heat required for water heating calculated for each month

	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463 (64)

Total per year (kWh/year) = Sum(64)m = 1765.1697 (64)

Heat gains from water heating, kWh/month

	55.4378	48.4381	50.3153	44.4779	42.9880	37.7144	35.9094	40.2467	40.6980	46.5474	49.9037	54.0477 (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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997 (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)

	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975 (71)

Water heating gains (Table 5)

	74.5131	72.0806	67.6280	61.7748	57.7796	52.3811	48.2653	54.0950	56.5250	62.5637	69.3106	72.6447 (72)

Total internal gains

	319.8697	317.3449	305.5770	287.1456	268.6795	250.7949	239.5237	245.4456	255.1908	273.8078	295.0256	310.8457 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.6300	0.7000	0.7700	10.5940	(74)
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)

Solar gains	73.4614	123.2063	165.5559	203.4911	228.9060	228.3426	219.6435	200.0784	178.3682	135.1525	87.5884	63.1549 (83)
Total gains	393.3311	440.5511	471.1329	490.6366	497.5854	479.1376	459.1671	445.5240	433.5590	408.9603	382.6139	374.0006 (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	47.2469	47.3673	47.4859	48.0511	48.1583	48.6639	48.6639	48.7587	48.4679	48.1583	47.9419	47.7177	
alpha	4.1498	4.1578	4.1657	4.2034	4.2106	4.2443	4.2443	4.2506	4.2312	4.2106	4.1961	4.1812	
util living area	0.9969	0.9946	0.9899	0.9777	0.9449	0.8591	0.7215	0.7553	0.9111	0.9799	0.9945	0.9975	(86)
MIT	19.4022	19.5531	19.8071	20.1547	20.5036	20.7974	20.9328	20.9161	20.7056	20.2589	19.7720	19.3785	(87)
Th 2	19.7102	19.7130	19.7158	19.7288	19.7313	19.7427	19.7427	19.7448	19.7383	19.7313	19.7263	19.7212	(88)
util rest of house	0.9958	0.9927	0.9859	0.9676	0.9154	0.7732	0.5588	0.6025	0.8507	0.9687	0.9921	0.9967	(89)
MIT 2	17.6155	17.8373	18.2090	18.7198	19.2112	19.5911	19.7160	19.7073	19.4864	18.8748	18.1665	17.5881	(90)

Living area fraction fLA = Living area / (4) = 0.3315 (91)

MIT	18.2078	18.4061	18.7387	19.1955	19.6396	19.9910	20.1193	20.1081	19.8906	19.3336	18.6987	18.1816	(92)

Temperature adjustment 0.0000

adjusted MIT	18.2078	18.4061	18.7387	19.1955	19.6396	19.9910	20.1193	20.1081	19.8906	19.3336	18.6987	18.1816	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9897	0.9815	0.9618	0.9126	0.7935	0.6134	0.6528	0.8599	0.9638	0.9892	0.9950	(94)
Useful gains	390.9321	436.0265	462.4341	471.8983	454.1054	380.1917	281.6349	290.8426	372.8194	394.1646	378.4980	372.1457	(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	1225.2889	1186.8747	1072.8170	891.8629	686.2489	461.1197	301.0295	316.5545	497.3058	754.8769	1007.0452	1219.6431	(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	620.7615	504.5700	454.1249	302.3745	172.7148	0.0000	0.0000	0.0000	0.0000	268.3700	452.5540	630.5381	(98)

Space heating 3406.0076 (98)

Space heating per m2 (98) / (4) = 56.8236 (99)

8c. Space cooling requirement

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3646.6891	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	620.7615	504.5700	454.1249	302.3745	172.7148	0.0000	0.0000	0.0000	0.0000	268.3700	452.5540	630.5381	(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)													
	664.6268	540.2248	486.2151	323.7414	184.9195	0.0000	0.0000	0.0000	0.0000	287.3340	484.5332	675.0943	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement													
	178.0270	155.5112	161.7993	143.5078	138.9409	122.3714	117.2411	130.6964	132.1398	150.4675	160.6210	173.8463	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9350	87.7983	87.5086	86.8828	85.6001	80.3000	80.3000	80.3000	80.3000	86.4918	87.5165	88.0076	(217)
Fuel for water heating, kWh/month													
	202.4530	177.1232	184.8953	165.1740	162.3140	152.3928	146.0039	162.7601	164.5576	173.9673	183.5322	197.5354	(219)
Water heating fuel used												2072.7090	(219)
Annual totals kWh/year													
Space heating fuel - main system												3646.6891	(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)	297.7858	(232)
Total delivered energy for all uses	6092.1839	(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	3646.6891	0.2160	787.6849	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2072.7090	0.2160	447.7051	(264)
Space and water heating			1235.3900	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	297.7858	0.5190	154.5508	(268)
Total CO2, kg/m2/year			1428.8658	(272)
Emissions per m2 for space and water heating			20.6104	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5784	(272b)
Emissions per m2 for pumps and fans			0.6494	(272c)
Target Carbon Dioxide Emission Rate (TER) = (20.6104 * 1.00) + 2.5784 + 0.6494, rounded to 2 d.p.			23.8400	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	2.4700 (1b)	x	2.5900 (2b)	=	6.3973	(1b) - (3b)
First floor	57.4700 (1c)	x	2.2800 (2c)	=	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.4289	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1455	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3960	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3960	(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	0.5049	0.4950	0.4851	0.4356	0.4257	0.3762	0.3762	0.3663	0.3960	0.4257	0.4455	0.4653	(22b)
Effective ac	0.6275	0.6225	0.6177	0.5949	0.5906	0.5708	0.5708	0.5671	0.5784	0.5906	0.5993	0.6083	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			7.6600	1.3347	10.2240			(27)
150mm TE Platinum GF			2.4900	0.1800	0.4482			(28a)
Over Access			18.6300	0.1800	3.3534			(28b)
Over Garages			33.5600	0.1700	5.7052			(28b)
Over Store			2.8000	0.1700	0.4760			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.2700	0.1269			(29a)
50mm AP to Access	6.8900		6.8900	0.2700	1.8603			(29a)
50mm AP to Garage	6.8900		6.8900	0.2200	1.5158			(29a)
50mm AP with Acousti	60.9300	7.6600	53.2700	0.2500	13.3175			(29a)
Sheltered to Store	2.4400		2.4400	0.3700	0.9028			(29a)
400mm mineral wool	57.4700		57.4700	0.1100	6.3217			(30)
Total net area of external elements Aum(A, m2)			194.5400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2218			(33)
E-WM-20/22			12.3300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	122.3100	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	23.1147	(36)
Total fabric heat loss	(33) + (36) = 69.3365	(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	28.4572	28.2327	28.0127	26.9791	26.7857	25.8855	25.8855	25.7188	26.2322	26.7857	27.1769	27.5859	(38)
Heat transfer coeff	97.7937	97.5692	97.3491	96.3156	96.1222	95.2219	95.2219	95.0552	95.5687	96.1222	96.5134	96.9224	(39)
Average = Sum(39)m / 12 =												96.3146	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6315	1.6278	1.6241	1.6069	1.6036	1.5886	1.5886	1.5858	1.5944	1.6036	1.6102	1.6170	(40)
HLP (average)												1.6069	(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	1.9799 (42)
Average daily hot water use (litres/day)	81.2235 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)
Energy content (annual)										Total = Sum(45)m =		1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.1557	24.6251	25.4109	22.1539	21.2572	18.3433	16.9978	19.5052	19.7382	23.0029	25.1095	27.2673	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	37.8437	36.6446	34.1545	30.7693	28.5715	25.4768	22.8465	26.2167	27.4141	30.9179	34.8743	36.6496	(72)
Total internal gains													
	280.2002	278.9088	269.1035	253.1400	236.4713	220.8907	211.1048	214.5672	223.0800	239.1620	257.5892	271.8505	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.7100	0.7000	0.7700	11.9393	(74)
South	4.4000	46.7521	0.7100	0.7000	0.7700	70.8505	(78)

Solar gains	82.7898	138.8515	186.5789	229.3312	257.9734	257.3385	247.5347	225.4852	201.0181	152.3147	98.7107	71.1746	(83)
Total gains	362.9900	417.7604	455.6824	482.4712	494.4447	478.2292	458.6395	440.0524	424.0981	391.4767	356.2999	343.0251	(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	20.8241	20.8720	20.9192	21.1436	21.1862	21.3865	21.3865	21.4240	21.3089	21.1862	21.1003	21.0113	
alpha	2.3883	2.3915	2.3946	2.4096	2.4124	2.4258	2.4258	2.4283	2.4206	2.4124	2.4067	2.4008	
util living area													
	0.9784	0.9687	0.9538	0.9264	0.8765	0.7881	0.6754	0.7060	0.8426	0.9339	0.9695	0.9811	(86)
MIT	18.0722	18.3257	18.7575	19.3432	19.9371	20.4611	20.7470	20.7065	20.3011	19.5365	18.7049	18.0292	(87)
Th 2	19.5903	19.5930	19.5957	19.6083	19.6107	19.6217	19.6217	19.6237	19.6174	19.6107	19.6059	19.6009	(88)
util rest of house													
	0.9740	0.9623	0.9436	0.9078	0.8391	0.7081	0.5328	0.5728	0.7801	0.9136	0.9620	0.9773	(89)
MIT 2	16.9747	17.2274	17.6563	18.2399	18.8133	19.2983	19.5211	19.4977	19.1629	18.4370	17.6147	16.9389	(90)
Living area fraction									fLA = Living area / (4) =			0.3315	(91)
MIT	17.3385	17.5915	18.0214	18.6056	19.1858	19.6837	19.9275	19.8984	19.5402	18.8015	17.9761	17.3004	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3385	17.5915	18.0214	18.6056	19.1858	19.6837	19.9275	19.8984	19.5402	18.8015	17.9761	17.3004	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9639	0.9494	0.9279	0.8902	0.8247	0.7124	0.5696	0.6042	0.7757	0.8976	0.9497	0.9681	(94)
Useful gains	349.8847	396.6396	422.8394	429.4840	407.7906	340.6856	261.2486	265.8726	328.9717	351.3875	338.3736	332.0828	(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													
	1275.0838	1238.2985	1121.5944	934.8005	719.5511	484.0838	316.8509	332.5399	519.9102	788.3482	1049.6888	1269.7183	(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													
	688.3481	565.5948	519.8737	363.8279	231.9498	0.0000	0.0000	0.0000	0.0000	325.0987	512.1469	697.6009	(98)
Space heating												3904.4408	(98)
Space heating per m2											(98) / (4) =	65.1392	(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	895.0862	704.6424	722.4198	0.0000	0.0000	0.0000	0.0000	(100)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5789	0.6551	0.6331	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	518.2063	461.5909	457.3526	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	633.5901	609.2930	588.9281	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	83.0763	109.8904	97.8922	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												290.8588 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	20.7691	27.4726	24.4730	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												72.7147 (107)
Space cooling per m2												1.2131 (108)
Energy for space heating												65.1392 (99)
Energy for space cooling												1.2131 (108)
Total												66.3523 (109)
Dwelling Fabric Energy Efficiency (DFEE)												66.4 (109)

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	2.4700	(1b)	x 2.5900	(2b) =	6.3973	(1b) - (3b)
First floor	57.4700	(1c)	x 2.2800	(2c) =	131.0316	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		137.4289	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1455	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3955	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3955	(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	0.5043	0.4944	0.4845	0.4351	0.4252	0.3758	0.3758	0.3659	0.3955	0.4252	0.4450	0.4647	(22b)
Effective ac	0.6272	0.6222	0.6174	0.5946	0.5904	0.5706	0.5706	0.5669	0.5782	0.5904	0.5990	0.6080	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			7.6600	1.3258	10.1553			(27)
150mm TE Platinum GF			2.4900	0.1300	0.3237			(28a)
Over Access			18.6300	0.1300	2.4219			(28b)
Over Garages			33.5600	0.1300	4.3628			(28b)
Over Store			2.8000	0.1300	0.3640			(28b)
50mm Alreflex Plat	2.4400	1.9700	0.4700	0.1800	0.0846			(29a)
50mm AP to Access	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP to Garage	6.8900		6.8900	0.1800	1.2402			(29a)
50mm AP with Acousti	60.9300	7.6600	53.2700	0.1800	9.5886			(29a)
Sheltered to Store	2.4400		2.4400	0.1800	0.4392			(29a)
400mm mineral wool	57.4700		57.4700	0.1300	7.4711			(30)
Total net area of external elements Aum(A, m2)			194.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6616			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	19.9967	(36)
Total fabric heat loss (33) + (36) =	59.6583	(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	28.4426	28.2187	27.9992	26.9682	26.7753	25.8774	25.8774	25.7111	26.2233	26.7753	27.1656	27.5735	(38)
Heat transfer coeff	88.1009	87.8770	87.6575	86.6265	86.4336	85.5357	85.5357	85.3694	85.8816	86.4336	86.8239	87.2318	(39)
Average = Sum(39)m / 12 =												86.6256	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4698	1.4661	1.4624	1.4452	1.4420	1.4270	1.4270	1.4242	1.4328	1.4420	1.4485	1.4553	(40)
HLP (average)												1.4452	(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	1.9799	(42)
Average daily hot water use (litres/day)	81.2235	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.3459	86.0969	82.8480	79.5990	76.3501	73.1012	73.1012	76.3501	79.5990	82.8480	86.0969	89.3459	(44)
Energy conte	132.4973	115.8830	119.5809	104.2535	100.0337	86.3215	79.9896	91.7892	92.8855	108.2490	118.1623	128.3166	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1277.9621	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.1557	24.6251	25.4109	22.1539	21.2572	18.3433	16.9978	19.5052	19.7382	23.0029	25.1095	27.2673	(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	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	98.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.8619	14.9766	12.1798	9.2209	6.8927	5.8191	6.2878	8.1731	10.9699	13.9288	16.2569	17.3305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	172.7956	174.5887	170.0702	160.4508	148.3081	136.8957	129.2715	127.4784	131.9969	141.6163	153.7590	165.1714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	32.8997	(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)													
	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	-79.1975	(71)
Water heating gains (Table 5)													
	37.8437	36.6446	34.1545	30.7693	28.5715	25.4768	22.8465	26.2167	27.4141	30.9179	34.8743	36.6496	(72)
Total internal gains													
	280.2002	278.9088	269.1035	253.1400	236.4713	220.8907	211.1048	214.5672	223.0800	239.1620	257.5892	271.8505	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2600	10.6334	0.6300	0.7000	0.7700	10.5940	(74)
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)

Solar gains	73.4614	123.2063	165.5559	203.4911	228.9060	228.3426	219.6435	200.0784	178.3682	135.1525	87.5884	63.1549	(83)
Total gains	353.6616	402.1151	434.6594	456.6311	465.3773	449.2333	430.7483	414.6456	401.4481	374.3145	345.1776	335.0054	(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	47.2469	47.3673	47.4859	48.0511	48.1583	48.6639	48.6639	48.7587	48.4679	48.1583	47.9419	47.7177	
alpha	4.1498	4.1578	4.1657	4.2034	4.2106	4.2443	4.2443	4.2506	4.2312	4.2106	4.1961	4.1812	
util living area													
	0.9980	0.9962	0.9924	0.9826	0.9552	0.8799	0.7511	0.7869	0.9286	0.9853	0.9963	0.9984	(86)
MIT	19.3442	19.4974	19.7552	20.1086	20.4655	20.7731	20.9212	20.9009	20.6725	20.2113	19.7176	19.3212	(87)
Th 2	19.7102	19.7130	19.7158	19.7288	19.7313	19.7427	19.7427	19.7448	19.7383	19.7313	19.7263	19.7212	(88)
util rest of house													
	0.9972	0.9948	0.9894	0.9745	0.9301	0.8007	0.5894	0.6375	0.8763	0.9768	0.9946	0.9978	(89)
MIT 2	18.2223	18.3771	18.6360	18.9957	19.3425	19.6231	19.7204	19.7132	19.5409	19.1011	18.6074	18.2077	(90)
Living area fraction									fLA = Living area / (4) =			0.3315	(91)
MIT	18.5942	18.7485	19.0070	19.3646	19.7148	20.0043	20.1185	20.1069	19.9160	19.4691	18.9754	18.5768	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5942	18.7485	19.0070	19.3646	19.7148	20.0043	20.1185	20.1069	19.9160	19.4691	18.9754	18.5768	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9933	0.9871	0.9714	0.9297	0.8207	0.6444	0.6876	0.8857	0.9744	0.9932	0.9971	(94)
Useful gains	352.3517	399.4113	429.0521	443.5722	432.6498	368.6862	277.5952	285.1112	355.5561	364.7227	342.8426	334.0202	(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													
	1259.3302	1216.9617	1096.3316	906.5143	692.7456	462.2605	300.9560	316.4549	499.4896	766.5895	1031.0723	1254.1166	(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													
	674.7920	549.3939	496.4560	333.3183	193.5113	0.0000	0.0000	0.0000	0.0000	298.9889	495.5254	684.5517	(98)
Space heating												3726.5374	(98)
Space heating per m2											(98) / (4) =	62.1711	(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	804.0354	632.9640	648.8073	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6763	0.7699	0.7451	0.0000	0.0000	0.0000	0.0000	(101)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	543.7755	487.2996	483.4272	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	599.6988	576.6928	559.2318	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	40.2648	66.5086	56.3986	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												163.1719 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	10.0662	16.6271	14.0997	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												40.7930 (107)
Space cooling per m2												0.6806 (108)
Energy for space heating												62.1711 (99)
Energy for space cooling												0.6806 (108)
Total												62.8517 (109)
Target Fabric Energy Efficiency (TFEE)												72.3 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Apartment First Floor	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Plot 008, Lakeside Walk, Lake Road, Hamworthy, BH15		

SAP Rating	83 B	**DER**	19.11	**TER**	19.05
Environmental	87 B	**% DER<TER**	-0.34		
CO_2 Emissions (t/year)	0.84	**DFEE**	45.50	**TFEE**	45.39
General Requirements Compliance	Fail	**% DFEE<TFEE**	-0.24		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 53 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) 19.05 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.11 kgCO□/m²Fail
Excess emissions =0.06 kgCO□/m² (0.3%)

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)45.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.5 kWh/m²/yrFail
Excess energy =0.1 kWh/m²/yr (0.2%)
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.29 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.44 (max. 2.00)	1.56 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Medium OK
Based on:
Overshading: Average
Windows facing North: 1.10 m², No overhang
Windows facing East: 5.32 m², No overhang
Windows facing West: 1.86 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
None

ARUN DISTRICT COUNCIL A/45/22/PL

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	53.4600 (1b)	x	2.3100 (2b)	=	123.4926	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.4926	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2429	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4934	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4564	(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	0.5819	0.5705	0.5591	0.5021	0.4907	0.4336	0.4336	0.4222	0.4564	0.4907	0.5135	0.5363	(22b)
Effective ac	0.6693	0.6628	0.6563	0.6260	0.6204	0.5940	0.5940	0.5891	0.6042	0.6204	0.6318	0.6438	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			8.2800	1.3347	11.0515			(27)
Opening Type 7			1.9300	1.5600	3.0108			(26)
50mm Alreflex Plat	57.4600	8.2800	49.1800	0.2900	14.2622			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.2500	3.5650			(29a)
Total net area of external elements Aum(A, m2)			73.6500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.8895			(33)
Party Floor 1			53.4600					(32d)
Party Ceiling 1			53.4600					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.0100	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2372	(36)
Total fabric heat loss					(33) + (36) =		38.1267	(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	27.2768	27.0088	26.7462	25.5125	25.2817	24.2072	24.2072	24.0082	24.6211	25.2817	25.7486	26.2368	(38)
Heat transfer coeff	65.4035	65.1355	64.8729	63.6392	63.4084	62.3339	62.3339	62.1350	62.7478	63.4084	63.8753	64.3635	(39)
Average = Sum(39)m / 12 =												63.6381	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2234	1.2184	1.2135	1.1904	1.1861	1.1660	1.1660	1.1623	1.1737	1.1861	1.1948	1.2040	(40)
HLP (average)												1.1904	(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												1.7921	(42)
Average daily hot water use (litres/day)												76.7627	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	18.7831	16.4278	16.9520	14.7792	14.1810	12.2371	11.3395	13.0122	13.1676	15.3456	16.7509	18.1904	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0103	12.6392	13.9689	13.4907	13.9203	13.4481	13.8819	13.9068	13.4713	13.9488	13.5309	14.0023	(61)
Total heat required for water heating calculated for each month													
	139.2308	122.1578	126.9824	112.0186	108.4601	95.0288	89.4784	100.6549	101.2554	116.2528	125.2036	135.2717	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	139.2308	122.1578	126.9824	112.0186	108.4601	95.0288	89.4784	100.6549	101.2554	116.2528	125.2036	135.2717	(64)
								Total per year (kWh/year) = Sum(64)m =				1371.9953	(64)
Heat gains from water heating, kWh/month													
	45.1384	39.5747	41.0692	36.1332	34.9146	30.4876	28.6063	32.3204	32.5560	37.5033	40.5139	43.8226	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6240	12.9889	10.5633	7.9971	5.9779	5.0468	5.4533	7.0883	9.5140	12.0802	14.0993	15.0304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	60.6699	58.8910	55.2005	50.1850	46.9282	42.3439	38.4493	43.4414	45.2167	50.4076	56.2693	58.9014	(72)
Total internal gains													
	284.3841	282.5911	272.3902	256.1125	239.8595	224.0271	213.6467	218.6529	226.9386	243.3916	262.2496	276.1297	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.7400	0.7000	0.7700	4.1988	(74)
East	5.3200	19.6403	0.7400	0.7000	0.7700	37.5078	(76)
West	1.8600	19.6403	0.7400	0.7000	0.7700	13.1136	(80)

Solar gains	54.8203	107.0505	176.7173	259.7471	320.9920	329.9747	313.5678	267.4154	206.0651	127.0548	68.2988	45.1290	(83)
Total gains	339.2044	389.6416	449.1075	515.8596	560.8515	554.0019	527.2145	486.0683	433.0037	370.4465	330.5484	321.2587	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.1036	36.2521	36.3989	37.1045	37.2395	37.8814	37.8814	38.0027	37.6316	37.2395	36.9673	36.6869	
alpha	3.4069	3.4168	3.4266	3.4736	3.4826	3.5254	3.5254	3.5335	3.5088	3.4826	3.4645	3.4458	
util living area													
	0.9871	0.9784	0.9569	0.9015	0.7960	0.6382	0.4939	0.5472	0.7782	0.9364	0.9793	0.9892	(86)
MIT	19.1663	19.3821	19.7600	20.2555	20.6499	20.8886	20.9659	20.9513	20.7646	20.2361	19.6243	19.1425	(87)
Th 2	19.9013	19.9053	19.9092	19.9277	19.9311	19.9473	19.9473	19.9503	19.9411	19.9311	19.9241	19.9168	(88)
util rest of house													
	0.9842	0.9736	0.9470	0.8784	0.7482	0.5572	0.3865	0.4382	0.7094	0.9166	0.9738	0.9868	(89)
MIT 2	17.4670	17.7821	18.3288	19.0385	19.5650	19.8588	19.9298	19.9229	19.7280	19.0287	18.1482	17.4419	(90)
Living area fraction										fLA = Living area / (4) =		0.4085	(91)
MIT	18.1612	18.4357	18.9135	19.5357	20.0082	20.2795	20.3531	20.3430	20.1515	19.5220	18.7513	18.1367	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.0112	18.2857	18.7635	19.3857	19.8582	20.1295	20.2031	20.1930	20.0015	19.3720	18.6013	17.9867	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9637	0.9333	0.8643	0.7445	0.5722	0.4137	0.4648	0.7138	0.9033	0.9644	0.9805	(94)
Useful gains	331.4123	375.4884	419.1557	445.8472	417.5691	317.0019	218.0918	225.9074	309.0985	334.6109	318.7868	315.0072	(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													
	896.7618	871.8875	795.5666	667.3006	517.2972	344.6743	224.5939	235.6803	370.3061	556.2157	734.6468	887.3579	(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													
	420.6200	333.5802	280.0498	159.4465	74.1978	0.0000	0.0000	0.0000	0.0000	164.8740	299.4192	425.8289	(98)
Space heating												2158.0163	(98)
Space heating per m2											(98) / (4) =	40.3669	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2384.5484	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	420.6200	333.5802	280.0498	159.4465	74.1978	0.0000	0.0000	0.0000	0.0000	164.8740	299.4192	425.8289	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	464.7735	368.5969	309.4472	176.1840	81.9865	0.0000	0.0000	0.0000	0.0000	182.1812	330.8500	470.5291	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	139.2308	122.1578	126.9824	112.0186	108.4601	95.0288	89.4784	100.6549	101.2554	116.2528	125.2036	135.2717	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6825	89.6195	89.4768	89.1515	88.5722	87.3000	87.3000	87.3000	87.3000	89.1487	89.5323	89.7073	(217)
Fuel for water heating, kWh/month													
	155.2487	136.3072	141.9165	125.6496	122.4539	108.8531	102.4953	115.2977	115.9856	130.4032	139.8418	150.7924	(219)
Water heating fuel used												1545.2451	(219)
Annual totals kWh/year													
Space heating fuel - main system												2384.5484	(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)												258.2642	(232)
Total delivered energy for all uses												4263.0576	(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	2384.5484	0.2160	515.0625	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1545.2451	0.2160	333.7729	(264)
Space and water heating			848.8354	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	258.2642	0.5190	134.0391	(268)
Total CO2, kg/year			1021.7995	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.1100	(273)

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

DER		19.1100	ZC1
Total Floor Area	TFA	53.4600	
Assumed number of occupants	N	1.7921	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3150	ZC2
CO2 emissions from cooking, equation (L16)		3.0305	ZC3
Total CO2 emissions		39.4555	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		39.4555	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	53.4600 (1b)	x	2.3100 (2b)	=	123.4926	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.4926	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4120	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3811	(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	0.4858	0.4763	0.4668	0.4192	0.4096	0.3620	0.3620	0.3525	0.3811	0.4096	0.4287	0.4477	(22b)
Effective ac	0.6180	0.6134	0.6089	0.5878	0.5839	0.5655	0.5655	0.5621	0.5726	0.5839	0.5919	0.6002	(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			1.9300	1.0000	1.9300			(26)
TER Opening Type (Uw = 1.40)			8.2800	1.3258	10.9773			(27)
50mm Alreflex Plat	57.4600	8.2800	49.1800	0.1800	8.8524			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.1800	2.5668			(29a)
Total net area of external elements Aum(A, m2)			73.6500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.3265			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5802	(36)
Total fabric heat loss					(33) + (36) =		30.9067	(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	25.1860	24.9993	24.8162	23.9563	23.7954	23.0465	23.0465	22.9078	23.3350	23.7954	24.1209	24.4612	(38)
Heat transfer coeff	56.0927	55.9060	55.7229	54.8630	54.7021	53.9532	53.9532	53.8145	54.2417	54.7021	55.0276	55.3678	(39)
Average = Sum(39)m / 12 =												54.8622	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0492	1.0458	1.0423	1.0262	1.0232	1.0092	1.0092	1.0066	1.0146	1.0232	1.0293	1.0357	(40)
HLP (average)												1.0262	(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												1.7921	(42)
Average daily hot water use (litres/day)												76.7627	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	18.7831	16.4278	16.9520	14.7792	14.1810	12.2371	11.3395	13.0122	13.1676	15.3456	16.7509	18.1904	(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	43.0292	37.4518	39.8998	37.0985	36.7704	34.0700	35.2057	36.7704	37.0985	39.8998	40.1269	43.0292	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	168.2497	146.9704	152.9132	135.6263	131.3102	115.6507	110.8022	123.5185	124.8826	142.2037	151.7997	164.2985	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	168.2497	146.9704	152.9132	135.6263	131.3102	115.6507	110.8022	123.5185	124.8826	142.2037	151.7997	164.2985	(64)
								Total per year (kWh/year) = Sum(64)m =				1668.2257	(64)
Heat gains from water heating, kWh/month													
	52.3931	45.7779	47.5519	42.0351	40.6271	35.6431	33.9373	38.0363	38.4628	43.9910	47.1629	51.0794	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6240	12.9889	10.5633	7.9971	5.9779	5.0468	5.4533	7.0883	9.5140	12.0802	14.0993	15.0304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	70.4209	68.1219	63.9139	58.3821	54.6063	49.5043	45.6146	51.1241	53.4206	59.1277	65.5041	68.6551	(72)
Total internal gains													
	294.1351	291.8219	281.1036	264.3097	247.5376	231.1875	220.8120	226.3356	235.1425	252.1117	271.4843	285.8834	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.6300	0.7000	0.7700	3.5747	(74)
East	5.3200	19.6403	0.6300	0.7000	0.7700	31.9323	(76)
West	1.8600	19.6403	0.6300	0.7000	0.7700	11.1643	(80)

Solar gains	46.6713	91.1376	150.4485	221.1360	273.2770	280.9244	266.9564	227.6644	175.4338	108.1683	58.1463	38.4206	(83)
Total gains	340.8064	382.9595	431.5521	485.4457	520.8146	512.1120	487.7684	454.0000	410.5763	360.2800	329.6306	324.3040	(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	66.1851	66.4062	66.6243	67.6686	67.8676	68.8096	68.8096	68.9870	68.4437	67.8676	67.4662	67.0516	
alpha	5.4123	5.4271	5.4416	5.5112	5.5245	5.5873	5.5873	5.5991	5.5629	5.5245	5.4977	5.4701	
util living area													
	0.9973	0.9944	0.9844	0.9449	0.8366	0.6480	0.4822	0.5368	0.8058	0.9690	0.9944	0.9980	(86)
MIT	19.9319	20.0701	20.3134	20.6313	20.8687	20.9758	20.9960	20.9931	20.9218	20.6048	20.2149	19.9118	(87)
Th 2	20.0425	20.0454	20.0482	20.0615	20.0640	20.0757	20.0757	20.0778	20.0712	20.0640	20.0590	20.0537	(88)
util rest of house													
	0.9964	0.9926	0.9790	0.9261	0.7870	0.5653	0.3833	0.4336	0.7324	0.9547	0.9922	0.9973	(89)
MIT 2	18.6181	18.8216	19.1757	19.6330	19.9386	20.0600	20.0742	20.0750	20.0101	19.6064	19.0434	18.5970	(90)
Living area fraction										fLA = Living area / (4) =		0.4085	(91)
MIT	19.1548	19.3316	19.6405	20.0408	20.3186	20.4341	20.4508	20.4500	20.3825	20.0143	19.5220	19.1341	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1548	19.3316	19.6405	20.0408	20.3186	20.4341	20.4508	20.4500	20.3825	20.0143	19.5220	19.1341	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9907	0.9761	0.9256	0.8016	0.5984	0.4239	0.4759	0.7591	0.9538	0.9905	0.9964	(94)
Useful gains	339.2066	379.4040	421.2320	449.3269	417.5013	306.4354	206.7458	216.0747	311.6560	343.6220	326.5074	323.1231	(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													
	833.2456	806.8144	732.2250	611.2202	471.4533	314.7683	207.7625	217.9511	340.7746	514.9808	683.5507	826.8701	(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													
	367.5650	287.2198	231.3788	116.5632	40.1403	0.0000	0.0000	0.0000	0.0000	127.4910	257.0712	374.7878	(98)
Space heating												1802.2170	(98)
Space heating per m2											(98) / (4) =	33.7115	(99)

8c. Space cooling requirement

Not applicable

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

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1929.5685	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	367.5650	287.2198	231.3788	116.5632	40.1403	0.0000	0.0000	0.0000	0.0000	127.4910	257.0712	374.7878	(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)													
	393.5386	307.5158	247.7289	124.8000	42.9767	0.0000	0.0000	0.0000	0.0000	136.4999	275.2368	401.2717	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	168.2497	146.9704	152.9132	135.6263	131.3102	115.6507	110.8022	123.5185	124.8826	142.2037	151.7997	164.2985	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.9653	86.7084	86.0913	84.6725	82.4569	80.3000	80.3000	80.3000	80.3000	84.7776	86.3669	87.0626	(217)
Fuel for water heating, kWh/month													
	193.4676	169.4997	177.6176	160.1775	159.2472	144.0233	137.9853	153.8212	155.5200	167.7375	175.7614	188.7132	(219)
Water heating fuel used												1983.5715	(219)
Annual totals kWh/year													
Space heating fuel - main system												1929.5685	(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)												258.2642	(232)
Total delivered energy for all uses												4246.4041	(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	1929.5685	0.2160	416.7868	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1983.5715	0.2160	428.4514	(264)
Space and water heating			845.2382	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	258.2642	0.5190	134.0391	(268)
Total CO2, kg/m2/year			1018.2023	(272)
Emissions per m2 for space and water heating			15.8107	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5073	(272b)
Emissions per m2 for pumps and fans			0.7281	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8107 * 1.00) + 2.5073 + 0.7281, rounded to 2 d.p.			19.0500	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.4600 (1b)	x	2.3100 (2b)	=	123.4926	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.4926	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4125	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3815	(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	0.4864	0.4769	0.4674	0.4197	0.4101	0.3624	0.3624	0.3529	0.3815	0.4101	0.4292	0.4483	(22b)
Effective ac	0.6183	0.6137	0.6092	0.5881	0.5841	0.5657	0.5657	0.5623	0.5728	0.5841	0.5921	0.6005	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			8.2800	1.3347	11.0515			(27)
Opening Type 7			1.9300	1.5600	3.0108			(26)
50mm Alreflex Plat	57.4600	8.2800	49.1800	0.2900	14.2622			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.2500	3.5650			(29a)
Total net area of external elements Aum(A, m2)			73.6500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.8895			(33)
Party Floor 1			53.4600					(32d)
Party Ceiling 1			53.4600					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.0100	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2372	(36)
Total fabric heat loss					(33) + (36) =		38.1267	(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	25.1977	25.0105	24.8270	23.9650	23.8038	23.0530	23.0530	22.9140	23.3422	23.8038	24.1300	24.4711	(38)
Heat transfer coeff	63.3244	63.1372	62.9537	62.0917	61.9305	61.1797	61.1797	61.0407	61.4689	61.9305	62.2567	62.5978	(39)
Average = Sum(39)m / 12 =												62.0910	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1845	1.1810	1.1776	1.1615	1.1584	1.1444	1.1444	1.1418	1.1498	1.1584	1.1645	1.1709	(40)
HLP (average)												1.1614	(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												1.7921	(42)
Average daily hot water use (litres/day)												76.7627	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.6094	23.2727	24.0154	20.9372	20.0897	17.3359	16.0643	18.4340	18.6541	21.7396	23.7305	25.7697	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6240	12.9889	10.5633	7.9971	5.9779	5.0468	5.4533	7.0883	9.5140	12.0802	14.0993	15.0304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	35.7653	34.6320	32.2787	29.0794	27.0023	24.0776	21.5917	24.7768	25.9085	29.2199	32.9590	34.6368	(72)
Total internal gains													
	256.4795	255.3321	246.4684	232.0069	216.9336	202.7609	193.7891	196.9883	204.6304	219.2039	235.9393	248.8651	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.7400	0.7000	0.7700	4.1988	(74)
East	5.3200	19.6403	0.7400	0.7000	0.7700	37.5078	(76)
West	1.8600	19.6403	0.7400	0.7000	0.7700	13.1136	(80)

Solar gains	54.8203	107.0505	176.7173	259.7471	320.9920	329.9747	313.5678	267.4154	206.0651	127.0548	68.2988	45.1290	(83)
Total gains	311.2998	362.3826	423.1857	491.7540	537.9256	532.7356	507.3569	464.4037	410.6955	346.2587	304.2381	293.9941	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.2889	37.3995	37.5085	38.0292	38.1282	38.5961	38.5961	38.6840	38.4145	38.1282	37.9284	37.7218	
alpha	3.4859	3.4933	3.5006	3.5353	3.5419	3.5731	3.5731	3.5789	3.5610	3.5419	3.5286	3.5148	
util living area													
	0.9900	0.9823	0.9624	0.9096	0.8057	0.6492	0.5032	0.5608	0.7931	0.9454	0.9836	0.9918	(86)
MIT	19.1680	19.3837	19.7619	20.2523	20.6491	20.8871	20.9657	20.9497	20.7573	20.2205	19.6089	19.1354	(87)
Th 2	19.9324	19.9352	19.9380	19.9510	19.9534	19.9647	19.9647	19.9668	19.9604	19.9534	19.9485	19.9433	(88)
util rest of house													
	0.9878	0.9783	0.9537	0.8880	0.7595	0.5691	0.3960	0.4517	0.7270	0.9280	0.9793	0.9900	(89)
MIT 2	18.2640	18.4799	18.8546	19.3374	19.7009	19.9028	19.9525	19.9472	19.8083	19.3186	18.7150	18.2396	(90)
Living area fraction									fLA = Living area / (4) =			0.4085	(91)
MIT	18.6333	18.8491	19.2252	19.7112	20.0883	20.3049	20.3664	20.3568	20.1960	19.6871	19.0802	18.6056	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6333	18.8491	19.2252	19.7112	20.0883	20.3049	20.3664	20.3568	20.1960	19.6871	19.0802	18.6056	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9841	0.9730	0.9464	0.8823	0.7660	0.5969	0.4390	0.4948	0.7436	0.9226	0.9745	0.9868	(94)
Useful gains	306.3532	352.6146	400.5221	433.8763	412.0694	317.9738	222.7241	229.7667	305.4133	319.4579	296.4934	290.1132	(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													
	907.6508	880.7069	801.1003	671.2862	519.4905	349.0262	230.4285	241.5228	374.7134	562.7674	745.8480	901.7575	(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													
	447.3654	354.8781	298.0302	170.9351	79.9214	0.0000	0.0000	0.0000	0.0000	181.0222	323.5352	455.0633	(98)
Space heating												2310.7509	(98)
Space heating per m2											(98) / (4) =	43.2239	(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	575.0894	452.7300	463.9093	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8466	0.9004	0.8744	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	486.8468	407.6529	405.6355	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	690.4750	659.5413	610.4503	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	146.6123	187.4049	152.3823	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												486.3995	(104)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF 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	36.6531	46.8512	38.0956	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												121.5999 (107)
Space cooling per m2												2.2746 (108)
Energy for space heating												43.2239 (99)
Energy for space cooling												2.2746 (108)
Total												45.4985 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.5 (109)

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	53.4600 (1b)	x	2.3100 (2b)	=	123.4926	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.4926	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4120	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3811	(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	0.4858	0.4763	0.4668	0.4192	0.4096	0.3620	0.3620	0.3525	0.3811	0.4096	0.4287	0.4477	(22b)
Effective ac	0.6180	0.6134	0.6089	0.5878	0.5839	0.5655	0.5655	0.5621	0.5726	0.5839	0.5919	0.6002	(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			1.9300	1.0000	1.9300			(26)
TER Opening Type (Uw = 1.40)			8.2800	1.3258	10.9773			(27)
50mm Alreflex Plat	57.4600	8.2800	49.1800	0.1800	8.8524			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.1800	2.5668			(29a)
Total net area of external elements Aum(A, m2)			73.6500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.3265			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5802	(36)
Total fabric heat loss					(33) + (36) =		30.9067	(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	25.1860	24.9993	24.8162	23.9563	23.7954	23.0465	23.0465	22.9078	23.3350	23.7954	24.1209	24.4612	(38)
Heat transfer coeff	56.0927	55.9060	55.7229	54.8630	54.7021	53.9532	53.9532	53.8145	54.2417	54.7021	55.0276	55.3678	(39)
Average = Sum(39)m / 12 =												54.8622	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0492	1.0458	1.0423	1.0262	1.0232	1.0092	1.0092	1.0066	1.0146	1.0232	1.0293	1.0357	(40)
HLP (average)												1.0262	(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		1.7921 (42)
Average daily hot water use (litres/day)		76.7627 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	26.6094	23.2727	24.0154	20.9372	20.0897	17.3359	16.0643	18.4340	18.6541	21.7396	23.7305	25.7697 (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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6240	12.9889	10.5633	7.9971	5.9779	5.0468	5.4533	7.0883	9.5140	12.0802	14.0993	15.0304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	35.7653	34.6320	32.2787	29.0794	27.0023	24.0776	21.5917	24.7768	25.9085	29.2199	32.9590	34.6368	(72)
Total internal gains													
	256.4795	255.3321	246.4684	232.0069	216.9336	202.7609	193.7891	196.9883	204.6304	219.2039	235.9393	248.8651	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.6300	0.7000	0.7700	3.5747	(74)
East	5.3200	19.6403	0.6300	0.7000	0.7700	31.9323	(76)
West	1.8600	19.6403	0.6300	0.7000	0.7700	11.1643	(80)

Solar gains	46.6713	91.1376	150.4485	221.1360	273.2770	280.9244	266.9564	227.6644	175.4338	108.1683	58.1463	38.4206	(83)
Total gains	303.1508	346.4697	396.9169	453.1430	490.2106	483.6853	460.7455	424.6528	380.0642	327.3722	294.0856	287.2857	(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	66.1851	66.4062	66.6243	67.6686	67.8676	68.8096	68.8096	68.9870	68.4437	67.8676	67.4662	67.0516	
alpha	5.4123	5.4271	5.4416	5.5112	5.5245	5.5873	5.5873	5.5991	5.5629	5.5245	5.4977	5.4701	
util living area													
	0.9985	0.9965	0.9893	0.9578	0.8620	0.6790	0.5090	0.5707	0.8410	0.9794	0.9968	0.9989	(86)
MIT	19.8653	20.0065	20.2558	20.5869	20.8450	20.9696	20.9948	20.9907	20.9016	20.5535	20.1526	19.8460	(87)
Th 2	20.0425	20.0454	20.0482	20.0615	20.0640	20.0757	20.0757	20.0778	20.0712	20.0640	20.0590	20.0537	(88)
util rest of house													
	0.9980	0.9954	0.9854	0.9424	0.8161	0.5950	0.4054	0.4626	0.7726	0.9692	0.9955	0.9985	(89)
MIT 2	19.0036	19.1467	19.3963	19.7285	19.9606	20.0619	20.0743	20.0751	20.0167	19.7036	19.3039	18.9935	(90)
Living area fraction									fLA = Living area / (4) =			0.4085	(91)
MIT	19.3557	19.4979	19.7474	20.0792	20.3219	20.4327	20.4504	20.4492	20.3782	20.0508	19.6507	19.3418	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3557	19.4979	19.7474	20.0792	20.3219	20.4327	20.4504	20.4492	20.3782	20.0508	19.6507	19.3418	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9945	0.9839	0.9428	0.8299	0.6287	0.4480	0.5071	0.7975	0.9690	0.9947	0.9981	(94)
Useful gains	302.3906	344.5549	390.5290	427.2104	406.8337	304.1129	206.4019	215.3415	303.1042	317.2378	292.5339	286.7459	(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													
	844.5124	816.1109	738.1842	613.3241	471.6387	314.6949	207.7404	217.9034	340.5402	516.9811	690.6320	838.3675	(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													
	403.3387	316.8856	258.6555	134.0019	48.2149	0.0000	0.0000	0.0000	0.0000	148.6090	286.6306	410.4065	(98)
Space heating												2006.7426	(98)
Space heating per m2										(98) / (4) =		37.5373	(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	507.1600	399.2536	408.9902	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9250	0.9644	0.9483	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	469.1279	385.0253	387.8617	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	633.1435	605.0604	563.9882	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	118.0913	163.7061	131.0381	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												412.8355	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	29.5228	40.9265	32.7595	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												103.2089 (107)
Space cooling per m2												1.9306 (108)
Energy for space heating												37.5373 (99)
Energy for space cooling												1.9306 (108)
Total												39.4679 (109)
Target Fabric Energy Efficiency (TFEE)												45.4 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Apartment Groud Floor	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Plot 006, Lakeside Walk, Lake Road, Hamworthy, BH15		

SAP Rating	82 B	**DER**	21.83	**TER**	21.44
Environmental	86 B	**% DER<TER**	-1.84		
CO_2 Emissions (t/year)	0.95	**DFEE**	56.14	**TFEE**	56.69
General Requirements Compliance	Fail	**% DFEE<TFEE**	0.98		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 53 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) 21.44 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 21.83 kgCO□/m²Fail
Excess emissions =0.39 kgCO□/m² (1.8%)

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)56.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.29 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.44 (max. 2.00)	1.56 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability

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

---
4 Heating efficiency

Main heating system:	Boiler system with radiators or underfloor - Mains gas	
Data from database		
Ideal LOGIC COMBI ESP1 35		
Combi boiler		
Efficiency: 89.6% SEDBUK2009		
Minimum: 88.0%	OK	
Secondary heating system:	None	

---
5 Cylinder insulation

Hot water storage	No cylinder	

---
6 Controls

Space heating controls:	Time and temperature zone control	OK
Hot water controls:	No cylinder	
Boiler interlock	Yes	OK

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

Minimum	75%	OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature

Overheating risk (Southern England):	Slight	OK
Based on:		
Overshading:	Average	
Windows facing North:	1.10 m², No overhang	
Windows facing East:	3.72 m², No overhang	
Windows facing West:	1.86 m², No overhang	
Air change rate:	3.00 ach	
Blinds/curtains:	Dark-coloured curtain or roller blind, closed 100% of daylight hours	

---
10 Key features
None

ARUN DISTRICT COUNCIL A/45/22/PL

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	53.4600 (1b)	x	2.3100 (2b)	=	123.4926	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.4926	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2429	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4934	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4564	(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	0.5819	0.5705	0.5591	0.5021	0.4907	0.4336	0.4336	0.4222	0.4564	0.4907	0.5135	0.5363	(22b)
Effective ac	0.6693	0.6628	0.6563	0.6260	0.6204	0.5940	0.5940	0.5891	0.6042	0.6204	0.6318	0.6438	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			6.6800	1.3347	8.9159			(27)
Opening Type 7			1.9300	1.5600	3.0108			(26)
150mm TE Platinum GF			53.4600	0.1500	8.0190			(28a)
50mm Alreflex Plat	57.4600	6.6800	50.7800	0.2900	14.7262			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.2500	3.5650			(29a)
Total net area of external elements Aum(A, m2)			127.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.2369			(33)
Party Ceiling 1			53.4600					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		210.5600 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.2642 (36)
Total fabric heat loss	(33) + (36) =	46.5012 (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	27.2768	27.0088	26.7462	25.5125	25.2817	24.2072	24.2072	24.0082	24.6211	25.2817	25.7486	26.2368	(38)
Heat transfer coeff	73.7779	73.5100	73.2473	72.0137	71.7829	70.7084	70.7084	70.5094	71.1223	71.7829	72.2498	72.7379	(39)
Average = Sum(39)m / 12 =												72.0126	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3801	1.3750	1.3701	1.3471	1.3427	1.3226	1.3226	1.3189	1.3304	1.3427	1.3515	1.3606	(40)
HLP (average)												1.3470	(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	1.7921 (42)
Average daily hot water use (litres/day)	76.7627 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	18.7831	16.4278	16.9520	14.7792	14.1810	12.2371	11.3395	13.0122	13.1676	15.3456	16.7509	18.1904	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0103	12.6392	13.9689	13.4907	13.9203	13.4481	13.8819	13.9068	13.4713	13.9488	13.5309	14.0023	(61)
Total heat required for water heating calculated for each month													
	139.2308	122.1578	126.9824	112.0186	108.4601	95.0288	89.4784	100.6549	101.2554	116.2528	125.2036	135.2717	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	139.2308	122.1578	126.9824	112.0186	108.4601	95.0288	89.4784	100.6549	101.2554	116.2528	125.2036	135.2717	(64)
								Total per year (kWh/year) = Sum(64)m =				1371.9953	(64)
Heat gains from water heating, kWh/month													
	45.1384	39.5747	41.0692	36.1332	34.9146	30.4876	28.6063	32.3204	32.5560	37.5033	40.5139	43.8226	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.3195	13.6066	11.0657	8.3774	6.2622	5.2868	5.7126	7.4255	9.9664	12.6547	14.7699	15.7453	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	60.6699	58.8910	55.2005	50.1850	46.9282	42.3439	38.4493	43.4414	45.2167	50.4076	56.2693	58.9014	(72)
Total internal gains													
	285.0796	283.2088	272.8926	256.4928	240.1438	224.2672	213.9061	218.9901	227.3911	243.9662	262.9202	276.8446	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.7400	0.7000	0.7700	4.1988	(74)
East	3.7200	19.6403	0.7400	0.7000	0.7700	26.2273	(76)
West	1.8600	19.6403	0.7400	0.7000	0.7700	13.1136	(80)

Solar gains	43.5397	84.9833	140.3758	206.7453	256.0363	263.4810	250.2631	213.0375	163.7985	100.8703	54.2333	35.8524	(83)
Total gains	328.6193	368.1921	413.2684	463.2381	496.1800	487.7481	464.1691	432.0276	391.1896	344.8364	317.1534	312.6970	(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	42.3815	42.5359	42.6885	43.4198	43.5594	44.2213	44.2213	44.3461	43.9640	43.5594	43.2779	42.9874	
alpha	3.8254	3.8357	3.8459	3.8947	3.9040	3.9481	3.9481	3.9564	3.9309	3.9040	3.8852	3.8658	
util living area													
	0.9953	0.9922	0.9836	0.9581	0.8948	0.7670	0.6174	0.6714	0.8764	0.9730	0.9922	0.9962	(86)
MIT	19.2666	19.4313	19.7418	20.1757	20.5686	20.8480	20.9525	20.9335	20.7139	20.2069	19.6716	19.2493	(87)
Th 2	19.7787	19.7825	19.7863	19.8042	19.8075	19.8231	19.8231	19.8260	19.8171	19.8075	19.8007	19.7937	(88)
util rest of house													
	0.9939	0.9898	0.9783	0.9432	0.8542	0.6752	0.4755	0.5330	0.8123	0.9607	0.9894	0.9950	(89)
MIT 2	17.4913	17.7337	18.1872	18.8206	19.3606	19.7096	19.8027	19.7939	19.5654	18.8758	18.0971	17.4756	(90)
Living area fraction										fLA = Living area / (4) =		0.4085	(91)
MIT	18.2165	18.4272	18.8223	19.3742	19.8541	20.1747	20.2724	20.2595	20.0346	19.4196	18.7403	18.2002	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.0665	18.2772	18.6723	19.2242	19.7041	20.0247	20.1224	20.1095	19.8846	19.2696	18.5903	18.0502	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9909	0.9854	0.9714	0.9338	0.8500	0.6929	0.5143	0.5696	0.8168	0.9529	0.9852	0.9925	(94)
Useful gains	325.6400	362.8260	401.4625	432.5492	421.7352	337.9481	238.7057	246.0976	319.5153	328.5979	312.4482	310.3474	(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													
	1015.6669	983.3596	891.5916	743.4821	574.5558	383.5702	249.0639	261.5536	411.4122	622.3260	830.1749	1007.4356	(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													
	513.3800	416.9986	364.6561	223.8717	113.6985	0.0000	0.0000	0.0000	0.0000	218.5337	372.7632	518.6336	(98)
Space heating												2742.5354	(98)
Space heating per m2											(98) / (4) =	51.3007	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3030.4259	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	513.3800	416.9986	364.6561	223.8717	113.6985	0.0000	0.0000	0.0000	0.0000	218.5337	372.7632	518.6336	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	567.2707	460.7719	402.9349	247.3720	125.6337	0.0000	0.0000	0.0000	0.0000	241.4737	411.8930	573.0758	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	139.2308	122.1578	126.9824	112.0186	108.4601	95.0288	89.4784	100.6549	101.2554	116.2528	125.2036	135.2717	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7978	89.7546	89.6512	89.4071	88.9089	87.3000	87.3000	87.3000	87.3000	89.3626	89.6735	89.8189	(217)
Fuel for water heating, kWh/month													
	155.0493	136.1020	141.6404	125.2905	121.9901	108.8531	102.4953	115.2977	115.9856	130.0911	139.6216	150.6049	(219)
Water heating fuel used												1543.0217	(219)
Annual totals kWh/year													
Space heating fuel - main system												3030.4259	(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)												270.5468	(232)
Total delivered energy for all uses												4918.9944	(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	3030.4259	0.2160	654.5720	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1543.0217	0.2160	333.2927	(264)
Space and water heating			987.8647	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	270.5468	0.5190	140.4138	(268)
Total CO2, kg/year			1167.2035	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			21.8300	(273)

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

DER		21.8300	ZC1
Total Floor Area	TFA	53.4600	
Assumed number of occupants	N	1.7921	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3150	ZC2
CO2 emissions from cooking, equation (L16)		3.0305	ZC3
Total CO2 emissions		42.1755	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		42.1755	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	53.4600 (1b)	x	2.3100 (2b)	=	123.4926	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.4926	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4120	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3811	(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	0.4858	0.4763	0.4668	0.4192	0.4096	0.3620	0.3620	0.3525	0.3811	0.4096	0.4287	0.4477	(22b)
Effective ac	0.6180	0.6134	0.6089	0.5878	0.5839	0.5655	0.5655	0.5621	0.5726	0.5839	0.5919	0.6002	(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			1.9300	1.0000	1.9300			(26)
TER Opening Type (Uw = 1.40)			6.6800	1.3258	8.8561			(27)
150mm TE Platinum GF			53.4600	0.1300	6.9498			(28a)
50mm Alreflex Plat	57.4600	6.6800	50.7800	0.1800	9.1404			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.1800	2.5668			(29a)
Total net area of external elements Aum(A, m2)			127.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4431			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1784	(36)
Total fabric heat loss						(33) + (36) =	38.6215	(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	25.1860	24.9993	24.8162	23.9563	23.7954	23.0465	23.0465	22.9078	23.3350	23.7954	24.1209	24.4612	(38)
Heat transfer coeff	63.8075	63.6207	63.4377	62.5778	62.4169	61.6680	61.6680	61.5293	61.9565	62.4169	62.7424	63.0826	(39)
Average = Sum(39)m / 12 =												62.5770	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1936	1.1901	1.1866	1.1706	1.1675	1.1535	1.1535	1.1509	1.1589	1.1675	1.1736	1.1800	(40)
HLP (average)												1.1705	(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	1.7921	(42)
Average daily hot water use (litres/day)	76.7627	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	18.7831	16.4278	16.9520	14.7792	14.1810	12.2371	11.3395	13.0122	13.1676	15.3456	16.7509	18.1904	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	43.0292	37.4518	39.8998	37.0985	36.7704	34.0700	35.2057	36.7704	37.0985	39.8998	40.1269	43.0292	(61)
Total heat required for water heating calculated for each month													
	168.2497	146.9704	152.9132	135.6263	131.3102	115.6507	110.8022	123.5185	124.8826	142.2037	151.7997	164.2985	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	168.2497	146.9704	152.9132	135.6263	131.3102	115.6507	110.8022	123.5185	124.8826	142.2037	151.7997	164.2985	(64)
									Total per year (kWh/year) = Sum(64)m =			1668.2257	(64)
Heat gains from water heating, kWh/month													
	52.3931	45.7779	47.5519	42.0351	40.6271	35.6431	33.9373	38.0363	38.4628	43.9910	47.1629	51.0794	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.3195	13.6066	11.0657	8.3774	6.2622	5.2868	5.7126	7.4255	9.9664	12.6547	14.7699	15.7453	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	70.4209	68.1219	63.9139	58.3821	54.6063	49.5043	45.6146	51.1241	53.4206	59.1277	65.5041	68.6551	(72)
Total internal gains													
	294.8305	292.4397	281.6059	264.6900	247.8219	231.4276	221.0713	226.6727	235.5950	252.6862	272.1549	286.5982	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.6300	0.7000	0.7700	3.5747	(74)
East	3.7200	19.6403	0.6300	0.7000	0.7700	22.3286	(76)
West	1.8600	19.6403	0.6300	0.7000	0.7700	11.1643	(80)

Solar gains	37.0676	72.3507	119.5092	176.0129	217.9768	224.3149	213.0618	181.3698	139.4501	85.8760	46.1716	30.5230	(83)
Total gains	331.8982	364.7904	401.1151	440.7028	465.7987	455.7424	434.1331	408.0425	375.0450	338.5623	318.3265	317.1212	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.1828	58.3536	58.5220	59.3262	59.4791	60.2014	60.2014	60.3371	59.9211	59.4791	59.1705	58.8514	
alpha	4.8789	4.8902	4.9015	4.9551	4.9653	5.0134	5.0134	5.0225	4.9947	4.9653	4.9447	4.9234	
util living area													
	0.9977	0.9959	0.9903	0.9702	0.9094	0.7686	0.6014	0.6556	0.8827	0.9807	0.9956	0.9982	(86)
MIT	19.7199	19.8472	20.0880	20.4231	20.7253	20.9220	20.9820	20.9727	20.8308	20.4447	20.0289	19.7014	(87)
Th 2	19.9252	19.9280	19.9307	19.9436	19.9461	19.9574	19.9574	19.9594	19.9530	19.9461	19.9412	19.9360	(88)
util rest of house													
	0.9969	0.9944	0.9867	0.9581	0.8710	0.6785	0.4707	0.5255	0.8189	0.9707	0.9938	0.9975	(89)
MIT 2	18.2247	18.4124	18.7646	19.2545	19.6666	19.9029	19.9505	19.9477	19.8104	19.2928	18.6875	18.2053	(90)
Living area fraction									fLA = Living area / (4) =			0.4085	(91)
MIT	18.8355	18.9985	19.3052	19.7319	20.0991	20.3193	20.3719	20.3665	20.2272	19.7634	19.2355	18.8165	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8355	18.9985	19.3052	19.7319	20.0991	20.3193	20.3719	20.3665	20.2272	19.7634	19.2355	18.8165	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9927	0.9838	0.9551	0.8775	0.7123	0.5246	0.5791	0.8382	0.9684	0.9922	0.9966	(94)
Useful gains	330.4783	362.1190	394.6245	420.9187	408.7279	324.6247	227.7629	236.2805	314.3627	327.8686	315.8296	316.0327	(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													
	927.4743	896.9584	812.3320	677.8370	524.2440	352.6948	232.6043	244.0535	379.6226	571.9491	761.4101	922.0457	(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													
	444.1650	359.4121	310.7744	184.9812	85.9440	0.0000	0.0000	0.0000	0.0000	181.5959	320.8180	450.8737	(98)
Space heating												2338.5643	(98)
Space heating per m2											(98) / (4) =	43.7442	(99)

8c. Space cooling requirement

Not applicable

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

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2503.8161	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	444.1650	359.4121	310.7744	184.9812	85.9440	0.0000	0.0000	0.0000	0.0000	181.5959	320.8180	450.8737	(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)	475.5514	384.8095	332.7349	198.0527	92.0171	0.0000	0.0000	0.0000	0.0000	194.4282	343.4882	482.7341	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	168.2497	146.9704	152.9132	135.6263	131.3102	115.6507	110.8022	123.5185	124.8826	142.2037	151.7997	164.2985	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3805	87.2161	86.7997	85.8330	84.0132	80.3000	80.3000	80.3000	80.3000	85.6679	86.8898	87.4619	(217)
Fuel for water heating, kWh/month	192.5482	168.5129	176.1680	158.0119	156.2971	144.0233	137.9853	153.8212	155.5200	165.9943	174.7037	187.8515	(219)
Water heating fuel used												1971.4374	(219)
Annual totals kWh/year													
Space heating fuel - main system												2503.8161	(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)												270.5468	(232)
Total delivered energy for all uses												4820.8003	(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	2503.8161	0.2160	540.8243	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1971.4374	0.2160	425.8305	(264)
Space and water heating			966.6548	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	270.5468	0.5190	140.4138	(268)
Total CO2, kg/m2/year			1145.9935	(272)
Emissions per m2 for space and water heating			18.0818	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6265	(272b)
Emissions per m2 for pumps and fans			0.7281	(272c)
Target Carbon Dioxide Emission Rate (TER) = (18.0818 * 1.00) + 2.6265 + 0.7281, rounded to 2 d.p.			21.4400	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.4600 (1b)	x	2.3100 (2b)	=	123.4926	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.4926	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4125	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3815	(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	0.4864	0.4769	0.4674	0.4197	0.4101	0.3624	0.3624	0.3529	0.3815	0.4101	0.4292	0.4483	(22b)
Effective ac	0.6183	0.6137	0.6092	0.5881	0.5841	0.5657	0.5657	0.5623	0.5728	0.5841	0.5921	0.6005	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			6.6800	1.3347	8.9159			(27)
Opening Type 7			1.9300	1.5600	3.0108			(26)
150mm TE Platinum GF			53.4600	0.1500	8.0190			(28a)
50mm Alreflex Plat	57.4600	6.6800	50.7800	0.2900	14.7262			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.2500	3.5650			(29a)
Total net area of external elements Aum(A, m2)			127.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.2369			(33)
Party Ceiling 1			53.4600					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	210.5600	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.2642	(36)
Total fabric heat loss (33) + (36) =	46.5012	(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	25.1977	25.0105	24.8270	23.9650	23.8038	23.0530	23.0530	22.9140	23.3422	23.8038	24.1300	24.4711	(38)
Heat transfer coeff	71.6989	71.5117	71.3282	70.4662	70.3049	69.5542	69.5542	69.4152	69.8434	70.3049	70.6312	70.9723	(39)
Average = Sum(39)m / 12 =												70.4654	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3412	1.3377	1.3342	1.3181	1.3151	1.3011	1.3011	1.2985	1.3065	1.3151	1.3212	1.3276	(40)
HLP (average)												1.3181	(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	1.7921 (42)
Average daily hot water use (litres/day)	76.7627 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.6094	23.2727	24.0154	20.9372	20.0897	17.3359	16.0643	18.4340	18.6541	21.7396	23.7305	25.7697	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.3195	13.6066	11.0657	8.3774	6.2622	5.2868	5.7126	7.4255	9.9664	12.6547	14.7699	15.7453	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	35.7653	34.6320	32.2787	29.0794	27.0023	24.0776	21.5917	24.7768	25.9085	29.2199	32.9590	34.6368	(72)
Total internal gains													
	257.1750	255.9498	246.9708	232.3873	217.2179	203.0009	194.0485	197.3255	205.0829	219.7784	236.6098	249.5799	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.7400	0.7000	0.7700	4.1988	(74)
East	3.7200	19.6403	0.7400	0.7000	0.7700	26.2273	(76)
West	1.8600	19.6403	0.7400	0.7000	0.7700	13.1136	(80)

Solar gains	43.5397	84.9833	140.3758	206.7453	256.0363	263.4810	250.2631	213.0375	163.7985	100.8703	54.2333	35.8524	(83)
Total gains	300.7147	340.9332	387.3466	439.1325	473.2542	466.4819	444.3115	410.3629	368.8814	320.6487	290.8431	285.4323	(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	43.6104	43.7246	43.8370	44.3733	44.4751	44.9551	44.9551	45.0452	44.7690	44.4751	44.2696	44.0569	
alpha	3.9074	3.9150	3.9225	3.9582	3.9650	3.9970	3.9970	4.0030	3.9846	3.9650	3.9513	3.9371	
util living area													
	0.9966	0.9940	0.9866	0.9636	0.9041	0.7807	0.6316	0.6897	0.8902	0.9783	0.9942	0.9973	(86)
MIT	19.2672	19.4306	19.7395	20.1671	20.5615	20.8425	20.9506	20.9293	20.7015	20.1899	19.6577	19.2431	(87)
Th 2	19.8087	19.8114	19.8141	19.8267	19.8290	19.8400	19.8400	19.8420	19.8358	19.8290	19.8243	19.8193	(88)
util rest of house													
	0.9956	0.9921	0.9822	0.9504	0.8662	0.6914	0.4901	0.5523	0.8309	0.9681	0.9921	0.9964	(89)
MIT 2	18.2402	18.4050	18.7138	19.1429	19.5155	19.7584	19.8252	19.8182	19.6529	19.1724	18.6417	18.2242	(90)
Living area fraction									fLA = Living area / (4) =			0.4085	(91)
MIT	18.6598	18.8240	19.1329	19.5613	19.9428	20.2013	20.2849	20.2721	20.0813	19.5881	19.0568	18.6405	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6598	18.8240	19.1329	19.5613	19.9428	20.2013	20.2849	20.2721	20.0813	19.5881	19.0568	18.6405	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9900	0.9789	0.9467	0.8705	0.7223	0.5479	0.6078	0.8458	0.9654	0.9902	0.9953	(94)
Useful gains	298.9742	337.5403	379.1675	415.7163	411.9663	336.9184	243.4516	249.4037	312.0028	309.5430	288.0035	284.0872	(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													
	1029.5817	995.7307	901.0792	751.2611	579.5098	389.5921	256.3025	268.7825	417.7533	631.9043	844.5222	1024.8716	(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													
	543.5720	442.3039	388.3024	241.5923	124.6524	0.0000	0.0000	0.0000	0.0000	239.8367	400.6935	551.1436	(98)
Space heating												2932.0967	(98)
Space heating per m2											(98) / (4) =	54.8466	(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	653.8093	514.7009	527.5552	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7736	0.8483	0.8148	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	505.7588	436.6028	429.8776	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	613.3551	586.1971	547.7346	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	77.4693	111.2981	87.6856	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												276.4530	(104)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF 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	19.3673	27.8245	21.9214	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												69.1133 (107)
Space cooling per m2												1.2928 (108)
Energy for space heating												54.8466 (99)
Energy for space cooling												1.2928 (108)
Total												56.1394 (109)
Dwelling Fabric Energy Efficiency (DFEE)												56.1 (109)

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	53.4600 (1b)	x	2.3100 (2b)	=	123.4926	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.4926	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4120	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3811	(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	0.4858	0.4763	0.4668	0.4192	0.4096	0.3620	0.3620	0.3525	0.3811	0.4096	0.4287	0.4477	(22b)
Effective ac	0.6180	0.6134	0.6089	0.5878	0.5839	0.5655	0.5655	0.5621	0.5726	0.5839	0.5919	0.6002	(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			1.9300	1.0000	1.9300			(26)
TER Opening Type (Uw = 1.40)			6.6800	1.3258	8.8561			(27)
150mm TE Platinum GF			53.4600	0.1300	6.9498			(28a)
50mm Alreflex Plat	57.4600	6.6800	50.7800	0.1800	9.1404			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.1800	2.5668			(29a)
Total net area of external elements Aum(A, m2)			127.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4431			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1784	(36)
Total fabric heat loss						(33) + (36) =	38.6215	(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	25.1860	24.9993	24.8162	23.9563	23.7954	23.0465	23.0465	22.9078	23.3350	23.7954	24.1209	24.4612	(38)
Heat transfer coeff	63.8075	63.6207	63.4377	62.5778	62.4169	61.6680	61.6680	61.5293	61.9565	62.4169	62.7424	63.0826	(39)
Average = Sum(39)m / 12 =												62.5770	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1936	1.1901	1.1866	1.1706	1.1675	1.1535	1.1535	1.1509	1.1589	1.1675	1.1736	1.1800	(40)
HLP (average)												1.1705	(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		1.7921 (42)
Average daily hot water use (litres/day)		76.7627 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.6094	23.2727	24.0154	20.9372	20.0897	17.3359	16.0643	18.4340	18.6541	21.7396	23.7305	25.7697	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.3195	13.6066	11.0657	8.3774	6.2622	5.2868	5.7126	7.4255	9.9664	12.6547	14.7699	15.7453	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	35.7653	34.6320	32.2787	29.0794	27.0023	24.0776	21.5917	24.7768	25.9085	29.2199	32.9590	34.6368	(72)
Total internal gains													
	257.1750	255.9498	246.9708	232.3873	217.2179	203.0009	194.0485	197.3255	205.0829	219.7784	236.6098	249.5799	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.6300	0.7000	0.7700	3.5747	(74)
East	3.7200	19.6403	0.6300	0.7000	0.7700	22.3286	(76)
West	1.8600	19.6403	0.6300	0.7000	0.7700	11.1643	(80)

Solar gains	37.0676	72.3507	119.5092	176.0129	217.9768	224.3149	213.0618	181.3698	139.4501	85.8760	46.1716	30.5230	(83)
Total gains	294.2426	328.3005	366.4799	408.4001	435.1947	427.3158	407.1102	378.6952	344.5329	305.6545	282.7814	280.1029	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.1828	58.3536	58.5220	59.3262	59.4791	60.2014	60.2014	60.3371	59.9211	59.4791	59.1705	58.8514	
alpha	4.8789	4.8902	4.9015	4.9551	4.9653	5.0134	5.0134	5.0225	4.9947	4.9653	4.9447	4.9234	
util living area													
	0.9986	0.9974	0.9934	0.9778	0.9270	0.7989	0.6346	0.6945	0.9090	0.9873	0.9974	0.9989	(86)
MIT	19.6549	19.7847	20.0301	20.3737	20.6900	20.9065	20.9772	20.9648	20.7995	20.3917	19.9678	19.6372	(87)
Th 2	19.9252	19.9280	19.9307	19.9436	19.9461	19.9574	19.9574	19.9594	19.9530	19.9461	19.9412	19.9360	(88)
util rest of house													
	0.9982	0.9965	0.9908	0.9684	0.8938	0.7118	0.5000	0.5621	0.8538	0.9804	0.9963	0.9986	(89)
MIT 2	18.6994	18.8311	19.0775	19.4263	19.7259	19.9113	19.9512	19.9487	19.8329	19.4492	19.0247	18.6903	(90)
Living area fraction									fLA = Living area / (4) =			0.4085	(91)
MIT	19.0897	19.2206	19.4667	19.8133	20.1198	20.3179	20.3704	20.3638	20.2278	19.8343	19.4100	19.0772	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0897	19.2206	19.4667	19.8133	20.1198	20.3179	20.3704	20.3638	20.2278	19.8343	19.4100	19.0772	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9956	0.9894	0.9670	0.9002	0.7448	0.5558	0.6170	0.8709	0.9794	0.9956	0.9982	(94)
Useful gains	293.5546	326.8700	362.5842	394.9201	391.7788	318.2740	226.2831	233.6415	300.0457	299.3561	281.5316	279.5920	(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													
	943.6959	911.0895	822.5752	682.9330	525.5361	352.6094	232.5117	243.8900	379.6548	576.3746	772.3572	938.4907	(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													
	483.7051	392.5955	342.2333	207.3693	99.5154	0.0000	0.0000	0.0000	0.0000	206.1018	353.3945	490.2206	(98)
Space heating												2575.1355	(98)
Space heating per m2											(98) / (4) =	48.1694	(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	579.6790	456.3431	467.6226	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8248	0.8969	0.8684	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	478.1123	409.2974	406.1017	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	567.5765	542.7151	510.7203	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	64.4143	99.2628	77.8362	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												241.5133	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	16.1036	24.8157	19.4591	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											60.3783	(107)
Space cooling per m2											1.1294	(108)
Energy for space heating											48.1694	(99)
Energy for space cooling											1.1294	(108)
Total											49.2988	(109)
Target Fabric Energy Efficiency (TFEE)											56.7	(109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Apartment Second Floor PV	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Plot 010, Lakeside Walk, Lake Road, Hamworthy, BH15		

SAP Rating	94 A	**DER**	6.54	**TER**	20.80
Environmental	97 A	**% DER<TER**	68.55		
CO_2 Emissions (t/year)	0.03	**DFEE**	52.28	**TFEE**	54.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	3.80		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 53 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) 20.80 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.54 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.29 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.44 (max. 2.00)	1.56 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Medium OK
Based on:
Overshading: Average
Windows facing North: 1.10 m², No overhang
Windows facing East: 5.32 m², No overhang
Windows facing West: 1.86 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Roof U-value 0.11 W/m²K
Photovoltaic array 2.20 kW

ARUN DISTRICT COUNCIL A/45/22/PL

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	53.4600 (1b)	x	2.3700 (2b)	=	126.7002	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.7002	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2368	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4873	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4507	(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	0.5747	0.5634	0.5521	0.4958	0.4845	0.4282	0.4282	0.4169	0.4507	0.4845	0.5071	0.5296	(22b)
Effective ac	0.6651	0.6587	0.6524	0.6229	0.6174	0.5917	0.5917	0.5869	0.6016	0.6174	0.6286	0.6402	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			8.2800	1.3347	11.0515			(27)
Opening Type 7			1.9300	1.5600	3.0108			(26)
50mm Alreflex Plat	57.4600	8.2800	49.1800	0.2900	14.2622			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.2500	3.5650			(29a)
400mm Mineral Wool	53.4600		53.4600	0.1100	5.8806			(30)
Total net area of external elements Aum(A, m2)			127.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.7701			(33)
Party Floor 1			53.4600					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		156.3500 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.7118 (36)
Total fabric heat loss	(33) + (36) =	44.4819 (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	27.8099	27.5418	27.2790	26.0446	25.8137	24.7386	24.7386	24.5395	25.1527	25.8137	26.2809	26.7693	(38)
Heat transfer coeff	72.2917	72.0236	71.7608	70.5265	70.2956	69.2205	69.2205	69.0214	69.6346	70.2956	70.7627	71.2512	(39)
Average = Sum(39)m / 12 =												70.5254	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3523	1.3472	1.3423	1.3192	1.3149	1.2948	1.2948	1.2911	1.3026	1.3149	1.3237	1.3328	(40)
HLP (average)												1.3192	(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	1.7921 (42)
Average daily hot water use (litres/day)	76.7627 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	18.7831	16.4278	16.9520	14.7792	14.1810	12.2371	11.3395	13.0122	13.1676	15.3456	16.7509	18.1904	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0103	12.6392	13.9689	13.4907	13.9203	13.4481	13.8819	13.9068	13.4713	13.9488	13.5309	14.0023	(61)
Total heat required for water heating calculated for each month													
	139.2308	122.1578	126.9824	112.0186	108.4601	95.0288	89.4784	100.6549	101.2554	116.2528	125.2036	135.2717	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	139.2308	122.1578	126.9824	112.0186	108.4601	95.0288	89.4784	100.6549	101.2554	116.2528	125.2036	135.2717	(64)
								Total per year (kWh/year) = Sum(64)m =				1371.9953	(64)
Heat gains from water heating, kWh/month													
	45.1384	39.5747	41.0692	36.1332	34.9146	30.4876	28.6063	32.3204	32.5560	37.5033	40.5139	43.8226	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6240	12.9889	10.5633	7.9971	5.9779	5.0468	5.4533	7.0883	9.5140	12.0802	14.0993	15.0304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	60.6699	58.8910	55.2005	50.1850	46.9282	42.3439	38.4493	43.4414	45.2167	50.4076	56.2693	58.9014	(72)
Total internal gains													
	284.3841	282.5911	272.3902	256.1125	239.8595	224.0271	213.6467	218.6529	226.9386	243.3916	262.2496	276.1297	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.7400	0.7000	0.7700	4.1988	(74)
East	5.3200	19.6403	0.7400	0.7000	0.7700	37.5078	(76)
West	1.8600	19.6403	0.7400	0.7000	0.7700	13.1136	(80)

Solar gains	54.8203	107.0505	176.7173	259.7471	320.9920	329.9747	313.5678	267.4154	206.0651	127.0548	68.2988	45.1290	(83)
Total gains	339.2044	389.6416	449.1075	515.8596	560.8515	554.0019	527.2145	486.0683	433.0037	370.4465	330.5484	321.2587	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.1171	32.2366	32.3547	32.9209	33.0291	33.5421	33.5421	33.6388	33.3426	33.0291	32.8110	32.5861	
alpha	3.1411	3.1491	3.1570	3.1947	3.2019	3.2361	3.2361	3.2426	3.2228	3.2019	3.1874	3.1724	
util living area													
	0.9866	0.9784	0.9587	0.9099	0.8168	0.6727	0.5319	0.5851	0.8013	0.9406	0.9792	0.9887	(86)
MIT	18.9304	19.1516	19.5498	20.0818	20.5317	20.8308	20.9419	20.9203	20.6794	20.0841	19.4238	18.9043	(87)
Th 2	19.8001	19.8040	19.8078	19.8258	19.8292	19.8449	19.8449	19.8478	19.8388	19.8292	19.8223	19.8152	(88)
util rest of house													
	0.9835	0.9734	0.9488	0.8874	0.7691	0.5863	0.4102	0.4637	0.7317	0.9212	0.9736	0.9861	(89)
MIT 2	17.0666	17.3897	17.9662	18.7303	19.3380	19.7101	19.8154	19.8034	19.5477	18.7510	17.7988	17.0375	(90)
Living area fraction										fLA = Living area / (4) =		0.4085	(91)
MIT	17.8280	18.1095	18.6131	19.2824	19.8256	20.1679	20.2756	20.2597	20.0100	19.2956	18.4626	17.8001	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.6780	17.9595	18.4631	19.1324	19.6756	20.0179	20.1256	20.1097	19.8600	19.1456	18.3126	17.6501	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9755	0.9625	0.9339	0.8708	0.7619	0.6004	0.4415	0.4934	0.7332	0.9062	0.9633	0.9790	(94)
Useful gains	330.8999	375.0379	419.4013	449.2311	427.3013	332.6361	232.7741	239.8163	317.4801	335.6830	318.4048	314.5247	(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													
	967.1197	940.5923	858.4853	721.6566	560.6527	375.0326	244.0442	256.0470	401.0973	600.7207	793.4371	958.3372	(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													
	473.3475	380.0525	326.6784	196.1464	99.2135	0.0000	0.0000	0.0000	0.0000	197.1880	342.0233	478.9965	(98)
Space heating												2493.6461	(98)
Space heating per m2											(98) / (4) =	46.6451	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2755.4101	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	473.3475	380.0525	326.6784	196.1464	99.2135	0.0000	0.0000	0.0000	0.0000	197.1880	342.0233	478.9965	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	523.0359	419.9475	360.9707	216.7363	109.6282	0.0000	0.0000	0.0000	0.0000	217.8873	377.9263	529.2778	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	139.2308	122.1578	126.9824	112.0186	108.4601	95.0288	89.4784	100.6549	101.2554	116.2528	125.2036	135.2717	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7523	89.7002	89.5809	89.3100	88.8000	87.3000	87.3000	87.3000	87.3000	89.2861	89.6197	89.7753	(217)
Fuel for water heating, kWh/month	155.1280	136.1845	141.7516	125.4266	122.1397	108.8531	102.4953	115.2977	115.9856	130.2025	139.7055	150.6780	(219)
Water heating fuel used												1543.8481	(219)
Annual totals kWh/year													
Space heating fuel - main system												2755.4101	(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)												258.2642	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.20 * 1029 * 0.80) =										-1449.0949		-1449.0949	(233)
Total delivered energy for all uses												3183.4275	(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	2755.4101	0.2160	595.1686	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1543.8481	0.2160	333.4712	(264)
Space and water heating			928.6398	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	258.2642	0.5190	134.0391	(268)
Energy saving/generation technologies				
PV Unit	-1449.0949	0.5190	-752.0803	(269)
Total CO2, kg/year			349.5236	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.5400	(273)

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

DER		6.5400	ZC1
Total Floor Area	TFA	53.4600	
Assumed number of occupants	N	1.7921	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3150	ZC2
CO2 emissions from cooking, equation (L16)		3.0305	ZC3
Total CO2 emissions		26.8855	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.8855	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	53.4600 (1b)	x	2.3700 (2b)	=	126.7002	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.7002	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4079	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3773	(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	0.4810	0.4716	0.4621	0.4150	0.4056	0.3584	0.3584	0.3490	0.3773	0.4056	0.4244	0.4433	(22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5712	0.5822	0.5901	0.5983	(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			1.9300	1.0000	1.9300			(26)
TER Opening Type (Uw = 1.40)			8.2800	1.3258	10.9773			(27)
50mm Alreflex Plat	57.4600	8.2800	49.1800	0.1800	8.8524			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.1800	2.5668			(29a)
400mm Mineral Wool	53.4600		53.4600	0.1300	6.9498			(30)
Total net area of external elements Aum(A, m2)			127.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.2763			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2964	(36)
Total fabric heat loss					(33) + (36) =		37.5727	(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	25.7425	25.5547	25.3706	24.5058	24.3440	23.5909	23.5909	23.4514	23.8810	24.3440	24.6713	25.0135	(38)
Heat transfer coeff	63.3152	63.1273	62.9432	62.0785	61.9167	61.1635	61.1635	61.0241	61.4537	61.9167	62.2440	62.5862	(39)
Average = Sum(39)m / 12 =												62.0777	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1843	1.1808	1.1774	1.1612	1.1582	1.1441	1.1441	1.1415	1.1495	1.1582	1.1643	1.1707	(40)
HLP (average)												1.1612	(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	1.7921	(42)
Average daily hot water use (litres/day)	76.7627	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	18.7831	16.4278	16.9520	14.7792	14.1810	12.2371	11.3395	13.0122	13.1676	15.3456	16.7509	18.1904	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	43.0292	37.4518	39.8998	37.0985	36.7704	34.0700	35.2057	36.7704	37.0985	39.8998	40.1269	43.0292	(61)
Total heat required for water heating calculated for each month													
	168.2497	146.9704	152.9132	135.6263	131.3102	115.6507	110.8022	123.5185	124.8826	142.2037	151.7997	164.2985	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	168.2497	146.9704	152.9132	135.6263	131.3102	115.6507	110.8022	123.5185	124.8826	142.2037	151.7997	164.2985	(64)
									Total per year (kWh/year) = Sum(64)m =			1668.2257	(64)
Heat gains from water heating, kWh/month													
	52.3931	45.7779	47.5519	42.0351	40.6271	35.6431	33.9373	38.0363	38.4628	43.9910	47.1629	51.0794	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6240	12.9889	10.5633	7.9971	5.9779	5.0468	5.4533	7.0883	9.5140	12.0802	14.0993	15.0304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	70.4209	68.1219	63.9139	58.3821	54.6063	49.5043	45.6146	51.1241	53.4206	59.1277	65.5041	68.6551	(72)
Total internal gains													
	294.1351	291.8219	281.1036	264.3097	247.5376	231.1875	220.8120	226.3356	235.1425	252.1117	271.4843	285.8834	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.6300	0.7000	0.7700	3.5747	(74)
East	5.3200	19.6403	0.6300	0.7000	0.7700	31.9323	(76)
West	1.8600	19.6403	0.6300	0.7000	0.7700	11.1643	(80)

Solar gains	46.6713	91.1376	150.4485	221.1360	273.2770	280.9244	266.9564	227.6644	175.4338	108.1683	58.1463	38.4206	(83)
Total gains	340.8064	382.9595	431.5521	485.4457	520.8146	512.1120	487.7684	454.0000	410.5763	360.2800	329.6306	324.3040	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6352	58.8097	58.9817	59.8033	59.9596	60.6979	60.6979	60.8366	60.4114	59.9596	59.6443	59.3182	
alpha	4.9090	4.9206	4.9321	4.9869	4.9973	5.0465	5.0465	5.0558	5.0274	4.9973	4.9763	4.9545	
util living area													
	0.9974	0.9949	0.9867	0.9567	0.8721	0.7066	0.5391	0.5963	0.8472	0.9750	0.9949	0.9980	(86)
MIT	19.7475	19.8901	20.1490	20.4973	20.7867	20.9479	20.9892	20.9825	20.8662	20.4867	20.0587	19.7262	(87)
Th 2	19.9325	19.9354	19.9381	19.9512	19.9536	19.9650	19.9650	19.9671	19.9606	19.9536	19.9487	19.9435	(88)
util rest of house													
	0.9965	0.9931	0.9819	0.9404	0.8253	0.6146	0.4188	0.4733	0.7751	0.9626	0.9928	0.9973	(89)
MIT 2	18.2701	18.4800	18.8575	19.3618	19.7449	19.9305	19.9610	19.9599	19.8527	19.3567	18.7361	18.2468	(90)
Living area fraction									fLA = Living area / (4) =			0.4085	(91)
MIT	18.8736	19.0560	19.3851	19.8257	20.1705	20.3462	20.3810	20.3777	20.2667	19.8183	19.2764	18.8512	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8736	19.0560	19.3851	19.8257	20.1705	20.3462	20.3810	20.3777	20.2667	19.8183	19.2764	18.8512	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9911	0.9787	0.9380	0.8362	0.6504	0.4683	0.5239	0.7990	0.9605	0.9910	0.9962	(94)
Useful gains	339.1845	379.5539	422.3438	455.3487	435.4821	333.0749	228.4166	237.8571	328.0449	346.0479	326.6537	323.0855	(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													
	922.7310	893.6323	811.0301	678.2493	524.4661	351.4561	231.2620	242.7324	378.9693	570.7663	757.9080	916.9622	(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													
	434.1586	345.4607	289.1826	160.4885	66.2041	0.0000	0.0000	0.0000	0.0000	167.1905	310.5031	441.8443	(98)
Space heating												2215.0323	(98)
Space heating per m2											(98) / (4) =	41.4335	(99)

8c. Space cooling requirement

Not applicable

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

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2371.5549	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	434.1586	345.4607	289.1826	160.4885	66.2041	0.0000	0.0000	0.0000	0.0000	167.1905	310.5031	441.8443	(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)													
	464.8379	369.8722	309.6174	171.8292	70.8823	0.0000	0.0000	0.0000	0.0000	179.0048	332.4444	473.0667	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	168.2497	146.9704	152.9132	135.6263	131.3102	115.6507	110.8022	123.5185	124.8826	142.2037	151.7997	164.2985	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3321	87.1292	86.6312	85.4758	83.4241	80.3000	80.3000	80.3000	80.3000	85.4596	86.8146	87.4196	(217)
Fuel for water heating, kWh/month													
	192.6551	168.6810	176.5107	158.6721	157.4007	144.0233	137.9853	153.8212	155.5200	166.3988	174.8551	187.9424	(219)
Water heating fuel used												1974.4658	(219)
Annual totals kWh/year													
Space heating fuel - main system												2371.5549	(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)												258.2642	(232)
Total delivered energy for all uses												4679.2849	(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	2371.5549	0.2160	512.2559	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.4658	0.2160	426.4846	(264)
Space and water heating			938.7405	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	258.2642	0.5190	134.0391	(268)
Total CO2, kg/m2/year			1111.7046	(272)
Emissions per m2 for space and water heating			17.5597	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5073	(272b)
Emissions per m2 for pumps and fans			0.7281	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.5597 * 1.00) + 2.5073 + 0.7281, rounded to 2 d.p.			20.8000	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.4600 (1b)	x	2.3700 (2b)	=	126.7002	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.7002	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4084	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3777	(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	0.4816	0.4722	0.4627	0.4155	0.4061	0.3588	0.3588	0.3494	0.3777	0.4061	0.4249	0.4438	(22b)
Effective ac	0.6160	0.6115	0.6071	0.5863	0.5824	0.5644	0.5644	0.5610	0.5713	0.5824	0.5903	0.5985	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			8.2800	1.3347	11.0515			(27)
Opening Type 7			1.9300	1.5600	3.0108			(26)
50mm Alreflex Plat	57.4600	8.2800	49.1800	0.2900	14.2622			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.2500	3.5650			(29a)
400mm Mineral Wool	53.4600		53.4600	0.1100	5.8806			(30)
Total net area of external elements Aum(A, m2)			127.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.7701			(33)
Party Floor 1			53.4600					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	156.3500	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.7118	(36)
Total fabric heat loss (33) + (36) =	44.4819	(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	25.7544	25.5661	25.3815	24.5147	24.3525	23.5975	23.5975	23.4576	23.8883	24.3525	24.6806	25.0236	(38)
Heat transfer coeff	70.2362	70.0479	69.8634	68.9965	68.8343	68.0793	68.0793	67.9395	68.3702	68.8343	69.1624	69.5055	(39)
Average = Sum(39)m / 12 =												68.9958	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3138	1.3103	1.3068	1.2906	1.2876	1.2735	1.2735	1.2708	1.2789	1.2876	1.2937	1.3001	(40)
HLP (average)												1.2906	(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	1.7921 (42)
Average daily hot water use (litres/day)	76.7627 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.6094	23.2727	24.0154	20.9372	20.0897	17.3359	16.0643	18.4340	18.6541	21.7396	23.7305	25.7697	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6240	12.9889	10.5633	7.9971	5.9779	5.0468	5.4533	7.0883	9.5140	12.0802	14.0993	15.0304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	35.7653	34.6320	32.2787	29.0794	27.0023	24.0776	21.5917	24.7768	25.9085	29.2199	32.9590	34.6368	(72)
Total internal gains													
	256.4795	255.3321	246.4684	232.0069	216.9336	202.7609	193.7891	196.9883	204.6304	219.2039	235.9393	248.8651	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.7400	0.7000	0.7700	4.1988	(74)
East	5.3200	19.6403	0.7400	0.7000	0.7700	37.5078	(76)
West	1.8600	19.6403	0.7400	0.7000	0.7700	13.1136	(80)

Solar gains	54.8203	107.0505	176.7173	259.7471	320.9920	329.9747	313.5678	267.4154	206.0651	127.0548	68.2988	45.1290	(83)
Total gains	311.2998	362.3826	423.1857	491.7540	537.9256	532.7356	507.3569	464.4037	410.6955	346.2587	304.2381	293.9941	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.0570	33.1458	33.2334	33.6509	33.7302	34.1043	34.1043	34.1745	33.9592	33.7302	33.5702	33.4045	
alpha	3.2038	3.2097	3.2156	3.2434	3.2487	3.2736	3.2736	3.2783	3.2639	3.2487	3.2380	3.2270	
util living area													
	0.9895	0.9821	0.9639	0.9174	0.8263	0.6841	0.5423	0.5994	0.8155	0.9489	0.9834	0.9912	(86)
MIT	18.9291	19.1502	19.5486	20.0759	20.5285	20.8276	20.9409	20.9173	20.6695	20.0665	19.4066	18.8947	(87)
Th 2	19.8300	19.8328	19.8355	19.8482	19.8506	19.8617	19.8617	19.8637	19.8574	19.8506	19.8458	19.8407	(88)
util rest of house													
	0.9871	0.9780	0.9552	0.8965	0.7805	0.5988	0.4207	0.4783	0.7490	0.9318	0.9789	0.9892	(89)
MIT 2	17.9540	18.1754	18.5705	19.0908	19.5102	19.7669	19.8409	19.8317	19.6496	19.0936	18.4411	17.9276	(90)
Living area fraction									fLA = Living area / (4) =			0.4085	(91)
MIT	18.3524	18.5736	18.9701	19.4932	19.9262	20.2002	20.2903	20.2752	20.0663	19.4911	18.8355	18.3227	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3524	18.5736	18.9701	19.4932	19.9262	20.2002	20.2903	20.2752	20.0663	19.4911	18.8355	18.3227	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9721	0.9470	0.8888	0.7839	0.6262	0.4688	0.5250	0.7629	0.9251	0.9735	0.9856	(94)
Useful gains	305.9726	352.2627	400.7702	437.0841	421.6575	333.5886	237.8632	243.8241	313.3067	320.3181	296.1817	289.7598	(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													
	986.9854	957.8097	871.2021	730.8961	566.2463	381.2599	251.2313	263.2806	407.9147	612.0101	811.6579	981.6059	(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													
	506.6736	406.9276	350.0014	211.5447	107.5741	0.0000	0.0000	0.0000	0.0000	217.0188	371.1428	514.7335	(98)
Space heating												2685.6163	(98)
Space heating per m2											(98) / (4) =	50.2360	(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	639.9458	503.7871	516.3403	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7942	0.8570	0.8259	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	508.2650	431.7527	426.4451	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	690.4750	659.5413	610.4503	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	131.1912	169.4747	136.8999	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												437.5659	(104)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF 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	32.7978	42.3687	34.2250	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												109.3915 (107)
Space cooling per m2												2.0462 (108)
Energy for space heating												50.2360 (99)
Energy for space cooling												2.0462 (108)
Total												52.2822 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.3 (109)

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	53.4600 (1b)	x	2.3700 (2b)	=	126.7002	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.7002	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1579	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.4079	(18)
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3773	(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	0.4810	0.4716	0.4621	0.4150	0.4056	0.3584	0.3584	0.3490	0.3773	0.4056	0.4244	0.4433	(22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5712	0.5822	0.5901	0.5983	(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			1.9300	1.0000	1.9300			(26)
TER Opening Type (Uw = 1.40)			8.2800	1.3258	10.9773			(27)
50mm Alreflex Plat	57.4600	8.2800	49.1800	0.1800	8.8524			(29a)
Wall to Stairwell	16.1900	1.9300	14.2600	0.1800	2.5668			(29a)
400mm Mineral Wool	53.4600		53.4600	0.1300	6.9498			(30)
Total net area of external elements Aum(A, m2)			127.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.2763			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2964	(36)
Total fabric heat loss					(33) + (36) =		37.5727	(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	25.7425	25.5547	25.3706	24.5058	24.3440	23.5909	23.5909	23.4514	23.8810	24.3440	24.6713	25.0135	(38)
Heat transfer coeff	63.3152	63.1273	62.9432	62.0785	61.9167	61.1635	61.1635	61.0241	61.4537	61.9167	62.2440	62.5862	(39)
Average = Sum(39)m / 12 =												62.0777	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1843	1.1808	1.1774	1.1612	1.1582	1.1441	1.1441	1.1415	1.1495	1.1582	1.1643	1.1707	(40)
HLP (average)												1.1612	(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												1.7921	(42)
Average daily hot water use (litres/day)												76.7627	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.4389	81.3684	78.2979	75.2274	72.1569	69.0864	69.0864	72.1569	75.2274	78.2979	81.3684	84.4389	(44)
Energy conte	125.2205	109.5187	113.0135	98.5279	94.5398	81.5807	75.5965	86.7481	87.7841	102.3039	111.6728	121.2694	(45)
Energy content (annual)										Total = Sum(45)m =		1207.7758	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.6094	23.2727	24.0154	20.9372	20.0897	17.3359	16.0643	18.4340	18.6541	21.7396	23.7305	25.7697	(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	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	89.6056	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6240	12.9889	10.5633	7.9971	5.9779	5.0468	5.4533	7.0883	9.5140	12.0802	14.0993	15.0304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2085	157.8295	153.7447	145.0488	134.0717	123.7548	116.8624	115.2415	119.3262	128.0222	138.9993	149.3162	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	31.9606	(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)													
	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	-71.6845	(71)
Water heating gains (Table 5)													
	35.7653	34.6320	32.2787	29.0794	27.0023	24.0776	21.5917	24.7768	25.9085	29.2199	32.9590	34.6368	(72)
Total internal gains													
	256.4795	255.3321	246.4684	232.0069	216.9336	202.7609	193.7891	196.9883	204.6304	219.2039	235.9393	248.8651	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1000	10.6334	0.6300	0.7000	0.7700	3.5747	(74)
East	5.3200	19.6403	0.6300	0.7000	0.7700	31.9323	(76)
West	1.8600	19.6403	0.6300	0.7000	0.7700	11.1643	(80)

Solar gains	46.6713	91.1376	150.4485	221.1360	273.2770	280.9244	266.9564	227.6644	175.4338	108.1683	58.1463	38.4206	(83)
Total gains	303.1508	346.4697	396.9169	453.1430	490.2106	483.6853	460.7455	424.6528	380.0642	327.3722	294.0856	287.2857	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6352	58.8097	58.9817	59.8033	59.9596	60.6979	60.6979	60.8366	60.4114	59.9596	59.6443	59.3182	
alpha	4.9090	4.9206	4.9321	4.9869	4.9973	5.0465	5.0465	5.0558	5.0274	4.9973	4.9763	4.9545	
util living area													
	0.9985	0.9967	0.9906	0.9665	0.8926	0.7358	0.5673	0.6309	0.8762	0.9830	0.9969	0.9988	(86)
MIT	19.6825	19.8278	20.0919	20.4509	20.7574	20.9375	20.9864	20.9775	20.8401	20.4349	19.9977	19.6620	(87)
Th 2	19.9325	19.9354	19.9381	19.9512	19.9536	19.9650	19.9650	19.9671	19.9606	19.9536	19.9487	19.9435	(88)
util rest of house													
	0.9979	0.9955	0.9871	0.9532	0.8501	0.6444	0.4424	0.5039	0.8109	0.9740	0.9956	0.9984	(89)
MIT 2	18.7327	18.8798	19.1445	19.5056	19.7882	19.9360	19.9615	19.9606	19.8693	19.4970	19.0604	18.7210	(90)
Living area fraction									fLA = Living area / (4) =			0.4085	(91)
MIT	19.1207	19.2671	19.5315	19.8918	20.1841	20.3451	20.3802	20.3761	20.2659	19.8802	19.4433	19.1055	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1207	19.2671	19.5315	19.8918	20.1841	20.3451	20.3802	20.3761	20.2659	19.8802	19.4433	19.1055	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9946	0.9854	0.9523	0.8607	0.6802	0.4940	0.5564	0.8328	0.9732	0.9948	0.9980	(94)
Useful gains	302.3495	344.5832	391.1292	431.5117	421.9198	328.9843	227.6064	236.2819	316.5279	318.6031	292.5547	286.7042	(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													
	938.3754	906.9556	820.2474	682.3551	525.3104	351.3931	231.2120	242.6348	378.9161	574.5991	768.2977	932.8752	(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													
	473.2033	377.9143	319.2640	180.6073	76.9226	0.0000	0.0000	0.0000	0.0000	190.4610	342.5349	480.7512	(98)
Space heating												2441.6586	(98)
Space heating per m2											(98) / (4) =	45.6726	(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	574.9373	452.6102	463.7829	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8721	0.9296	0.9048	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	501.4066	420.7510	419.6283	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	633.1435	605.0604	563.9882	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	94.8506	137.1262	107.4038	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												339.3806	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
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   23.7126   34.2815   26.8509    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              84.8451 (107)
Space cooling per m2                                                                                                        1.5871 (108)
Energy for space heating                                                                                                   45.6726 (99)
Energy for space cooling                                                                                                    1.5871 (108)
Total                                                                                                                      47.2597 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                        54.3 (109)
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Denford End-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Denford DS00 Hipped, EOT, Part L2013 Masonry, Classic Range, Barratt Developments plc		

SAP Rating	83 B	**DER**	20.02	**TER**	20.55
Environmental	86 B	**% DER<TER**	2.58		
CO_2 Emissions (t/year)	1.01	**DFEE**	52.50	**TFEE**	54.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	4.44		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 57 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) 20.55 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 20.02 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 6.14 m², No overhang
Windows facing South West: 3.30 m², No overhang
Windows facing North West: 0.66 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K

ARUN DISTRICT COUNCIL A/45/22/PL

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	28.4200 (1b)	x	2.3100 (2b)	=	65.6502	(1b) - (3b)
First floor	28.4200 (1c)	x	2.5600 (2c)	=	72.7552	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	138.4054	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3950	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3061	(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	0.3903	0.3827	0.3750	0.3367	0.3291	0.2908	0.2908	0.2832	0.3061	0.3291	0.3444	0.3597	(22b)
Effective ac	0.5762	0.5732	0.5703	0.5567	0.5541	0.5423	0.5423	0.5401	0.5469	0.5541	0.5593	0.5647	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			10.1000	1.3347	13.4807			(27)
Opening Type 3			1.9700	1.0000	1.9700			(26)
150mm TE Platinum GF			28.4200	0.1500	4.2630			(28a)
50mm AP (60mmCavity)	4.2100	1.9700	2.2400	0.2700	0.6048			(29a)
BDW Std 50mm AP	69.3000	10.1000	59.2000	0.2700	15.9840			(29a)
400mm MW	28.4200		28.4200	0.1100	3.1262			(30)
Total net area of external elements Aum(A, m2)			130.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.4287			(33)
E-WM-20/22			35.1100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	177.2140	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.8186	(36)
Total fabric heat loss (33) + (36) =	48.2473	(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	26.3159	26.1809	26.0484	25.4265	25.3101	24.7684	24.7684	24.6680	24.9770	25.3101	25.5455	25.7916	(38)
Heat transfer coeff	74.5632	74.4281	74.2957	73.6737	73.5574	73.0157	73.0157	72.9153	73.2243	73.5574	73.7928	74.0389	(39)
Average = Sum(39)m / 12 =												73.6732	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3118	1.3094	1.3071	1.2962	1.2941	1.2846	1.2846	1.2828	1.2883	1.2941	1.2983	1.3026	(40)
HLP (average)												1.2962	(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	1.8910 (42)
Average daily hot water use (litres/day)	79.1120 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.0232	83.8587	80.6942	77.5297	74.3653	71.2008	71.2008	74.3653	77.5297	80.6942	83.8587	87.0232	(44)
Energy conte	129.0529	112.8705	116.4722	101.5433	97.4332	84.0775	77.9101	89.4030	90.4708	105.4349	115.0905	124.9808	(45)
Energy content (annual)										Total = Sum(45)m =		1244.7396	(45)
Distribution loss (46)m = 0.15 x (45)m	19.3579	16.9306	17.4708	15.2315	14.6150	12.6116	11.6865	13.4105	13.5706	15.8152	17.2636	18.7471	(46)
Water storage loss:													
Total storage loss													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0261	12.6524	13.9821	13.5017	13.9305	13.4565	13.8897	13.9161	13.4811	13.9608	13.5444	14.0176	(61)
Total heat required for water heating calculated for each month													
	143.0790	125.5229	130.4543	115.0450	111.3637	97.5339	91.7998	103.3191	103.9519	119.3957	128.6349	138.9984	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	143.0790	125.5229	130.4543	115.0450	111.3637	97.5339	91.7998	103.3191	103.9519	119.3957	128.6349	138.9984	(64)
								Total per year (kWh/year) = Sum(64)m =				1409.0987	(64)
Heat gains from water heating, kWh/month													
	46.4166	40.6925	42.2225	37.1386	35.8792	31.3199	29.3775	33.2055	33.4518	38.5473	41.6537	45.0605	(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	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.0476	13.3651	10.8693	8.2287	6.1511	5.1930	5.6112	7.2937	9.7895	12.4301	14.5077	15.4658	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	164.9131	166.6244	162.3120	153.1315	141.5427	130.6509	123.3745	121.6632	125.9756	135.1561	146.7449	157.6367	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	(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)													
	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	(71)
Water heating gains (Table 5)													
	62.3879	60.5544	56.7507	51.5814	48.2247	43.4998	39.4859	44.6311	46.4608	51.8109	57.8524	60.5652	(72)
Total internal gains													
	296.7141	294.9094	284.2975	267.3070	250.2839	233.7092	222.8371	227.9534	236.5914	253.7625	273.4704	288.0332	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.7100	0.7000	0.7700	23.8605	(75)
Southwest	3.3000	36.7938	0.7100	0.7000	0.7700	41.8195	(79)
Northwest	0.6600	11.2829	0.7100	0.7000	0.7700	2.5648	(81)

Solar gains	68.2448	125.0236	194.3772	279.9214	349.2044	362.3688	342.8328	288.7459	223.6230	144.4639	83.3400	57.3690	(83)
Total gains	364.9589	419.9330	478.6747	547.2284	599.4883	596.0779	565.6699	516.6994	460.2144	398.2265	356.8105	345.4022	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.5254	37.5935	37.6605	37.9784	38.0385	38.3207	38.3207	38.3734	38.2115	38.0385	37.9171	37.7911	
alpha	3.5017	3.5062	3.5107	3.5319	3.5359	3.5547	3.5547	3.5582	3.5474	3.5359	3.5278	3.5194	
util living area													
	0.9903	0.9834	0.9669	0.9226	0.8279	0.6775	0.5324	0.5923	0.8150	0.9497	0.9841	0.9920	(86)
MIT	19.1731	19.3757	19.7285	20.1981	20.6103	20.8681	20.9582	20.9388	20.7294	20.1972	19.6013	19.1332	(87)
Th 2	19.8316	19.8335	19.8353	19.8438	19.8454	19.8529	19.8529	19.8543	19.8500	19.8454	19.8422	19.8388	(88)
util rest of house													
	0.9879	0.9792	0.9582	0.9012	0.7793	0.5882	0.4085	0.4673	0.7442	0.9315	0.9794	0.9900	(89)
MIT 2	17.4170	17.7122	18.2226	18.8925	19.4443	19.7525	19.8334	19.8226	19.6109	18.9057	18.0479	17.3633	(90)
Living area fraction									fLA = Living area / (4) =			0.4236	(91)
MIT	18.1609	18.4169	18.8606	19.4456	19.9383	20.2251	20.3099	20.2955	20.0848	19.4529	18.7060	18.1131	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.0109	18.2669	18.7106	19.2956	19.7883	20.0751	20.1599	20.1455	19.9348	19.3029	18.5560	17.9631	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9824	0.9713	0.9470	0.8886	0.7766	0.6070	0.4434	0.5013	0.7502	0.9202	0.9719	0.9852	(94)
Useful gains	358.5288	407.8926	453.2929	486.2884	465.5420	361.7916	250.8080	259.0152	345.2704	366.4441	346.7737	340.2944	(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													
	1022.3328	994.8773	907.1939	765.8808	594.9505	399.7700	259.9268	273.1038	427.2468	640.1601	845.3674	1019.0038	(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													
	493.8702	394.4537	337.7024	201.3065	96.2800	0.0000	0.0000	0.0000	0.0000	203.6447	358.9875	504.9598	(98)
Space heating												2591.2047	(98)
Space heating per m2											(98) / (4) =	45.5877	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2863.2097	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	493.8702	394.4537	337.7024	201.3065	96.2800	0.0000	0.0000	0.0000	0.0000	203.6447	358.9875	504.9598	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	545.7129	435.8604	373.1518	222.4382	106.3867	0.0000	0.0000	0.0000	0.0000	225.0218	396.6712	557.9667	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	143.0790	125.5229	130.4543	115.0450	111.3637	97.5339	91.7998	103.3191	103.9519	119.3957	128.6349	138.9984	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7609	89.7062	89.5850	89.3095	88.7552	87.3000	87.3000	87.3000	87.3000	89.2903	89.6333	89.7896	(217)
Fuel for water heating, kWh/month	159.4001	139.9266	145.6208	128.8161	125.4729	111.7227	105.1544	118.3495	119.0743	133.7163	143.5125	154.8046	(219)
Water heating fuel used												1585.5709	(219)
Annual totals kWh/year													
Space heating fuel - main system												2863.2097	(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)												265.7451	(232)
Total delivered energy for all uses												4789.5256	(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	2863.2097	0.2160	618.4533	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1585.5709	0.2160	342.4833	(264)
Space and water heating			960.9366	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	265.7451	0.5190	137.9217	(268)
Total CO2, kg/year			1137.7833	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			20.0200	(273)

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

DER		20.0200	ZC1
Total Floor Area	TFA	56.8400	
Assumed number of occupants	N	1.8910	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1928	ZC2
CO2 emissions from cooking, equation (L16)		2.8921	ZC3
Total CO2 emissions		40.1049	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		40.1049	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	28.4200	(1b)	x 2.3100	(2b) =	65.6502	(1b) - (3b)
First floor	28.4200	(1c)	x 2.5600	(2c) =	72.7552	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		138.4054	(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							2 * 10 =		20.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3945	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3057	(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	0.3898	0.3822	0.3745	0.3363	0.3287	0.2905	0.2905	0.2828	0.3057	0.3287	0.3440	0.3592	(22b)
Effective ac	0.5760	0.5730	0.5701	0.5566	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5592	0.5645	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			10.1000	1.3258	13.3902			(27)
150mm TE Platinum GF			28.4200	0.1300	3.6946			(28a)
50mm AP (60mmCavity)	4.2100	1.9700	2.2400	0.1800	0.4032			(29a)
BDW Std 50mm AP	69.3000	10.1000	59.2000	0.1800	10.6560			(29a)
400mm MW	28.4200		28.4200	0.1300	3.6946			(30)
Total net area of external elements Aum(A, m2)			130.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8086			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9467	(36)
Total fabric heat loss					(33) + (36) =		41.7552	(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	26.3071	26.1724	26.0403	25.4199	25.3038	24.7635	24.7635	24.6634	24.9716	25.3038	25.5386	25.7841	(38)
Heat transfer coeff	68.0624	67.9276	67.7955	67.1751	67.0591	66.5187	66.5187	66.4186	66.7268	67.0591	67.2939	67.5394	(39)
Average = Sum(39)m / 12 =												67.1746	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1974	1.1951	1.1927	1.1818	1.1798	1.1703	1.1703	1.1685	1.1739	1.1798	1.1839	1.1882	(40)
HLP (average)												1.1818	(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	1.8910	(42)
Average daily hot water use (litres/day)	79.1120	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.0232	83.8587	80.6942	77.5297	74.3653	71.2008	71.2008	74.3653	77.5297	80.6942	83.8587	87.0232	(44)
Energy conte	129.0529	112.8705	116.4722	101.5433	97.4332	84.0775	77.9101	89.4030	90.4708	105.4349	115.0905	124.9808	(45)
Energy content (annual)										Total = Sum(45)m =		1244.7396	(45)
Distribution loss (46)m = 0.15 x (45)m	19.3579	16.9306	17.4708	15.2315	14.6150	12.6116	11.6865	13.4105	13.5706	15.8152	17.2636	18.7471	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	44.3461	38.5980	41.1209	38.2338	37.8957	35.1127	36.2831	37.8957	38.2338	41.1209	41.3550	44.3461 (61)
Total heat required for water heating calculated for each month												
	173.3989	151.4684	157.5931	139.7771	135.3289	119.1902	114.1933	127.2987	128.7046	146.5558	156.4455	169.3269 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	173.3989	151.4684	157.5931	139.7771	135.3289	119.1902	114.1933	127.2987	128.7046	146.5558	156.4455	169.3269 (64)
								Total per year (kWh/year) = Sum(64)m =				1719.2815 (64)
Heat gains from water heating, kWh/month												
	53.9966	47.1789	49.0072	43.3216	41.8705	36.7339	34.9759	39.2004	39.6400	45.3373	48.6063	52.6426 (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	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.0476	13.3651	10.8693	8.2287	6.1511	5.1930	5.6112	7.2937	9.7895	12.4301	14.5077	15.4658	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	164.9131	166.6244	162.3120	153.1315	141.5427	130.6509	123.3745	121.6632	125.9756	135.1561	146.7449	157.6367	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	(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)													
	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	(71)
Water heating gains (Table 5)													
	72.5761	70.2067	65.8699	60.1689	56.2775	51.0194	47.0106	52.6887	55.0555	60.9373	67.5088	70.7562	(72)
Total internal gains													
	306.9022	304.5617	293.4167	275.8946	258.3367	241.2287	230.3618	236.0111	245.1861	262.8889	283.1269	298.2242	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.6300	0.7000	0.7700	21.1720	(75)
Southwest	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074	(79)
Northwest	0.6600	11.2829	0.6300	0.7000	0.7700	2.2758	(81)

Solar gains	60.5553	110.9365	172.4756	248.3809	309.8574	321.5385	304.2038	256.2112	198.4260	128.1863	73.9496	50.9049 (83)
Total gains	367.4575	415.4982	465.8922	524.2755	568.1941	562.7672	534.5655	492.2223	443.6121	391.0752	357.0765	349.1291 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9942	58.1092	58.2224	58.7602	58.8619	59.3400	59.3400	59.4294	59.1549	58.8619	58.6565	58.4433	
alpha	4.8663	4.8739	4.8815	4.9173	4.9241	4.9560	4.9560	4.9620	4.9437	4.9241	4.9104	4.8962	
util living area													
	0.9972	0.9944	0.9861	0.9556	0.8674	0.6995	0.5346	0.5973	0.8468	0.9737	0.9945	0.9978	(86)
MIT	19.7383	19.8849	20.1415	20.4877	20.7851	20.9472	20.9887	20.9810	20.8606	20.4797	20.0471	19.7098	(87)
Th 2	19.9221	19.9239	19.9258	19.9346	19.9362	19.9438	19.9438	19.9453	19.9409	19.9362	19.9329	19.9294	(88)
util rest of house													
	0.9963	0.9925	0.9811	0.9388	0.8192	0.6061	0.4129	0.4719	0.7738	0.9606	0.9923	0.9971	(89)
MIT 2	18.2493	18.4642	18.8377	19.3353	19.7272	19.9092	19.9398	19.9375	19.8289	19.3335	18.7081	18.2129	(90)
Living area fraction									fLA = Living area / (4) =			0.4236	(91)
MIT	18.8801	19.0661	19.3900	19.8235	20.1753	20.3489	20.3841	20.3796	20.2660	19.8190	19.2753	18.8471	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8801	19.0661	19.3900	19.8235	20.1753	20.3489	20.3841	20.3796	20.2660	19.8190	19.2753	18.8471	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9905	0.9778	0.9367	0.8313	0.6439	0.4648	0.5253	0.7990	0.9587	0.9904	0.9960	(94)
Useful gains	365.6124	411.5303	455.5435	491.0796	472.3465	362.3420	248.4921	258.5829	354.4318	374.9351	353.6391	347.7481	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	992.3569	962.2668	873.8869	733.7899	568.3487	382.4123	251.7155	264.3190	411.4344	618.2205	819.3261	989.2538	(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													
	466.2979	370.0950	311.2475	174.7514	71.4257	0.0000	0.0000	0.0000	0.0000	181.0044	335.2946	477.2803	(98)
Space heating												2387.3967	(98)
Space heating per m2											(98) / (4) =	42.0021	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												2556.0992	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	466.2979	370.0950	311.2475	174.7514	71.4257	0.0000	0.0000	0.0000	0.0000	181.0044	335.2946	477.2803	(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)													
	499.2483	396.2473	333.2414	187.1000	76.4729	0.0000	0.0000	0.0000	0.0000	193.7948	358.9878	511.0067	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.3989	151.4684	157.5931	139.7771	135.3289	119.1902	114.1933	127.2987	128.7046	146.5558	156.4455	169.3269	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4195	87.2143	86.7331	85.6145	83.5238	80.3000	80.3000	80.3000	80.3000	85.5837	86.9217	87.5174	(217)
Fuel for water heating, kWh/month													
	198.3527	173.6739	181.6990	163.2634	162.0245	148.4311	142.2083	158.5289	160.2797	171.2426	179.9843	193.4780	(219)
Water heating fuel used												2033.1664	(219)
Annual totals kWh/year													
Space heating fuel - main system												2556.0992	(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)												265.7451	(232)
Total delivered energy for all uses												4930.0107	(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	2556.0992	0.2160	552.1174	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2033.1664	0.2160	439.1639	(264)
Space and water heating			991.2814	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	265.7451	0.5190	137.9217	(268)
Total CO2, kg/m2/year			1168.1281	(272)
Emissions per m2 for space and water heating			17.4399	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4265	(272b)
Emissions per m2 for pumps and fans			0.6848	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.4399 * 1.00) + 2.4265 + 0.6848, rounded to 2 d.p.			20.5500	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	28.4200 (1b)	x	2.3100 (2b)	=	65.6502	(1b) - (3b)
First floor	28.4200 (1c)	x	2.5600 (2c)	=	72.7552	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	138.4054	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3950	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3061	(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	0.3903	0.3827	0.3750	0.3367	0.3291	0.2908	0.2908	0.2832	0.3061	0.3291	0.3444	0.3597	(22b)
Effective ac	0.5762	0.5732	0.5703	0.5567	0.5541	0.5423	0.5423	0.5401	0.5469	0.5541	0.5593	0.5647	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			10.1000	1.3347	13.4807			(27)
Opening Type 3			1.9700	1.0000	1.9700			(26)
150mm TE Platinum GF			28.4200	0.1500	4.2630			(28a)
50mm AP (60mmCavity)	4.2100	1.9700	2.2400	0.2700	0.6048			(29a)
BDW Std 50mm AP	69.3000	10.1000	59.2000	0.2700	15.9840			(29a)
400mm MW	28.4200		28.4200	0.1100	3.1262			(30)
Total net area of external elements Aum(A, m2)			130.3500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4287			(33)
E-WM-20/22			35.1100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	177.2140	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.8186	(36)
Total fabric heat loss (33) + (36) =	48.2473	(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	26.3159	26.1809	26.0484	25.4265	25.3101	24.7684	24.7684	24.6680	24.9770	25.3101	25.5455	25.7916	(38)
Heat transfer coeff	74.5632	74.4281	74.2957	73.6737	73.5574	73.0157	73.0157	72.9153	73.2243	73.5574	73.7928	74.0389	(39)
Average = Sum(39)m / 12 =												73.6732	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3118	1.3094	1.3071	1.2962	1.2941	1.2846	1.2846	1.2828	1.2883	1.2941	1.2983	1.3026	(40)
HLP (average)												1.2962	(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	1.8910 (42)
Average daily hot water use (litres/day)	79.1120 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.0232	83.8587	80.6942	77.5297	74.3653	71.2008	71.2008	74.3653	77.5297	80.6942	83.8587	87.0232	(44)
Energy conte	129.0529	112.8705	116.4722	101.5433	97.4332	84.0775	77.9101	89.4030	90.4708	105.4349	115.0905	124.9808	(45)
Energy content (annual)										Total = Sum(45)m =		1244.7396	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	27.4237	23.9850	24.7503	21.5780	20.7046	17.8665	16.5559	18.9981	19.2250	22.4049	24.4567	26.5584	(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	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.0476	13.3651	10.8693	8.2287	6.1511	5.1930	5.6112	7.2937	9.7895	12.4301	14.5077	15.4658	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	164.9131	166.6244	162.3120	153.1315	141.5427	130.6509	123.3745	121.6632	125.9756	135.1561	146.7449	157.6367	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	(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)													
	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	(71)
Water heating gains (Table 5)													
	36.8599	35.6919	33.2666	29.9694	27.8287	24.8145	22.2526	25.5351	26.7014	30.1141	33.9677	35.6968	(72)
Total internal gains													
	268.1860	267.0469	257.8133	242.6950	226.8879	212.0239	202.6037	205.8575	213.8320	229.0658	246.5858	260.1648	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.7100	0.7000	0.7700	23.8605	(75)
Southwest	3.3000	36.7938	0.7100	0.7000	0.7700	41.8195	(79)
Northwest	0.6600	11.2829	0.7100	0.7000	0.7700	2.5648	(81)

Solar gains	68.2448	125.0236	194.3772	279.9214	349.2044	362.3688	342.8328	288.7459	223.6230	144.4639	83.3400	57.3690	(83)
Total gains	336.4308	392.0705	452.1906	522.6164	576.0923	574.3926	545.4365	494.6034	437.4550	373.5297	329.9258	317.5338	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.5254	37.5935	37.6605	37.9784	38.0385	38.3207	38.3207	38.3734	38.2115	38.0385	37.9171	37.7911	
alpha	3.5017	3.5062	3.5107	3.5319	3.5359	3.5547	3.5547	3.5582	3.5474	3.5359	3.5278	3.5194	
util living area													
	0.9925	0.9865	0.9719	0.9311	0.8411	0.6940	0.5485	0.6121	0.8325	0.9578	0.9875	0.9939	(86)
MIT	19.1162	19.3216	19.6802	20.1602	20.5859	20.8572	20.9540	20.9320	20.7069	20.1548	19.5487	19.0771	(87)
Th 2	19.8316	19.8335	19.8353	19.8438	19.8454	19.8529	19.8529	19.8543	19.8500	19.8454	19.8422	19.8388	(88)
util rest of house													
	0.9906	0.9831	0.9643	0.9115	0.7946	0.6050	0.4224	0.4855	0.7649	0.9420	0.9837	0.9923	(89)
MIT 2	18.1266	18.3318	18.6874	19.1595	19.5520	19.7779	19.8381	19.8299	19.6705	19.1643	18.5655	18.0930	(90)
Living area fraction										fLA = Living area / (4) =		0.4236	(91)
MIT	18.5458	18.7511	19.1080	19.5834	19.9900	20.2351	20.3108	20.2968	20.1095	19.5839	18.9820	18.5099	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5458	18.7511	19.1080	19.5834	19.9900	20.2351	20.3108	20.2968	20.1095	19.5839	18.9820	18.5099	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9877	0.9788	0.9583	0.9062	0.8011	0.6369	0.4751	0.5375	0.7824	0.9375	0.9799	0.9899	(94)
Useful gains	332.3051	383.7716	433.3449	473.6096	461.5311	365.8134	259.1228	265.8531	342.2609	350.1711	323.3018	314.3185	(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													
	1062.2164	1030.9147	936.7196	787.0861	609.7897	411.4537	270.9496	284.1366	440.0434	660.8313	876.8067	1059.4904	(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													
	543.0540	434.8801	374.5108	225.7031	110.3044	0.0000	0.0000	0.0000	0.0000	231.1311	398.5236	554.4078	(98)
Space heating												2872.5149	(98)
Space heating per m2											(98) / (4) =	50.5369	(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	686.3472	540.3159	554.1566	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8100	0.8717	0.8377	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	555.9461	470.9926	464.2071	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	742.4040	707.1931	648.9092	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													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	134.2497	175.7332	137.4184	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												447.4013 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	33.5624	43.9333	34.3546	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												111.8503 (107)
Space cooling per m2												1.9678 (108)
Energy for space heating												50.5369 (99)
Energy for space cooling												1.9678 (108)
Total												52.5047 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.5 (109)

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	28.4200	(1b)	x 2.3100	(2b) =	65.6502	(1b) - (3b)
First floor	28.4200	(1c)	x 2.5600	(2c) =	72.7552	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.8400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	138.4054	(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							2 * 10	=	20.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3945	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3057	(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	0.3898	0.3822	0.3745	0.3363	0.3287	0.2905	0.2905	0.2828	0.3057	0.3287	0.3440	0.3592	(22b)
Effective ac	0.5760	0.5730	0.5701	0.5566	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5592	0.5645	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			10.1000	1.3258	13.3902			(27)
150mm TE Platinum GF			28.4200	0.1300	3.6946			(28a)
50mm AP (60mmCavity)	4.2100	1.9700	2.2400	0.1800	0.4032			(29a)
BDW Std 50mm AP	69.3000	10.1000	59.2000	0.1800	10.6560			(29a)
400mm MW	28.4200		28.4200	0.1300	3.6946			(30)
Total net area of external elements Aum(A, m2)			130.3500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8086			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.9467	(36)
Total fabric heat loss (33) + (36) =	41.7552	(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	26.3071	26.1724	26.0403	25.4199	25.3038	24.7635	24.7635	24.6634	24.9716	25.3038	25.5386	25.7841	(38)
Heat transfer coeff	68.0624	67.9276	67.7955	67.1751	67.0591	66.5187	66.5187	66.4186	66.7268	67.0591	67.2939	67.5394	(39)
Average = Sum(39)m / 12 =												67.1746	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1974	1.1951	1.1927	1.1818	1.1798	1.1703	1.1703	1.1685	1.1739	1.1798	1.1839	1.1882	(40)
HLP (average)												1.1818	(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	1.8910 (42)
Average daily hot water use (litres/day)	79.1120 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.0232	83.8587	80.6942	77.5297	74.3653	71.2008	71.2008	74.3653	77.5297	80.6942	83.8587	87.0232	(44)
Energy conte	129.0529	112.8705	116.4722	101.5433	97.4332	84.0775	77.9101	89.4030	90.4708	105.4349	115.0905	124.9808	(45)
Energy content (annual)										Total = Sum(45)m =		1244.7396	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	27.4237	23.9850	24.7503	21.5780	20.7046	17.8665	16.5559	18.9981	19.2250	22.4049	24.4567	26.5584	(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	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.0476	13.3651	10.8693	8.2287	6.1511	5.1930	5.6112	7.2937	9.7895	12.4301	14.5077	15.4658	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	164.9131	166.6244	162.3120	153.1315	141.5427	130.6509	123.3745	121.6632	125.9756	135.1561	146.7449	157.6367	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	(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)	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	(71)
Water heating gains (Table 5)	36.8599	35.6919	33.2666	29.9694	27.8287	24.8145	22.2526	25.5351	26.7014	30.1141	33.9677	35.6968	(72)
Total internal gains	268.1860	267.0469	257.8133	242.6950	226.8879	212.0239	202.6037	205.8575	213.8320	229.0658	246.5858	260.1648	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.6300	0.7000	0.7700	21.1720	(75)
Southwest	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074	(79)
Northwest	0.6600	11.2829	0.6300	0.7000	0.7700	2.2758	(81)

Solar gains	60.5553	110.9365	172.4756	248.3809	309.8574	321.5385	304.2038	256.2112	198.4260	128.1863	73.9496	50.9049	(83)
Total gains	328.7413	377.9834	430.2889	491.0760	536.7453	533.5623	506.8075	462.0686	412.2580	357.2521	320.5354	311.0697	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9942	58.1092	58.2224	58.7602	58.8619	59.3400	59.3400	59.4294	59.1549	58.8619	58.6565	58.4433	
alpha	4.8663	4.8739	4.8815	4.9173	4.9241	4.9560	4.9560	4.9620	4.9437	4.9241	4.9104	4.8962	
util living area	0.9983	0.9963	0.9900	0.9650	0.8870	0.7267	0.5608	0.6298	0.8742	0.9816	0.9966	0.9987	(86)
MIT	19.6756	19.8249	20.0867	20.4432	20.7575	20.9374	20.9861	20.9761	20.8354	20.4302	19.9885	19.6479	(87)
Th 2	19.9221	19.9239	19.9258	19.9346	19.9362	19.9438	19.9438	19.9453	19.9409	19.9362	19.9329	19.9294	(88)
util rest of house	0.9977	0.9950	0.9862	0.9512	0.8429	0.6336	0.4347	0.5006	0.8076	0.9719	0.9951	0.9983	(89)
MIT 2	18.7176	18.8678	19.1293	19.4842	19.7720	19.9152	19.9404	19.9384	19.8474	19.4779	19.0386	18.6958	(90)
Living area fraction										fLA = Living area / (4) =		0.4236	(91)
MIT	19.1234	19.2733	19.5349	19.8905	20.1895	20.3483	20.3834	20.3780	20.2660	19.8813	19.4410	19.0992	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1234	19.2733	19.5349	19.8905	20.1895	20.3483	20.3834	20.3780	20.2660	19.8813	19.4410	19.0992	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9940	0.9845	0.9505	0.8547	0.6715	0.4887	0.5560	0.8309	0.9712	0.9943	0.9978	(94)
Useful gains	327.7943	375.7041	423.6116	466.7540	458.7537	358.2742	247.6580	256.8894	342.5550	346.9783	318.6928	310.3837	(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	1008.9188	976.3419	883.7053	738.2871	569.2985	382.3673	251.6648	264.2156	411.4374	622.3971	830.4753	1006.2801	(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	506.7566	403.6286	342.3097	195.5039	82.2453	0.0000	0.0000	0.0000	0.0000	204.9116	368.4834	517.7469	(98)
Space heating												2621.5859	(98)
Space heating per m2											(98) / (4) =	46.1222	(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	625.2759	492.2384	504.7817	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8727	0.9288	0.9008	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	545.6690	457.1731	454.7031	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	694.6803	662.0423	610.8816	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	107.2882	152.4227	116.1968	0.0000	0.0000	0.0000	0.0000	(104)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling                                                                                                    375.9077 (104)
Cooled fraction                                                                  fC = cooled area / (4) =          1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   26.8220   38.1057   29.0492    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                     93.9769 (107)
Space cooling per m2                                                                                               1.6534 (108)
Energy for space heating                                                                                          46.1222 (99)
Energy for space cooling                                                                                           1.6534 (108)
Total                                                                                                             47.7756 (109)
Target Fabric Energy Efficiency (TFEE)                                                                            54.9 (109)
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Denford Mid-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	DS00 Denford , Mid Terr, Masonry, Classic Range, Barratt Developments plc		

SAP Rating	84 B	**DER**	18.24	**TER**	19.06
Environmental	88 B	**% DER<TER**	4.32		
CO_2 Emissions (t/year)	0.90	**DFEE**	42.87	**TFEE**	47.05
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.89		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 57 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) 19.06 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.24 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)47.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.9 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 3.30 m², No overhang
Windows facing North West: 6.14 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K

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	28.4200 (1b)	x	2.3100 (2b)	=	65.6502	(1b) - (3b)
First floor	28.4200 (1c)	x	2.5600 (2c)	=	72.7552	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	138.4054	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2168	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4673	(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) =	0.3972	(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	0.5064	0.4965	0.4865	0.4369	0.4270	0.3773	0.3773	0.3674	0.3972	0.4270	0.4468	0.4667	(22b)
Effective ac	0.6282	0.6232	0.6184	0.5954	0.5911	0.5712	0.5712	0.5675	0.5789	0.5911	0.5998	0.6089	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			9.4400	1.3347	12.5998			(27)
Opening Type 3			1.9700	1.0000	1.9700			(26)
150mm TE Platinum GF			28.4200	0.1300	3.6946			(28a)
50mm AP (60mmCavity)	4.2100	1.9700	2.2400	0.2700	0.6048			(29a)
BDW Std 50mm AP	34.1800	9.4400	24.7400	0.2700	6.6798			(29a)
400mm MW	28.4200		28.4200	0.1100	3.1262			(30)
Total net area of external elements Aum(A, m2)			95.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.6752			(33)
E-WM-20/22			70.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	193.9100	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.4401	(36)
Total fabric heat loss (33) + (36) =	37.1153	(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	28.6929	28.4655	28.2426	27.1957	26.9998	26.0880	26.0880	25.9191	26.4392	26.9998	27.3961	27.8103	(38)
Heat transfer coeff	65.8082	65.5808	65.3579	64.3110	64.1151	63.2033	63.2033	63.0344	63.5545	64.1151	64.5114	64.9256	(39)
Average = Sum(39)m / 12 =												64.3100	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1538	1.1499	1.1314	1.1280	1.1120	1.1120	1.1090	1.1181	1.1280	1.1350	1.1423	(40)
HLP (average)												1.1314	(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	1.8910 (42)
Average daily hot water use (litres/day)	79.1120 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.0232	83.8587	80.6942	77.5297	74.3653	71.2008	71.2008	74.3653	77.5297	80.6942	83.8587	87.0232	(44)
Energy conte	129.0529	112.8705	116.4722	101.5433	97.4332	84.0775	77.9101	89.4030	90.4708	105.4349	115.0905	124.9808	(45)
Energy content (annual)										Total = Sum(45)m =		1244.7396	(45)
Distribution loss (46)m = 0.15 x (45)m	19.3579	16.9306	17.4708	15.2315	14.6150	12.6116	11.6865	13.4105	13.5706	15.8152	17.2636	18.7471	(46)
Water storage loss:													
Total storage loss													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0261	12.6524	13.9821	13.5017	13.9305	13.4565	13.8897	13.9161	13.4811	13.9608	13.5444	14.0176	(61)
Total heat required for water heating calculated for each month													
	143.0790	125.5229	130.4543	115.0450	111.3637	97.5339	91.7998	103.3191	103.9519	119.3957	128.6349	138.9984	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	143.0790	125.5229	130.4543	115.0450	111.3637	97.5339	91.7998	103.3191	103.9519	119.3957	128.6349	138.9984	(64)
								Total per year (kWh/year) = Sum(64)m =				1409.0987	(64)
Heat gains from water heating, kWh/month													
	46.4166	40.6925	42.2225	37.1386	35.8792	31.3199	29.3775	33.2055	33.4518	38.5473	41.6537	45.0605	(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	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.2286	13.5259	11.0000	8.3277	6.2251	5.2555	5.6787	7.3814	9.9073	12.5796	14.6822	15.6518	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	164.9131	166.6244	162.3120	153.1315	141.5427	130.6509	123.3745	121.6632	125.9756	135.1561	146.7449	157.6367	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	(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)													
	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	(71)
Water heating gains (Table 5)													
	62.3879	60.5544	56.7507	51.5814	48.2247	43.4998	39.4859	44.6311	46.4608	51.8109	57.8524	60.5652	(72)
Total internal gains													
	296.8951	295.0701	284.4282	267.4060	250.3579	233.7716	222.9046	228.0411	236.7092	253.9121	273.6449	288.2192	(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	
Southeast	3.3000	36.7938	0.7100	0.7000	0.7700	41.8195	(77)
Northwest	6.1400	11.2829	0.7100	0.7000	0.7700	23.8605	(81)

Solar gains	65.6800	119.8029	184.9711	264.4738	328.4398	340.2315	322.1239	272.2365	212.1615	138.0837	80.1128	55.2745	(83)
Total gains	362.5751	414.8730	469.3993	531.8798	578.7977	574.0031	545.0285	500.2777	448.8706	391.9958	353.7578	343.4937	(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	46.5234	46.6848	46.8440	47.6065	47.7520	48.4409	48.4409	48.5707	48.1732	47.7520	47.4587	47.1559	
alpha	4.1016	4.1123	4.1229	4.1738	4.1835	4.2294	4.2294	4.2380	4.2115	4.1835	4.1639	4.1437	
util living area													
	0.9929	0.9869	0.9714	0.9248	0.8189	0.6483	0.4953	0.5540	0.7986	0.9523	0.9873	0.9943	(86)
MIT	19.5182	19.7027	20.0123	20.4227	20.7532	20.9344	20.9835	20.9740	20.8380	20.4076	19.8968	19.4926	(87)
Th 2	19.9539	19.9572	19.9603	19.9752	19.9780	19.9911	19.9911	19.9935	19.9861	19.9780	19.9724	19.9665	(88)
util rest of house													
	0.9910	0.9834	0.9635	0.9039	0.7706	0.5652	0.3886	0.4440	0.7283	0.9348	0.9834	0.9928	(89)
MIT 2	17.9838	18.2539	18.7028	19.2915	19.7276	19.9427	19.9836	19.9805	19.8463	19.2838	18.5481	17.9549	(90)
Living area fraction										fLA = Living area / (4) =		0.4236	(91)
MIT	18.6339	18.8677	19.2576	19.7707	20.1621	20.3628	20.4072	20.4014	20.2664	19.7599	19.1195	18.6063	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4839	18.7177	19.1076	19.6207	20.0121	20.2128	20.2572	20.2514	20.1164	19.6099	18.9695	18.4563	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9872	0.9778	0.9552	0.8953	0.7724	0.5845	0.4175	0.4733	0.7384	0.9267	0.9780	0.9896	(94)
Useful gains	357.9521	405.6508	448.3719	476.1738	447.0551	335.4907	227.5687	236.8013	331.4638	363.2650	345.9737	339.9188	(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													
	933.4159	906.1747	824.0044	689.4597	532.9280	354.7481	231.1461	242.7705	382.3716	577.6699	765.7148	925.5992	(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													
	428.1451	336.3520	279.4705	153.5659	63.8894	0.0000	0.0000	0.0000	0.0000	159.5172	302.2136	435.7463	(98)
Space heating												2158.9000	(98)
Space heating per m2											(98) / (4) =	37.9821	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2385.5249	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	428.1451	336.3520	279.4705	153.5659	63.8894	0.0000	0.0000	0.0000	0.0000	159.5172	302.2136	435.7463	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	473.0885	371.6597	308.8072	169.6860	70.5961	0.0000	0.0000	0.0000	0.0000	176.2621	333.9377	481.4876	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	143.0790	125.5229	130.4543	115.0450	111.3637	97.5339	91.7998	103.3191	103.9519	119.3957	128.6349	138.9984	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6767	89.6074	89.4565	89.1012	88.4400	87.3000	87.3000	87.3000	87.3000	89.1019	89.5203	89.7048	(217)
Fuel for water heating, kWh/month													
	159.5499	140.0810	145.8300	129.1173	125.9200	111.7227	105.1544	118.3495	119.0743	133.9991	143.6936	154.9509	(219)
Water heating fuel used												1587.4427	(219)
Annual totals kWh/year													
Space heating fuel - main system												2385.5249	(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)												268.9418	(232)
Total delivered energy for all uses												4316.9094	(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	2385.5249	0.2160	515.2734	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1587.4427	0.2160	342.8876	(264)
Space and water heating			858.1610	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	268.9418	0.5190	139.5808	(268)
Total CO2, kg/year			1036.6668	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.2400	(273)

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

DER		18.2400	ZC1
Total Floor Area	TFA	56.8400	
Assumed number of occupants	N	1.8910	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1928	ZC2
CO2 emissions from cooking, equation (L16)		2.8921	ZC3
Total CO2 emissions		38.3249	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		38.3249	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	28.4200	(1b)	x 2.3100	(2b) =	65.6502	(1b) - (3b)
First floor	28.4200	(1c)	x 2.5600	(2c) =	72.7552	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		138.4054	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3945	(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) =	0.3353	(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	0.4275	0.4192	0.4108	0.3689	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			9.4400	1.3258	12.5152			(27)
150mm TE Platinum GF			28.4200	0.1300	3.6946			(28a)
50mm AP (60mmCavity)	4.2100	1.9700	2.2400	0.1800	0.4032			(29a)
BDW Std 50mm AP	34.1800	9.4400	24.7400	0.1800	4.4532			(29a)
400mm MW	28.4200		28.4200	0.1300	3.6946			(30)
Total net area of external elements Aum(A, m2)			95.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.7308			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.3423	(36)
Total fabric heat loss (33) + (36) =	34.0730	(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	27.0113	26.8492	26.6903	25.9440	25.8044	25.1544	25.1544	25.0340	25.4048	25.8044	26.0869	26.3822	(38)
Heat transfer coeff	61.0843	60.9222	60.7634	60.0171	59.8774	59.2274	59.2274	59.1071	59.4778	59.8774	60.1599	60.4552	(39)
Average = Sum(39)m / 12 =												60.0164	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0747	1.0718	1.0690	1.0559	1.0534	1.0420	1.0420	1.0399	1.0464	1.0534	1.0584	1.0636	(40)
HLP (average)												1.0559	(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	1.8910 (42)
Average daily hot water use (litres/day)	79.1120 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.0232	83.8587	80.6942	77.5297	74.3653	71.2008	71.2008	74.3653	77.5297	80.6942	83.8587	87.0232	(44)
Energy conte	129.0529	112.8705	116.4722	101.5433	97.4332	84.0775	77.9101	89.4030	90.4708	105.4349	115.0905	124.9808	(45)
Energy content (annual)										Total = Sum(45)m =		1244.7396	(45)
Distribution loss (46)m = 0.15 x (45)m	19.3579	16.9306	17.4708	15.2315	14.6150	12.6116	11.6865	13.4105	13.5706	15.8152	17.2636	18.7471	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	44.3461	38.5980	41.1209	38.2338	37.8957	35.1127	36.2831	37.8957	38.2338	41.1209	41.3550	44.3461 (61)
Total heat required for water heating calculated for each month												
	173.3989	151.4684	157.5931	139.7771	135.3289	119.1902	114.1933	127.2987	128.7046	146.5558	156.4455	169.3269 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	173.3989	151.4684	157.5931	139.7771	135.3289	119.1902	114.1933	127.2987	128.7046	146.5558	156.4455	169.3269 (64)
								Total per year (kWh/year) = Sum(64)m =				1719.2815 (64)
Heat gains from water heating, kWh/month												
	53.9966	47.1789	49.0072	43.3216	41.8705	36.7339	34.9759	39.2004	39.6400	45.3373	48.6063	52.6426 (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	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.2286	13.5259	11.0000	8.3277	6.2251	5.2555	5.6787	7.3814	9.9073	12.5796	14.6822	15.6518	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	164.9131	166.6244	162.3120	153.1315	141.5427	130.6509	123.3745	121.6632	125.9756	135.1561	146.7449	157.6367	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	(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)													
	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	(71)
Water heating gains (Table 5)													
	72.5761	70.2067	65.8699	60.1689	56.2775	51.0194	47.0106	52.6887	55.0555	60.9373	67.5088	70.7562	(72)
Total internal gains													
	307.0832	304.7225	293.5474	275.9935	258.4107	241.2911	230.4293	236.0988	245.3039	263.0384	283.3014	298.4102	(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	
Southeast	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074	(77)
Northwest	6.1400	11.2829	0.6300	0.7000	0.7700	21.1720	(81)

Solar gains	58.2795	106.3040	164.1293	234.6739	291.4325	301.8956	285.8283	241.5620	188.2559	122.5250	71.0860	49.0464 (83)
Total gains	365.3627	411.0264	457.6767	510.6675	549.8432	543.1867	516.2575	477.6608	433.5598	385.5635	354.3874	347.4566 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.6192	64.7912	64.9606	65.7683	65.9217	66.6452	66.6452	66.7809	66.3646	65.9217	65.6122	65.2917	
alpha	5.3079	5.3194	5.3307	5.3846	5.3948	5.4430	5.4430	5.4521	5.4243	5.3948	5.3741	5.3528	
util living area													
	0.9972	0.9943	0.9851	0.9502	0.8489	0.6648	0.4987	0.5576	0.8203	0.9699	0.9943	0.9979	(86)
MIT	19.9014	20.0410	20.2785	20.5949	20.8485	20.9698	20.9947	20.9906	20.9078	20.5816	20.1869	19.8771	(87)
Th 2	20.0216	20.0239	20.0262	20.0370	20.0390	20.0485	20.0485	20.0502	20.0448	20.0390	20.0349	20.0307	(88)
util rest of house													
	0.9963	0.9924	0.9800	0.9325	0.8003	0.5794	0.3941	0.4484	0.7474	0.9558	0.9920	0.9972	(89)
MIT 2	18.5584	18.7633	19.1091	19.5638	19.8930	20.0288	20.0465	20.0464	19.9719	19.5546	18.9850	18.5295	(90)
Living area fraction										fLA = Living area / (4) =		0.4236	(91)
MIT	19.1274	19.3046	19.6045	20.0006	20.2978	20.4274	20.4482	20.4464	20.3684	19.9897	19.4942	19.1004	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1274	19.3046	19.6045	20.0006	20.2978	20.4274	20.4482	20.4464	20.3684	19.9897	19.4942	19.1004	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9905	0.9771	0.9317	0.8146	0.6147	0.4386	0.4949	0.7743	0.9549	0.9903	0.9962	(94)
Useful gains	363.5964	407.1285	447.1966	475.8001	447.8889	333.8762	226.4249	236.3891	335.7222	368.1714	350.9431	346.1514	(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													
	905.7196	877.5598	796.2740	666.2244	514.8133	345.1443	227.9188	239.1703	372.8307	562.2300	745.6344	900.8050	(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													
	403.3397	316.1298	259.7135	137.1055	49.7918	0.0000	0.0000	0.0000	0.0000	144.3796	284.1777	412.6623	(98)
Space heating												2007.3000	(98)
Space heating per m2											(98) / (4) =	35.3149	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												2149.1434	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	403.3397	316.1298	259.7135	137.1055	49.7918	0.0000	0.0000	0.0000	0.0000	144.3796	284.1777	412.6623	(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)													
	431.8412	338.4688	278.0659	146.7939	53.3102	0.0000	0.0000	0.0000	0.0000	154.5821	304.2588	441.8226	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.3989	151.4684	157.5931	139.7771	135.3289	119.1902	114.1933	127.2987	128.7046	146.5558	156.4455	169.3269	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.1060	86.8610	86.3008	85.0027	82.7878	80.3000	80.3000	80.3000	80.3000	85.0136	86.5355	87.2086	(217)
Fuel for water heating, kWh/month													
	199.0665	174.3803	182.6092	164.4385	163.4648	148.4311	142.2083	158.5289	160.2797	172.3911	180.7877	194.1630	(219)
Water heating fuel used												2040.7490	(219)
Annual totals kWh/year													
Space heating fuel - main system												2149.1434	(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)												268.9418	(232)
Total delivered energy for all uses												4533.8342	(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	2149.1434	0.2160	464.2150	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2040.7490	0.2160	440.8018	(264)
Space and water heating			905.0168	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	268.9418	0.5190	139.5808	(268)
Total CO2, kg/m2/year			1083.5226	(272)
Emissions per m2 for space and water heating			15.9222	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4557	(272b)
Emissions per m2 for pumps and fans			0.6848	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9222 * 1.00) + 2.4557 + 0.6848, rounded to 2 d.p.			19.0600	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	28.4200 (1b)	x	2.3100 (2b)	=	65.6502	(1b) - (3b)
First floor	28.4200 (1c)	x	2.5600 (2c)	=	72.7552	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	138.4054	(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							2 * 10	=	20.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0100	
Infiltration rate			0.3950	(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)	=	0.3358	(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	0.4281	0.4197	0.4113	0.3693	0.3609	0.3190	0.3190	0.3106	0.3358	0.3609	0.3777	0.3945	(22b)
Effective ac	0.5916	0.5881	0.5846	0.5682	0.5651	0.5509	0.5509	0.5482	0.5564	0.5651	0.5713	0.5778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			9.4400	1.3347	12.5998			(27)
Opening Type 3			1.9700	1.0000	1.9700			(26)
150mm TE Platinum GF			28.4200	0.1300	3.6946			(28a)
50mm AP (60mmCavity)	4.2100	1.9700	2.2400	0.2700	0.6048			(29a)
BDW Std 50mm AP	34.1800	9.4400	24.7400	0.2700	6.6798			(29a)
400mm MW	28.4200		28.4200	0.1100	3.1262			(30)
Total net area of external elements Aum(A, m2)			95.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.6752			(33)
E-WM-20/22			70.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	193.9100	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.4401	(36)
Total fabric heat loss (33) + (36) =	37.1153	(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	27.0219	26.8594	26.7001	25.9519	25.8119	25.1603	25.1603	25.0396	25.4113	25.8119	26.0951	26.3912	(38)
Heat transfer coeff	64.1372	63.9747	63.8154	63.0672	62.9272	62.2756	62.2756	62.1549	62.5266	62.9272	63.2104	63.5064	(39)
Average = Sum(39)m / 12 =												63.0665	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1284	1.1255	1.1227	1.1096	1.1071	1.0956	1.0956	1.0935	1.1000	1.1071	1.1121	1.1173	(40)
HLP (average)												1.1095	(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	1.8910 (42)
Average daily hot water use (litres/day)	79.1120 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.0232	83.8587	80.6942	77.5297	74.3653	71.2008	71.2008	74.3653	77.5297	80.6942	83.8587	87.0232	(44)
Energy conte	129.0529	112.8705	116.4722	101.5433	97.4332	84.0775	77.9101	89.4030	90.4708	105.4349	115.0905	124.9808	(45)
Energy content (annual)										Total = Sum(45)m =		1244.7396	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	27.4237	23.9850	24.7503	21.5780	20.7046	17.8665	16.5559	18.9981	19.2250	22.4049	24.4567	26.5584	(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	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.2286	13.5259	11.0000	8.3277	6.2251	5.2555	5.6787	7.3814	9.9073	12.5796	14.6822	15.6518	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	164.9131	166.6244	162.3120	153.1315	141.5427	130.6509	123.3745	121.6632	125.9756	135.1561	146.7449	157.6367	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	(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)													
	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	(71)
Water heating gains (Table 5)													
	36.8599	35.6919	33.2666	29.9694	27.8287	24.8145	22.2526	25.5351	26.7014	30.1141	33.9677	35.6968	(72)
Total internal gains													
	268.3670	267.2077	257.9441	242.7940	226.9619	212.0863	202.6712	205.9452	213.9498	229.2153	246.7603	260.3508	(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	
Southeast	3.3000	36.7938	0.7100	0.7000	0.7700	41.8195	(77)
Northwest	6.1400	11.2829	0.7100	0.7000	0.7700	23.8605	(81)

Solar gains	65.6800	119.8029	184.9711	264.4738	328.4398	340.2315	322.1239	272.2365	212.1615	138.0837	80.1128	55.2745	(83)
Total gains	334.0470	387.0105	442.9152	507.2678	555.4017	552.3178	524.7951	478.1817	426.1112	367.2991	326.8731	315.6253	(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	47.7356	47.8568	47.9763	48.5454	48.6534	49.1625	49.1625	49.2580	48.9652	48.6534	48.4354	48.2096	
alpha	4.1824	4.1905	4.1984	4.2364	4.2436	4.2775	4.2775	4.2839	4.2643	4.2436	4.2290	4.2140	
util living area													
	0.9947	0.9896	0.9758	0.9326	0.8298	0.6610	0.5061	0.5695	0.8150	0.9603	0.9904	0.9958	(86)
MIT	19.5089	19.6934	20.0035	20.4122	20.7479	20.9320	20.9829	20.9723	20.8291	20.3881	19.8760	19.4774	(87)
Th 2	19.9777	19.9800	19.9823	19.9930	19.9950	20.0044	20.0044	20.0061	20.0008	19.9950	19.9910	19.9867	(88)
util rest of house													
	0.9933	0.9869	0.9692	0.9135	0.7834	0.5785	0.3990	0.4589	0.7476	0.9452	0.9873	0.9947	(89)
MIT 2	18.6181	18.8031	19.1111	19.5143	19.8188	19.9697	19.9990	19.9965	19.8985	19.5002	18.9942	18.5936	(90)
Living area fraction									fLA = Living area / (4) =			0.4236	(91)
MIT	18.9955	19.1802	19.4892	19.8947	20.2124	20.3774	20.4159	20.4099	20.2927	19.8764	19.3678	18.9680	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9955	19.1802	19.4892	19.8947	20.2124	20.3774	20.4159	20.4099	20.2927	19.8764	19.3678	18.9680	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9915	0.9841	0.9651	0.9113	0.7944	0.6109	0.4443	0.5054	0.7694	0.9431	0.9848	0.9932	(94)
Useful gains	331.2178	380.8394	427.4742	462.2906	441.1932	337.4078	233.1789	241.6754	327.8447	346.3869	321.9208	313.4903	(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													
	942.5263	913.5738	828.9105	693.4049	535.6629	359.7900	237.6347	249.2370	387.2103	583.7368	775.4503	937.8625	(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													
	454.8135	357.9975	298.6686	166.4023	70.2855	0.0000	0.0000	0.0000	0.0000	176.5883	326.5412	464.5329	(98)
Space heating												2315.8299	(98)
Space heating per m2											(98) / (4) =	40.7430	(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	585.3903	460.8392	472.3771	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8825	0.9309	0.9067	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	516.6277	429.0134	428.3017	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	716.6855	683.1566	629.8319	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	144.0416	189.0826	149.9384	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												483.0627 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	36.0104	47.2706	37.4846	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												120.7657 (107)
Space cooling per m2												2.1247 (108)
Energy for space heating												40.7430 (99)
Energy for space cooling												2.1247 (108)
Total												42.8676 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.9 (109)

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	28.4200 (1b)	x	2.3100 (2b)	=	65.6502	(1b) - (3b)
First floor	28.4200 (1c)	x	2.5600 (2c)	=	72.7552	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	138.4054	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3945	(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) =	0.3353	(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	0.4275	0.4192	0.4108	0.3689	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			9.4400	1.3258	12.5152			(27)
150mm TE Platinum GF			28.4200	0.1300	3.6946			(28a)
50mm AP (60mmCavity)	4.2100	1.9700	2.2400	0.1800	0.4032			(29a)
BDW Std 50mm AP	34.1800	9.4400	24.7400	0.1800	4.4532			(29a)
400mm MW	28.4200		28.4200	0.1300	3.6946			(30)
Total net area of external elements Aum(A, m2)			95.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.7308			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.3423	(36)
Total fabric heat loss (33) + (36) =	34.0730	(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	27.0113	26.8492	26.6903	25.9440	25.8044	25.1544	25.1544	25.0340	25.4048	25.8044	26.0869	26.3822	(38)
Heat transfer coeff	61.0843	60.9222	60.7634	60.0171	59.8774	59.2274	59.2274	59.1071	59.4778	59.8774	60.1599	60.4552	(39)
Average = Sum(39)m / 12 =												60.0164	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0747	1.0718	1.0690	1.0559	1.0534	1.0420	1.0420	1.0399	1.0464	1.0534	1.0584	1.0636	(40)
HLP (average)												1.0559	(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	1.8910 (42)
Average daily hot water use (litres/day)	79.1120 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.0232	83.8587	80.6942	77.5297	74.3653	71.2008	71.2008	74.3653	77.5297	80.6942	83.8587	87.0232	(44)
Energy conte	129.0529	112.8705	116.4722	101.5433	97.4332	84.0775	77.9101	89.4030	90.4708	105.4349	115.0905	124.9808	(45)
Energy content (annual)										Total = Sum(45)m =		1244.7396	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

27.4237	23.9850	24.7503	21.5780	20.7046	17.8665	16.5559	18.9981	19.2250	22.4049	24.4567	26.5584	(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	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	94.5516	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

15.2286	13.5259	11.0000	8.3277	6.2251	5.2555	5.6787	7.3814	9.9073	12.5796	14.6822	15.6518	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

164.9131	166.6244	162.3120	153.1315	141.5427	130.6509	123.3745	121.6632	125.9756	135.1561	146.7449	157.6367	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	32.4552	(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)

-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	-75.6412	(71)

Water heating gains (Table 5)

36.8599	35.6919	33.2666	29.9694	27.8287	24.8145	22.2526	25.5351	26.7014	30.1141	33.9677	35.6968	(72)

Total internal gains

268.3670	267.2077	257.9441	242.7940	226.9619	212.0863	202.6712	205.9452	213.9498	229.2153	246.7603	260.3508	(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	
Southeast	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074	(77)
Northwest	6.1400	11.2829	0.6300	0.7000	0.7700	21.1720	(81)

Solar gains	58.2795	106.3040	164.1293	234.6739	291.4325	301.8956	285.8283	241.5620	188.2559	122.5250	71.0860	49.0464	(83)
Total gains	326.6465	373.5116	422.0734	477.4680	518.3944	513.9819	488.4995	447.5072	402.2057	351.7403	317.8463	309.3972	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.6192	64.7912	64.9606	65.7683	65.9217	66.6452	66.6452	66.7809	66.3646	65.9217	65.6122	65.2917	
alpha	5.3079	5.3194	5.3307	5.3846	5.3948	5.4430	5.4430	5.4521	5.4243	5.3948	5.3741	5.3528	
util living area	0.9984	0.9963	0.9896	0.9615	0.8722	0.6945	0.5252	0.5912	0.8527	0.9795	0.9966	0.9988	(86)
MIT	19.8374	19.9797	20.2229	20.5510	20.8239	20.9628	20.9932	20.9876	20.8865	20.5321	20.1271	19.8138	(87)
Th 2	20.0216	20.0239	20.0262	20.0370	20.0390	20.0485	20.0485	20.0502	20.0448	20.0390	20.0349	20.0307	(88)
util rest of house	0.9978	0.9951	0.9859	0.9471	0.8274	0.6083	0.4160	0.4774	0.7853	0.9693	0.9952	0.9984	(89)
MIT 2	18.9588	19.1025	19.3457	19.6736	19.9206	20.0316	20.0467	20.0467	19.9813	19.6619	19.2589	18.9426	(90)
Living area fraction										fLA = Living area / (4) =		0.4236	(91)
MIT	19.3310	19.4742	19.7173	20.0453	20.3033	20.4261	20.4477	20.4453	20.3647	20.0306	19.6267	19.3117	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3310	19.4742	19.7173	20.0453	20.3033	20.4261	20.4477	20.4453	20.3647	20.0306	19.6267	19.3117	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9942	0.9844	0.9473	0.8410	0.6440	0.4626	0.5260	0.8104	0.9692	0.9944	0.9980	(94)
Useful gains	325.7728	371.3406	415.4715	452.3009	435.9466	331.0227	225.9584	235.3879	325.9293	340.8961	316.0632	308.7744	(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	918.1583	887.8899	803.1280	668.9077	515.1419	345.0638	227.8888	239.1055	372.6133	564.6772	753.6058	913.5803	(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	440.7348	347.1211	288.4165	155.9569	58.9213	0.0000	0.0000	0.0000	0.0000	166.4931	315.0307	449.9756	(98)
Space heating												2222.6500	(98)
Space heating per m2											(98) / (4) =	39.1036	(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	556.7379	438.2830	449.2137	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9123	0.9562	0.9364	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	507.8961	419.0942	420.6259	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	671.8773	640.7331	593.9785	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	118.0665	164.8994	128.9744	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												411.9402	(104)

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	29.5166	41.2248	32.2436	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												102.9850 (107)
Space cooling per m2												1.8118 (108)
Energy for space heating												39.1036 (99)
Energy for space cooling												1.8118 (108)
Total												40.9155 (109)
Target Fabric Energy Efficiency (TFEE)												47.1 (109)

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Ellerton End-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	DS01 Ellerton, EOT, Part L 2013 Masonry		

SAP Rating	84 B	**DER**	17.76	**TER**	18.54
Environmental	87 B	**% DER<TER**	4.21		
CO_2 Emissions (t/year)	1.20	**DFEE**	47.72	**TFEE**	51.58
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.48		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 77 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.54 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.76 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.35 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 6.45 m², No overhang
Windows facing South West: 4.23 m², No overhang
Windows facing North West: 1.32 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K

ARUN DISTRICT COUNCIL A/45/22/PL

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	38.5600 (1b)	x	2.3300 (2b)	=	89.8448	(1b) - (3b)
First floor	38.5600 (1c)	x	2.5600 (2c)	=	98.7136	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.1200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	188.5584	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1591	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4096	(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) =	0.3482	(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	0.4439	0.4352	0.4265	0.3830	0.3743	0.3308	0.3308	0.3220	0.3482	0.3743	0.3917	0.4091	(22b)
Effective ac	0.5985	0.5947	0.5910	0.5733	0.5700	0.5547	0.5547	0.5519	0.5606	0.5700	0.5767	0.5837	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			12.0000	1.3347	16.0167			(27)
150mm Platinum			38.5600	0.1500	5.7840			(28a)
50 mm A. Platinum	85.9300	13.9700	71.9600	0.2700	19.4292			(29a)
400mm Mineral wool	38.5600		38.5600	0.1100	4.2416			(30)
Total net area of external elements Aum(A, m2)			163.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.4415			(33)
E-WM-22			40.5200	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							201.0900	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5495	(36)
Total fabric heat loss					(33) + (36) =		55.9909	(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	37.2429	37.0048	36.7714	35.6754	35.4703	34.5157	34.5157	34.3390	34.8834	35.4703	35.8852	36.3189	(38)
Heat transfer coeff	93.2338	92.9957	92.7624	91.6663	91.4613	90.5067	90.5067	90.3299	90.8744	91.4613	91.8761	92.3098	(39)
Average = Sum(39)m / 12 =												91.6654	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2089	1.2059	1.2028	1.1886	1.1860	1.1736	1.1736	1.1713	1.1784	1.1860	1.1913	1.1970	(40)
HLP (average)												1.1886	(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	2.4059	(42)
Average daily hot water use (litres/day)	91.3412	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.4753	96.8216	93.1680	89.5143	85.8607	82.2071	82.2071	85.8607	89.5143	93.1680	96.8216	100.4753	(44)
Energy conte	149.0020	130.3181	134.4766	117.2399	112.4945	97.0742	89.9535	103.2230	104.4558	121.7331	132.8812	144.3004	(45)
Energy content (annual)										Total = Sum(45)m =		1437.1523	(45)
Distribution loss (46)m = 0.15 x (45)m	22.3503	19.5477	20.1715	17.5860	16.8742	14.5611	13.4930	15.4834	15.6684	18.2600	19.9322	21.6451	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1142	12.7281	14.0573	13.5647	13.9884	13.5043	13.9340	13.9693	13.5372	14.0288	13.6216	14.1029	(61)
Total heat required for water heating calculated for each month													
	163.1161	143.0462	148.5338	130.8046	126.4829	110.5785	103.8876	117.1922	117.9930	135.7619	146.5028	158.4033	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.1161	143.0462	148.5338	130.8046	126.4829	110.5785	103.8876	117.1922	117.9930	135.7619	146.5028	158.4033	(64)
								Total per year (kWh/year) = Sum(64)m =				1602.3029	(64)
Heat gains from water heating, kWh/month													
	53.0717	46.5128	48.2278	42.3734	40.9015	35.6533	33.3931	37.8140	38.1159	43.9835	47.5884	51.5056	(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	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9515	17.7207	14.4115	10.9104	8.1557	6.8853	7.4399	9.6706	12.9799	16.4809	19.2357	20.5060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	213.3163	215.5298	209.9517	198.0767	183.0865	168.9978	159.5858	157.3722	162.9503	174.8254	189.8156	203.9042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	(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)													
	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	(71)
Water heating gains (Table 5)													
	71.3329	69.2154	64.8223	58.8520	54.9752	49.5184	44.8831	50.8252	52.9387	59.1176	66.0950	69.2280	(72)
Total internal gains													
	366.6898	364.5552	351.2746	329.9282	308.3065	287.4908	273.9979	279.9572	290.9580	312.5130	337.2354	355.7273	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.4500	11.2829	0.7100	0.7000	0.7700	25.0652	(75)
Southwest	4.2300	36.7938	0.7100	0.7000	0.7700	53.6050	(79)
Northwest	1.3200	11.2829	0.7100	0.7000	0.7700	5.1296	(81)

Solar gains	83.7998	152.7716	235.6690	336.6583	417.8425	432.7486	409.7552	346.4472	270.2095	176.0280	102.1993	70.5333	(83)
Total gains	450.4897	517.3268	586.9436	666.5865	726.1490	720.2394	683.7531	626.4044	561.1675	488.5411	439.4348	426.2606	(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	46.2042	46.3225	46.4390	46.9943	47.0997	47.5964	47.5964	47.6896	47.4039	47.0997	46.8870	46.6667	
alpha	4.0803	4.0882	4.0959	4.1330	4.1400	4.1731	4.1731	4.1793	4.1603	4.1400	4.1258	4.1111	
util living area													
	0.9955	0.9915	0.9808	0.9475	0.8634	0.7104	0.5553	0.6177	0.8482	0.9681	0.9919	0.9964	(86)
MIT	19.4231	19.5989	19.9041	20.3177	20.6803	20.9031	20.9734	20.9590	20.7837	20.3164	19.7989	19.3940	(87)
Th 2	19.9129	19.9153	19.9177	19.9291	19.9312	19.9412	19.9412	19.9430	19.9374	19.9312	19.9269	19.9224	(88)
util rest of house													
	0.9942	0.9891	0.9751	0.9309	0.8197	0.6233	0.4339	0.4953	0.7829	0.9550	0.9892	0.9954	(89)
MIT 2	17.8132	18.0709	18.5152	19.1121	19.6012	19.8688	19.9293	19.9225	19.7462	19.1212	18.3714	17.7771	(90)
Living area fraction									fLA = Living area / (4) =			0.1859	(91)
MIT	18.1125	18.3550	18.7734	19.3363	19.8019	20.0611	20.1234	20.1153	19.9391	19.3434	18.6368	18.0778	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9625	18.2050	18.6234	19.1863	19.6519	19.9111	19.9734	19.9653	19.7891	19.1934	18.4868	17.9278	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9907	0.9833	0.9654	0.9159	0.8061	0.6206	0.4378	0.4981	0.7718	0.9421	0.9836	0.9924	(94)
Useful gains	446.2781	508.7061	566.6434	610.5422	585.3332	446.9492	299.3812	312.0277	433.1201	460.2662	432.2373	423.0397	(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													
	1273.8094	1237.3058	1124.5988	942.9048	727.2904	480.6914	305.3159	322.0506	516.9971	785.9648	1046.1795	1267.2098	(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													
	615.6833	489.6190	415.1188	239.3011	105.6162	0.0000	0.0000	0.0000	0.0000	242.3197	442.0384	628.0626	(98)
Space heating												3177.7591	(98)
Space heating per m2											(98) / (4) =	41.2054	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3511.3360	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	615.6833	489.6190	415.1188	239.3011	105.6162	0.0000	0.0000	0.0000	0.0000	242.3197	442.0384	628.0626	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	680.3131	541.0154	458.6949	264.4211	116.7030	0.0000	0.0000	0.0000	0.0000	267.7566	488.4402	693.9918	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.1161	143.0462	148.5338	130.8046	126.4829	110.5785	103.8876	117.1922	117.9930	135.7619	146.5028	158.4033	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8105	89.7561	89.6342	89.3426	88.7276	87.3000	87.3000	87.3000	87.3000	89.3243	89.6817	89.8368	(217)
Fuel for water heating, kWh/month													
	181.6225	159.3720	165.7111	146.4079	142.5518	126.6650	119.0006	134.2408	135.1581	151.9877	163.3587	176.3235	(219)
Water heating fuel used												1802.3998	(219)
Annual totals kWh/year													
Space heating fuel - main system												3511.3360	(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)												352.3493	(232)
Total delivered energy for all uses												5741.0851	(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	3511.3360	0.2160	758.4486	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.3998	0.2160	389.3183	(264)
Space and water heating			1147.7669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	352.3493	0.5190	182.8693	(268)
Total CO2, kg/year			1369.5612	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.7600	(273)

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

DER		17.7600	ZC1
Total Floor Area	TFA	77.1200	
Assumed number of occupants	N	2.4059	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3909	ZC2
CO2 emissions from cooking, equation (L16)		2.2918	ZC3
Total CO2 emissions		36.4427	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.4427	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	38.5600 (1b)	x	2.3300 (2b)	=	89.8448	(1b) - (3b)
First floor	38.5600 (1c)	x	2.5600 (2c)	=	98.7136	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.1200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	188.5584	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1591	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4091	(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) =	0.3477	(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	0.4434	0.4347	0.4260	0.3825	0.3738	0.3303	0.3303	0.3217	0.3477	0.3738	0.3912	0.4086	(22b)
Effective ac	0.5983	0.5945	0.5907	0.5732	0.5699	0.5546	0.5546	0.5517	0.5605	0.5699	0.5765	0.5835	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			12.0000	1.3258	15.9091			(27)
150mm Platinum			38.5600	0.1300	5.0128			(28a)
50 mm A. Platinum	85.9300	13.9700	71.9600	0.1800	12.9528			(29a)
400mm Mineral wool	38.5600		38.5600	0.1300	5.0128			(30)
Total net area of external elements Aum(A, m2)			163.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.8575			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2829	(36)
Total fabric heat loss					(33) + (36) =		50.1404	(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	37.2279	36.9904	36.7576	35.6643	35.4597	34.5074	34.5074	34.3311	34.8742	35.4597	35.8735	36.3062	(38)
Heat transfer coeff	87.3683	87.1308	86.8980	85.8047	85.6001	84.6478	84.6478	84.4715	85.0146	85.6001	86.0139	86.4466	(39)
Average = Sum(39)m / 12 =												85.8037	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1329	1.1298	1.1268	1.1126	1.1100	1.0976	1.0976	1.0953	1.1024	1.1100	1.1153	1.1209	(40)
HLP (average)												1.1126	(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												2.4059	(42)
Average daily hot water use (litres/day)												91.3412	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.4753	96.8216	93.1680	89.5143	85.8607	82.2071	82.2071	85.8607	89.5143	93.1680	96.8216	100.4753	(44)
Energy conte	149.0020	130.3181	134.4766	117.2399	112.4945	97.0742	89.9535	103.2230	104.4558	121.7331	132.8812	144.3004	(45)
Energy content (annual)										Total = Sum(45)m =		1437.1523	(45)
Distribution loss (46)m = 0.15 x (45)m	22.3503	19.5477	20.1715	17.5860	16.8742	14.5611	13.4930	15.4834	15.6684	18.2600	19.9322	21.6451	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.5645	47.4774	44.1441	43.7537	40.5405	41.8918	43.7537	44.1441	47.4774	47.7477	50.9589	(61)
Total heat required for water heating calculated for each month													
	199.9609	174.8825	181.9540	161.3840	156.2482	137.6147	131.8453	146.9766	148.5998	169.2105	180.6289	195.2593	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	199.9609	174.8825	181.9540	161.3840	156.2482	137.6147	131.8453	146.9766	148.5998	169.2105	180.6289	195.2593	(64)
								Total per year (kWh/year) = Sum(64)m =				1984.5648	(64)
Heat gains from water heating, kWh/month													
	62.2829	54.4719	56.5828	50.0183	48.3428	42.4123	40.3825	45.2601	45.7676	52.3456	56.1199	60.7196	(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	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9515	17.7207	14.4115	10.9104	8.1557	6.8853	7.4399	9.6706	12.9799	16.4809	19.2357	20.5060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	213.3163	215.5298	209.9517	198.0767	183.0865	168.9978	159.5858	157.3722	162.9503	174.8254	189.8156	203.9042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	(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)													
	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	(71)
Water heating gains (Table 5)													
	83.7135	81.0593	76.0522	69.4698	64.9769	58.9060	54.2776	60.8334	63.5661	70.3570	77.9443	81.6124	(72)
Total internal gains													
	379.0705	376.3991	362.5045	340.5461	318.3082	296.8783	283.3923	289.9654	301.5854	323.7525	349.0848	368.1117	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.4500	11.2829	0.6300	0.7000	0.7700	22.2410	(75)
Southwest	4.2300	36.7938	0.6300	0.7000	0.7700	47.5650	(79)
Northwest	1.3200	11.2829	0.6300	0.7000	0.7700	4.5516	(81)

Solar gains	74.3576	135.5579	209.1147	298.7249	370.7617	383.9882	363.5856	307.4109	239.7634	156.1939	90.6839	62.5859	(83)
Total gains	453.4281	511.9570	571.6192	639.2710	689.0699	680.8665	646.9779	597.3763	541.3488	479.9464	439.7687	430.6977	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2986	61.4657	61.6303	62.4157	62.5648	63.2687	63.2687	63.4008	62.9957	62.5648	62.2638	61.9522	
alpha	5.0866	5.0977	5.1087	5.1610	5.1710	5.2179	5.2179	5.2267	5.1997	5.1710	5.1509	5.1301	
util living area													
	0.9982	0.9963	0.9903	0.9669	0.8919	0.7306	0.5615	0.6247	0.8704	0.9807	0.9963	0.9986	(86)
MIT	19.7705	19.9088	20.1513	20.4848	20.7774	20.9456	20.9887	20.9811	20.8582	20.4853	20.0717	19.7486	(87)
Th 2	19.9741	19.9766	19.9790	19.9905	19.9927	20.0028	20.0028	20.0047	19.9989	19.9927	19.9883	19.9838	(88)
util rest of house													
	0.9976	0.9950	0.9867	0.9539	0.8501	0.6415	0.4416	0.5022	0.8050	0.9708	0.9948	0.9982	(89)
MIT 2	18.3332	18.5368	18.8913	19.3767	19.7698	19.9658	19.9985	19.9966	19.8807	19.3853	18.7838	18.3080	(90)
Living area fraction										fLA = Living area / (4) =		0.1859	(91)
MIT	18.6005	18.7919	19.1256	19.5828	19.9572	20.1480	20.1827	20.1796	20.0624	19.5898	19.0233	18.5759	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6005	18.7919	19.1256	19.5828	19.9572	20.1480	20.1827	20.1796	20.0624	19.5898	19.0233	18.5759	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9928	0.9825	0.9472	0.8484	0.6555	0.4639	0.5248	0.8099	0.9654	0.9927	0.9971	(94)
Useful gains	451.7588	508.2611	561.6410	605.4879	584.6160	446.3321	300.1455	313.5327	438.4455	463.3213	436.5462	429.4700	(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													
	1249.4075	1210.4129	1097.1372	916.6299	706.8149	469.6224	303.2644	319.2721	506.8955	769.5296	1025.5661	1242.7445	(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													
	593.4506	471.8460	398.4092	224.0223	90.9160	0.0000	0.0000	0.0000	0.0000	227.8189	424.0944	605.0762	(98)
Space heating												3035.6336	(98)
Space heating per m2											(98) / (4) =	39.3625	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												3250.1431	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	593.4506	471.8460	398.4092	224.0223	90.9160	0.0000	0.0000	0.0000	0.0000	227.8189	424.0944	605.0762	(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)													
	635.3861	505.1885	426.5623	239.8525	97.3405	0.0000	0.0000	0.0000	0.0000	243.9175	454.0625	647.8332	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.9609	174.8825	181.9540	161.3840	156.2482	137.6147	131.8453	146.9766	148.5998	169.2105	180.6289	195.2593	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6224	87.4265	86.9704	85.8770	83.7415	80.3000	80.3000	80.3000	80.3000	85.8006	87.1267	87.7085	(217)
Fuel for water heating, kWh/month													
	228.2074	200.0339	209.2136	187.9245	186.5839	171.3757	164.1909	183.0344	185.0559	197.2137	207.3175	222.6229	(219)
Water heating fuel used												2342.7744	(219)
Annual totals kWh/year													
Space heating fuel - main system												3250.1431	(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)												352.3493	(232)
Total delivered energy for all uses												6020.2668	(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	3250.1431	0.2160	702.0309	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2342.7744	0.2160	506.0393	(264)
Space and water heating			1208.0702	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	352.3493	0.5190	182.8693	(268)
Total CO2, kg/m2/year			1429.8645	(272)
Emissions per m2 for space and water heating			15.6648	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3712	(272b)
Emissions per m2 for pumps and fans			0.5047	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6648 * 1.00) + 2.3712 + 0.5047, rounded to 2 d.p.			18.5400	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.5600 (1b)	x	2.3300 (2b)	=	89.8448	(1b) - (3b)
First floor	38.5600 (1c)	x	2.5600 (2c)	=	98.7136	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.1200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	188.5584	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1591	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4096	(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) =	0.3482	(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	0.4439	0.4352	0.4265	0.3830	0.3743	0.3308	0.3308	0.3220	0.3482	0.3743	0.3917	0.4091	(22b)
Effective ac	0.5985	0.5947	0.5910	0.5733	0.5700	0.5547	0.5547	0.5519	0.5606	0.5700	0.5767	0.5837	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			12.0000	1.3347	16.0167			(27)
150mm Platinum			38.5600	0.1500	5.7840			(28a)
50 mm A. Platinum	85.9300	13.9700	71.9600	0.2700	19.4292			(29a)
400mm Mineral wool	38.5600		38.5600	0.1100	4.2416			(30)
Total net area of external elements Aum(A, m2)			163.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.4415			(33)
E-WM-22			40.5200	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							201.0900	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5495	(36)
Total fabric heat loss					(33) + (36) =		55.9909	(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	37.2429	37.0048	36.7714	35.6754	35.4703	34.5157	34.5157	34.3390	34.8834	35.4703	35.8852	36.3189	(38)
Heat transfer coeff	93.2338	92.9957	92.7624	91.6663	91.4613	90.5067	90.5067	90.3299	90.8744	91.4613	91.8761	92.3098	(39)
Average = Sum(39)m / 12 =												91.6654	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2089	1.2059	1.2028	1.1886	1.1860	1.1736	1.1736	1.1713	1.1784	1.1860	1.1913	1.1970	(40)
HLP (average)												1.1886	(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	2.4059	(42)
Average daily hot water use (litres/day)	91.3412	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.4753	96.8216	93.1680	89.5143	85.8607	82.2071	82.2071	85.8607	89.5143	93.1680	96.8216	100.4753	(44)
Energy conte	149.0020	130.3181	134.4766	117.2399	112.4945	97.0742	89.9535	103.2230	104.4558	121.7331	132.8812	144.3004	(45)
Energy content (annual)										Total = Sum(45)m =		1437.1523	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.6629	27.6926	28.5763	24.9135	23.9051	20.6283	19.1151	21.9349	22.1969	25.8683	28.2373	30.6638	(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	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9515	17.7207	14.4115	10.9104	8.1557	6.8853	7.4399	9.6706	12.9799	16.4809	19.2357	20.5060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	213.3163	215.5298	209.9517	198.0767	183.0865	168.9978	159.5858	157.3722	162.9503	174.8254	189.8156	203.9042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	(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)													
	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	(71)
Water heating gains (Table 5)													
	42.5577	41.2092	38.4090	34.6021	32.1305	28.6504	25.6924	29.4824	30.8290	34.7692	39.2184	41.2148	(72)
Total internal gains													
	334.9146	333.5489	321.8613	302.6783	282.4618	263.6227	251.8072	255.6144	265.8483	285.1647	307.3588	324.7142	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.4500	11.2829	0.7100	0.7000	0.7700	25.0652	(75)
Southwest	4.2300	36.7938	0.7100	0.7000	0.7700	53.6050	(79)
Northwest	1.3200	11.2829	0.7100	0.7000	0.7700	5.1296	(81)

Solar gains	83.7998	152.7716	235.6690	336.6583	417.8425	432.7486	409.7552	346.4472	270.2095	176.0280	102.1993	70.5333	(83)
Total gains	418.7144	486.3205	557.5303	639.3366	700.3043	696.3713	661.5623	602.0616	536.0578	461.1927	409.5582	395.2475	(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	46.2042	46.3225	46.4390	46.9943	47.0997	47.5964	47.5964	47.6896	47.4039	47.0997	46.8870	46.6667	
alpha	4.0803	4.0882	4.0959	4.1330	4.1400	4.1731	4.1731	4.1793	4.1603	4.1400	4.1258	4.1111	
util living area													
	0.9966	0.9932	0.9839	0.9538	0.8750	0.7262	0.5709	0.6370	0.8637	0.9736	0.9938	0.9973	(86)
MIT	19.3787	19.5563	19.8655	20.2866	20.6600	20.8946	20.9705	20.9541	20.7651	20.2821	19.7576	19.3505	(87)
Th 2	19.9129	19.9153	19.9177	19.9291	19.9312	19.9412	19.9412	19.9430	19.9374	19.9312	19.9269	19.9224	(88)
util rest of house													
	0.9956	0.9912	0.9791	0.9389	0.8334	0.6397	0.4475	0.5131	0.8020	0.9625	0.9916	0.9965	(89)
MIT 2	18.4352	18.6138	18.9224	19.3423	19.6894	19.8868	19.9321	19.9271	19.7934	19.3458	18.8241	18.4143	(90)
Living area fraction									fLA = Living area / (4) =			0.1859	(91)
MIT	18.6106	18.7891	19.0978	19.5179	19.8699	20.0742	20.1252	20.1181	19.9741	19.5199	18.9977	18.5884	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6106	18.7891	19.0978	19.5179	19.8699	20.0742	20.1252	20.1181	19.9741	19.5199	18.9977	18.5884	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9884	0.9742	0.9317	0.8306	0.6516	0.4701	0.5352	0.8045	0.9567	0.9890	0.9952	(94)
Useful gains	416.1682	480.6904	543.1294	595.6626	581.7027	453.7490	310.9894	322.2390	431.2622	441.2253	405.0683	393.3407	(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													
	1334.2315	1291.6245	1168.5972	973.3006	747.2266	495.4480	319.0507	335.8524	533.8012	815.8231	1093.1133	1328.1898	(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													
	683.0391	544.9477	465.3480	271.8993	123.1498	0.0000	0.0000	0.0000	0.0000	278.7008	495.3924	695.5277	(98)
Space heating												3558.0048	(98)
Space heating per m2											(98) / (4) =	46.1360	(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	850.7626	669.7493	686.5071	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8303	0.8931	0.8605	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	706.3919	598.1267	590.7324	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	903.8699	861.3748	793.4416	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	142.1842	195.8566	150.8157	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												488.8564 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	35.5460	48.9641	37.7039	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												122.2141 (107)
Space cooling per m2												1.5847 (108)
Energy for space heating												46.1360 (99)
Energy for space cooling												1.5847 (108)
Total												47.7207 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.7 (109)

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	38.5600 (1b)	x	2.3300 (2b)	=	89.8448	(1b) - (3b)
First floor	38.5600 (1c)	x	2.5600 (2c)	=	98.7136	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.1200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	188.5584	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1591	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4091	(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) =	0.3477	(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	0.4434	0.4347	0.4260	0.3825	0.3738	0.3303	0.3303	0.3217	0.3477	0.3738	0.3912	0.4086	(22b)
Effective ac	0.5983	0.5945	0.5907	0.5732	0.5699	0.5546	0.5546	0.5517	0.5605	0.5699	0.5765	0.5835	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			12.0000	1.3258	15.9091			(27)
150mm Platinum			38.5600	0.1300	5.0128			(28a)
50 mm A. Platinum	85.9300	13.9700	71.9600	0.1800	12.9528			(29a)
400mm Mineral wool	38.5600		38.5600	0.1300	5.0128			(30)
Total net area of external elements Aum(A, m2)			163.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.8575			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2829	(36)
Total fabric heat loss (33) + (36) =	50.1404	(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	37.2279	36.9904	36.7576	35.6643	35.4597	34.5074	34.5074	34.3311	34.8742	35.4597	35.8735	36.3062	(38)
Heat transfer coeff	87.3683	87.1308	86.8980	85.8047	85.6001	84.6478	84.6478	84.4715	85.0146	85.6001	86.0139	86.4466	(39)
Average = Sum(39)m / 12 =												85.8037	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1329	1.1298	1.1268	1.1126	1.1100	1.0976	1.0976	1.0953	1.1024	1.1100	1.1153	1.1209	(40)
HLP (average)												1.1126	(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	2.4059	(42)
Average daily hot water use (litres/day)	91.3412	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.4753	96.8216	93.1680	89.5143	85.8607	82.2071	82.2071	85.8607	89.5143	93.1680	96.8216	100.4753	(44)
Energy conte	149.0020	130.3181	134.4766	117.2399	112.4945	97.0742	89.9535	103.2230	104.4558	121.7331	132.8812	144.3004	(45)
Energy content (annual)										Total = Sum(45)m =		1437.1523	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.6629	27.6926	28.5763	24.9135	23.9051	20.6283	19.1151	21.9349	22.1969	25.8683	28.2373	30.6638	(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	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	120.2972	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9515	17.7207	14.4115	10.9104	8.1557	6.8853	7.4399	9.6706	12.9799	16.4809	19.2357	20.5060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	213.3163	215.5298	209.9517	198.0767	183.0865	168.9978	159.5858	157.3722	162.9503	174.8254	189.8156	203.9042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	35.0297	(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)													
	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	-96.2378	(71)
Water heating gains (Table 5)													
	42.5577	41.2092	38.4090	34.6021	32.1305	28.6504	25.6924	29.4824	30.8290	34.7692	39.2184	41.2148	(72)
Total internal gains													
	334.9146	333.5489	321.8613	302.6783	282.4618	263.6227	251.8072	255.6144	265.8483	285.1647	307.3588	324.7142	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.4500	11.2829	0.6300	0.7000	0.7700	22.2410	(75)
Southwest	4.2300	36.7938	0.6300	0.7000	0.7700	47.5650	(79)
Northwest	1.3200	11.2829	0.6300	0.7000	0.7700	4.5516	(81)

Solar gains	74.3576	135.5579	209.1147	298.7249	370.7617	383.9882	363.5856	307.4109	239.7634	156.1939	90.6839	62.5859	(83)
Total gains	409.2722	469.1068	530.9760	601.4032	653.2235	647.6109	615.3927	563.0253	505.6117	441.3586	398.0427	387.3001	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2986	61.4657	61.6303	62.4157	62.5648	63.2687	63.2687	63.4008	62.9957	62.5648	62.2638	61.9522	
alpha	5.0866	5.0977	5.1087	5.1610	5.1710	5.2179	5.2179	5.2267	5.1997	5.1710	5.1509	5.1301	
util living area													
	0.9989	0.9975	0.9930	0.9740	0.9085	0.7562	0.5870	0.6560	0.8941	0.9864	0.9977	0.9992	(86)
MIT	19.7170	19.8573	20.1038	20.4452	20.7514	20.9360	20.9862	20.9763	20.8347	20.4420	20.0214	19.6958	(87)
Th 2	19.9741	19.9766	19.9790	19.9905	19.9927	20.0028	20.0028	20.0047	19.9989	19.9927	19.9883	19.9838	(88)
util rest of house													
	0.9985	0.9966	0.9903	0.9634	0.8707	0.6680	0.4633	0.5306	0.8353	0.9792	0.9967	0.9989	(89)
MIT 2	18.8004	18.9424	19.1896	19.5341	19.8196	19.9724	19.9992	19.9976	19.9016	19.5366	19.1160	18.7869	(90)
Living area fraction									fLA = Living area / (4) =			0.1859	(91)
MIT	18.9708	19.1125	19.3596	19.7035	19.9929	20.1516	20.1827	20.1796	20.0751	19.7049	19.2843	18.9559	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9708	19.1125	19.3596	19.7035	19.9929	20.1516	20.1827	20.1796	20.0751	19.7049	19.2843	18.9559	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9956	0.9881	0.9595	0.8707	0.6824	0.4865	0.5540	0.8407	0.9764	0.9958	0.9985	(94)
Useful gains	408.4337	467.0337	524.6839	577.0672	568.7548	441.9288	299.3887	311.9252	425.0426	430.9315	396.3526	386.7038	(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													
	1281.7666	1238.3467	1117.4764	926.9933	709.8703	469.9283	303.2682	319.2659	507.9737	779.3818	1048.0218	1275.5995	(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													
	649.7596	518.3223	441.0376	251.9468	104.9900	0.0000	0.0000	0.0000	0.0000	259.2470	469.2018	661.3384	(98)
Space heating												3355.8436	(98)
Space heating per m2											(98) / (4) =	43.5146	(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	795.6896	626.3939	641.9832	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8641	0.9249	0.8961	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	687.5932	579.3443	575.2592	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	846.8772	807.4104	747.8148	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	114.6845	169.6811	128.3813	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												412.7470	(104)

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	28.6711	42.4203	32.0953	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												103.1867 (107)
Space cooling per m2												1.3380 (108)
Energy for space heating												43.5146 (99)
Energy for space cooling												1.3380 (108)
Total												44.8526 (109)
Target Fabric Energy Efficiency (TFEE)												51.6 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Hesketh Detached PV	**Issued on Date**	23/02/2022
Assessment Reference	2	**Prop Type Ref**	
Property	Hesketh , Detached, 2016 Classic Range, Barratt Developments plc		

SAP Rating	93 A	**DER**	8.09	**TER**	15.77
Environmental	93 A	**% DER<TER**	48.71		
CO_2 Emissions (t/year)	0.72	**DFEE**	47.60	**TFEE**	51.72
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.98		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Detached House, total floor area 121 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.77 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.09 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.6 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H15

Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.20 kWh/day
Permitted by DBSCG 2.10 OK
Primary pipework insulated: Yes OK
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Midlands): Slight OK
Based on:
Overshading: Average
Windows facing North: 1.32 m², No overhang
Windows facing East: 3.08 m², No overhang
Windows facing South: 9.46 m², No overhang
Windows facing West: 7.49 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
External wall U-value 0.12 W/m²K
Roof U-value 0.12 W/m²K
Roof U-value 0.12 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 2.75 kW

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	43.4900 (1b)	x	2.3300 (2b)	=	101.3317	(1b) - (3b)
First floor	43.4900 (1c)	x	2.5500 (2c)	=	110.8995	(1c) - (3c)
Second floor	34.1900 (1d)	x	2.3200 (2d)	=	79.3208	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	291.5520	(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							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/	(5) =	0.1715	(8)
Pressure test				Yes	
Measured/design AP50				5.0100	
Infiltration rate				0.4220	(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) =			0.3587	(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	0.4573	0.4484	0.4394	0.3946	0.3856	0.3408	0.3408	0.3318	0.3587	0.3856	0.4035	0.4215	(22b)
Effective ac	0.6046	0.6005	0.5965	0.5778	0.5743	0.5581	0.5581	0.5550	0.5643	0.5743	0.5814	0.5888	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1700	1.0000	2.1700			(26)
Opening Type 2 (Uw = 1.41)			4.4100	1.3347	5.8861			(27)
Opening Type 3 (Uw = 1.41)			16.9400	1.3347	22.6102			(27)
Opening Type 20 (Uw = 1.80)			1.8400	1.6791	3.0896			(27a)
150mm TE Platinum GF			43.4900	0.1600	6.9584			(28a)
50mm A Platinum	136.1100	23.5200	112.5900	0.2700	30.3993			(29a)
I-Roof Gable	18.6600		18.6600	0.2500	4.6650			(29a)
Wall to Roofspace	27.7000		27.7000	0.1200	3.3240			(29a)
Ceiling to Ridge	15.3300		15.3300	0.1200	1.8396			(30)
Ceiling to Roofspace	9.3300		9.3300	0.1200	1.1196			(30)
I-roof	25.5100	1.8400	23.6700	0.1600	3.7872			(30)
Total net area of external elements Aum(A, m2)			276.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		85.8490			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		121.0400	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.0781	(36)
Total fabric heat loss	(33) + (36) =	99.9271	(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	58.1679	57.7771	57.3942	55.5954	55.2588	53.6921	53.6921	53.4020	54.2956	55.2588	55.9396	56.6514	(38)
Heat transfer coeff	158.0950	157.7042	157.3213	155.5224	155.1859	153.6192	153.6192	153.3290	154.2227	155.1859	155.8667	156.5785	(39)
Average = Sum(39)m / 12 =												155.5208	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3047	1.3015	1.2984	1.2835	1.2807	1.2678	1.2678	1.2654	1.2728	1.2807	1.2863	1.2922	(40)
HLP (average)												1.2835	(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	2.8677	(42)
Average daily hot water use (litres/day)	102.3084	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.5393	108.4469	104.3546	100.2623	96.1699	92.0776	92.0776	96.1699	100.2623	104.3546	108.4469	112.5393	(44)
Energy conte	166.8925	145.9652	150.6231	131.3168	126.0016	108.7298	100.7542	115.6169	116.9977	136.3496	148.8362	161.6265	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1609.7101	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0339	21.8948	22.5935	19.6975	18.9002	16.3095	15.1131	17.3425	17.5497	20.4524	22.3254	24.2440	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6480	(55)
Total storage loss													
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(56)
If cylinder contains dedicated solar storage													
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	210.2429	185.1204	193.9735	173.2688	169.3520	150.6818	144.1046	158.9673	158.9497	179.7000	190.7882	204.9769	(62)
WWHRS	-20.2987	-17.8608	-18.2290	-14.9945	-13.9207	-11.4825	-9.7155	-11.7641	-12.1084	-14.9711	-17.3457	-19.6205	eq.(G10)
Total of WWHRS savings												-182.3114	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
											Solar input (sum of months) = Sum(63)m =	0.0000	(63)
Output from w/h													
	189.9442	167.2596	175.7445	158.2744	155.4313	139.1993	134.3891	147.2032	146.8413	164.7289	173.4425	185.3564	(64)
											Total per year (kWh/year) = Sum(64)m =	1937.8147	(64)
Heat gains from water heating, kWh/month													
	90.1721	79.8576	84.7625	77.2244	76.5759	69.7143	68.1811	73.1229	72.4633	80.0165	83.0496	88.4211	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.8234	22.9361	18.6529	14.1215	10.5560	8.9118	9.6295	12.5168	16.8000	21.3315	24.8970	26.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	286.7286	289.7039	282.2062	266.2443	246.0953	227.1581	214.5068	211.5315	219.0293	234.9912	255.1402	274.0774	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	(71)
Water heating gains (Table 5)													
	121.1990	118.8357	113.9281	107.2562	102.9245	96.8254	91.6412	98.2835	100.6435	107.5491	115.3467	118.8456	(72)
Total internal gains													
	502.7669	500.4917	483.8030	456.6378	428.5917	401.9111	384.7934	391.3477	405.4887	432.8876	464.3997	488.4800	(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	
West	4.4100	19.6403	0.7100	0.7000	0.7700	29.8315	(80)
North	1.3200	10.6334	0.7100	0.7000	0.7700	4.8343	(74)
East	3.0800	19.6403	0.7100	0.7000	0.7700	20.8347	(76)
South	9.4600	46.7521	0.7100	0.7000	0.7700	152.3286	(78)
West	3.0800	19.6403	0.7100	0.7000	0.7700	20.8347	(80)
South	1.8400	47.6975	0.7600	0.7000	1.0000	42.0211	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	270.6850	473.1164	671.8484	861.3329	982.2932	980.5416	943.2933	853.7934	738.4088	530.2244	326.5919	230.0161	(83)
Total gains	773.4520	973.6081	1155.6514	1317.9707	1410.8848	1382.4527	1328.0868	1245.1410	1143.8974	963.1120	790.9916	718.4961	(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	25.7694	25.8332	25.8961	26.1956	26.2524	26.5202	26.5202	26.5703	26.4164	26.2524	26.1377	26.0189	
alpha	2.7180	2.7222	2.7264	2.7464	2.7502	2.7680	2.7680	2.7714	2.7611	2.7502	2.7425	2.7346	
util living area	0.9746	0.9533	0.9161	0.8471	0.7416	0.6006	0.4671	0.5089	0.7071	0.8861	0.9590	0.9789	(86)
MIT	18.6433	18.9856	19.4698	20.0377	20.5006	20.8069	20.9299	20.9094	20.6780	20.0431	19.2314	18.5835	(87)
Th 2	19.8371	19.8396	19.8421	19.8538	19.8560	19.8661	19.8661	19.8680	19.8622	19.8560	19.8515	19.8469	(88)
util rest of house	0.9700	0.9450	0.9010	0.8189	0.6924	0.5217	0.3615	0.4029	0.6361	0.8587	0.9503	0.9751	(89)
MIT 2	16.7152	17.2096	17.9029	18.7043	19.3237	19.7037	19.8261	19.8124	19.5647	18.7330	17.5779	16.6340	(90)
Living area fraction									fLA = Living area / (4) =			0.1310	(91)
MIT	16.9677	17.4422	18.1081	18.8789	19.4778	19.8482	19.9707	19.9561	19.7105	18.9046	17.7944	16.8893	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.8177	17.2922	17.9581	18.7289	19.3278	19.6982	19.8207	19.8061	19.5605	18.7546	17.6444	16.7393	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9511	0.9186	0.8680	0.7848	0.6662	0.5088	0.3570	0.3967	0.6143	0.8240	0.9254	0.9585	(94)
Useful gains	735.6400	894.3750	1003.1293	1034.3754	939.8883	703.3791	474.0718	493.8932	702.6924	793.6332	731.9509	688.6447	(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													
	1978.9904	1954.3015	1802.6095	1528.6185	1183.7338	783.1821	494.7543	522.2535	842.1347	1265.4720	1643.5270	1963.3926	(97)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	925.0527	712.2706	594.8132	355.8551	181.4211	0.0000	0.0000	0.0000	0.0000	351.0481	656.3348	948.4125	(98)
Space heating												4725.2080	(98)
Space heating per m2											(98) / (4) =	38.9965	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5227.0000	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	925.0527	712.2706	594.8132	355.8551	181.4211	0.0000	0.0000	0.0000	0.0000	351.0481	656.3348	948.4125	(98)
Space heating efficiency (main heating system 1)													
	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)													
	1023.2884	787.9100	657.9792	393.6450	200.6870	0.0000	0.0000	0.0000	0.0000	388.3276	726.0340	1049.1289	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	189.9442	167.2596	175.7445	158.2744	155.4313	139.1993	134.3891	147.2032	146.8413	164.7289	173.4425	185.3564	(64)
Efficiency of water heater												79.7000	(216)
(217)m	88.3787	88.1495	87.7142	86.8121	85.1266	79.7000	79.7000	79.7000	79.7000	86.6832	87.9324	88.4585	(217)
Fuel for water heating, kWh/month													
	214.9207	189.7455	200.3603	182.3184	182.5884	174.6541	168.6186	184.6966	184.2425	190.0355	197.2452	209.5407	(219)
Water heating fuel used												2278.9666	(219)
Annual totals kWh/year													
Space heating fuel - main system												5227.0000	(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)												456.0498	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.75 * 1004 * 0.80) =										-1767.0333		-1767.0333	(233)
Total delivered energy for all uses												6269.9831	(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	5227.0000	0.2160	1129.0320	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2278.9666	0.2160	492.2568	(264)
Space and water heating			1621.2888	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	456.0498	0.5190	236.6898	(268)
Energy saving/generation technologies				
PV Unit	-1767.0333	0.5190	-917.0903	(269)
Total CO2, kg/year			979.8133	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.0900	(273)

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

DER		8.0900	ZC1
Total Floor Area	TFA	121.1700	
Assumed number of occupants	N	2.8677	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0224	ZC2
CO2 emissions from cooking, equation (L16)		1.5501	ZC3
Total CO2 emissions		23.6625	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.6625	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	43.4900 (1b)	x	2.3300 (2b)	=	101.3317	(1b) - (3b)
First floor	43.4900 (1c)	x	2.5500 (2c)	=	110.8995	(1c) - (3c)
Second floor	34.1900 (1d)	x	2.3200 (2d)	=	79.3208	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	291.5520	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1372	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3872	(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) =		0.3291	(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	0.4196	0.4114	0.4032	0.3620	0.3538	0.3127	0.3127	0.3044	0.3291	0.3538	0.3703	0.3867	(22b)
Effective ac	0.5880	0.5846	0.5813	0.5655	0.5626	0.5489	0.5489	0.5463	0.5542	0.5626	0.5685	0.5748	(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			2.1700	1.0000	2.1700			(26)
TER Opening Type (Uw = 1.40)			21.3500	1.3258	28.3049			(27)
TER Room Window (Uw = 1.70)			1.8400	1.5918	2.9288			(27a)
150mm TE Platinum GF			43.4900	0.1300	5.6537			(28a)
50mm A Platinum	136.1100	23.5200	112.5900	0.1800	20.2662			(29a)
I-Roof Gable	18.6600		18.6600	0.1800	3.3588			(29a)
Wall to Roofspace	27.7000		27.7000	0.1800	4.9860			(29a)
Ceiling to Ridge	15.3300		15.3300	0.1300	1.9929			(30)
Ceiling to Roofspace	9.3300		9.3300	0.1300	1.2129			(30)
I-roof	25.5100	1.8400	23.6700	0.1300	3.0771			(30)
Total net area of external elements Aum(A, m2)			276.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.9514			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3061	(36)
Total fabric heat loss (33) + (36) =	88.2575	(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	56.5768	56.2479	55.9255	54.4111	54.1278	52.8088	52.8088	52.5645	53.3168	54.1278	54.7010	55.3002	(38)
Heat transfer coeff	144.8343	144.5054	144.1829	142.6686	142.3852	141.0663	141.0663	140.8220	141.5743	142.3852	142.9584	143.5577	(39)
Average = Sum(39)m / 12 =												142.6672	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1953	1.1926	1.1899	1.1774	1.1751	1.1642	1.1642	1.1622	1.1684	1.1751	1.1798	1.1848	(40)
HLP (average)												1.1774	(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	2.8677 (42)
Average daily hot water use (litres/day)	102.3084 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.5393	108.4469	104.3546	100.2623	96.1699	92.0776	92.0776	96.1699	100.2623	104.3546	108.4469	112.5393	(44)
Energy conte	166.8925	145.9652	150.6231	131.3168	126.0016	108.7298	100.7542	115.6169	116.9977	136.3496	148.8362	161.6265	(45)
Energy content (annual)										Total = Sum(45)m =		1609.7101	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
              25.0339    21.8948    22.5935    19.6975    18.9002    16.3095    15.1131    17.3425    17.5497    20.4524    22.3254    24.2440 (46)
Water storage loss:
Store volume                                                                                                                            180.0000 (47)
a) If  manufacturer declared loss factor is known  (kWh/day):                                                                             1.5520 (48)
  Temperature factor from Table 2b                                                                                                        0.5400 (49)
Enter (49) or (54) in (55)                                                                                                                0.8381 (55)
Total storage loss
              25.9803    23.4661    25.9803    25.1422    25.9803    25.1422    25.9803    25.9803    25.1422    25.9803    25.1422    25.9803 (56)
If cylinder contains dedicated solar storage
              25.9803    23.4661    25.9803    25.1422    25.9803    25.1422    25.9803    25.9803    25.1422    25.9803    25.1422    25.9803 (57)
Primary loss  23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
             216.1352   190.4425   199.8657   178.9710   175.2443   156.3840   149.9968   164.8596   164.6519   185.5922   196.4904   210.8691 (62)
Solar input    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                          Solar input (sum of months) = Sum(63)m =        0.0000 (63)
Output from w/h
             216.1352   190.4425   199.8657   178.9710   175.2443   156.3840   149.9968   164.8596   164.6519   185.5922   196.4904   210.8691 (64)
                                                                                            Total per year (kWh/year) = Sum(64)m =     2189.5028 (64)
Heat gains from water heating, kWh/month
              94.8859    84.1152    89.4763    81.7862    81.2897    74.2760    72.8949    77.8367    77.0251    84.7304    87.6114    93.1349 (65)
```

---

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

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m        143.3862   143.3862   143.3862   143.3862   143.3862   143.3862   143.3862   143.3862   143.3862   143.3862   143.3862   143.3862 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              25.8234    22.9361    18.6529    14.1215    10.5560     8.9118     9.6295    12.5168    16.8000    21.3315    24.8970    26.5411 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             286.7286   289.7039   282.2062   266.2443   246.0953   227.1581   214.5068   211.5315   219.0293   234.9912   255.1402   274.0774 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.3386    37.3386    37.3386    37.3386    37.3386    37.3386    37.3386    37.3386    37.3386    37.3386    37.3386    37.3386 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -114.7089  -114.7089  -114.7089  -114.7089  -114.7089  -114.7089  -114.7089  -114.7089  -114.7089  -114.7089  -114.7089  -114.7089 (71)
Water heating gains (Table 5)
             127.5348   125.1715   120.2639   113.5920   109.2603   103.1611    97.9770   104.6193   106.9793   113.8849   121.6825   125.1814 (72)
Total internal gains
             509.1027   506.8274   490.1388   462.9736   434.9274   408.2469   391.1292   397.6834   411.8244   439.2234   470.7355   494.8157 (73)
```

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896	(74)
East	3.0800	19.6403	0.6300	0.7000	0.7700	18.4871	(76)
South	9.4600	46.7521	0.6300	0.7000	0.7700	135.1648	(78)
West	7.4900	19.6403	0.6300	0.7000	0.7700	44.9574	(80)
South	1.8400	47.6975	0.6300	0.7000	1.0000	34.8333	(82)

```
Solar gains  237.7323   415.4566   589.8416   756.0502   862.1359   860.5705   827.8905   749.3942   648.2222   465.5669   286.8207   202.0229 (83)
Total gains  746.8350   922.2841  1079.9804  1219.0237  1297.0633  1268.8174  1219.0197  1147.0776  1060.0466   904.7903   757.5561   696.8386 (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, ni1,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          58.0980    58.2303    58.3605    58.9799    59.0973    59.6499    59.6499    59.7533    59.4358    59.0973    58.8604    58.6147
alpha         4.8732     4.8820     4.8907     4.9320     4.9398     4.9767     4.9767     4.9836     4.9624     4.9398     4.9240     4.9076
util living area
              0.9977     0.9934     0.9805     0.9395     0.8401     0.6681     0.5003     0.5500     0.7965     0.9639     0.9946     0.9984 (86)

MIT          19.7135    19.9153    20.2061    20.5519    20.8191    20.9574    20.9917    20.9869    20.8977    20.5304    20.0490    19.6783 (87)
Th 2         19.9238    19.9259    19.9281    19.9381    19.9400    19.9487    19.9487    19.9504    19.9454    19.9400    19.9362    19.9322 (88)
util rest of house
              0.9970     0.9911     0.9737     0.9182     0.7874     0.5757     0.3854     0.4319     0.7157     0.9469     0.9924     0.9978 (89)
MIT 2        18.2143    18.5097    18.9312    19.4236    19.7682    19.9215    19.9458    19.9452    19.8675    19.4053    18.7131    18.1689 (90)
Living area fraction                                                                                    fLA = Living area / (4) =         0.1310 (91)
MIT          18.4106    18.6938    19.0982    19.5714    19.9059    20.0571    20.0828    20.0817    20.0024    19.5527    18.8881    18.3666 (92)
Temperature adjustment                                                                                                                    0.0000
adjusted MIT 18.4106    18.6938    19.0982    19.5714    19.9059    20.0571    20.0828    20.0817    20.0024    19.5527    18.8881    18.3666 (93)
```

---

8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation   0.9953     0.9874     0.9666     0.9091     0.7854     0.5858     0.4004     0.4472     0.7207     0.9386     0.9892     0.9966 (94)
Useful gains 743.3165   910.6495  1043.8566  1108.2014  1018.7700   743.2973   488.1040   512.9834   763.9358   849.2491   749.3496   694.4460 (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
             2043.7054  1993.2793  1816.4422  1522.4700  1168.3951   769.8183   491.3038   518.4606   835.6267  1274.7321  1685.2081  2033.7191 (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
              967.4893   727.5272   574.8037   298.2734   111.3211     0.0000     0.0000     0.0000     0.0000   316.5594   673.8181   996.4192 (98)
Space heating                                                                                                                          4666.2115 (98)
```


ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating per m2 (98) / (4) = 38.5096 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.5000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4990.6005 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	967.4893	727.5272	574.8037	298.2734	111.3211	0.0000	0.0000	0.0000	0.0000	316.5594	673.8181	996.4192	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1034.7480	778.1040	614.7633	319.0090	119.0600	0.0000	0.0000	0.0000	0.0000	338.5662	720.6611	1065.6890	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	216.1352	190.4425	199.8657	178.9710	175.2443	156.3840	149.9968	164.8596	164.6519	185.5922	196.4904	210.8691	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.3371	88.0507	87.4739	86.1672	83.6416	79.8000	79.8000	79.8000	79.8000	86.2268	87.8408	88.4290	(217)
Fuel for water heating, kWh/month	244.6709	216.2874	228.4861	207.7020	209.5181	195.9700	187.9660	206.5909	206.3307	215.2372	223.6891	238.4615	(219)
Water heating fuel used												2580.9098	(219)

Annual totals kWh/year	
Space heating fuel - main system	4990.6005 (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)	456.0498 (232)
Total delivered energy for all uses	8102.5601 (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	4990.6005	0.2160	1077.9697	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2580.9098	0.2160	557.4765	(264)
Space and water heating			1635.4462	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	456.0498	0.5190	236.6898	(268)
Total CO2, kg/m2/year			1911.0611	(272)
Emissions per m2 for space and water heating			13.4971	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9534	(272b)
Emissions per m2 for pumps and fans			0.3212	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.4971 * 1.00) + 1.9534 + 0.3212, rounded to 2 d.p.			15.7700	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	43.4900 (1b)	x	2.3300 (2b)	=	101.3317	(1b) - (3b)
First floor	43.4900 (1c)	x	2.5500 (2c)	=	110.8995	(1c) - (3c)
Second floor	34.1900 (1d)	x	2.3200 (2d)	=	79.3208	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	291.5520	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/	(5) =	0.1372	(8)
Pressure test				Yes	
Measured/design AP50				5.0100	
Infiltration rate				0.3877	(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) =			0.3295	(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	0.4202	0.4119	0.4037	0.3625	0.3543	0.3131	0.3131	0.3048	0.3295	0.3543	0.3707	0.3872	(22b)
Effective ac	0.5883	0.5848	0.5815	0.5657	0.5627	0.5490	0.5490	0.5465	0.5543	0.5627	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1700	1.0000	2.1700			(26)
Opening Type 2 (Uw = 1.41)			4.4100	1.3347	5.8861			(27)
Opening Type 3 (Uw = 1.41)			16.9400	1.3347	22.6102			(27)
Opening Type 20 (Uw = 1.80)			1.8400	1.6791	3.0896			(27a)
150mm TE Platinum GF			43.4900	0.1600	6.9584			(28a)
50mm A Platinum	136.1100	23.5200	112.5900	0.2700	30.3993			(29a)
I-Roof Gable	18.6600		18.6600	0.2500	4.6650			(29a)
Wall to Roofspace	27.7000		27.7000	0.1200	3.3240			(29a)
Ceiling to Ridge	15.3300		15.3300	0.1200	1.8396			(30)
Ceiling to Roofspace	9.3300		9.3300	0.1200	1.1196			(30)
I-roof	25.5100	1.8400	23.6700	0.1600	3.7872			(30)
Total net area of external elements Aum(A, m2)			276.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		85.8490			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		121.0400	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.0781	(36)
Total fabric heat loss	(33) + (36) =	99.9271	(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	56.5987	56.2689	55.9457	54.4274	54.1433	52.8209	52.8209	52.5761	53.3303	54.1433	54.7180	55.3188	(38)
Heat transfer coeff	156.5258	156.1960	155.8728	154.3545	154.0704	152.7480	152.7480	152.5032	153.2574	154.0704	154.6451	155.2459	(39)
Average = Sum(39)m / 12 =												154.3531	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2918	1.2891	1.2864	1.2739	1.2715	1.2606	1.2606	1.2586	1.2648	1.2715	1.2763	1.2812	(40)
HLP (average)												1.2739	(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	2.8677	(42)
Average daily hot water use (litres/day)	102.3084	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.5393	108.4469	104.3546	100.2623	96.1699	92.0776	92.0776	96.1699	100.2623	104.3546	108.4469	112.5393	(44)
Energy conte	166.8925	145.9652	150.6231	131.3168	126.0016	108.7298	100.7542	115.6169	116.9977	136.3496	148.8362	161.6265	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1609.7101	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.4647	31.0176	32.0074	27.9048	26.7753	23.1051	21.4103	24.5686	24.8620	28.9743	31.6277	34.3456	(65)

---

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.8234	22.9361	18.6529	14.1215	10.5560	8.9118	9.6295	12.5168	16.8000	21.3315	24.8970	26.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	286.7286	289.7039	282.2062	266.2443	246.0953	227.1581	214.5068	211.5315	219.0293	234.9912	255.1402	274.0774	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	(71)
Water heating gains (Table 5)													
	47.6675	46.1572	43.0207	38.7567	35.9884	32.0904	28.7772	33.0223	34.5306	38.9439	43.9274	46.1635	(72)
Total internal gains													
	426.2354	424.8131	409.8956	385.1383	358.6555	334.1761	318.9294	323.0864	336.3757	361.2824	389.9803	412.7978	(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	
West	4.4100	19.6403	0.7100	0.7000	0.7700	29.8315	(80)
North	1.3200	10.6334	0.7100	0.7000	0.7700	4.8343	(74)
East	3.0800	19.6403	0.7100	0.7000	0.7700	20.8347	(76)
South	9.4600	46.7521	0.7100	0.7000	0.7700	152.3286	(78)
West	3.0800	19.6403	0.7100	0.7000	0.7700	20.8347	(80)
South	1.8400	47.6975	0.7600	0.7000	1.0000	42.0211	(82)

Solar gains	270.6850	473.1164	671.8484	861.3329	982.2932	980.5416	943.2933	853.7934	738.4088	530.2244	326.5919	230.0161	(83)
Total gains	696.9205	897.9295	1081.7440	1246.4712	1340.9486	1314.7177	1262.2228	1176.8798	1074.7845	891.5068	716.5722	642.8139	(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	26.0277	26.0826	26.1367	26.3938	26.4425	26.6714	26.6714	26.7142	26.5828	26.4425	26.3442	26.2423	
alpha	2.7352	2.7388	2.7424	2.7596	2.7628	2.7781	2.7781	2.7809	2.7722	2.7628	2.7563	2.7495	
util living area													
	0.9801	0.9609	0.9262	0.8605	0.7581	0.6193	0.4848	0.5296	0.7289	0.9013	0.9672	0.9839	(86)
MIT	18.5784	18.9266	19.4195	19.9976	20.4748	20.7932	20.9239	20.9009	20.6536	19.9922	19.1650	18.5146	(87)
Th 2	19.8473	19.8494	19.8515	19.8614	19.8632	19.8718	19.8718	19.8734	19.8685	19.8632	19.8595	19.8556	(88)
util rest of house													
	0.9764	0.9538	0.9126	0.8341	0.7103	0.5404	0.3771	0.4218	0.6597	0.8767	0.9601	0.9809	(89)
MIT 2	17.6488	17.9936	18.4775	19.0390	19.4781	19.7518	19.8418	19.8313	19.6472	19.0487	18.2403	17.5912	(90)
Living area fraction										fLA = Living area / (4) =		0.1310	(91)
MIT	17.7705	18.1158	18.6008	19.1646	19.6086	19.8882	19.9835	19.9714	19.7790	19.1723	18.3614	17.7122	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7705	18.1158	18.6008	19.1646	19.6086	19.8882	19.9835	19.9714	19.7790	19.1723	18.3614	17.7122	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9671	0.9395	0.8939	0.8148	0.6982	0.5416	0.3885	0.4319	0.6534	0.8579	0.9472	0.9728	(94)
Useful gains	673.9654	843.6148	966.9943	1015.6804	936.2141	712.0864	490.3753	508.3419	702.2749	764.8222	678.7487	625.3536	(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													
	2108.4863	2064.2548	1886.1929	1584.3855	1218.4881	807.7612	516.8246	544.6458	870.3477	1320.7373	1741.5162	2097.7058	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1067.2836	820.2700	683.8838	409.4676	210.0118	0.0000	0.0000	0.0000	0.0000	413.6008	765.1926	1095.4301	(98)
Space heating												5465.1403	(98)
Space heating per m2											(98) / (4) =	45.1031	(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

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1435.8316	1130.3355	1159.0240	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7789	0.8404	0.8151	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1118.3592	949.9555	944.6971	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1624.4891	1561.6245	1466.6949	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	364.4135	455.0817	388.3663	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1207.8615	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	91.1034	113.7704	97.0916	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												301.9654	(107)
Space cooling per m2												2.4921	(108)
Energy for space heating												45.1031	(99)
Energy for space cooling												2.4921	(108)
Total												47.5952	(109)
Dwelling Fabric Energy Efficiency (DFEE)												47.6	(109)

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	43.4900 (1b)	x	2.3300 (2b)	=	101.3317	(1b) - (3b)
First floor	43.4900 (1c)	x	2.5500 (2c)	=	110.8995	(1c) - (3c)
Second floor	34.1900 (1d)	x	2.3200 (2d)	=	79.3208	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	291.5520	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1372	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3872	(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) =	0.3291	(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	0.4196	0.4114	0.4032	0.3620	0.3538	0.3127	0.3127	0.3044	0.3291	0.3538	0.3703	0.3867	(22b)
Effective ac	0.5880	0.5846	0.5813	0.5655	0.5626	0.5489	0.5489	0.5463	0.5542	0.5626	0.5685	0.5748	(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			2.1700	1.0000	2.1700			(26)
TER Opening Type (Uw = 1.40)			21.3500	1.3258	28.3049			(27)
TER Room Window (Uw = 1.70)			1.8400	1.5918	2.9288			(27a)
150mm TE Platinum GF			43.4900	0.1300	5.6537			(28a)
50mm A Platinum	136.1100	23.5200	112.5900	0.1800	20.2662			(29a)
I-Roof Gable	18.6600		18.6600	0.1800	3.3588			(29a)
Wall to Roofspace	27.7000		27.7000	0.1800	4.9860			(29a)
Ceiling to Ridge	15.3300		15.3300	0.1300	1.9929			(30)
Ceiling to Roofspace	9.3300		9.3300	0.1300	1.2129			(30)
I-roof	25.5100	1.8400	23.6700	0.1300	3.0771			(30)
Total net area of external elements Aum(A, m2)			276.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.9514			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3061	(36)
Total fabric heat loss (33) + (36) =	88.2575	(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	56.5768	56.2479	55.9255	54.4111	54.1278	52.8088	52.8088	52.5645	53.3168	54.1278	54.7010	55.3002	(38)
Heat transfer coeff	144.8343	144.5054	144.1829	142.6686	142.3852	141.0663	141.0663	140.8220	141.5743	142.3852	142.9584	143.5577	(39)
Average = Sum(39)m / 12 =												142.6672	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1953	1.1926	1.1899	1.1774	1.1751	1.1642	1.1642	1.1622	1.1684	1.1751	1.1798	1.1848	(40)
HLP (average)												1.1774	(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	2.8677 (42)
Average daily hot water use (litres/day)	102.3084 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.5393	108.4469	104.3546	100.2623	96.1699	92.0776	92.0776	96.1699	100.2623	104.3546	108.4469	112.5393	(44)
Energy conte	166.8925	145.9652	150.6231	131.3168	126.0016	108.7298	100.7542	115.6169	116.9977	136.3496	148.8362	161.6265	(45)
Energy content (annual)										Total = Sum(45)m =		1609.7101	(45)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.4647	31.0176	32.0074	27.9048	26.7753	23.1051	21.4103	24.5686	24.8620	28.9743	31.6277	34.3456 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	143.3862	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.8234	22.9361	18.6529	14.1215	10.5560	8.9118	9.6295	12.5168	16.8000	21.3315	24.8970	26.5411	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	286.7286	289.7039	282.2062	266.2443	246.0953	227.1581	214.5068	211.5315	219.0293	234.9912	255.1402	274.0774	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	37.3386	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	-114.7089	(71)

Water heating gains (Table 5)

	47.6675	46.1572	43.0207	38.7567	35.9884	32.0904	28.7772	33.0223	34.5306	38.9439	43.9274	46.1635	(72)

Total internal gains

	426.2354	424.8131	409.8956	385.1383	358.6555	334.1761	318.9294	323.0864	336.3757	361.2824	389.9803	412.7978	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896	(74)
East	3.0800	19.6403	0.6300	0.7000	0.7700	18.4871	(76)
South	9.4600	46.7521	0.6300	0.7000	0.7700	135.1648	(78)
West	7.4900	19.6403	0.6300	0.7000	0.7700	44.9574	(80)
South	1.8400	47.6975	0.6300	0.7000	1.0000	34.8333	(82)

Solar gains	237.7323	415.4566	589.8416	756.0502	862.1359	860.5705	827.8905	749.3942	648.2222	465.5669	286.8207	202.0229	(83)
Total gains	663.9677	840.2697	999.7373	1141.1885	1220.7913	1194.7466	1146.8199	1072.4806	984.5979	826.8493	676.8010	614.8207	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.0980	58.2303	58.3605	58.9799	59.0973	59.6499	59.6499	59.7533	59.4358	59.0973	58.8604	58.6147	
alpha	4.8732	4.8820	4.8907	4.9320	4.9398	4.9767	4.9767	4.9836	4.9624	4.9398	4.9240	4.9076	
util living area	0.9987	0.9956	0.9857	0.9519	0.8636	0.6993	0.5292	0.5836	0.8290	0.9744	0.9967	0.9991	(86)
MIT	19.6504	19.8540	20.1495	20.5064	20.7917	20.9479	20.9894	20.9831	20.8759	20.4791	19.9882	19.6156	(87)
Th 2	19.9238	19.9259	19.9281	19.9381	19.9400	19.9487	19.9487	19.9504	19.9454	19.9400	19.9362	19.9322	(88)
util rest of house	0.9982	0.9940	0.9805	0.9340	0.8147	0.6063	0.4090	0.4606	0.7528	0.9616	0.9953	0.9988	(89)
MIT 2	18.6937	18.8983	19.1926	19.5456	19.8021	19.9254	19.9461	19.9457	19.8786	19.5273	19.0409	18.6657	(90)
Living area fraction									fLA = Living area / (4) =			0.1310	(91)
MIT	18.8190	19.0235	19.3179	19.6714	19.9317	20.0593	20.0828	20.0816	20.0093	19.6520	19.1649	18.7901	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8190	19.0235	19.3179	19.6714	19.9317	20.0593	20.0828	20.0816	20.0093	19.6520	19.1649	18.7901	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9922	0.9766	0.9284	0.8143	0.6168	0.4248	0.4767	0.7581	0.9569	0.9939	0.9983	(94)
Useful gains	662.3156	833.7415	976.3765	1059.5221	994.0559	736.9518	487.1414	511.1998	746.4171	791.2182	672.6773	613.7599	(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

	2102.8521	2040.9235	1848.1237	1536.7455	1172.0788	770.1299	491.3009	518.4486	836.5983	1288.8705	1724.7854	2094.5192	(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

	1071.7591	811.2263	648.5799	343.6009	132.4491	0.0000	0.0000	0.0000	0.0000	370.2533	757.5179	1101.6849	(98)

Space heating 5237.0714 (98)

Space heating per m2 (98) / (4) = 43.2209 (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

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	1326.0228	1043.8903	1070.2472	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8770	0.9337	0.9130	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1162.9249	974.6473	977.1140	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1488.9567	1431.2479	1348.7250	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	234.7429	339.7108	276.4785	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												850.9322 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	58.6857	84.9277	69.1196	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												212.7330 (107)
Space cooling per m2												1.7557 (108)
Energy for space heating												43.2209 (99)
Energy for space cooling												1.7557 (108)
Total												44.9765 (109)
Target Fabric Energy Efficiency (TFEE)												51.7 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Kenley End-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Kenley DS01 (Hipped), EOT, BKNL 00HE, Part L2013 Masonry		

SAP Rating	83 B	**DER**	19.52	**TER**	20.27
Environmental	87 B	**% DER<TER**	3.71		
CO_2 Emissions (t/year)	1.00	**DFEE**	51.26	**TFEE**	54.64
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.19		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 58 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) 20.27 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.52 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.35 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Midlands): Slight OK
Based on:
Overshading: Average
Windows facing North East: 6.14 m², No overhang
Windows facing South West: 3.30 m², No overhang
Windows facing North West: 1.32 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K

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	28.9900	(1b)	x 2.3300	(2b) =	67.5467	(1b) - (3b)
First floor	28.9900	(1c)	x 2.5600	(2c) =	74.2144	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.9800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	141.7611	(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							2 * 10	=	20.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1411	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3916	(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) =	0.3328	(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	0.4244	0.4161	0.4077	0.3661	0.3578	0.3162	0.3162	0.3079	0.3328	0.3578	0.3745	0.3911	(22b)
Effective ac	0.5900	0.5866	0.5831	0.5670	0.5640	0.5500	0.5500	0.5474	0.5554	0.5640	0.5701	0.5765	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			10.7600	1.3347	14.3616			(27)
150mm Platinum			28.9900	0.1500	4.3485			(28a)
50mm A. Platinum	74.4700	12.7300	61.7400	0.2700	16.6698			(29a)
400mm Mineral wool	28.9900		28.9900	0.1100	3.1889			(30)
Total net area of external elements Aum(A, m2)			132.4500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.5388			(33)
E-WM-22			35.4600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	205.2650	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.7996	(36)
Total fabric heat loss (33) + (36) =	48.3384	(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	27.6031	27.4396	27.2792	26.5261	26.3852	25.7293	25.7293	25.6078	25.9819	26.3852	26.6703	26.9683	(38)
Heat transfer coeff	75.9415	75.7779	75.6176	74.8645	74.7236	74.0677	74.0677	73.9462	74.3203	74.7236	75.0086	75.3066	(39)
Average = Sum(39)m / 12 =												74.8638	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3098	1.3070	1.3042	1.2912	1.2888	1.2775	1.2775	1.2754	1.2818	1.2888	1.2937	1.2988	(40)
HLP (average)												1.2912	(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	1.9240 (42)
Average daily hot water use (litres/day)	79.8946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.8841	84.6883	81.4925	78.2967	75.1009	71.9051	71.9051	75.1009	78.2967	81.4925	84.6883	87.8841	(44)
Energy conte	130.3295	113.9870	117.6244	102.5478	98.3971	84.9092	78.6808	90.2874	91.3657	106.4780	116.2290	126.2172	(45)
Energy content (annual)										Total = Sum(45)m =		1257.0531	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5494	17.0981	17.6437	15.3822	14.7596	12.7364	11.8021	13.5431	13.7049	15.9717	17.4344	18.9326	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0315	12.6570	13.9866	13.5055	13.9339	13.4593	13.8923	13.9193	13.4845	13.9648	13.5490	14.0228 (61)
Total heat required for water heating calculated for each month												
	144.3610	126.6440	131.6110	116.0533	112.3310	98.3685	92.5732	104.2067	104.8502	120.4428	129.7780	140.2400 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	144.3610	126.6440	131.6110	116.0533	112.3310	98.3685	92.5732	104.2067	104.8502	120.4428	129.7780	140.2400 (64)
								Total per year (kWh/year) = Sum(64)m =				1421.4596 (64)
Heat gains from water heating, kWh/month												
	46.8424	41.0649	42.6068	37.4735	36.2005	31.5971	29.6345	33.5004	33.7502	38.8951	42.0334	45.4729 (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	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.2101	13.5094	10.9866	8.3176	6.2175	5.2491	5.6718	7.3724	9.8952	12.5643	14.6644	15.6328	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.8252	169.5667	165.1782	155.8356	144.0421	132.9580	125.5531	123.8116	128.2001	137.5428	149.3362	160.4203	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	(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)													
	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	(71)
Water heating gains (Table 5)													
	62.9603	61.1085	57.2672	52.0466	48.6566	43.8849	39.8313	45.0274	46.8753	52.2784	58.3797	61.1195	(72)
Total internal gains													
	300.8553	299.0444	288.2917	271.0594	253.7760	236.9517	225.9159	231.0712	239.8304	257.2452	277.2400	292.0324	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.7100	0.7000	0.7700	23.8605	(75)
Southwest	3.3000	36.7938	0.7100	0.7000	0.7700	41.8195	(79)
Northwest	1.3200	11.2829	0.7100	0.7000	0.7700	5.1296	(81)

Solar gains	70.8096	130.2444	203.7834	295.3690	369.9690	384.5060	363.5418	305.2553	235.0845	150.8441	86.5672	59.4636 (83)
Total gains	371.6649	429.2888	492.0751	566.4284	623.7449	621.4577	589.4577	536.3265	474.9149	408.0893	363.8073	351.4960 (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	43.5323	43.6262	43.7187	44.1585	44.2418	44.6336	44.6336	44.7069	44.4819	44.2418	44.0737	43.8993	
alpha	3.9022	3.9084	3.9146	3.9439	3.9495	3.9756	3.9756	3.9805	3.9655	3.9495	3.9382	3.9266	
util living area													
	0.9941	0.9890	0.9756	0.9348	0.8386	0.6795	0.5281	0.5920	0.8280	0.9611	0.9896	0.9953	(86)
MIT	19.3599	19.5476	19.8739	20.3106	20.6851	20.9049	20.9732	20.9584	20.7806	20.2946	19.7503	19.3259	(87)
Th 2	19.8332	19.8354	19.8375	19.8477	19.8496	19.8585	19.8585	19.8602	19.8551	19.8496	19.8458	19.8417	(88)
util rest of house													
	0.9924	0.9858	0.9682	0.9143	0.7883	0.5863	0.4024	0.4636	0.7548	0.9448	0.9861	0.9939	(89)
MIT 2	17.6662	17.9405	18.4137	19.0382	19.5348	19.7909	19.8474	19.8408	19.6690	19.0293	18.2441	17.6222	(90)
Living area fraction									fLA = Living area / (4) =			0.2377	(91)
MIT	18.0688	18.3224	18.7607	19.3406	19.8082	20.0556	20.1150	20.1064	19.9331	19.3300	18.6021	18.0271	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9188	18.1724	18.6107	19.1906	19.6582	19.9056	19.9650	19.9564	19.7831	19.1800	18.4521	17.8771	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9881	0.9791	0.9573	0.8993	0.7785	0.5905	0.4147	0.4753	0.7493	0.9317	0.9796	0.9903	(94)
Useful gains	367.2464	420.3223	471.0706	509.3686	485.5707	366.9545	244.4732	254.8915	355.8597	380.1965	356.3779	348.0806	(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													
	1034.2292	1005.7583	915.7851	770.3994	594.6645	392.9756	249.2343	262.9806	422.3733	641.1302	851.5021	1029.9785	(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													
	496.2352	393.4130	330.8676	187.9421	81.1658	0.0000	0.0000	0.0000	0.0000	194.1347	356.4894	507.3320	(98)
Space heating												2547.5798	(98)
Space heating per m2											(98) / (4) =	43.9389	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2815.0053	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	496.2352	393.4130	330.8676	187.9421	81.1658	0.0000	0.0000	0.0000	0.0000	194.1347	356.4894	507.3320	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000		(210)
Space heating fuel (main heating system)													
	548.3262	434.7105	365.5996	207.6709	89.6860	0.0000	0.0000	0.0000	0.0000	214.5134	393.9109	560.5879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.3610	126.6440	131.6110	116.0533	112.3310	98.3685	92.5732	104.2067	104.8502	120.4428	129.7780	140.2400	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7586	89.6993	89.5657	89.2511	88.6143	87.3000	87.3000	87.3000	87.3000	89.2475	89.6232	89.7873	(217)
Fuel for water heating, kWh/month													
	160.8325	141.1872	146.9435	130.0302	126.7639	112.6787	106.0403	119.3662	120.1033	134.9537	144.8040	156.1914	(219)
Water heating fuel used												1599.8950	(219)
Annual totals kWh/year													
Space heating fuel - main system												2815.0053	(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)												268.6143	(232)
Total delivered energy for all uses												4758.5146	(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	2815.0053	0.2160	608.0411	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1599.8950	0.2160	345.5773	(264)
Space and water heating			953.6185	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	268.6143	0.5190	139.4108	(268)
Total CO2, kg/year			1131.9543	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.5200	(273)

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

DER		19.5200	ZC1
Total Floor Area	TFA	57.9800	
Assumed number of occupants	N	1.9240	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1524	ZC2
CO2 emissions from cooking, equation (L16)		2.8488	ZC3
Total CO2 emissions		39.5213	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		39.5213	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	28.9900 (1b)	x	2.3300 (2b)	=	67.5467	(1b) - (3b)
First floor	28.9900 (1c)	x	2.5600 (2c)	=	74.2144	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	141.7611	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1411	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3911	(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) =	0.3324	(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	0.4238	0.4155	0.4072	0.3657	0.3574	0.3158	0.3158	0.3075	0.3324	0.3574	0.3740	0.3906	(22b)
Effective ac	0.5898	0.5863	0.5829	0.5669	0.5639	0.5499	0.5499	0.5473	0.5553	0.5639	0.5699	0.5763	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			10.7600	1.3258	14.2652			(27)
150mm Platinum			28.9900	0.1300	3.7687			(28a)
50mm A. Platinum	74.4700	12.7300	61.7400	0.1800	11.1132			(29a)
400mm Mineral wool	28.9900		28.9900	0.1300	3.7687			(30)
Total net area of external elements Aum(A, m2)			132.4500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.8858			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.0425	(36)
Total fabric heat loss (33) + (36) =	42.9283	(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	27.5924	27.4292	27.2693	26.5181	26.3776	25.7233	25.7233	25.6021	25.9753	26.3776	26.6619	26.9591	(38)
Heat transfer coeff	70.5206	70.3575	70.1975	69.4464	69.3058	68.6516	68.6516	68.5304	68.9036	69.3058	69.5901	69.8874	(39)
Average = Sum(39)m / 12 =												69.4457	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2163	1.2135	1.2107	1.1978	1.1953	1.1841	1.1841	1.1820	1.1884	1.1953	1.2002	1.2054	(40)
HLP (average)												1.1978	(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	1.9240 (42)
Average daily hot water use (litres/day)	79.8946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.8841	84.6883	81.4925	78.2967	75.1009	71.9051	71.9051	75.1009	78.2967	81.4925	84.6883	87.8841	(44)
Energy conte	130.3295	113.9870	117.6244	102.5478	98.3971	84.9092	78.6808	90.2874	91.3657	106.4780	116.2290	126.2172	(45)
Energy content (annual)										Total = Sum(45)m =		1257.0531	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5494	17.0981	17.6437	15.3822	14.7596	12.7364	11.8021	13.5431	13.7049	15.9717	17.4344	18.9326	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	44.7848	38.9798	41.5277	38.6121	38.2706	35.4601	36.6421	38.2706	38.6121	41.5277	41.7641	44.7848	(61)
Total heat required for water heating calculated for each month													
	175.1143	152.9668	159.1521	141.1599	136.6677	120.3693	115.3229	128.5580	129.9778	148.0056	157.9931	171.0019	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	175.1143	152.9668	159.1521	141.1599	136.6677	120.3693	115.3229	128.5580	129.9778	148.0056	157.9931	171.0019	(64)
								Total per year (kWh/year) = Sum(64)m =				1736.2894	(64)
Heat gains from water heating, kWh/month													
	54.5308	47.6456	49.4920	43.7502	42.2847	37.0973	35.3219	39.5882	40.0321	45.7858	49.0872	53.1634	(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	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.2101	13.5094	10.9866	8.3176	6.2175	5.2491	5.6718	7.3724	9.8952	12.5643	14.6644	15.6328	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.8252	169.5667	165.1782	155.8356	144.0421	132.9580	125.5531	123.8116	128.2001	137.5428	149.3362	160.4203	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	(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)													
	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	(71)
Water heating gains (Table 5)													
	73.2940	70.9012	66.5216	60.7641	56.8342	51.5241	47.4757	53.2100	55.6002	61.5401	68.1766	71.4562	(72)
Total internal gains													
	311.1891	308.8372	297.5461	279.7770	261.9536	244.5909	233.5603	239.2537	248.5553	266.5069	287.0369	302.3691	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.6300	0.7000	0.7700	21.1720	(75)
Southwest	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074	(79)
Northwest	1.3200	11.2829	0.6300	0.7000	0.7700	4.5516	(81)

Solar gains	62.8311	115.5690	180.8219	262.0879	328.2823	341.1814	322.5793	270.8604	208.5961	133.8476	76.8132	52.7635	(83)
Total gains	374.0202	424.4061	478.3680	541.8649	590.2359	585.7722	556.1396	510.1141	457.1514	400.3545	363.8501	355.1325	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0952	57.2276	57.3580	57.9784	58.0960	58.6496	58.6496	58.7533	58.4351	58.0960	57.8586	57.6125	
alpha	4.8063	4.8152	4.8239	4.8652	4.8731	4.9100	4.9100	4.9169	4.8957	4.8731	4.8572	4.8408	
util living area													
	0.9972	0.9944	0.9859	0.9545	0.8641	0.6942	0.5304	0.5945	0.8462	0.9738	0.9946	0.9979	(86)
MIT	19.7121	19.8620	20.1249	20.4812	20.7839	20.9473	20.9886	20.9807	20.8575	20.4684	20.0282	19.6855	(87)
Th 2	19.9070	19.9092	19.9114	19.9218	19.9237	19.9328	19.9328	19.9345	19.9293	19.9237	19.9198	19.9157	(88)
util rest of house													
	0.9963	0.9925	0.9809	0.9373	0.8149	0.6001	0.4083	0.4683	0.7726	0.9607	0.9924	0.9971	(89)
MIT 2	18.2005	18.4205	18.8033	19.3161	19.7144	19.8984	19.9287	19.9267	19.8151	19.3083	18.6713	18.1677	(90)
Living area fraction										fLA = Living area / (4) =		0.2377	(91)
MIT	18.5598	18.7631	19.1174	19.5930	19.9686	20.1477	20.1806	20.1772	20.0628	19.5840	18.9938	18.5284	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5598	18.7631	19.1174	19.5930	19.9686	20.1477	20.1806	20.1772	20.0628	19.5840	18.9938	18.5284	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9896	0.9758	0.9307	0.8173	0.6204	0.4375	0.4984	0.7832	0.9551	0.9896	0.9957	(94)
Useful gains	371.9887	420.0103	466.7780	504.3392	482.3705	363.3958	243.3035	254.2287	358.0492	382.3976	360.0553	353.6126	(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													
	1005.6080	975.3715	885.7127	742.5910	573.0599	380.8595	245.8141	258.8506	410.8602	622.6443	827.6924	1001.3776	(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													
	471.4128	373.2027	311.6874	171.5413	67.4730	0.0000	0.0000	0.0000	0.0000	178.7436	336.6987	481.9372	(98)
Space heating												2392.6965	(98)
Space heating per m2											(98) / (4) =	41.2676	(99)

8c. Space cooling requirement

Not applicable

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												2561.7736	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	471.4128	373.2027	311.6874	171.5413	67.4730	0.0000	0.0000	0.0000	0.0000	178.7436	336.6987	481.9372	(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)													
	504.7246	399.5746	333.7124	183.6630	72.2409	0.0000	0.0000	0.0000	0.0000	191.3743	360.4911	515.9927	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	175.1143	152.9668	159.1521	141.1599	136.6677	120.3693	115.3229	128.5580	129.9778	148.0056	157.9931	171.0019	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4218	87.2110	86.7134	85.5430	83.3790	80.3000	80.3000	80.3000	80.3000	85.5273	86.9088	87.5171	(217)
Fuel for water heating, kWh/month													
	200.3097	175.3985	183.5381	165.0164	163.9114	149.8994	143.6151	160.0972	161.8653	173.0508	181.7918	195.3926	(219)
Water heating fuel used												2053.8862	(219)
Annual totals kWh/year													
Space heating fuel - main system												2561.7736	(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)												268.6143	(232)
Total delivered energy for all uses												4959.2741	(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	2561.7736	0.2160	553.3431	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2053.8862	0.2160	443.6394	(264)
Space and water heating			996.9825	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	268.6143	0.5190	139.4108	(268)
Total CO2, kg/m2/year			1175.3183	(272)
Emissions per m2 for space and water heating			17.1953	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4045	(272b)
Emissions per m2 for pumps and fans			0.6714	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.1953 * 1.00) + 2.4045 + 0.6714, rounded to 2 d.p.			20.2700	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	28.9900	(1b)	x 2.3300	(2b) =	67.5467	(1b) - (3b)
First floor	28.9900	(1c)	x 2.5600	(2c) =	74.2144	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.9800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	141.7611	(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							2 * 10	=	20.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1411	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3916	(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) =	0.3328	(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	0.4244	0.4161	0.4077	0.3661	0.3578	0.3162	0.3162	0.3079	0.3328	0.3578	0.3745	0.3911	(22b)
Effective ac	0.5900	0.5866	0.5831	0.5670	0.5640	0.5500	0.5500	0.5474	0.5554	0.5640	0.5701	0.5765	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			10.7600	1.3347	14.3616			(27)
150mm Platinum			28.9900	0.1500	4.3485			(28a)
50mm A. Platinum	74.4700	12.7300	61.7400	0.2700	16.6698			(29a)
400mm Mineral wool	28.9900		28.9900	0.1100	3.1889			(30)
Total net area of external elements Aum(A, m2)			132.4500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.5388			(33)
E-WM-22			35.4600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	205.2650	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.7996	(36)
Total fabric heat loss (33) + (36) =	48.3384	(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	27.6031	27.4396	27.2792	26.5261	26.3852	25.7293	25.7293	25.6078	25.9819	26.3852	26.6703	26.9683	(38)
Heat transfer coeff	75.9415	75.7779	75.6176	74.8645	74.7236	74.0677	74.0677	73.9462	74.3203	74.7236	75.0086	75.3066	(39)
Average = Sum(39)m / 12 =												74.8638	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3098	1.3070	1.3042	1.2912	1.2888	1.2775	1.2775	1.2754	1.2818	1.2888	1.2937	1.2988	(40)
HLP (average)												1.2912	(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	1.9240 (42)
Average daily hot water use (litres/day)	79.8946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.8841	84.6883	81.4925	78.2967	75.1009	71.9051	71.9051	75.1009	78.2967	81.4925	84.6883	87.8841	(44)
Energy conte	130.3295	113.9870	117.6244	102.5478	98.3971	84.9092	78.6808	90.2874	91.3657	106.4780	116.2290	126.2172	(45)
Energy content (annual)										Total = Sum(45)m =		1257.0531	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	27.6950	24.2222	24.9952	21.7914	20.9094	18.0432	16.7197	19.1861	19.4152	22.6266	24.6987	26.8212	(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	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.2101	13.5094	10.9866	8.3176	6.2175	5.2491	5.6718	7.3724	9.8952	12.5643	14.6644	15.6328	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.8252	169.5667	165.1782	155.8356	144.0421	132.9580	125.5531	123.8116	128.2001	137.5428	149.3362	160.4203	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	(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)													
	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	(71)
Water heating gains (Table 5)													
	37.2245	36.0450	33.5957	30.2658	28.1040	25.0600	22.4727	25.7877	26.9656	30.4120	34.3037	36.0499	(72)
Total internal gains													
	272.1195	270.9809	261.6203	246.2787	230.2234	215.1268	205.5573	208.8315	216.9207	232.3788	250.1640	263.9628	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.7100	0.7000	0.7700	23.8605	(75)
Southwest	3.3000	36.7938	0.7100	0.7000	0.7700	41.8195	(79)
Northwest	1.3200	11.2829	0.7100	0.7000	0.7700	5.1296	(81)

Solar gains	70.8096	130.2444	203.7834	295.3690	369.9690	384.5060	363.5418	305.2553	235.0845	150.8441	86.5672	59.4636	(83)
Total gains	342.9292	401.2253	465.4036	541.6477	600.1923	599.6328	569.0991	514.0868	452.0052	383.2229	336.7312	323.4264	(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	43.5323	43.6262	43.7187	44.1585	44.2418	44.6336	44.6336	44.7069	44.4819	44.2418	44.0737	43.8993	
alpha	3.9022	3.9084	3.9146	3.9439	3.9495	3.9756	3.9756	3.9805	3.9655	3.9495	3.9382	3.9266	
util living area													
	0.9956	0.9913	0.9796	0.9426	0.8519	0.6962	0.5442	0.6121	0.8456	0.9680	0.9921	0.9965	(86)
MIT	19.3087	19.4986	19.8298	20.2759	20.6634	20.8961	20.9703	20.9531	20.7603	20.2556	19.7027	19.2756	(87)
Th 2	19.8332	19.8354	19.8375	19.8477	19.8496	19.8585	19.8585	19.8602	19.8551	19.8496	19.8458	19.8417	(88)
util rest of house													
	0.9943	0.9887	0.9733	0.9240	0.8037	0.6032	0.4159	0.4817	0.7760	0.9541	0.9893	0.9955	(89)
MIT 2	18.3028	18.4932	18.8226	19.2631	19.6176	19.8074	19.8500	19.8450	19.7138	19.2530	18.7053	18.2762	(90)
Living area fraction										fLA = Living area / (4) =		0.2377	(91)
MIT	18.5419	18.7322	19.0619	19.5038	19.8662	20.0662	20.1162	20.1084	19.9625	19.4913	18.9424	18.5137	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5419	18.7322	19.0619	19.5038	19.8662	20.0662	20.1162	20.1084	19.9625	19.4913	18.9424	18.5137	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9922	0.9854	0.9678	0.9171	0.8045	0.6216	0.4463	0.5121	0.7837	0.9485	0.9863	0.9938	(94)
Useful gains	340.2710	395.3672	450.4157	496.7643	482.8578	372.7185	253.9919	263.2549	354.2295	363.4681	332.1086	321.4168	(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													
	1081.5486	1048.1726	949.9041	793.8511	610.2062	404.8673	260.4386	274.2205	435.7062	664.3913	888.2788	1077.9195	(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													
	551.5106	438.6852	371.6194	213.9025	94.7472	0.0000	0.0000	0.0000	0.0000	223.8868	400.4425	562.8381	(98)
Space heating												2857.6324	(98)
Space heating per m2											(98) / (4) =	49.2865	(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	696.2360	548.1007	561.9910	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8385	0.8972	0.8640	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	583.7927	491.7369	485.5849	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	772.9975	735.9113	672.7517	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	136.2275	181.6658	139.2521	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												457.1454 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.0569	45.4164	34.8130	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												114.2863 (107)
Space cooling per m2												1.9711 (108)
Energy for space heating												49.2865 (99)
Energy for space cooling												1.9711 (108)
Total												51.2577 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.3 (109)

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	28.9900 (1b)	x	2.3300 (2b)	=	67.5467	(1b) - (3b)
First floor	28.9900 (1c)	x	2.5600 (2c)	=	74.2144	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	141.7611	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1411	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3911	(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) =	0.3324	(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	0.4238	0.4155	0.4072	0.3657	0.3574	0.3158	0.3158	0.3075	0.3324	0.3574	0.3740	0.3906	(22b)
Effective ac	0.5898	0.5863	0.5829	0.5669	0.5639	0.5499	0.5499	0.5473	0.5553	0.5639	0.5699	0.5763	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			10.7600	1.3258	14.2652			(27)
150mm Platinum			28.9900	0.1300	3.7687			(28a)
50mm A. Platinum	74.4700	12.7300	61.7400	0.1800	11.1132			(29a)
400mm Mineral wool	28.9900		28.9900	0.1300	3.7687			(30)
Total net area of external elements Aum(A, m2)			132.4500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.8858			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.0425	(36)
Total fabric heat loss (33) + (36) =	42.9283	(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	27.5924	27.4292	27.2693	26.5181	26.3776	25.7233	25.7233	25.6021	25.9753	26.3776	26.6619	26.9591	(38)
Heat transfer coeff	70.5206	70.3575	70.1975	69.4464	69.3058	68.6516	68.6516	68.5304	68.9036	69.3058	69.5901	69.8874	(39)
Average = Sum(39)m / 12 =												69.4457	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2163	1.2135	1.2107	1.1978	1.1953	1.1841	1.1841	1.1820	1.1884	1.1953	1.2002	1.2054	(40)
HLP (average)												1.1978	(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	1.9240 (42)
Average daily hot water use (litres/day)	79.8946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.8841	84.6883	81.4925	78.2967	75.1009	71.9051	71.9051	75.1009	78.2967	81.4925	84.6883	87.8841	(44)
Energy conte	130.3295	113.9870	117.6244	102.5478	98.3971	84.9092	78.6808	90.2874	91.3657	106.4780	116.2290	126.2172	(45)
Energy content (annual)										Total = Sum(45)m =		1257.0531	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	27.6950	24.2222	24.9952	21.7914	20.9094	18.0432	16.7197	19.1861	19.4152	22.6266	24.6987	26.8212	(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	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.2101	13.5094	10.9866	8.3176	6.2175	5.2491	5.6718	7.3724	9.8952	12.5643	14.6644	15.6328	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.8252	169.5667	165.1782	155.8356	144.0421	132.9580	125.5531	123.8116	128.2001	137.5428	149.3362	160.4203	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	(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)													
	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	(71)
Water heating gains (Table 5)													
	37.2245	36.0450	33.5957	30.2658	28.1040	25.0600	22.4727	25.7877	26.9656	30.4120	34.3037	36.0499	(72)
Total internal gains													
	272.1195	270.9809	261.6203	246.2787	230.2234	215.1268	205.5573	208.8315	216.9207	232.3788	250.1640	263.9628	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.6300	0.7000	0.7700	21.1720	(75)
Southwest	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074	(79)
Northwest	1.3200	11.2829	0.6300	0.7000	0.7700	4.5516	(81)

Solar gains	62.8311	115.5690	180.8219	262.0879	328.2823	341.1814	322.5793	270.8604	208.5961	133.8476	76.8132	52.7635	(83)
Total gains	334.9506	386.5499	442.4421	508.3667	558.5057	556.3082	528.1366	479.6919	425.5168	366.2264	326.9772	316.7263	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0952	57.2276	57.3580	57.9784	58.0960	58.6496	58.6496	58.7533	58.4351	58.0960	57.8586	57.6125	
alpha	4.8063	4.8152	4.8239	4.8652	4.8731	4.9100	4.9100	4.9169	4.8957	4.8731	4.8572	4.8408	
util living area													
	0.9983	0.9963	0.9898	0.9638	0.8833	0.7205	0.5556	0.6260	0.8729	0.9815	0.9966	0.9987	(86)
MIT	19.6503	19.8028	20.0709	20.4375	20.7570	20.9379	20.9861	20.9759	20.8327	20.4195	19.9704	19.6244	(87)
Th 2	19.9070	19.9092	19.9114	19.9218	19.9237	19.9328	19.9328	19.9345	19.9293	19.9237	19.9198	19.9157	(88)
util rest of house													
	0.9977	0.9950	0.9859	0.9496	0.8380	0.6266	0.4292	0.4961	0.8056	0.9718	0.9952	0.9983	(89)
MIT 2	18.6803	18.8341	19.1020	19.4678	19.7600	19.9046	19.9293	19.9276	19.8346	19.4574	19.0101	18.6614	(90)
Living area fraction									fLA = Living area / (4) =			0.2377	(91)
MIT	18.9109	19.0643	19.3323	19.6983	19.9970	20.1502	20.1805	20.1768	20.0718	19.6860	19.2384	18.8903	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9109	19.0643	19.3323	19.6983	19.9970	20.1502	20.1805	20.1768	20.0718	19.6860	19.2384	18.8903	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9936	0.9832	0.9459	0.8416	0.6472	0.4595	0.5273	0.8162	0.9689	0.9939	0.9977	(94)
Useful gains	333.9289	384.0649	435.0301	480.8478	470.0357	360.0656	242.6974	252.9338	347.2894	354.8328	324.9751	315.9875	(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													
	1030.3674	996.5675	900.7950	749.9010	575.0289	381.0278	245.8054	258.8233	411.4789	629.7144	844.7097	1026.6666	(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													
	518.1503	411.6018	346.5291	193.7183	78.1150	0.0000	0.0000	0.0000	0.0000	204.5119	374.2089	528.7452	(98)
Space heating												2655.5804	(98)
Space heating per m2											(98) / (4) =	45.8017	(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	645.3246	508.0215	520.8310	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8740	0.9292	0.9006	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	564.0073	472.0543	469.0546	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	722.3584	688.0332	632.5498	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	114.0128	160.6882	121.6405	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												396.3415	(104)

ARUN DISTRICT COUNCIL A/45/22/PL

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	28.5032	40.1721	30.4101	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												99.0854 (107)
Space cooling per m2												1.7090 (108)
Energy for space heating												45.8017 (99)
Energy for space cooling												1.7090 (108)
Total												47.5106 (109)
Target Fabric Energy Efficiency (TFEE)												54.6 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Kenley Mid-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	DS08 Kenley , Mid Terr, Part L2013 Masonry		

SAP Rating	84 B	**DER**	17.52	**TER**	18.67
Environmental	88 B	**% DER<TER**	6.15		
CO_2 Emissions (t/year)	0.88	**DFEE**	40.35	**TFEE**	45.75
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.81		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 58 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.67 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.52 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)45.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 6.14 m², No overhang
Windows facing South West: 3.30 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K

ARUN DISTRICT COUNCIL A/45/22/PL

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	28.9900	(1b)	x 2.3300	(2b) =	67.5467	(1b) - (3b)
First floor	28.9900	(1c)	x 2.5600	(2c) =	74.2144	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.9800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	141.7611	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2116	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4621	(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) =	0.3928	(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	0.5008	0.4910	0.4812	0.4321	0.4223	0.3732	0.3732	0.3633	0.3928	0.4223	0.4419	0.4615	(22b)
Effective ac	0.6254	0.6205	0.6158	0.5933	0.5892	0.5696	0.5696	0.5660	0.5771	0.5892	0.5976	0.6065	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			9.4400	1.3347	12.5998			(27)
150mm Platinum			28.9900	0.1300	3.7687			(28a)
50mm A. Platinum	39.0100	11.4100	27.6000	0.2700	7.4520			(29a)
400mm Mineral wool	28.9900		28.9900	0.1100	3.1889			(30)
Total net area of external elements Aum(A, m2)			96.9900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.9794			(33)
E-WM-22			70.9200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	221.2880	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.8311	(36)
Total fabric heat loss (33) + (36) =	35.8105	(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	29.2576	29.0298	28.8064	27.7576	27.5613	26.6478	26.6478	26.4786	26.9997	27.5613	27.9583	28.3734	(38)
Heat transfer coeff	65.0681	64.8403	64.6170	63.5681	63.3718	62.4583	62.4583	62.2891	62.8102	63.3718	63.7688	64.1839	(39)
Average = Sum(39)m / 12 =												63.5671	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1223	1.1183	1.1145	1.0964	1.0930	1.0772	1.0772	1.0743	1.0833	1.0930	1.0998	1.1070	(40)
HLP (average)												1.0964	(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	1.9240	(42)
Average daily hot water use (litres/day)	79.8946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.8841	84.6883	81.4925	78.2967	75.1009	71.9051	71.9051	75.1009	78.2967	81.4925	84.6883	87.8841	(44)
Energy conte	130.3295	113.9870	117.6244	102.5478	98.3971	84.9092	78.6808	90.2874	91.3657	106.4780	116.2290	126.2172	(45)
Energy content (annual)										Total = Sum(45)m =		1257.0531	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5494	17.0981	17.6437	15.3822	14.7596	12.7364	11.8021	13.5431	13.7049	15.9717	17.4344	18.9326	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0315	12.6570	13.9866	13.5055	13.9339	13.4593	13.8923	13.9193	13.4845	13.9648	13.5490	14.0228 (61)
Total heat required for water heating calculated for each month												
	144.3610	126.6440	131.6110	116.0533	112.3310	98.3685	92.5732	104.2067	104.8502	120.4428	129.7780	140.2400 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	144.3610	126.6440	131.6110	116.0533	112.3310	98.3685	92.5732	104.2067	104.8502	120.4428	129.7780	140.2400 (64)
								Total per year (kWh/year) = Sum(64)m =				1421.4596 (64)
Heat gains from water heating, kWh/month												
	46.8424	41.0649	42.6068	37.4735	36.2005	31.5971	29.6345	33.5004	33.7502	38.8951	42.0334	45.4729 (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	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5562	13.8169	11.2367	8.5069	6.3590	5.3685	5.8009	7.5402	10.1205	12.8502	14.9981	15.9886	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.8252	169.5667	165.1782	155.8356	144.0421	132.9580	125.5531	123.8116	128.2001	137.5428	149.3362	160.4203	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	(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)													
	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	(71)
Water heating gains (Table 5)													
	62.9603	61.1085	57.2672	52.0466	48.6566	43.8849	39.8313	45.0274	46.8753	52.2784	58.3797	61.1195	(72)
Total internal gains													
	301.2015	299.3519	288.5418	271.2487	253.9175	237.0712	226.0450	231.2390	240.0556	257.5312	277.5738	292.3882	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.7100	0.7000	0.7700	23.8605	(75)
Southwest	3.3000	36.7938	0.7100	0.7000	0.7700	41.8195	(79)

Solar gains	65.6800	119.8029	184.9711	264.4738	328.4398	340.2315	322.1239	272.2365	212.1615	138.0837	80.1128	55.2745	(83)
Total gains	366.8815	419.1548	473.5129	535.7225	582.3573	577.3027	548.1689	503.4755	452.2171	395.6149	357.6866	347.6627	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7729	54.9653	55.1553	56.0654	56.2390	57.0615	57.0615	57.2165	56.7419	56.2390	55.8889	55.5274	
alpha	4.6515	4.6644	4.6770	4.7377	4.7493	4.8041	4.8041	4.8144	4.7828	4.7493	4.7259	4.7018	
util living area													
	0.9957	0.9915	0.9792	0.9375	0.8310	0.6511	0.4921	0.5522	0.8090	0.9626	0.9918	0.9967	(86)
MIT	19.7078	19.8734	20.1508	20.5192	20.8100	20.9569	20.9909	20.9846	20.8781	20.4986	20.0432	19.6850	(87)
Th 2	19.9827	19.9859	19.9890	20.0038	20.0066	20.0195	20.0195	20.0219	20.0145	20.0066	20.0010	19.9951	(88)
util rest of house													
	0.9945	0.9889	0.9728	0.9179	0.7819	0.5668	0.3870	0.4429	0.7372	0.9470	0.9889	0.9957	(89)
MIT 2	18.2625	18.5057	18.9090	19.4390	19.8190	19.9896	20.0157	20.0149	19.9137	19.4220	18.7648	18.2379	(90)
Living area fraction										fLA = Living area / (4) =		0.2377	(91)
MIT	18.6060	18.8308	19.2041	19.6957	20.0545	20.2195	20.2475	20.2454	20.1429	19.6779	19.0687	18.5818	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4560	18.6808	19.0541	19.5457	19.9045	20.0695	20.0975	20.0954	19.9929	19.5279	18.9187	18.4318	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9842	0.9648	0.9067	0.7762	0.5713	0.3956	0.4514	0.7354	0.9369	0.9843	0.9934	(94)
Useful gains	363.8146	412.5475	456.8339	485.7464	452.0182	329.8400	216.8576	227.2638	332.5571	370.6689	352.0572	345.3594	(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													
	921.1032	893.5499	811.2092	676.7289	519.9356	341.6145	218.4465	230.1803	370.1328	565.7751	753.6625	913.4547	(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													
	414.6227	323.2336	263.6552	137.5074	50.5306	0.0000	0.0000	0.0000	0.0000	145.1590	289.1558	422.6629	(98)
Space heating												2046.5273	(98)
Space heating per m2											(98) / (4) =	35.2971	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2261.3561	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	414.6227	323.2336	263.6552	137.5074	50.5306	0.0000	0.0000	0.0000	0.0000	145.1590	289.1558	422.6629	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	458.1466	357.1642	291.3317	151.9419	55.8349	0.0000	0.0000	0.0000	0.0000	160.3967	319.5092	467.0308	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.3610	126.6440	131.6110	116.0533	112.3310	98.3685	92.5732	104.2067	104.8502	120.4428	129.7780	140.2400	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6513	89.5757	89.4088	89.0067	88.2684	87.3000	87.3000	87.3000	87.3000	89.0203	89.4839	89.6810	(217)
Fuel for water heating, kWh/month													
	161.0249	141.3821	147.2015	130.3871	127.2607	112.6787	106.0403	119.3662	120.1033	135.2981	145.0295	156.3764	(219)
Water heating fuel used												1602.1489	(219)
Annual totals kWh/year													
Space heating fuel - main system												2261.3561	(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)												274.7279	(232)
Total delivered energy for all uses												4213.2329	(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	2261.3561	0.2160	488.4529	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1602.1489	0.2160	346.0642	(264)
Space and water heating			834.5171	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.7279	0.5190	142.5838	(268)
Total CO2, kg/year			1016.0259	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.5200	(273)

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

DER		17.5200	ZC1
Total Floor Area	TFA	57.9800	
Assumed number of occupants	N	1.9240	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1524	ZC2
CO2 emissions from cooking, equation (L16)		2.8488	ZC3
Total CO2 emissions		37.5213	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		37.5213	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	28.9900 (1b)	x	2.3300 (2b)	=	67.5467	(1b) - (3b)
First floor	28.9900 (1c)	x	2.5600 (2c)	=	74.2144	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	141.7611	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1411	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3911	(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) =	0.3324	(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	0.4238	0.4155	0.4072	0.3657	0.3574	0.3158	0.3158	0.3075	0.3324	0.3574	0.3740	0.3906	(22b)
Effective ac	0.5898	0.5863	0.5829	0.5669	0.5639	0.5499	0.5499	0.5473	0.5553	0.5639	0.5699	0.5763	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			9.4400	1.3258	12.5152			(27)
150mm Platinum			28.9900	0.1300	3.7687			(28a)
50mm A. Platinum	39.0100	11.4100	27.6000	0.1800	4.9680			(29a)
400mm Mineral wool	28.9900		28.9900	0.1300	3.7687			(30)
Total net area of external elements Aum(A, m2)			96.9900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9906			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.2682	(36)
Total fabric heat loss					(33) + (36) =		34.2588	(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	27.5924	27.4292	27.2693	26.5181	26.3776	25.7233	25.7233	25.6021	25.9753	26.3776	26.6619	26.9591	(38)
Heat transfer coeff	61.8511	61.6880	61.5280	60.7769	60.6363	59.9821	59.9821	59.8609	60.2341	60.6363	60.9206	61.2179	(39)
Average = Sum(39)m / 12 =												60.7762	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0668	1.0640	1.0612	1.0482	1.0458	1.0345	1.0345	1.0324	1.0389	1.0458	1.0507	1.0558	(40)
HLP (average)												1.0482	(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			1.9240	(42)
Average daily hot water use (litres/day)			79.8946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.8841	84.6883	81.4925	78.2967	75.1009	71.9051	71.9051	75.1009	78.2967	81.4925	84.6883	87.8841	(44)
Energy conte	130.3295	113.9870	117.6244	102.5478	98.3971	84.9092	78.6808	90.2874	91.3657	106.4780	116.2290	126.2172	(45)
Energy content (annual)										Total = Sum(45)m =		1257.0531	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5494	17.0981	17.6437	15.3822	14.7596	12.7364	11.8021	13.5431	13.7049	15.9717	17.4344	18.9326	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	44.7848	38.9798	41.5277	38.6121	38.2706	35.4601	36.6421	38.2706	38.6121	41.5277	41.7641	44.7848	(61)
Total heat required for water heating calculated for each month													
	175.1143	152.9668	159.1521	141.1599	136.6677	120.3693	115.3229	128.5580	129.9778	148.0056	157.9931	171.0019	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	175.1143	152.9668	159.1521	141.1599	136.6677	120.3693	115.3229	128.5580	129.9778	148.0056	157.9931	171.0019	(64)
								Total per year (kWh/year) = Sum(64)m =				1736.2894	(64)
Heat gains from water heating, kWh/month													
	54.5308	47.6456	49.4920	43.7502	42.2847	37.0973	35.3219	39.5882	40.0321	45.7858	49.0872	53.1634	(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	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5562	13.8169	11.2367	8.5069	6.3590	5.3685	5.8009	7.5402	10.1205	12.8502	14.9981	15.9886	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.8252	169.5667	165.1782	155.8356	144.0421	132.9580	125.5531	123.8116	128.2001	137.5428	149.3362	160.4203	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	(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)													
	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	(71)
Water heating gains (Table 5)													
	73.2940	70.9012	66.5216	60.7641	56.8342	51.5241	47.4757	53.2100	55.6002	61.5401	68.1766	71.4562	(72)
Total internal gains													
	311.5352	309.1446	297.7962	279.9663	262.0951	244.7103	233.6894	239.4215	248.7805	266.7929	287.3707	302.7249	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.6300	0.7000	0.7700	21.1720	(75)
Southwest	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074	(79)

Solar gains	58.2795	106.3040	164.1293	234.6739	291.4325	301.8956	285.8283	241.5620	188.2559	122.5250	71.0860	49.0464	(83)
Total gains	369.8147	415.4486	461.9255	514.6402	553.5276	546.6059	519.5177	480.9835	437.0364	389.3179	358.4567	351.7712	(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	65.0981	65.2702	65.4399	66.2487	66.4023	67.1266	67.1266	67.2624	66.8457	66.4023	66.0924	65.7715	
alpha	5.3399	5.3513	5.3627	5.4166	5.4268	5.4751	5.4751	5.4842	5.4564	5.4268	5.4062	5.3848	
util living area													
	0.9973	0.9945	0.9856	0.9517	0.8521	0.6687	0.5018	0.5607	0.8231	0.9708	0.9944	0.9980	(86)
MIT	19.9078	20.0455	20.2807	20.5946	20.8477	20.9696	20.9947	20.9906	20.9076	20.5828	20.1911	19.8836	(87)
Th 2	20.0281	20.0304	20.0327	20.0433	20.0453	20.0547	20.0547	20.0564	20.0511	20.0453	20.0413	20.0371	(88)
util rest of house													
	0.9964	0.9927	0.9806	0.9345	0.8042	0.5836	0.3973	0.4517	0.7509	0.9570	0.9923	0.9973	(89)
MIT 2	18.5723	18.7748	19.1171	19.5688	19.8981	20.0348	20.0527	20.0525	19.9778	19.5613	18.9958	18.5436	(90)
Living area fraction									fLA = Living area / (4) =			0.2377	(91)
MIT	18.8897	19.0768	19.3937	19.8126	20.1238	20.2570	20.2766	20.2755	20.1988	19.8041	19.2799	18.8621	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8897	19.0768	19.3937	19.8126	20.1238	20.2570	20.2766	20.2755	20.1988	19.8041	19.2799	18.8621	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9901	0.9763	0.9294	0.8086	0.6026	0.4222	0.4777	0.7635	0.9525	0.9898	0.9961	(94)
Useful gains	367.9450	411.3502	450.9598	478.3246	447.5673	329.4061	219.3590	229.7667	333.6769	370.8122	354.7941	350.3885	(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													
	902.3912	874.5366	793.3238	663.2316	510.7858	339.3158	220.5277	231.9887	367.3526	558.1001	742.0069	897.5824	(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													
	397.6280	311.2613	254.7188	133.1330	47.0346	0.0000	0.0000	0.0000	0.0000	139.3422	278.7932	407.1122	(98)
Space heating												1969.0233	(98)
Space heating per m2											(98) / (4) =	33.9604	(99)

8c. Space cooling requirement

Not applicable

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

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2108.1620	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	397.6280	311.2613	254.7188	133.1330	47.0346	0.0000	0.0000	0.0000	0.0000	139.3422	278.7932	407.1122	(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)													
	425.7259	333.2562	272.7182	142.5407	50.3582	0.0000	0.0000	0.0000	0.0000	149.1887	298.4938	435.8803	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	175.1143	152.9668	159.1521	141.1599	136.6677	120.3693	115.3229	128.5580	129.9778	148.0056	157.9931	171.0019	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.0523	86.8025	86.2293	84.9042	82.6647	80.3000	80.3000	80.3000	80.3000	84.8997	86.4661	87.1574	(217)
Fuel for water heating, kWh/month													
	201.1599	176.2241	184.5684	166.2578	165.3277	149.8994	143.6151	160.0972	161.8653	174.3299	182.7225	196.1990	(219)
Water heating fuel used												2062.2663	(219)
Annual totals kWh/year													
Space heating fuel - main system												2108.1620	(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)												274.7279	(232)
Total delivered energy for all uses												4520.1563	(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	2108.1620	0.2160	455.3630	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2062.2663	0.2160	445.4495	(264)
Space and water heating			900.8125	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.7279	0.5190	142.5838	(268)
Total CO2, kg/m2/year			1082.3213	(272)
Emissions per m2 for space and water heating			15.5366	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4592	(272b)
Emissions per m2 for pumps and fans			0.6714	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5366 * 1.00) + 2.4592 + 0.6714, rounded to 2 d.p.			18.6700	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	28.9900 (1b)	x	2.3300 (2b)	=	67.5467	(1b) - (3b)
First floor	28.9900 (1c)	x	2.5600 (2c)	=	74.2144	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	141.7611	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1411	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3916	(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) =	0.3328	(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	0.4244	0.4161	0.4077	0.3661	0.3578	0.3162	0.3162	0.3079	0.3328	0.3578	0.3745	0.3911	(22b)
Effective ac	0.5900	0.5866	0.5831	0.5670	0.5640	0.5500	0.5500	0.5474	0.5554	0.5640	0.5701	0.5765	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			9.4400	1.3347	12.5998			(27)
150mm Platinum			28.9900	0.1300	3.7687			(28a)
50mm A. Platinum	39.0100	11.4100	27.6000	0.2700	7.4520			(29a)
400mm Mineral wool	28.9900		28.9900	0.1100	3.1889			(30)
Total net area of external elements Aum(A, m2)			96.9900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.9794			(33)
E-WM-22			70.9200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	221.2880	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.8311	(36)
Total fabric heat loss (33) + (36) =	35.8105	(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	27.6031	27.4396	27.2792	26.5261	26.3852	25.7293	25.7293	25.6078	25.9819	26.3852	26.6703	26.9683	(38)
Heat transfer coeff	63.4136	63.2501	63.0897	62.3366	62.1957	61.5398	61.5398	61.4183	61.7924	62.1957	62.4808	62.7788	(39)
Average = Sum(39)m / 12 =												62.3359	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0937	1.0909	1.0881	1.0751	1.0727	1.0614	1.0614	1.0593	1.0658	1.0727	1.0776	1.0828	(40)
HLP (average)												1.0751	(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	1.9240 (42)
Average daily hot water use (litres/day)	79.8946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.8841	84.6883	81.4925	78.2967	75.1009	71.9051	71.9051	75.1009	78.2967	81.4925	84.6883	87.8841	(44)
Energy conte	130.3295	113.9870	117.6244	102.5478	98.3971	84.9092	78.6808	90.2874	91.3657	106.4780	116.2290	126.2172	(45)
Energy content (annual)										Total = Sum(45)m =		1257.0531	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month												
	27.6950	24.2222	24.9952	21.7914	20.9094	18.0432	16.7197	19.1861	19.4152	22.6266	24.6987	26.8212 (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	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5562	13.8169	11.2367	8.5069	6.3590	5.3685	5.8009	7.5402	10.1205	12.8502	14.9981	15.9886	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.8252	169.5667	165.1782	155.8356	144.0421	132.9580	125.5531	123.8116	128.2001	137.5428	149.3362	160.4203	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	(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)													
	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	(71)
Water heating gains (Table 5)													
	37.2245	36.0450	33.5957	30.2658	28.1040	25.0600	22.4727	25.7877	26.9656	30.4120	34.3037	36.0499	(72)
Total internal gains													
	272.4657	271.2884	261.8703	246.4680	230.3649	215.2463	205.6864	208.9993	217.1459	232.6648	250.4978	264.3186	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.7100	0.7000	0.7700	23.8605	(75)
Southwest	3.3000	36.7938	0.7100	0.7000	0.7700	41.8195	(79)

Solar gains	65.6800	119.8029	184.9711	264.4738	328.4398	340.2315	322.1239	272.2365	212.1615	138.0837	80.1128	55.2745	(83)
Total gains	338.1457	391.0913	446.8414	510.9418	558.8047	555.4778	527.8103	481.2358	429.3074	370.7486	330.6106	319.5931	(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	56.2019	56.3472	56.4904	57.1729	57.3024	57.9132	57.9132	58.0277	57.6764	57.3024	57.0410	56.7702	
alpha	4.7468	4.7565	4.7660	4.8115	4.8202	4.8609	4.8609	4.8685	4.8451	4.8202	4.8027	4.7847	
util living area													
	0.9970	0.9935	0.9829	0.9447	0.8421	0.6643	0.5031	0.5681	0.8261	0.9696	0.9940	0.9977	(86)
MIT	19.6993	19.8646	20.1421	20.5088	20.8049	20.9549	20.9905	20.9834	20.8700	20.4800	20.0241	19.6712	(87)
Th 2	20.0060	20.0083	20.0105	20.0212	20.0232	20.0325	20.0325	20.0342	20.0289	20.0232	20.0191	20.0149	(88)
util rest of house													
	0.9961	0.9915	0.9775	0.9270	0.7951	0.5805	0.3974	0.4578	0.7573	0.9566	0.9918	0.9970	(89)
MIT 2	18.8183	18.9845	19.2609	19.6240	19.8904	20.0109	20.0298	20.0290	19.9542	19.6044	19.1527	18.7974	(90)
Living area fraction									fLA = Living area / (4) =			0.2377	(91)
MIT	19.0276	19.1937	19.4703	19.8343	20.1077	20.2353	20.2581	20.2558	20.1718	19.8125	19.3598	19.0051	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0276	19.1937	19.4703	19.8343	20.1077	20.2353	20.2581	20.2558	20.1718	19.8125	19.3598	19.0051	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9894	0.9738	0.9230	0.7996	0.5990	0.4226	0.4841	0.7687	0.9530	0.9899	0.9960	(94)
Useful gains	336.4047	386.9353	435.1379	471.6008	446.8175	332.7094	223.0541	232.9481	330.0206	353.3141	327.2632	318.3219	(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													
	933.9338	904.0774	818.2940	681.6076	522.9251	346.7940	225.1197	236.8189	375.1932	572.9777	766.0020	929.4443	(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													
	444.5616	347.5194	285.0682	151.2048	56.6241	0.0000	0.0000	0.0000	0.0000	163.4297	315.8920	454.6750	(98)
Space heating												2218.9749	(98)
Space heating per m2											(98) / (4) =	38.2714	(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	578.4740	455.3944	466.7792	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9067	0.9500	0.9290	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	524.5250	432.6305	433.6385	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	721.5468	687.8236	634.5778	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	141.8557	189.8637	149.4988	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												481.2182	(104)

CALCULATION OF 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	35.4639	47.4659	37.3747	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												120.3045 (107)
Space cooling per m2												2.0749 (108)
Energy for space heating												38.2714 (99)
Energy for space cooling												2.0749 (108)
Total												40.3463 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.3 (109)

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	28.9900 (1b)	x	2.3300 (2b)	=	67.5467	(1b) - (3b)
First floor	28.9900 (1c)	x	2.5600 (2c)	=	74.2144	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	141.7611	(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							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1411	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3911	(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) =	0.3324	(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	0.4238	0.4155	0.4072	0.3657	0.3574	0.3158	0.3158	0.3075	0.3324	0.3574	0.3740	0.3906	(22b)
Effective ac	0.5898	0.5863	0.5829	0.5669	0.5639	0.5499	0.5499	0.5473	0.5553	0.5639	0.5699	0.5763	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			9.4400	1.3258	12.5152			(27)
150mm Platinum			28.9900	0.1300	3.7687			(28a)
50mm A. Platinum	39.0100	11.4100	27.6000	0.1800	4.9680			(29a)
400mm Mineral wool	28.9900		28.9900	0.1300	3.7687			(30)
Total net area of external elements Aum(A, m2)			96.9900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9906			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.2682	(36)
Total fabric heat loss					(33) + (36) =		34.2588	(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	27.5924	27.4292	27.2693	26.5181	26.3776	25.7233	25.7233	25.6021	25.9753	26.3776	26.6619	26.9591	(38)
Heat transfer coeff	61.8511	61.6880	61.5280	60.7769	60.6363	59.9821	59.9821	59.8609	60.2341	60.6363	60.9206	61.2179	(39)
Average = Sum(39)m / 12 =												60.7762	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0668	1.0640	1.0612	1.0482	1.0458	1.0345	1.0345	1.0324	1.0389	1.0458	1.0507	1.0558	(40)
HLP (average)												1.0482	(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	1.9240	(42)
Average daily hot water use (litres/day)	79.8946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.8841	84.6883	81.4925	78.2967	75.1009	71.9051	71.9051	75.1009	78.2967	81.4925	84.6883	87.8841	(44)
Energy conte	130.3295	113.9870	117.6244	102.5478	98.3971	84.9092	78.6808	90.2874	91.3657	106.4780	116.2290	126.2172	(45)
Energy content (annual)										Total = Sum(45)m =		1257.0531	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	27.6950	24.2222	24.9952	21.7914	20.9094	18.0432	16.7197	19.1861	19.4152	22.6266	24.6987	26.8212	(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	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	96.1992	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5562	13.8169	11.2367	8.5069	6.3590	5.3685	5.8009	7.5402	10.1205	12.8502	14.9981	15.9886	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.8252	169.5667	165.1782	155.8356	144.0421	132.9580	125.5531	123.8116	128.2001	137.5428	149.3362	160.4203	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	32.6199	(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)													
	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	-76.9593	(71)
Water heating gains (Table 5)													
	37.2245	36.0450	33.5957	30.2658	28.1040	25.0600	22.4727	25.7877	26.9656	30.4120	34.3037	36.0499	(72)
Total internal gains													
	272.4657	271.2884	261.8703	246.4680	230.3649	215.2463	205.6864	208.9993	217.1459	232.6648	250.4978	264.3186	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.1400	11.2829	0.6300	0.7000	0.7700	21.1720	(75)
Southwest	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074	(79)

Solar gains	58.2795	106.3040	164.1293	234.6739	291.4325	301.8956	285.8283	241.5620	188.2559	122.5250	71.0860	49.0464	(83)
Total gains	330.7452	377.5924	425.9996	481.1420	521.7974	517.1418	491.5147	450.5613	405.4018	355.1898	321.5838	313.3650	(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	65.0981	65.2702	65.4399	66.2487	66.4023	67.1266	67.1266	67.2624	66.8457	66.4023	66.0924	65.7715	
alpha	5.3399	5.3513	5.3627	5.4166	5.4268	5.4751	5.4751	5.4842	5.4564	5.4268	5.4062	5.3848	
util living area													
	0.9984	0.9965	0.9900	0.9628	0.8752	0.6985	0.5285	0.5945	0.8554	0.9801	0.9967	0.9988	(86)
MIT	19.8443	19.9848	20.2255	20.5509	20.8230	20.9625	20.9932	20.9876	20.8862	20.5336	20.1318	19.8209	(87)
Th 2	20.0281	20.0304	20.0327	20.0433	20.0453	20.0547	20.0547	20.0564	20.0511	20.0453	20.0413	20.0371	(88)
util rest of house													
	0.9979	0.9953	0.9864	0.9489	0.8312	0.6127	0.4194	0.4810	0.7888	0.9702	0.9953	0.9985	(89)
MIT 2	18.9709	19.1129	19.3536	19.6790	19.9259	20.0376	20.0529	20.0528	19.9871	19.6687	19.2688	18.9549	(90)
Living area fraction									fLA = Living area / (4) =			0.2377	(91)
MIT	19.1785	19.3201	19.5608	19.8862	20.1391	20.2574	20.2764	20.2750	20.2008	19.8742	19.4739	19.1607	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1785	19.3201	19.5608	19.8862	20.1391	20.2574	20.2764	20.2750	20.2008	19.8742	19.4739	19.1607	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9941	0.9841	0.9461	0.8360	0.6321	0.4456	0.5082	0.8008	0.9679	0.9942	0.9980	(94)
Useful gains	329.8464	375.3666	419.2232	455.1861	436.2476	326.9108	218.9976	228.9676	324.6422	343.7842	319.7326	312.7245	(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													
	920.2517	889.5477	803.6065	667.7096	511.7159	339.3423	220.5162	231.9591	367.4758	562.3549	753.8245	915.8627	(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													
	439.2615	345.5297	285.9812	153.0169	56.1484	0.0000	0.0000	0.0000	0.0000	162.6167	312.5462	448.7348	(98)
Space heating												2203.8354	(98)
Space heating per m2											(98) / (4) =	38.0103	(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	563.8313	443.8672	454.9428	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9114	0.9559	0.9359	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	513.8848	424.2820	425.8034	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	676.7386	645.4001	598.7244	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	117.2547	164.5119	128.6533	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												410.4198	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	29.3137	41.1280	32.1633	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											102.6050	(107)
Space cooling per m2											1.7697	(108)
Energy for space heating											38.0103	(99)
Energy for space cooling											1.7697	(108)
Total											39.7799	(109)
Target Fabric Energy Efficiency (TFEE)											45.7	(109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Kingsley Detached	**Issued on Date**	23/02/2022
Assessment Reference	3	**Prop Type Ref**	
Property	Kingsley House Type, Detached, 2016 - Classic Range, Barratt Developments PLC		

SAP Rating	84 B	**DER**	17.84	**TER**	18.18
Environmental	85 B	**% DER<TER**	1.88		
CO_2 Emissions (t/year)	1.57	**DFEE**	52.80	**TFEE**	56.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.34		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Detached House, total floor area 100 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.18 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.84 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.8 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.24 m², No overhang
Windows facing South East: 0.92 m², No overhang
Windows facing South West: 4.54 m², No overhang
Windows facing North West: 2.24 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.037 W/m²K

ARUN DISTRICT COUNCIL A/45/22/PL

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	50.0800 (1b)	x	2.3300 (2b)	=	116.6864	(1b) - (3b)
First floor	50.0800 (1c)	x	2.5600 (2c)	=	128.2048	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.8912	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1633 (8)
Pressure test		Yes
Measured/design AP50		5.0100
Infiltration rate		0.4138 (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) =	0.3518 (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	0.4485	0.4397	0.4309	0.3869	0.3781	0.3342	0.3342	0.3254	0.3518	0.3781	0.3957	0.4133	(22b)
Effective ac	0.6006	0.5967	0.5928	0.5749	0.5715	0.5558	0.5558	0.5529	0.5619	0.5715	0.5783	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	
Opening Type 1 (Uw = 1.41)			14.9400	1.3347	19.9407			(27)
Opening Type 10			1.9500	1.0000	1.9500			(26)
150mm TE Platinum GF			50.0800	0.1500	7.5120			(28a)
50mm Alreflex Plat	146.1600	16.8900	129.2700	0.2700	34.9029			(29a)
400mm	50.0800		50.0800	0.1100	5.5088			(30)
Total net area of external elements Aum(A, m2)			246.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		69.8144			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							203.3300	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0665	(36)
Total fabric heat loss					(33) + (36) =		78.8810	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.5349	48.2193	47.9099	46.4568	46.1850	44.9194	44.9194	44.6850	45.4069	46.1850	46.7350	47.3099	(38)
Heat transfer coeff	127.4159	127.1003	126.7909	125.3378	125.0660	123.8004	123.8004	123.5660	124.2879	125.0660	125.6159	126.1909	(39)
Average = Sum(39)m / 12 =												125.3365	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2721	1.2690	1.2659	1.2514	1.2487	1.2360	1.2360	1.2337	1.2409	1.2487	1.2542	1.2599	(40)
HLP (average)												1.2514	(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												2.7410	(42)
Average daily hot water use (litres/day)												99.2988	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2287	105.2567	101.2848	97.3128	93.3409	89.3689	89.3689	93.3409	97.3128	101.2848	105.2567	109.2287	(44)
Energy conte	161.9830	141.6713	146.1921	127.4538	122.2950	105.5313	97.7903	112.2157	113.5560	132.3385	144.4578	156.8719	(45)
Energy content (annual)										Total = Sum(45)m =		1562.3568	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2974	21.2507	21.9288	19.1181	18.3443	15.8297	14.6685	16.8324	17.0334	19.8508	21.6687	23.5308	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1453	12.7653	14.1074	13.6105	14.0305	13.5391	13.9663	14.0079	13.5780	14.0742	13.6595	14.1331	(61)
Total heat required for water heating calculated for each month													
	176.1283	154.4366	160.2996	141.0643	136.3255	119.0704	111.7566	126.2237	127.1340	146.4127	158.1173	171.0049	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	176.1283	154.4366	160.2996	141.0643	136.3255	119.0704	111.7566	126.2237	127.1340	146.4127	158.1173	171.0049	(64)
								Total per year (kWh/year) = Sum(64)m =				1727.9739	(64)
Heat gains from water heating, kWh/month													
	57.3957	50.2970	52.1357	45.7810	44.1707	38.4739	36.0068	40.8137	41.1519	47.5211	51.4471	55.6932	(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	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.2094	21.5026	17.4871	13.2388	9.8962	8.3548	9.0276	11.7345	15.7500	19.9982	23.3408	24.8823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	256.5862	259.2487	252.5392	238.2553	220.2245	203.2780	191.9568	189.2942	196.0038	210.2876	228.3185	245.2649	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	(71)
Water heating gains (Table 5)													
	77.1447	74.8468	70.0749	63.5848	59.3692	53.4360	48.3963	54.8572	57.1554	63.8724	71.4543	74.8564	(72)
Total internal gains													
	425.0553	422.7131	407.2162	382.1939	356.6049	332.1839	316.4957	323.0008	336.0241	361.2733	390.2287	412.1186	(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	7.2400	11.2829	0.7100	0.7000	0.7700	28.1352	(75)
Southeast	0.9200	36.7938	0.7100	0.7000	0.7700	11.6588	(77)
Southwest	4.5400	36.7938	0.7100	0.7000	0.7700	57.5335	(79)
Northwest	2.2400	11.2829	0.7100	0.7000	0.7700	8.7048	(81)

Solar gains	106.0323	192.8490	296.3675	421.6938	522.0591	540.1570	511.6664	433.4453	339.2409	221.9029	129.2307	89.2996	(83)
Total gains	531.0876	615.5621	703.5836	803.8877	878.6640	872.3409	828.1621	756.4462	675.2650	583.1762	519.4593	501.4182	(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	44.3986	44.5089	44.6175	45.1348	45.2329	45.6953	45.6953	45.7819	45.5160	45.2329	45.0348	44.8296	
alpha	3.9599	3.9673	3.9745	4.0090	4.0155	4.0464	4.0464	4.0521	4.0344	4.0155	4.0023	3.9886	
util living area													
	0.9969	0.9940	0.9863	0.9615	0.8950	0.7615	0.6107	0.6746	0.8842	0.9776	0.9945	0.9976	(86)
MIT	19.2865	19.4613	19.7715	20.1993	20.5941	20.8617	20.9580	20.9372	20.7189	20.2130	19.6770	19.2591	(87)
Th 2	19.8627	19.8652	19.8677	19.8791	19.8813	19.8913	19.8913	19.8931	19.8874	19.8813	19.8769	19.8724	(88)
util rest of house													
	0.9960	0.9923	0.9820	0.9483	0.8565	0.6741	0.4774	0.5438	0.8258	0.9676	0.9926	0.9969	(89)
MIT 2	17.5798	17.8364	18.2892	18.9112	19.4543	19.7853	19.8722	19.8611	19.6320	18.9401	18.1600	17.5460	(90)
Living area fraction									fLA = Living area / (4) =			0.1608	(91)
MIT	17.8543	18.0978	18.5276	19.1184	19.6376	19.9585	20.0468	20.0342	19.8068	19.1448	18.4040	17.8216	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.7043	17.9478	18.3776	18.9684	19.4876	19.8085	19.8968	19.8842	19.6568	18.9948	18.2540	17.6716	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9932	0.9876	0.9735	0.9335	0.8396	0.6666	0.4782	0.5426	0.8103	0.9557	0.9881	0.9946	(94)
Useful gains	527.4912	607.9164	684.9511	750.4499	737.7052	581.5315	395.9883	410.4601	547.1562	557.3704	513.2546	498.6990	(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													
	1707.9238	1658.3733	1505.9772	1261.9543	973.9669	644.8089	408.1481	430.5227	690.6406	1049.9086	1401.1230	1699.9875	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	878.2419	705.9070	610.8434	368.2832	175.7787	0.0000	0.0000	0.0000	0.0000	366.4484	639.2653	893.7587	(98)
Space heating												4638.5265	(98)
Space heating per m2											(98) / (4) =	46.3112	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5125.4437	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	878.2419	705.9070	610.8434	368.2832	175.7787	0.0000	0.0000	0.0000	0.0000	366.4484	639.2653	893.7587	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000		(210)
Space heating fuel (main heating system)													
	970.4330	780.0078	674.9650	406.9428	194.2306	0.0000	0.0000	0.0000	0.0000	404.9154	706.3705	987.5786	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	176.1283	154.4366	160.2996	141.0643	136.3255	119.0704	111.7566	126.2237	127.1340	146.4127	158.1173	171.0049	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.9492	89.9084	89.8156	89.5905	89.0739	87.3000	87.3000	87.3000	87.3000	89.5628	89.8469	89.9703	(217)
Fuel for water heating, kWh/month													
	195.8086	171.7711	178.4762	157.4545	153.0477	136.3923	128.0144	144.5861	145.6288	163.4749	175.9852	190.0681	(219)
Water heating fuel used												1940.7080	(219)
Annual totals kWh/year													
Space heating fuel - main system												5125.4437	(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)												427.5456	(232)
Total delivered energy for all uses												7568.6972	(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	5125.4437	0.2160	1107.0958	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1940.7080	0.2160	419.1929	(264)
Space and water heating			1526.2888	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	427.5456	0.5190	221.8961	(268)
Total CO2, kg/year			1787.1099	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8400	(273)

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

DER		17.8400	ZC1
Total Floor Area	TFA	100.1600	
Assumed number of occupants	N	2.7410	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.1805	ZC2
CO2 emissions from cooking, equation (L16)		1.8449	ZC3
Total CO2 emissions		34.8654	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.8654	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	50.0800 (1b)	x	2.3300 (2b)	=	116.6864	(1b) - (3b)
First floor	50.0800 (1c)	x	2.5600 (2c)	=	128.2048	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.8912	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1633	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4133	(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) =	0.3513	(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	0.4480	0.4392	0.4304	0.3865	0.3777	0.3338	0.3338	0.3250	0.3513	0.3777	0.3953	0.4128	(22b)
Effective ac	0.6003	0.5964	0.5926	0.5747	0.5713	0.5557	0.5557	0.5528	0.5617	0.5713	0.5781	0.5852	(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			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.40)			14.9400	1.3258	19.8068			(27)
150mm TE Platinum GF			50.0800	0.1300	6.5104			(28a)
50mm Alreflex Plat	146.1600	16.8900	129.2700	0.1800	23.2686			(29a)
400mm	50.0800		50.0800	0.1300	6.5104			(30)
Total net area of external elements Aum(A, m2)			246.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.0462			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.1009	(36)
Total fabric heat loss (33) + (36) =	69.1471	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.5153	48.2004	47.8918	46.4422	46.1710	44.9085	44.9085	44.6747	45.3948	46.1710	46.7197	47.2933	(38)
Heat transfer coeff	117.6624	117.3475	117.0389	115.5894	115.3181	114.0556	114.0556	113.8218	114.5419	115.3181	115.8668	116.4404	(39)
Average = Sum(39)m / 12 =												115.5881	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1747	1.1716	1.1685	1.1540	1.1513	1.1387	1.1387	1.1364	1.1436	1.1513	1.1568	1.1625	(40)
HLP (average)												1.1540	(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	2.7410 (42)
Average daily hot water use (litres/day)	99.2988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2287	105.2567	101.2848	97.3128	93.3409	89.3689	89.3689	93.3409	97.3128	101.2848	105.2567	109.2287	(44)
Energy conte	161.9830	141.6713	146.1921	127.4538	122.2950	105.5313	97.7903	112.2157	113.5560	132.3385	144.4578	156.8719	(45)
Energy content (annual)										Total = Sum(45)m =		1562.3568	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2974	21.2507	21.9288	19.1181	18.3443	15.8297	14.6685	16.8324	17.0334	19.8508	21.6687	23.5308	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.9899	47.5655	44.0723	45.5414	47.5655	47.9899	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.9419	187.6987	197.1510	175.4437	169.8605	149.6036	143.3317	159.7812	161.5458	183.2974	193.7729	207.8308	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.9419	187.6987	197.1510	175.4437	169.8605	149.6036	143.3317	159.7812	161.5458	183.2974	193.7729	207.8308	(64)
								Total per year (kWh/year) = Sum(64)m =				2142.2594	(64)
Heat gains from water heating, kWh/month													
	66.5991	58.6126	61.3486	54.3759	52.5545	46.1072	43.9006	49.2031	49.7548	56.7423	60.3610	64.8996	(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	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.2094	21.5026	17.4871	13.2388	9.8962	8.3548	9.0276	11.7345	15.7500	19.9982	23.3408	24.8823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	256.5862	259.2487	252.5392	238.2553	220.2245	203.2780	191.9568	189.2942	196.0038	210.2876	228.3185	245.2649	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	(71)
Water heating gains (Table 5)													
	89.5149	87.2211	82.4578	75.5221	70.6377	64.0378	59.0062	66.1332	69.1039	76.2665	83.8347	87.2307	(72)
Total internal gains													
	437.4255	435.0874	419.5991	394.1312	367.8734	342.7857	327.1056	334.2769	347.9727	373.6674	402.6091	424.4929	(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	7.2400	11.2829	0.6300	0.7000	0.7700	24.9651	(75)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
Southwest	4.5400	36.7938	0.6300	0.7000	0.7700	51.0508	(79)
Northwest	2.2400	11.2829	0.6300	0.7000	0.7700	7.7240	(81)

Solar gains	94.0850	171.1195	262.9739	374.1790	463.2355	479.2943	454.0138	384.6064	301.0166	196.8997	114.6695	79.2376	(83)
Total gains	531.5105	606.2069	682.5730	768.3102	831.1089	822.0799	781.1195	718.8833	648.9892	570.5671	517.2785	503.7305	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1145	59.2731	59.4294	60.1747	60.3162	60.9839	60.9839	61.1092	60.7250	60.3162	60.0306	59.7349	
alpha	4.9410	4.9515	4.9620	5.0116	5.0211	5.0656	5.0656	5.0739	5.0483	5.0211	5.0020	4.9823	
util living area													
	0.9989	0.9976	0.9935	0.9770	0.9203	0.7819	0.6163	0.6820	0.9050	0.9873	0.9977	0.9991	(86)
MIT	19.6614	19.8002	20.0478	20.3928	20.7116	20.9181	20.9808	20.9687	20.8094	20.4038	19.9750	19.6408	(87)
Th 2	19.9403	19.9428	19.9453	19.9569	19.9591	19.9693	19.9693	19.9712	19.9654	19.9591	19.9547	19.9501	(88)
util rest of house													
	0.9985	0.9967	0.9910	0.9673	0.8852	0.6936	0.4850	0.5514	0.8488	0.9804	0.9967	0.9988	(89)
MIT 2	18.1498	18.3545	18.7172	19.2230	19.6615	19.9112	19.9618	19.9573	19.7990	19.2453	18.6189	18.1266	(90)
Living area fraction									fLA = Living area / (4) =			0.1608	(91)
MIT	18.3930	18.5871	18.9312	19.4111	19.8304	20.0732	20.1257	20.1200	19.9615	19.4316	18.8370	18.3702	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3930	18.5871	18.9312	19.4111	19.8304	20.0732	20.1257	20.1200	19.9615	19.4316	18.8370	18.3702	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9950	0.9874	0.9605	0.8799	0.7035	0.5060	0.5718	0.8485	0.9753	0.9951	0.9981	(94)
Useful gains	530.2021	603.1673	674.0037	737.9697	731.2657	578.3565	395.2510	411.0562	550.6659	556.4567	514.7238	502.7820	(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													
	1658.2104	1606.1441	1454.9385	1214.9735	937.5870	624.2444	402.1281	423.4143	671.3926	1018.4468	1359.9333	1649.9778	(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													
	839.2381	674.0004	581.0155	343.4428	153.5031	0.0000	0.0000	0.0000	0.0000	343.7206	608.5508	853.5137	(98)
Space heating												4396.9849	(98)
Space heating per m2											(98) / (4) =	43.8996	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												4707.6926	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	839.2381	674.0004	581.0155	343.4428	153.5031	0.0000	0.0000	0.0000	0.0000	343.7206	608.5508	853.5137	(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)													
	898.5419	721.6278	622.0722	367.7117	164.3502	0.0000	0.0000	0.0000	0.0000	368.0092	651.5534	913.8262	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.9419	187.6987	197.1510	175.4437	169.8605	149.6036	143.3317	159.7812	161.5458	183.2974	193.7729	207.8308	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1560	87.9893	87.6082	86.7123	84.7974	80.3000	80.3000	80.3000	80.3000	86.6111	87.7349	88.2270	(217)
Fuel for water heating, kWh/month													
	241.5513	213.3199	225.0371	202.3285	200.3133	186.3059	178.4952	198.9804	201.1779	211.6327	220.8620	235.5637	(219)
Water heating fuel used												2515.5678	(219)
Annual totals kWh/year													
Space heating fuel - main system												4707.6926	(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)												427.5456	(232)
Total delivered energy for all uses												7725.8060	(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	4707.6926	0.2160	1016.8616	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2515.5678	0.2160	543.3626	(264)
Space and water heating			1560.2243	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	427.5456	0.5190	221.8961	(268)
Total CO2, kg/m2/year			1821.0454	(272)
Emissions per m2 for space and water heating			15.5773	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2154	(272b)
Emissions per m2 for pumps and fans			0.3886	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5773 * 1.00) + 2.2154 + 0.3886, rounded to 2 d.p.			18.1800	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0800 (1b)	x	2.3300 (2b)	=	116.6864	(1b) - (3b)
First floor	50.0800 (1c)	x	2.5600 (2c)	=	128.2048	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.8912	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1633	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4138	(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) =	0.3518	(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	0.4485	0.4397	0.4309	0.3869	0.3781	0.3342	0.3342	0.3254	0.3518	0.3781	0.3957	0.4133	(22b)
Effective ac	0.6006	0.5967	0.5928	0.5749	0.5715	0.5558	0.5558	0.5529	0.5619	0.5715	0.5783	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	
Opening Type 1 (Uw = 1.41)			14.9400	1.3347	19.9407			(27)
Opening Type 10			1.9500	1.0000	1.9500			(26)
150mm TE Platinum GF			50.0800	0.1500	7.5120			(28a)
50mm Alreflex Plat	146.1600	16.8900	129.2700	0.2700	34.9029			(29a)
400mm	50.0800		50.0800	0.1100	5.5088			(30)
Total net area of external elements Aum(A, m2)			246.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		69.8144			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							203.3300	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0665	(36)
Total fabric heat loss					(33) + (36) =		78.8810	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.5349	48.2193	47.9099	46.4568	46.1850	44.9194	44.9194	44.6850	45.4069	46.1850	46.7350	47.3099	(38)
Heat transfer coeff	127.4159	127.1003	126.7909	125.3378	125.0660	123.8004	123.8004	123.5660	124.2879	125.0660	125.6159	126.1909	(39)
Average = Sum(39)m / 12 =												125.3365	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2721	1.2690	1.2659	1.2514	1.2487	1.2360	1.2360	1.2337	1.2409	1.2487	1.2542	1.2599	(40)
HLP (average)												1.2514	(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												2.7410	(42)
Average daily hot water use (litres/day)												99.2988	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2287	105.2567	101.2848	97.3128	93.3409	89.3689	89.3689	93.3409	97.3128	101.2848	105.2567	109.2287	(44)
Energy conte	161.9830	141.6713	146.1921	127.4538	122.2950	105.5313	97.7903	112.2157	113.5560	132.3385	144.4578	156.8719	(45)
Energy content (annual)										Total = Sum(45)m =		1562.3568	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.4214	30.1052	31.0658	27.0839	25.9877	22.4254	20.7804	23.8458	24.1306	28.1219	30.6973	33.3353	(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	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.2094	21.5026	17.4871	13.2388	9.8962	8.3548	9.0276	11.7345	15.7500	19.9982	23.3408	24.8823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	256.5862	259.2487	252.5392	238.2553	220.2245	203.2780	191.9568	189.2942	196.0038	210.2876	228.3185	245.2649	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	(71)
Water heating gains (Table 5)													
	46.2653	44.7993	41.7551	37.6166	34.9297	31.1464	27.9307	32.0509	33.5148	37.7983	42.6351	44.8055	(72)
Total internal gains													
	391.1759	389.6657	375.8964	353.2257	329.1654	306.8942	293.0301	297.1945	309.3835	332.1992	358.4095	379.0677	(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	7.2400	11.2829	0.7100	0.7000	0.7700	28.1352	(75)
Southeast	0.9200	36.7938	0.7100	0.7000	0.7700	11.6588	(77)
Southwest	4.5400	36.7938	0.7100	0.7000	0.7700	57.5335	(79)
Northwest	2.2400	11.2829	0.7100	0.7000	0.7700	8.7048	(81)

Solar gains	106.0323	192.8490	296.3675	421.6938	522.0591	540.1570	511.6664	433.4453	339.2409	221.9029	129.2307	89.2996	(83)
Total gains	497.2082	582.5146	672.2639	774.9195	851.2244	847.0513	804.6965	730.6399	648.6244	554.1020	487.6401	468.3672	(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	44.3986	44.5089	44.6175	45.1348	45.2329	45.6953	45.6953	45.7819	45.5160	45.2329	45.0348	44.8296	
alpha	3.9599	3.9673	3.9745	4.0090	4.0155	4.0464	4.0464	4.0521	4.0344	4.0155	4.0023	3.9886	
util living area													
	0.9976	0.9951	0.9883	0.9657	0.9032	0.7742	0.6245	0.6911	0.8954	0.9811	0.9956	0.9981	(86)
MIT	19.2506	19.4267	19.7397	20.1728	20.5753	20.8525	20.9544	20.9314	20.7013	20.1844	19.6436	19.2239	(87)
Th 2	19.8627	19.8652	19.8677	19.8791	19.8813	19.8913	19.8913	19.8931	19.8874	19.8813	19.8769	19.8724	(88)
util rest of house													
	0.9969	0.9936	0.9846	0.9537	0.8668	0.6881	0.4899	0.5600	0.8405	0.9725	0.9941	0.9976	(89)
MIT 2	18.2683	18.4457	18.7588	19.1932	19.5738	19.8133	19.8770	19.8688	19.6995	19.2113	18.6715	18.2490	(90)
Living area fraction									fLA = Living area / (4) =			0.1608	(91)
MIT	18.4263	18.6035	18.9166	19.3508	19.7349	19.9804	20.0503	20.0397	19.8607	19.3678	18.8278	18.4058	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4263	18.6035	18.9166	19.3508	19.7349	19.9804	20.0503	20.0397	19.8607	19.3678	18.8278	18.4058	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9913	0.9802	0.9463	0.8610	0.6960	0.5108	0.5793	0.8389	0.9670	0.9920	0.9965	(94)
Useful gains	494.9981	577.4649	658.9823	733.3369	732.9074	589.5137	411.0369	423.2611	544.1040	535.8232	483.7184	466.7282	(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													
	1799.9182	1741.7175	1574.3086	1309.8767	1004.8948	666.1001	427.1469	449.7468	715.9798	1096.5555	1473.2045	1792.6417	(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													
	970.8606	782.3777	681.0028	415.1087	202.3586	0.0000	0.0000	0.0000	0.0000	417.1848	712.4300	986.4797	(98)
Space heating												5167.8028	(98)
Space heating per m2											(98) / (4) =	51.5955	(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	1163.7236	916.1228	939.1017	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7770	0.8505	0.8106	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	904.2338	779.1675	761.2405	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1095.7928	1044.0611	959.5471	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	137.9224	197.0808	147.5401	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												482.5434 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.4806	49.2702	36.8850	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												120.6358 (107)
Space cooling per m2												1.2044 (108)
Energy for space heating												51.5955 (99)
Energy for space cooling												1.2044 (108)
Total												52.7999 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.8 (109)

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	50.0800 (1b)	x	2.3300 (2b)	=	116.6864	(1b) - (3b)
First floor	50.0800 (1c)	x	2.5600 (2c)	=	128.2048	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.8912	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1633 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.4133 (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) =	0.3513 (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	0.4480	0.4392	0.4304	0.3865	0.3777	0.3338	0.3338	0.3250	0.3513	0.3777	0.3953	0.4128	(22b)
Effective ac	0.6003	0.5964	0.5926	0.5747	0.5713	0.5557	0.5557	0.5528	0.5617	0.5713	0.5781	0.5852	(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			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.40)			14.9400	1.3258	19.8068			(27)
150mm TE Platinum GF			50.0800	0.1300	6.5104			(28a)
50mm Alreflex Plat	146.1600	16.8900	129.2700	0.1800	23.2686			(29a)
400mm	50.0800		50.0800	0.1300	6.5104			(30)
Total net area of external elements Aum(A, m2)			246.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.0462			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1009	(36)
Total fabric heat loss					(33) + (36) =		69.1471	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.5153	48.2004	47.8918	46.4422	46.1710	44.9085	44.9085	44.6747	45.3948	46.1710	46.7197	47.2933	(38)
Heat transfer coeff	117.6624	117.3475	117.0389	115.5894	115.3181	114.0556	114.0556	113.8218	114.5419	115.3181	115.8668	116.4404	(39)
Average = Sum(39)m / 12 =												115.5881	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1747	1.1716	1.1685	1.1540	1.1513	1.1387	1.1387	1.1364	1.1436	1.1513	1.1568	1.1625	(40)
HLP (average)												1.1540	(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												2.7410	(42)
Average daily hot water use (litres/day)												99.2988	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2287	105.2567	101.2848	97.3128	93.3409	89.3689	89.3689	93.3409	97.3128	101.2848	105.2567	109.2287	(44)
Energy conte	161.9830	141.6713	146.1921	127.4538	122.2950	105.5313	97.7903	112.2157	113.5560	132.3385	144.4578	156.8719	(45)
Energy content (annual)										Total = Sum(45)m =		1562.3568	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.4214	30.1052	31.0658	27.0839	25.9877	22.4254	20.7804	23.8458	24.1306	28.1219	30.6973	33.3353	(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	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	137.0501	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.2094	21.5026	17.4871	13.2388	9.8962	8.3548	9.0276	11.7345	15.7500	19.9982	23.3408	24.8823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	256.5862	259.2487	252.5392	238.2553	220.2245	203.2780	191.9568	189.2942	196.0038	210.2876	228.3185	245.2649	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	36.7050	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	-109.6401	(71)
Water heating gains (Table 5)													
	46.2653	44.7993	41.7551	37.6166	34.9297	31.1464	27.9307	32.0509	33.5148	37.7983	42.6351	44.8055	(72)
Total internal gains													
	391.1759	389.6657	375.8964	353.2257	329.1654	306.8942	293.0301	297.1945	309.3835	332.1992	358.4095	379.0677	(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	7.2400	11.2829	0.6300	0.7000	0.7700	24.9651	(75)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
Southwest	4.5400	36.7938	0.6300	0.7000	0.7700	51.0508	(79)
Northwest	2.2400	11.2829	0.6300	0.7000	0.7700	7.7240	(81)

Solar gains	94.0850	171.1195	262.9739	374.1790	463.2355	479.2943	454.0138	384.6064	301.0166	196.8997	114.6695	79.2376	(83)
Total gains	485.2609	560.7852	638.8704	727.4047	792.4009	786.1885	747.0439	681.8010	610.4001	529.0989	473.0789	458.3053	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1145	59.2731	59.4294	60.1747	60.3162	60.9839	60.9839	61.1092	60.7250	60.3162	60.0306	59.7349	
alpha	4.9410	4.9515	4.9620	5.0116	5.0211	5.0656	5.0656	5.0739	5.0483	5.0211	5.0020	4.9823	
util living area													
	0.9992	0.9983	0.9951	0.9815	0.9318	0.8027	0.6395	0.7095	0.9218	0.9908	0.9985	0.9994	(86)
MIT	19.6184	19.7583	20.0082	20.3585	20.6868	20.9071	20.9773	20.9626	20.7863	20.3671	19.9341	19.5984	(87)
Th 2	19.9403	19.9428	19.9453	19.9569	19.9591	19.9693	19.9693	19.9712	19.9654	19.9591	19.9547	19.9501	(88)
util rest of house													
	0.9990	0.9977	0.9932	0.9735	0.9004	0.7167	0.5056	0.5779	0.8720	0.9856	0.9978	0.9993	(89)
MIT 2	18.6750	18.8166	19.0677	19.4230	19.7351	19.9233	19.9632	19.9595	19.8344	19.4362	19.0019	18.6628	(90)
Living area fraction										fLA = Living area / (4) =		0.1608	(91)
MIT	18.8267	18.9681	19.2189	19.5734	19.8882	20.0816	20.1263	20.1209	19.9875	19.5860	19.1518	18.8133	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8267	18.9681	19.2189	19.5734	19.8882	20.0816	20.1263	20.1209	19.9875	19.5860	19.1518	18.8133	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9968	0.9914	0.9697	0.8977	0.7273	0.5273	0.5989	0.8733	0.9830	0.9971	0.9989	(94)
Useful gains	484.5701	559.0175	633.3514	705.3446	711.3621	571.7876	393.9368	408.3492	533.0674	520.0815	471.6839	457.8193	(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													
	1709.2474	1650.8552	1488.6115	1233.7347	944.2460	625.2029	402.1934	423.5146	674.3617	1036.2434	1396.4087	1701.5792	(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													
	911.1599	733.7149	636.3135	380.4409	173.2656	0.0000	0.0000	0.0000	0.0000	384.0245	665.8018	925.3573	(98)
Space heating												4810.0785	(98)
Space heating per m2											(98) / (4) =	48.0239	(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	1072.1228	844.0116	865.0458	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8157	0.8896	0.8525	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	874.4911	750.8622	737.4757	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1024.6545	976.6750	902.4627	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	108.1177	168.0047	122.7504	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											398.8727	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	27.0294	42.0012	30.6876	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											99.7182	(107)
Space cooling per m2											0.9956	(108)
Energy for space heating											48.0239	(99)
Energy for space cooling											0.9956	(108)
Total											49.0195	(109)
Target Fabric Energy Efficiency (TFEE)											56.4	(109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Lutterworth Detached	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Lutterworth (Hipped Roof), Detached, Part L2013 Masonry, Barratt Developments, January 2019		

SAP Rating	83 B	**DER**	17.97	**TER**	18.50
Environmental	85 B	**% DER<TER**	2.88		
CO_2 Emissions (t/year)	1.46	**DFEE**	51.83	**TFEE**	56.12
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.65		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Detached House, total floor area 92 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.50 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.97 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.25 m², No overhang
Windows facing South East: 4.47 m², No overhang
Windows facing West: 3.44 m², No overhang
Windows facing North West: 2.78 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.038 W/m²K

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	45.7700 (1b)	x	2.3100 (2b)	=	105.7287	(1b) - (3b)
First floor	45.7700 (1c)	x	2.5600 (2c)	=	117.1712	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.5400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	222.8999	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1795	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4300	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4300	(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	0.5482	0.5374	0.5267	0.4729	0.4622	0.4085	0.4085	0.3977	0.4300	0.4622	0.4837	0.5052	(22b)
Effective ac	0.6503	0.6444	0.6387	0.6118	0.6068	0.5834	0.5834	0.5791	0.5924	0.6068	0.6170	0.6276	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			14.9400	1.3347	19.9407			(27)
Opening Type 11			1.9700	1.0000	1.9700			(26)
150mm TE Platinum GF			45.7700	0.1500	6.8655			(28a)
50mm Alreflex Plat	135.2400	16.9100	118.3300	0.2700	31.9491			(29a)
400mm mineral	45.7700		45.7700	0.1100	5.0347			(30)
Total net area of external elements Aum(A, m2)			226.7800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.7600			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	160.2000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.6427	(36)
Total fabric heat loss (33) + (36) =	74.4027	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.8309	47.4017	46.9810	45.0051	44.6354	42.9144	42.9144	42.5957	43.5773	44.6354	45.3833	46.1651	(38)
Heat transfer coeff	122.2336	121.8044	121.3837	119.4078	119.0381	117.3172	117.3172	116.9985	117.9801	119.0381	119.7860	120.5679	(39)
Average = Sum(39)m / 12 =												119.4061	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3353	1.3306	1.3260	1.3044	1.3004	1.2816	1.2816	1.2781	1.2888	1.3004	1.3086	1.3171	(40)
HLP (average)												1.3044	(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	2.6462 (42)
Average daily hot water use (litres/day)	97.0477 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7524	102.8705	98.9886	95.1067	91.2248	87.3429	87.3429	91.2248	95.1067	98.9886	102.8705	106.7524	(44)
Energy conte	158.3108	138.4596	142.8779	124.5644	119.5225	103.1389	95.5733	109.6718	110.9816	129.3384	141.1829	153.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1526.9378	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7466	20.7689	21.4317	18.6847	17.9284	15.4708	14.3360	16.4508	16.6472	19.4008	21.1774	22.9973	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1365	12.7576	14.0960	13.5971	14.0182	13.5290	13.9569	13.9967	13.5661	14.0638	13.6516	14.1245	(61)
Total heat required for water heating calculated for each month													
	172.4473	151.2172	156.9739	138.1616	133.5408	116.6679	109.5302	123.6685	124.5477	143.4022	154.8346	167.4401	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.4473	151.2172	156.9739	138.1616	133.5408	116.6679	109.5302	123.6685	124.5477	143.4022	154.8346	167.4401	(64)
								Total per year (kWh/year) = Sum(64)m =				1692.4319	(64)
Heat gains from water heating, kWh/month													
	56.1725	49.2272	51.0309	44.8170	43.2458	37.6759	35.2674	39.9650	40.2929	46.5210	50.3562	54.5085	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4104	19.9047	16.1876	12.2551	9.1608	7.7339	8.3568	10.8625	14.5796	18.5122	21.6064	23.0333	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	241.8826	244.3925	238.0675	224.6021	207.6045	191.6292	180.9567	178.4467	184.7718	198.2372	215.2347	231.2101	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	(71)
Water heating gains (Table 5)													
	75.5006	73.2548	68.5899	62.2458	58.1261	52.3277	47.4024	53.7164	55.9624	62.5282	69.9392	73.2642	(72)
Total internal gains													
	405.4869	403.2453	388.5383	364.7962	340.5847	317.3841	302.4091	308.7189	321.0071	344.9708	372.4736	393.2008	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.2500	19.6403	0.7100	0.7000	0.7700	28.7492	(76)
Southeast	4.4700	36.7938	0.7100	0.7000	0.7700	56.6464	(77)
West	3.4400	19.6403	0.7100	0.7000	0.7700	23.2699	(80)
Northwest	2.7800	11.2829	0.7100	0.7000	0.7700	10.8033	(81)

Solar gains	119.4688	220.2407	339.2263	473.0609	570.2243	581.7736	554.5227	481.0134	386.1370	254.2632	146.3044	100.0780	(83)
Total gains	524.9557	623.4860	727.7646	837.8571	910.8090	899.1577	856.9319	789.7323	707.1441	599.2340	518.7781	493.2788	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.3258	33.4432	33.5591	34.1144	34.2204	34.7224	34.7224	34.8169	34.5273	34.2204	34.0067	33.7862	
alpha	3.2217	3.2295	3.2373	3.2743	3.2814	3.3148	3.3148	3.3211	3.3018	3.2814	3.2671	3.2524	
util living area													
	0.9906	0.9830	0.9656	0.9218	0.8350	0.6949	0.5521	0.6064	0.8184	0.9501	0.9846	0.9923	(86)
MIT	18.9184	19.1532	19.5499	20.0729	20.5218	20.8253	20.9403	20.9178	20.6743	20.0772	19.4103	18.8889	(87)
Th 2	19.8133	19.8169	19.8205	19.8374	19.8405	19.8553	19.8553	19.8580	19.8496	19.8405	19.8341	19.8275	(88)
util rest of house													
	0.9884	0.9790	0.9571	0.9014	0.7896	0.6089	0.4282	0.4836	0.7513	0.9330	0.9803	0.9905	(89)
MIT 2	17.0529	17.3961	17.9718	18.7253	19.3355	19.7151	19.8248	19.8120	19.5515	18.7472	17.7830	17.0182	(90)
Living area fraction									fLA = Living area / (4) =			0.1792	(91)
MIT	17.3871	17.7109	18.2545	18.9667	19.5480	19.9140	20.0247	20.0101	19.7527	18.9855	18.0746	17.3533	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.2371	17.5609	18.1045	18.8167	19.3980	19.7640	19.8747	19.8601	19.6027	18.8355	17.9246	17.2033	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9807	0.9673	0.9393	0.8780	0.7688	0.6012	0.4304	0.4839	0.7337	0.9120	0.9693	0.9839	(94)
Useful gains	514.8125	603.1061	683.5970	735.6085	700.1855	540.5642	368.8609	382.1141	518.8520	546.5042	502.8527	485.3563	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1581.3475	1542.1540	1408.5994	1184.1314	916.3572	605.8268	384.1764	404.8232	649.2083	980.3392	1296.6337	1567.7823	(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													
	793.5020	631.0402	539.4018	322.9365	160.8318	0.0000	0.0000	0.0000	0.0000	322.7733	571.5224	805.3250	(98)
Space heating												4147.3329	(98)
Space heating per m2											(98) / (4) =	45.3062	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4582.6883	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	793.5020	631.0402	539.4018	322.9365	160.8318	0.0000	0.0000	0.0000	0.0000	322.7733	571.5224	805.3250	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	876.7978	697.2820	596.0241	356.8359	177.7146	0.0000	0.0000	0.0000	0.0000	356.6555	631.5164	889.8619	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.4473	151.2172	156.9739	138.1616	133.5408	116.6679	109.5302	123.6685	124.5477	143.4022	154.8346	167.4401	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.9116	89.8632	89.7584	89.5168	89.0197	87.3000	87.3000	87.3000	87.3000	89.4909	89.7983	89.9326	(217)
Fuel for water heating, kWh/month													
	191.7964	168.2748	174.8850	154.3415	150.0126	133.6402	125.4642	141.6592	142.6664	160.2422	172.4248	186.1840	(219)
Water heating fuel used												1901.5911	(219)
Annual totals kWh/year													
Space heating fuel - main system												4582.6883	(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)												395.7751	(232)
Total delivered energy for all uses												6955.0545	(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	4582.6883	0.2160	989.8607	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1901.5911	0.2160	410.7437	(264)
Space and water heating			1400.6044	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	395.7751	0.5190	205.4073	(268)
Total CO2, kg/year			1644.9366	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.9700	(273)

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

DER		17.9700	ZC1
Total Floor Area	TFA	91.5400	
Assumed number of occupants	N	2.6462	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.6581	ZC2
CO2 emissions from cooking, equation (L16)		1.9938	ZC3
Total CO2 emissions		35.6219	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.6219	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	45.7700 (1b)	x	2.3100 (2b)	=	105.7287	(1b) - (3b)
First floor	45.7700 (1c)	x	2.5600 (2c)	=	117.1712	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.5400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	222.8999	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1346	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3846	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3846	(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	0.4904	0.4807	0.4711	0.4230	0.4134	0.3654	0.3654	0.3557	0.3846	0.4134	0.4327	0.4519	(22b)
Effective ac	0.6202	0.6156	0.6110	0.5895	0.5855	0.5667	0.5667	0.5633	0.5740	0.5855	0.5936	0.6021	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			14.9400	1.3258	19.8068			(27)
150mm TE Platinum GF			45.7700	0.1300	5.9501			(28a)
50mm Alreflex Plat	135.2400	16.9100	118.3300	0.1800	21.2994			(29a)
400mm mineral	45.7700		45.7700	0.1300	5.9501			(30)
Total net area of external elements Aum(A, m2)			226.7800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9764			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6166	(36)
Total fabric heat loss					(33) + (36) =		65.5930	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.6217	45.2783	44.9417	43.3607	43.0649	41.6880	41.6880	41.4330	42.2184	43.0649	43.6633	44.2889	(38)
Heat transfer coeff	111.2147	110.8713	110.5347	108.9537	108.6580	107.2810	107.2810	107.0260	107.8114	108.6580	109.2563	109.8819	(39)
Average = Sum(39)m / 12 =												108.9523	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2149	1.2112	1.2075	1.1902	1.1870	1.1720	1.1720	1.1692	1.1778	1.1870	1.1935	1.2004	(40)
HLP (average)												1.1902	(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		2.6462 (42)
Average daily hot water use (litres/day)		97.0477 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7524	102.8705	98.9886	95.1067	91.2248	87.3429	87.3429	91.2248	95.1067	98.9886	102.8705	106.7524	(44)
Energy conte	158.3108	138.4596	142.8779	124.5644	119.5225	103.1389	95.5733	109.6718	110.9816	129.3384	141.1829	153.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1526.9378	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7466	20.7689	21.4317	18.6847	17.9284	15.4708	14.3360	16.4508	16.6472	19.4008	21.1774	22.9973	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.4435	46.9019	46.4872	43.0732	44.5090	46.4872	46.9019	50.4435	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	209.2697	184.4870	193.3214	171.4664	166.0097	146.2121	140.0823	156.1590	157.8836	179.7819	190.4980	204.2744	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	209.2697	184.4870	193.3214	171.4664	166.0097	146.2121	140.0823	156.1590	157.8836	179.7819	190.4980	204.2744	(64)
								Total per year (kWh/year) = Sum(64)m =				2099.4455	(64)
Heat gains from water heating, kWh/month													
	65.3781	57.5447	60.1178	53.1432	51.3630	45.0620	42.9054	48.0877	48.6269	55.6159	59.2721	63.7171	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4104	19.9047	16.1876	12.2551	9.1608	7.7339	8.3568	10.8625	14.5796	18.5122	21.6064	23.0333	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	241.8826	244.3925	238.0675	224.6021	207.6045	191.6292	180.9567	178.4467	184.7718	198.2372	215.2347	231.2101	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	(71)
Water heating gains (Table 5)													
	87.8737	85.6320	80.8035	73.8099	69.0363	62.5861	57.6685	64.6340	67.5373	74.7525	82.3224	85.6413	(72)
Total internal gains													
	417.8600	415.6225	400.7518	376.3604	351.4950	327.6425	312.6753	319.6364	332.5820	357.1951	384.8568	405.5779	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.2500	19.6403	0.6300	0.7000	0.7700	25.5099	(76)
Southeast	4.4700	36.7938	0.6300	0.7000	0.7700	50.2637	(77)
West	3.4400	19.6403	0.6300	0.7000	0.7700	20.6480	(80)
Northwest	2.7800	11.2829	0.6300	0.7000	0.7700	9.5860	(81)

Solar gains	106.0076	195.4248	301.0036	419.7582	505.9737	516.2216	492.0413	426.8147	342.6286	225.6138	129.8194	88.8016	(83)
Total gains	523.8676	611.0473	701.7555	796.1187	857.4687	843.8641	804.7166	746.4511	675.2106	582.8089	514.6762	494.3796	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1592	57.3362	57.5108	58.3453	58.5042	59.2551	59.2551	59.3963	58.9636	58.5042	58.1838	57.8525	
alpha	4.8106	4.8224	4.8341	4.8897	4.9003	4.9503	4.9503	4.9598	4.9309	4.9003	4.8789	4.8568	
util living area													
	0.9984	0.9963	0.9895	0.9646	0.8909	0.7364	0.5685	0.6284	0.8690	0.9807	0.9966	0.9988	(86)
MIT	19.6471	19.8065	20.0777	20.4394	20.7487	20.9334	20.9852	20.9763	20.8396	20.4309	19.9763	19.6253	(87)
Th 2	19.9081	19.9111	19.9140	19.9278	19.9304	19.9425	19.9425	19.9447	19.9378	19.9304	19.9252	19.9197	(88)
util rest of house													
	0.9978	0.9949	0.9857	0.9505	0.8475	0.6435	0.4411	0.4994	0.8009	0.9707	0.9952	0.9984	(89)
MIT 2	18.1065	18.3412	18.7377	19.2643	19.6803	19.8974	19.9370	19.9348	19.8054	19.2616	18.5998	18.0827	(90)
Living area fraction									fLA = Living area / (4) =			0.1792	(91)
MIT	18.3825	18.6037	18.9778	19.4748	19.8717	20.0830	20.1248	20.1214	19.9906	19.4711	18.8464	18.3590	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3825	18.6037	18.9778	19.4748	19.8717	20.0830	20.1248	20.1214	19.9906	19.4711	18.8464	18.3590	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9926	0.9809	0.9428	0.8447	0.6570	0.4639	0.5223	0.8049	0.9646	0.9930	0.9974	(94)
Useful gains	522.0683	606.5064	688.3463	750.5940	724.2784	554.4210	373.3213	389.8477	543.5034	562.1708	511.0876	493.0904	(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													
	1566.1778	1519.3524	1379.2259	1152.1679	887.9161	588.2255	378.1435	398.2877	635.0783	963.9113	1283.3683	1555.8213	(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													
	776.8175	613.4325	514.0144	289.1332	121.7464	0.0000	0.0000	0.0000	0.0000	298.8950	556.0421	790.6718	(98)
Space heating												3960.7528	(98)
Space heating per m2											(98) / (4) =	43.2680	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												4240.6347	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	776.8175	613.4325	514.0144	289.1332	121.7464	0.0000	0.0000	0.0000	0.0000	298.8950	556.0421	790.6718	(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)													
	831.7104	656.7800	550.3366	309.5645	130.3495	0.0000	0.0000	0.0000	0.0000	320.0160	595.3341	846.5436	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	209.2697	184.4870	193.3214	171.4664	166.0097	146.2121	140.0823	156.1590	157.8836	179.7819	190.4980	204.2744	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0497	87.8454	87.3957	86.3565	84.2841	80.3000	80.3000	80.3000	80.3000	86.3221	87.5888	88.1243	(217)
Fuel for water heating, kWh/month													
	237.6723	210.0134	221.2026	198.5564	196.9644	182.0823	174.4487	194.4694	196.6171	208.2686	217.4913	231.8026	(219)
Water heating fuel used												2469.5892	(219)
Annual totals kWh/year													
Space heating fuel - main system												4240.6347	(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)												395.7751	(232)
Total delivered energy for all uses												7180.9991	(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	4240.6347	0.2160	915.9771	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2469.5892	0.2160	533.4313	(264)
Space and water heating			1449.4084	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	395.7751	0.5190	205.4073	(268)
Total CO2, kg/m2/year			1693.7407	(272)
Emissions per m2 for space and water heating			15.8336	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2439	(272b)
Emissions per m2 for pumps and fans			0.4252	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8336 * 1.00) + 2.2439 + 0.4252, rounded to 2 d.p.			18.5000	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.7700 (1b)	x	2.3100 (2b)	=	105.7287	(1b) - (3b)
First floor	45.7700 (1c)	x	2.5600 (2c)	=	117.1712	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.5400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	222.8999	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1346 (8)
Pressure test		Yes
Measured/design AP50		5.0100
Infiltration rate		0.3851 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3851 (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	0.4910	0.4814	0.4717	0.4236	0.4140	0.3658	0.3658	0.3562	0.3851	0.4140	0.4332	0.4525	(22b)
Effective ac	0.6205	0.6159	0.6113	0.5897	0.5857	0.5669	0.5669	0.5634	0.5741	0.5857	0.5938	0.6024	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			14.9400	1.3347	19.9407			(27)
Opening Type 11			1.9700	1.0000	1.9700			(26)
150mm TE Platinum GF			45.7700	0.1500	6.8655			(28a)
50mm Alreflex Plat	135.2400	16.9100	118.3300	0.2700	31.9491			(29a)
400mm mineral	45.7700		45.7700	0.1100	5.0347			(30)
Total net area of external elements Aum(A, m2)			226.7800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.7600			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							160.2000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6427	(36)
Total fabric heat loss					(33) + (36) =		74.4027	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.6447	45.3004	44.9629	43.3779	43.0813	41.7007	41.7007	41.4451	42.2325	43.0813	43.6812	44.3085	(38)
Heat transfer coeff	120.0474	119.7031	119.3657	117.7806	117.4840	116.1035	116.1035	115.8478	116.6353	117.4840	118.0840	118.7112	(39)
Average = Sum(39)m / 12 =												117.7792	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3114	1.3077	1.3040	1.2867	1.2834	1.2683	1.2683	1.2655	1.2741	1.2834	1.2900	1.2968	(40)
HLP (average)												1.2866	(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		2.6462 (42)
Average daily hot water use (litres/day)		97.0477 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7524	102.8705	98.9886	95.1067	91.2248	87.3429	87.3429	91.2248	95.1067	98.9886	102.8705	106.7524	(44)
Energy conte	158.3108	138.4596	142.8779	124.5644	119.5225	103.1389	95.5733	109.6718	110.9816	129.3384	141.1829	153.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1526.9378	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.6410	29.4227	30.3616	26.4699	25.3985	21.9170	20.3093	23.3053	23.5836	27.4844	30.0014	32.5796	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4104	19.9047	16.1876	12.2551	9.1608	7.7339	8.3568	10.8625	14.5796	18.5122	21.6064	23.0333	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	241.8826	244.3925	238.0675	224.6021	207.6045	191.6292	180.9567	178.4467	184.7718	198.2372	215.2347	231.2101	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	(71)
Water heating gains (Table 5)													
	45.2165	43.7837	40.8085	36.7638	34.1378	30.4403	27.2975	31.3243	32.7550	36.9414	41.6686	43.7897	(72)
Total internal gains													
	372.2027	370.7743	357.7569	336.3143	313.5964	292.4967	279.3043	283.3267	294.7997	316.3840	341.2030	360.7263	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.2500	19.6403	0.7100	0.7000	0.7700	28.7492	(76)
Southeast	4.4700	36.7938	0.7100	0.7000	0.7700	56.6464	(77)
West	3.4400	19.6403	0.7100	0.7000	0.7700	23.2699	(80)
Northwest	2.7800	11.2829	0.7100	0.7000	0.7700	10.8033	(81)

Solar gains	119.4688	220.2407	339.2263	473.0609	570.2243	581.7736	554.5227	481.0134	386.1370	254.2632	146.3044	100.0780	(83)
Total gains	491.6716	591.0150	696.9832	809.3752	883.8208	874.2703	833.8270	764.3401	680.9367	570.6472	487.5074	460.8044	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.9327	34.0303	34.1265	34.5857	34.6731	35.0853	35.0853	35.1628	34.9254	34.6731	34.4969	34.3146	
alpha	3.2622	3.2687	3.2751	3.3057	3.3115	3.3390	3.3390	3.3442	3.3284	3.3115	3.2998	3.2876	
util living area													
	0.9923	0.9854	0.9690	0.9270	0.8420	0.7035	0.5602	0.6173	0.8286	0.9555	0.9871	0.9938	(86)
MIT	18.9123	19.1473	19.5448	20.0656	20.5172	20.8219	20.9391	20.9150	20.6659	20.0624	19.3949	18.8778	(87)
Th 2	19.8319	19.8348	19.8377	19.8513	19.8538	19.8657	19.8657	19.8679	19.8611	19.8538	19.8487	19.8433	(88)
util rest of house													
	0.9904	0.9819	0.9613	0.9078	0.7980	0.6185	0.4363	0.4947	0.7638	0.9401	0.9835	0.9923	(89)
MIT 2	17.9359	18.1715	18.5664	19.0826	19.5037	19.7674	19.8443	19.8350	19.6503	19.0906	18.4292	17.9099	(90)
Living area fraction									fLA = Living area / (4) =			0.1792	(91)
MIT	18.1108	18.3463	18.7416	19.2587	19.6853	19.9564	20.0405	20.0285	19.8322	19.2647	18.6022	18.0833	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1108	18.3463	18.7416	19.2587	19.6853	19.9564	20.0405	20.0285	19.8322	19.2647	18.6022	18.0833	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9866	0.9757	0.9517	0.8955	0.7904	0.6260	0.4568	0.5138	0.7619	0.9296	0.9779	0.9890	(94)
Useful gains	485.0759	576.6698	663.2902	724.7583	698.5914	547.3136	380.8607	392.6815	518.7878	530.4482	476.7467	455.7539	(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													
	1657.9543	1609.5671	1461.2321	1220.0590	938.1406	621.8927	399.4497	420.3571	668.5780	1017.9692	1358.2289	1648.1033	(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													
	872.6215	694.1070	593.6688	356.6165	178.2246	0.0000	0.0000	0.0000	0.0000	362.7157	634.6672	887.1080	(98)
Space heating												4579.7293	(98)
Space heating per m2											(98) / (4) =	50.0298	(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	1091.3728	859.1658	880.4435	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7801	0.8466	0.8139	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	851.4268	727.3883	716.6246	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1122.2319	1072.8654	993.4902	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	194.9797	257.0350	205.9880	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												658.0027 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	48.7449	64.2588	51.4970	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												164.5007 (107)
Space cooling per m2												1.7970 (108)
Energy for space heating												50.0298 (99)
Energy for space cooling												1.7970 (108)
Total												51.8269 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.8 (109)

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	45.7700 (1b)	x	2.3100 (2b)	=	105.7287	(1b) - (3b)
First floor	45.7700 (1c)	x	2.5600 (2c)	=	117.1712	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.5400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	222.8999	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1346	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3846	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3846	(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	0.4904	0.4807	0.4711	0.4230	0.4134	0.3654	0.3654	0.3557	0.3846	0.4134	0.4327	0.4519	(22b)
Effective ac	0.6202	0.6156	0.6110	0.5895	0.5855	0.5667	0.5667	0.5633	0.5740	0.5855	0.5936	0.6021	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			14.9400	1.3258	19.8068			(27)
150mm TE Platinum GF			45.7700	0.1300	5.9501			(28a)
50mm Alreflex Plat	135.2400	16.9100	118.3300	0.1800	21.2994			(29a)
400mm mineral	45.7700		45.7700	0.1300	5.9501			(30)
Total net area of external elements Aum(A, m2)			226.7800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9764			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.6166	(36)
Total fabric heat loss (33) + (36) =	65.5930	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.6217	45.2783	44.9417	43.3607	43.0649	41.6880	41.6880	41.4330	42.2184	43.0649	43.6633	44.2889	(38)
Heat transfer coeff	111.2147	110.8713	110.5347	108.9537	108.6580	107.2810	107.2810	107.0260	107.8114	108.6580	109.2563	109.8819	(39)
Average = Sum(39)m / 12 =												108.9523	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2149	1.2112	1.2075	1.1902	1.1870	1.1720	1.1720	1.1692	1.1778	1.1870	1.1935	1.2004	(40)
HLP (average)												1.1902	(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	2.6462	(42)
Average daily hot water use (litres/day)	97.0477	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.7524	102.8705	98.9886	95.1067	91.2248	87.3429	87.3429	91.2248	95.1067	98.9886	102.8705	106.7524	(44)
Energy conte	158.3108	138.4596	142.8779	124.5644	119.5225	103.1389	95.5733	109.6718	110.9816	129.3384	141.1829	153.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1526.9378	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.6410	29.4227	30.3616	26.4699	25.3985	21.9170	20.3093	23.3053	23.5836	27.4844	30.0014	32.5796	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	132.3109	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4104	19.9047	16.1876	12.2551	9.1608	7.7339	8.3568	10.8625	14.5796	18.5122	21.6064	23.0333	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	241.8826	244.3925	238.0675	224.6021	207.6045	191.6292	180.9567	178.4467	184.7718	198.2372	215.2347	231.2101	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	36.2311	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	-105.8487	(71)
Water heating gains (Table 5)													
	45.2165	43.7837	40.8085	36.7638	34.1378	30.4403	27.2975	31.3243	32.7550	36.9414	41.6686	43.7897	(72)
Total internal gains													
	372.2027	370.7743	357.7569	336.3143	313.5964	292.4967	279.3043	283.3267	294.7997	316.3840	341.2030	360.7263	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.2500	19.6403	0.6300	0.7000	0.7700	25.5099	(76)
Southeast	4.4700	36.7938	0.6300	0.7000	0.7700	50.2637	(77)
West	3.4400	19.6403	0.6300	0.7000	0.7700	20.6480	(80)
Northwest	2.7800	11.2829	0.6300	0.7000	0.7700	9.5860	(81)

Solar gains	106.0076	195.4248	301.0036	419.7582	505.9737	516.2216	492.0413	426.8147	342.6286	225.6138	129.8194	88.8016	(83)
Total gains	478.2103	566.1991	658.7605	756.0725	819.5702	808.7184	771.3456	710.1414	637.4283	541.9978	471.0224	449.5280	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1592	57.3362	57.5108	58.3453	58.5042	59.2551	59.2551	59.3963	58.9636	58.5042	58.1838	57.8525	
alpha	4.8106	4.8224	4.8341	4.8897	4.9003	4.9503	4.9503	4.9598	4.9309	4.9003	4.8789	4.8568	
util living area													
	0.9989	0.9973	0.9919	0.9708	0.9046	0.7574	0.5899	0.6543	0.8886	0.9856	0.9977	0.9992	(86)
MIT	19.6011	19.7618	20.0362	20.4048	20.7257	20.9243	20.9826	20.9717	20.8188	20.3928	19.9325	19.5799	(87)
Th 2	19.9081	19.9111	19.9140	19.9278	19.9304	19.9425	19.9425	19.9447	19.9378	19.9304	19.9252	19.9197	(88)
util rest of house													
	0.9985	0.9964	0.9889	0.9588	0.8646	0.6656	0.4592	0.5229	0.8261	0.9778	0.9967	0.9989	(89)
MIT 2	18.6322	18.7948	19.0700	19.4424	19.7412	19.9069	19.9380	19.9365	19.8329	19.4373	18.9768	18.6202	(90)
Living area fraction									fLA = Living area / (4) =			0.1792	(91)
MIT	18.8058	18.9680	19.2431	19.6148	19.9176	20.0892	20.1252	20.1220	20.0095	19.6085	19.1480	18.7921	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8058	18.9680	19.2431	19.6148	19.9176	20.0892	20.1252	20.1220	20.0095	19.6085	19.1480	18.7921	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9952	0.9863	0.9543	0.8640	0.6797	0.4828	0.5465	0.8312	0.9746	0.9957	0.9985	(94)
Useful gains	477.2400	563.4700	649.7527	721.5558	708.1302	549.6501	372.4433	388.0764	529.8215	528.2221	469.0079	448.8554	(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													
	1613.2539	1559.7407	1408.5541	1167.4219	892.9023	588.8824	378.1839	398.3457	637.1132	978.8456	1316.3202	1603.4110	(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													
	845.1943	669.4939	564.5482	321.0236	137.4705	0.0000	0.0000	0.0000	0.0000	335.2639	610.0648	858.9894	(98)
Space heating												4342.0487	(98)
Space heating per m2											(98) / (4) =	47.4333	(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	1008.4413	793.8793	813.3976	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8466	0.9119	0.8827	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	853.7794	723.9499	718.0175	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1045.6127	999.8352	930.1411	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	138.1200	205.2586	157.8199	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											501.1985	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.5300	51.3147	39.4550	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											125.2996	(107)
Space cooling per m2											1.3688	(108)
Energy for space heating											47.4333	(99)
Energy for space cooling											1.3688	(108)
Total											48.8021	(109)
Target Fabric Energy Efficiency (TFEE)											56.1	(109)

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Moresby Detached PV	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	DS07 Moresby , Detached, Barratt Developments plc		

SAP Rating	95 A	**DER**	6.05	**TER**	19.57
Environmental	96 A	**% DER<TER**	69.08		
CO_2 Emissions (t/year)	0.21	**DFEE**	55.27	**TFEE**	58.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.05		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Detached House, total floor area 81 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) 19.57 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)55.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 5.34 m², No overhang
Windows facing South East: 3.71 m², No overhang
Windows facing South West: 0.66 m², No overhang
Windows facing North West: 5.35 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 3.20 kW

ARUN DISTRICT COUNCIL A/45/22/PL

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	40.4400 (1b)	x	2.3300 (2b)	=	94.2252	(1b) - (3b)
First floor	40.4400 (1c)	x	2.5600 (2c)	=	103.5264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.8800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.7516	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2023	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4528	(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) =	0.3849	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4907	0.4811	0.4715	0.4233	0.4137	0.3656	0.3656	0.3560	0.3849	0.4137	0.4330	0.4522	(22b)
Effective ac	0.6204	0.6157	0.6111	0.5896	0.5856	0.5668	0.5668	0.5634	0.5741	0.5856	0.5937	0.6022	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			15.0600	1.3347	20.1009			(27)
150mm Platinum			40.4400	0.1500	6.0660			(28a)
50mm A. Platinum	128.2300	17.0300	111.2000	0.2700	30.0240			(29a)
400mm Mineral wool	40.4400		40.4400	0.1100	4.4484			(30)
Total net area of external elements Aum(A, m2)			209.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.6093			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	191.1800	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.0294	(36)
Total fabric heat loss (33) + (36) =	71.6387	(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	40.4854	40.1804	39.8813	38.4768	38.2140	36.9907	36.9907	36.7641	37.4619	38.2140	38.7456	39.3014	(38)
Heat transfer coeff	112.1242	111.8191	111.5201	110.1155	109.8527	108.6294	108.6294	108.4029	109.1006	109.8527	110.3843	110.9401	(39)
Average = Sum(39)m / 12 =												110.1143	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3863	1.3825	1.3788	1.3615	1.3582	1.3431	1.3431	1.3403	1.3489	1.3582	1.3648	1.3717	(40)
HLP (average)												1.3615	(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	2.4793	(42)
Average daily hot water use (litres/day)	93.0845	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.3929	98.6695	94.9462	91.2228	87.4994	83.7760	83.7760	87.4994	91.2228	94.9462	98.6695	102.3929	(44)
Energy conte	151.8457	132.8053	137.0431	119.4775	114.6415	98.9269	91.6703	105.1930	106.4494	124.0565	135.4174	147.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1464.5812	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7769	19.9208	20.5565	17.9216	17.1962	14.8390	13.7505	15.7790	15.9674	18.6085	20.3126	22.0582	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1210	12.7398	14.0688	13.5744	13.9973	13.5117	13.9409	13.9775	13.5459	14.0392	13.6335	14.1095	(61)
Total heat required for water heating calculated for each month													
	165.9667	145.5450	151.1120	133.0519	128.6388	112.4386	105.6112	119.1705	119.9952	138.0957	149.0508	161.1640	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	165.9667	145.5450	151.1120	133.0519	128.6388	112.4386	105.6112	119.1705	119.9952	138.0957	149.0508	161.1640	(64)
								Total per year (kWh/year) = Sum(64)m =				1629.8406	(64)
Heat gains from water heating, kWh/month													
	54.0190	47.3427	49.0840	43.1199	41.6176	36.2711	33.9656	38.4711	38.7809	44.7586	48.4346	52.4230	(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	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.0440	17.8029	14.4783	10.9610	8.1935	6.9173	7.4744	9.7155	13.0401	16.5574	19.3249	20.6011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.2699	223.5660	217.7799	205.4621	189.9130	175.2990	165.5360	163.2399	169.0260	181.3438	196.8929	211.5069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	(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)													
	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	(71)
Water heating gains (Table 5)													
	72.6061	70.4504	65.9732	59.8887	55.9377	50.3766	45.6527	51.7084	53.8623	60.1594	67.2703	70.4610	(72)
Total internal gains													
	377.1102	375.0095	361.4216	339.5020	317.2343	295.7831	281.8533	287.8540	299.1186	321.2508	346.6784	365.7592	(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	5.3400	11.2829	0.7100	0.7000	0.7700	20.7517	(75)
Southeast	3.7100	36.7938	0.7100	0.7000	0.7700	47.0152	(77)
Southwest	0.6600	36.7938	0.7100	0.7000	0.7700	8.3639	(79)
Northwest	5.3500	11.2829	0.7100	0.7000	0.7700	20.7905	(81)

Solar gains	96.9213	178.8915	281.4189	410.1254	515.4486	536.3862	506.8691	424.5224	325.3953	207.5955	118.6023	81.3185	(83)
Total gains	474.0316	553.9011	642.8405	749.6274	832.6829	832.1693	788.7223	712.3764	624.5139	528.8463	465.2807	447.0777	(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	38.3073	38.4118	38.5148	39.0061	39.0994	39.5397	39.5397	39.6224	39.3690	39.0994	38.9111	38.7162	
alpha	3.5538	3.5608	3.5677	3.6004	3.6066	3.6360	3.6360	3.6415	3.6246	3.6066	3.5941	3.5811	
util living area													
	0.9943	0.9895	0.9772	0.9406	0.8550	0.7090	0.5632	0.6292	0.8503	0.9656	0.9904	0.9954	(86)
MIT	19.1017	19.3021	19.6581	20.1456	20.5779	20.8561	20.9538	20.9310	20.6972	20.1389	19.5388	19.0718	(87)
Th 2	19.7739	19.7768	19.7796	19.7930	19.7955	19.8072	19.8072	19.8094	19.8027	19.7955	19.7904	19.7851	(88)
util rest of house													
	0.9928	0.9866	0.9705	0.9220	0.8079	0.6155	0.4288	0.4948	0.7823	0.9514	0.9872	0.9941	(89)
MIT 2	17.2648	17.5584	18.0762	18.7789	19.3631	19.7002	19.7868	19.7751	19.5354	18.7833	17.9135	17.2281	(90)
Living area fraction									fLA = Living area / (4) =			0.1952	(91)
MIT	17.6234	17.8988	18.3850	19.0457	19.6003	19.9259	20.0146	20.0008	19.7622	19.0480	18.2308	17.5880	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.4734	17.7488	18.2350	18.8957	19.4503	19.7759	19.8646	19.8508	19.6122	18.8980	18.0808	17.4380	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9880	0.9791	0.9581	0.9035	0.7915	0.6128	0.4358	0.5000	0.7687	0.9359	0.9800	0.9901	(94)
Useful gains	468.3292	542.3235	615.8995	677.2992	659.0973	509.9194	343.6942	356.1564	480.0892	494.9227	455.9857	442.6633	(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													
	1477.0558	1436.7407	1308.6895	1100.6845	851.3925	562.2526	354.6348	374.0725	601.3884	911.5537	1212.1132	1468.6292	(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													
	750.4926	601.0484	515.4358	304.8375	143.0676	0.0000	0.0000	0.0000	0.0000	309.9734	544.4118	763.3186	(98)
Space heating												3932.5856	(98)
Space heating per m2											(98) / (4) =	48.6225	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4345.3985	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	750.4926	601.0484	515.4358	304.8375	143.0676	0.0000	0.0000	0.0000	0.0000	309.9734	544.4118	763.3186	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	829.2735	664.1419	569.5423	336.8370	158.0857	0.0000	0.0000	0.0000	0.0000	342.5121	601.5600	843.4460	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	165.9667	145.5450	151.1120	133.0519	128.6388	112.4386	105.6112	119.1705	119.9952	138.0957	149.0508	161.1640	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.9032	89.8579	89.7541	89.5031	88.9562	87.3000	87.3000	87.3000	87.3000	89.4890	89.7926	89.9254	(217)
Fuel for water heating, kWh/month													
	184.6060	161.9724	168.3621	148.6561	144.6091	128.7957	120.9750	136.5069	137.4516	154.3158	165.9946	179.2197	(219)
Water heating fuel used												1831.4651	(219)
Annual totals kWh/year													
Space heating fuel - main system												4345.3985	(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)												353.9840	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.20 * 1004 * 0.80) =										-2056.1842		-2056.1842	(233)
Total delivered energy for all uses												4549.6634	(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	4345.3985	0.2160	938.6061	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1831.4651	0.2160	395.5965	(264)
Space and water heating			1334.2025	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	353.9840	0.5190	183.7177	(268)
Energy saving/generation technologies				
PV Unit	-2056.1842	0.5190	-1067.1596	(269)
Total CO2, kg/year			489.6856	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.0500	(273)

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

DER		6.0500	ZC1
Total Floor Area	TFA	80.8800	
Assumed number of occupants	N	2.4793	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2117	ZC2
CO2 emissions from cooking, equation (L16)		2.2070	ZC3
Total CO2 emissions		24.4687	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.4687	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	40.4400 (1b)	x	2.3300 (2b)	=	94.2252	(1b) - (3b)
First floor	40.4400 (1c)	x	2.5600 (2c)	=	103.5264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.8800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.7516	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1517 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.4017 (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) =	0.3414 (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	0.4353	0.4268	0.4183	0.3756	0.3671	0.3244	0.3244	0.3158	0.3414	0.3671	0.3841	0.4012	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5705	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			15.0600	1.3258	19.9659			(27)
150mm Platinum			40.4400	0.1300	5.2572			(28a)
50mm A. Platinum	128.2300	17.0300	111.2000	0.1800	20.0160			(29a)
400mm Mineral wool	40.4400		40.4400	0.1300	5.2572			(30)
Total net area of external elements Aum(A, m2)			209.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.4663			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3390	(36)
Total fabric heat loss					(33) + (36) =		62.8053	(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	38.8131	38.5730	38.3376	37.2320	37.0252	36.0623	36.0623	35.8839	36.4332	37.0252	37.4436	37.8811	(38)
Heat transfer coeff	101.6184	101.3783	101.1429	100.0373	99.8305	98.8676	98.8676	98.6892	99.2385	99.8305	100.2489	100.6864	(39)
Average = Sum(39)m / 12 =												100.0364	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2564	1.2534	1.2505	1.2369	1.2343	1.2224	1.2224	1.2202	1.2270	1.2343	1.2395	1.2449	(40)
HLP (average)												1.2368	(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		2.4793 (42)
Average daily hot water use (litres/day)		93.0845 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.3929	98.6695	94.9462	91.2228	87.4994	83.7760	83.7760	87.4994	91.2228	94.9462	98.6695	102.3929	(44)
Energy conte	151.8457	132.8053	137.0431	119.4775	114.6415	98.9269	91.6703	105.1930	106.4494	124.0565	135.4174	147.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1464.5812	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7769	19.9208	20.5565	17.9216	17.1962	14.8390	13.7505	15.7790	15.9674	18.6085	20.3126	22.0582	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.4150	48.3835	44.9866	44.5887	41.3142	42.6913	44.5887	44.9866	48.3835	48.6590	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.8046	178.2203	185.4266	164.4641	159.2303	140.2411	134.3617	149.7818	151.4360	172.4400	184.0763	198.0134	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.8046	178.2203	185.4266	164.4641	159.2303	140.2411	134.3617	149.7818	151.4360	172.4400	184.0763	198.0134	(64)
								Total per year (kWh/year) = Sum(64)m =				2020.4962	(64)
Heat gains from water heating, kWh/month													
	63.2284	55.5115	57.6627	50.9729	49.2655	43.2218	41.1532	46.1239	46.6411	53.3447	57.1910	61.6353	(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	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.0440	17.8029	14.4783	10.9610	8.1935	6.9173	7.4744	9.7155	13.0401	16.5574	19.3249	20.6011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.2699	223.5660	217.7799	205.4621	189.9130	175.2990	165.5360	163.2399	169.0260	181.3438	196.8929	211.5069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	(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)													
	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	(71)
Water heating gains (Table 5)													
	84.9845	82.6064	77.5037	70.7957	66.2171	60.0302	55.3135	61.9945	64.7793	71.6998	79.4320	82.8432	(72)
Total internal gains													
	389.4886	387.1655	372.9521	350.4090	327.5137	305.4367	291.5140	298.1400	310.0355	332.7913	358.8400	378.1414	(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	5.3400	11.2829	0.6300	0.7000	0.7700	18.4135	(75)
Southeast	3.7100	36.7938	0.6300	0.7000	0.7700	41.7177	(77)
Southwest	0.6600	36.7938	0.6300	0.7000	0.7700	7.4215	(79)
Northwest	5.3500	11.2829	0.6300	0.7000	0.7700	18.4479	(81)

Solar gains	86.0006	158.7347	249.7097	363.9141	457.3699	475.9483	449.7571	376.6889	288.7310	184.2045	105.2386	72.1558	(83)
Total gains	475.4892	545.9002	622.6618	714.3231	784.8836	781.3850	741.2711	674.8289	598.7666	516.9957	464.0787	450.2972	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2721	55.4030	55.5320	56.1457	56.2620	56.8100	56.8100	56.9127	56.5977	56.2620	56.0272	55.7838	
alpha	4.6848	4.6935	4.7021	4.7430	4.7508	4.7873	4.7873	4.7942	4.7732	4.7508	4.7351	4.7189	
util living area													
	0.9981	0.9961	0.9897	0.9647	0.8876	0.7302	0.5670	0.6361	0.8772	0.9814	0.9963	0.9986	(86)
MIT	19.6075	19.7595	20.0304	20.4041	20.7350	20.9288	20.9832	20.9717	20.8174	20.3929	19.9362	19.5825	(87)
Th 2	19.8751	19.8775	19.8798	19.8906	19.8927	19.9021	19.9021	19.9039	19.8985	19.8927	19.8885	19.8843	(88)
util rest of house													
	0.9975	0.9947	0.9858	0.9505	0.8427	0.6346	0.4355	0.5021	0.8100	0.9715	0.9948	0.9981	(89)
MIT 2	18.0259	18.2493	18.6448	19.1866	19.6306	19.8546	19.8960	19.8922	19.7468	19.1800	18.5157	17.9955	(90)
Living area fraction									fLA = Living area / (4) =			0.1952	(91)
MIT	18.3347	18.5442	18.9153	19.4243	19.8462	20.0643	20.1083	20.1029	19.9558	19.4168	18.7930	18.3053	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3347	18.5442	18.9153	19.4243	19.8462	20.0643	20.1083	20.1029	19.9558	19.4168	18.7930	18.3053	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9923	0.9810	0.9428	0.8404	0.6500	0.4613	0.5280	0.8142	0.9654	0.9925	0.9970	(94)
Useful gains	473.6398	541.6721	610.8485	673.4343	659.6448	507.9324	341.9273	356.3246	487.5091	499.1289	460.5764	448.9344	(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													
	1426.1797	1383.2218	1255.7202	1052.8249	813.2355	540.2393	346.8534	365.4376	581.1177	880.1882	1172.2126	1420.2144	(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													
	708.6897	565.5214	479.7846	273.1613	114.2715	0.0000	0.0000	0.0000	0.0000	283.5081	512.3780	722.6324	(98)
Space heating												3659.9470	(98)
Space heating per m2											(98) / (4) =	45.2516	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												3918.5728	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	708.6897	565.5214	479.7846	273.1613	114.2715	0.0000	0.0000	0.0000	0.0000	283.5081	512.3780	722.6324	(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)													
	758.7684	605.4833	513.6880	292.4639	122.3463	0.0000	0.0000	0.0000	0.0000	303.5419	548.5846	773.6963	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.8046	178.2203	185.4266	164.4641	159.2303	140.2411	134.3617	149.7818	151.4360	172.4400	184.0763	198.0134	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9390	87.7551	87.3379	86.3198	84.2319	80.3000	80.3000	80.3000	80.3000	86.2950	87.4914	88.0189	(217)
Fuel for water heating, kWh/month													
	230.6197	203.0883	212.3095	190.5289	189.0378	174.6465	167.3246	186.5277	188.5877	199.8262	210.3935	224.9670	(219)
Water heating fuel used												2377.8575	(219)
Annual totals kWh/year													
Space heating fuel - main system												3918.5728	(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)												353.9840	(232)
Total delivered energy for all uses												6725.4143	(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	3918.5728	0.2160	846.4117	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2377.8575	0.2160	513.6172	(264)
Space and water heating			1360.0289	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	353.9840	0.5190	183.7177	(268)
Total CO2, kg/m2/year			1582.6716	(272)
Emissions per m2 for space and water heating			16.8154	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2715	(272b)
Emissions per m2 for pumps and fans			0.4813	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.8154 * 1.00) + 2.2715 + 0.4813, rounded to 2 d.p.			19.5700	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4400 (1b)	x	2.3300 (2b)	=	94.2252	(1b) - (3b)
First floor	40.4400 (1c)	x	2.5600 (2c)	=	103.5264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.8800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.7516	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1517	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4022	(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) =	0.3419	(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	0.4359	0.4273	0.4188	0.3761	0.3675	0.3248	0.3248	0.3162	0.3419	0.3675	0.3846	0.4017	(22b)
Effective ac	0.5950	0.5913	0.5877	0.5707	0.5675	0.5527	0.5527	0.5500	0.5584	0.5675	0.5740	0.5807	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			15.0600	1.3347	20.1009			(27)
150mm Platinum			40.4400	0.1500	6.0660			(28a)
50mm A. Platinum	128.2300	17.0300	111.2000	0.2700	30.0240			(29a)
400mm Mineral wool	40.4400		40.4400	0.1100	4.4484			(30)
Total net area of external elements Aum(A, m2)			209.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.6093			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.1800	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0294	(36)
Total fabric heat loss					(33) + (36) =		71.6387	(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	38.8285	38.5878	38.3518	37.2435	37.0361	36.0708	36.0708	35.8920	36.4426	37.0361	37.4556	37.8942	(38)
Heat transfer coeff	110.4673	110.2265	109.9906	108.8822	108.6749	107.7095	107.7095	107.5308	108.0814	108.6749	109.0944	109.5329	(39)
Average = Sum(39)m / 12 =												108.8812	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3658	1.3628	1.3599	1.3462	1.3437	1.3317	1.3317	1.3295	1.3363	1.3437	1.3488	1.3543	(40)
HLP (average)												1.3462	(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												2.4793	(42)
Average daily hot water use (litres/day)												93.0845	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.3929	98.6695	94.9462	91.2228	87.4994	83.7760	83.7760	87.4994	91.2228	94.9462	98.6695	102.3929	(44)
Energy conte	151.8457	132.8053	137.0431	119.4775	114.6415	98.9269	91.6703	105.1930	106.4494	124.0565	135.4174	147.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1464.5812	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.2672	28.2211	29.1217	25.3890	24.3613	21.0220	19.4799	22.3535	22.6205	26.3620	28.7762	31.2491	(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	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.0440	17.8029	14.4783	10.9610	8.1935	6.9173	7.4744	9.7155	13.0401	16.5574	19.3249	20.6011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.2699	223.5660	217.7799	205.4621	189.9130	175.2990	165.5360	163.2399	169.0260	181.3438	196.8929	211.5069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	(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)													
	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	(71)
Water heating gains (Table 5)													
	43.3699	41.9957	39.1420	35.2625	32.7437	29.1972	26.1827	30.0451	31.4174	35.4328	39.9669	42.0015	(72)
Total internal gains													
	344.8740	343.5548	331.5904	311.8757	291.0404	271.6037	259.3833	263.1906	273.6736	293.5242	316.3750	334.2996	(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	5.3400	11.2829	0.7100	0.7000	0.7700	20.7517	(75)
Southeast	3.7100	36.7938	0.7100	0.7000	0.7700	47.0152	(77)
Southwest	0.6600	36.7938	0.7100	0.7000	0.7700	8.3639	(79)
Northwest	5.3500	11.2829	0.7100	0.7000	0.7700	20.7905	(81)

Solar gains	96.9213	178.8915	281.4189	410.1254	515.4486	536.3862	506.8691	424.5224	325.3953	207.5955	118.6023	81.3185	(83)
Total gains	441.7954	522.4463	613.0093	722.0012	806.4890	807.9899	766.2524	687.7131	599.0689	501.1197	434.9773	415.6181	(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	38.8819	38.9668	39.0504	39.4479	39.5232	39.8774	39.8774	39.9437	39.7402	39.5232	39.3712	39.2136	
alpha	3.5921	3.5978	3.6034	3.6299	3.6349	3.6585	3.6585	3.6629	3.6493	3.6349	3.6247	3.6142	
util living area													
	0.9955	0.9913	0.9801	0.9457	0.8629	0.7191	0.5730	0.6423	0.8615	0.9704	0.9923	0.9964	(86)
MIT	19.0881	19.2887	19.6456	20.1327	20.5696	20.8515	20.9522	20.9274	20.6855	20.1196	19.5184	19.0547	(87)
Th 2	19.7896	19.7919	19.7942	19.8048	19.8068	19.8161	19.8161	19.8178	19.8125	19.8068	19.8028	19.7986	(88)
util rest of house													
	0.9943	0.9889	0.9742	0.9284	0.8175	0.6266	0.4382	0.5079	0.7966	0.9579	0.9897	0.9954	(89)
MIT 2	18.0589	18.2603	18.6156	19.0983	19.5036	19.7400	19.8015	19.7928	19.6205	19.0951	18.4981	18.0322	(90)
Living area fraction										fLA = Living area / (4) =		0.1952	(91)
MIT	18.2599	18.4611	18.8167	19.3003	19.7118	19.9570	20.0261	20.0143	19.8284	19.2951	18.6973	18.2318	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2599	18.4611	18.8167	19.3003	19.7118	19.9570	20.0261	20.0143	19.8284	19.2951	18.6973	18.2318	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9920	0.9851	0.9677	0.9192	0.8132	0.6389	0.4638	0.5325	0.7977	0.9506	0.9862	0.9935	(94)
Useful gains	438.2482	514.6440	593.2235	663.6611	655.8478	516.2069	355.3626	366.1841	477.8502	476.3416	428.9812	412.9262	(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													
	1542.1072	1494.7876	1354.7170	1132.4026	870.6764	576.9982	369.0244	388.6500	619.1362	944.9371	1265.1962	1536.9468	(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													
	821.2710	658.6565	566.5512	337.4939	159.8325	0.0000	0.0000	0.0000	0.0000	348.6350	602.0747	836.2713	(98)
Space heating												4330.7862	(98)
Space heating per m2											(98) / (4) =	53.5458	(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	1012.4697	797.0507	817.2340	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7946	0.8602	0.8202	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	804.5529	685.5927	670.2671	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1037.0180	986.3240	896.1128	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	167.3749	223.7441	168.0292	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling                                                                                                559.1482 (104)
Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   41.8437   55.9360   42.0073    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                139.7870 (107)
Space cooling per m2                                                                                           1.7283 (108)
Energy for space heating                                                                                      53.5458 (99)
Energy for space cooling                                                                                       1.7283 (108)
Total                                                                                                         55.2741 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                      55.3 (109)


-------------------------------------------------------------------------------------------------
```

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	40.4400 (1b)	x	2.3300 (2b)	=	94.2252	(1b) - (3b)
First floor	40.4400 (1c)	x	2.5600 (2c)	=	103.5264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.8800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.7516	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1517 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.4017 (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) =	0.3414 (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	0.4353	0.4268	0.4183	0.3756	0.3671	0.3244	0.3244	0.3158	0.3414	0.3671	0.3841	0.4012	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5705	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			15.0600	1.3258	19.9659			(27)
150mm Platinum			40.4400	0.1300	5.2572			(28a)
50mm A. Platinum	128.2300	17.0300	111.2000	0.1800	20.0160			(29a)
400mm Mineral wool	40.4400		40.4400	0.1300	5.2572			(30)
Total net area of external elements Aum(A, m2)			209.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.4663			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3390	(36)
Total fabric heat loss					(33) + (36) =		62.8053	(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	38.8131	38.5730	38.3376	37.2320	37.0252	36.0623	36.0623	35.8839	36.4332	37.0252	37.4436	37.8811	(38)
Heat transfer coeff	101.6184	101.3783	101.1429	100.0373	99.8305	98.8676	98.8676	98.6892	99.2385	99.8305	100.2489	100.6864	(39)
Average = Sum(39)m / 12 =												100.0364	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2564	1.2534	1.2505	1.2369	1.2343	1.2224	1.2224	1.2202	1.2270	1.2343	1.2395	1.2449	(40)
HLP (average)												1.2368	(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		2.4793 (42)
Average daily hot water use (litres/day)		93.0845 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.3929	98.6695	94.9462	91.2228	87.4994	83.7760	83.7760	87.4994	91.2228	94.9462	98.6695	102.3929	(44)
Energy conte	151.8457	132.8053	137.0431	119.4775	114.6415	98.9269	91.6703	105.1930	106.4494	124.0565	135.4174	147.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1464.5812	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.2672	28.2211	29.1217	25.3890	24.3613	21.0220	19.4799	22.3535	22.6205	26.3620	28.7762	31.2491	(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	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.0440	17.8029	14.4783	10.9610	8.1935	6.9173	7.4744	9.7155	13.0401	16.5574	19.3249	20.6011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.2699	223.5660	217.7799	205.4621	189.9130	175.2990	165.5360	163.2399	169.0260	181.3438	196.8929	211.5069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	(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)													
	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	(71)
Water heating gains (Table 5)													
	43.3699	41.9957	39.1420	35.2625	32.7437	29.1972	26.1827	30.0451	31.4174	35.4328	39.9669	42.0015	(72)
Total internal gains													
	344.8740	343.5548	331.5904	311.8757	291.0404	271.6037	259.3833	263.1906	273.6736	293.5242	316.3750	334.2996	(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	5.3400	11.2829	0.6300	0.7000	0.7700	18.4135	(75)
Southeast	3.7100	36.7938	0.6300	0.7000	0.7700	41.7177	(77)
Southwest	0.6600	36.7938	0.6300	0.7000	0.7700	7.4215	(79)
Northwest	5.3500	11.2829	0.6300	0.7000	0.7700	18.4479	(81)

Solar gains	86.0006	158.7347	249.7097	363.9141	457.3699	475.9483	449.7571	376.6889	288.7310	184.2045	105.2386	72.1558	(83)
Total gains	430.8747	502.2895	581.3002	675.7899	748.4103	747.5520	709.1404	639.8795	562.4047	477.7287	421.6136	406.4555	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2721	55.4030	55.5320	56.1457	56.2620	56.8100	56.8100	56.9127	56.5977	56.2620	56.0272	55.7838	
alpha	4.6848	4.6935	4.7021	4.7430	4.7508	4.7873	4.7873	4.7942	4.7732	4.7508	4.7351	4.7189	
util living area													
	0.9988	0.9973	0.9922	0.9712	0.9020	0.7519	0.5892	0.6634	0.8972	0.9863	0.9976	0.9991	(86)
MIT	19.5571	19.7107	19.9853	20.3666	20.7102	20.9190	20.9803	20.9662	20.7937	20.3515	19.8884	19.5327	(87)
Th 2	19.8751	19.8775	19.8798	19.8906	19.8927	19.9021	19.9021	19.9039	19.8985	19.8927	19.8885	19.8843	(88)
util rest of house													
	0.9984	0.9963	0.9892	0.9592	0.8606	0.6573	0.4543	0.5270	0.8361	0.9788	0.9965	0.9988	(89)
MIT 2	18.5623	18.7173	18.9923	19.3748	19.6939	19.8645	19.8971	19.8941	19.7780	19.3665	18.9038	18.5451	(90)
Living area fraction									fLA = Living area / (4) =			0.1952	(91)
MIT	18.7565	18.9112	19.1862	19.5684	19.8923	20.0704	20.1086	20.1034	19.9763	19.5588	19.0960	18.7379	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7565	18.9112	19.1862	19.5684	19.8923	20.0704	20.1086	20.1034	19.9763	19.5588	19.0960	18.7379	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9951	0.9866	0.9547	0.8606	0.6733	0.4809	0.5538	0.8414	0.9757	0.9954	0.9983	(94)
Useful gains	429.9009	499.8142	573.5335	645.1949	644.1005	503.3202	341.0146	354.3583	473.2151	466.0986	419.6947	405.7602	(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													
	1469.0459	1420.4347	1283.1196	1067.2397	817.8458	540.8402	346.8864	365.4838	583.1545	894.3613	1202.5886	1463.7678	(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													
	773.1239	618.6570	527.9320	303.8722	129.2665	0.0000	0.0000	0.0000	0.0000	318.6275	563.6836	787.1577	(98)
Space heating												4022.3203	(98)
Space heating per m2											(98) / (4) =	49.7320	(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	929.3551	731.6200	750.0383	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8430	0.9068	0.8708	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	783.4069	663.4130	653.1335	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	966.3763	919.5697	840.2035	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	131.7380	190.5806	139.1800	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											461.4986	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	32.9345	47.6451	34.7950	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											115.3747	(107)
Space cooling per m2											1.4265	(108)
Energy for space heating											49.7320	(99)
Energy for space cooling											1.4265	(108)
Total											51.1584	(109)
Target Fabric Energy Efficiency (TFEE)											58.8	(109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Moresby End-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	DS07 Moresby , EOT, Barratt Developments		

SAP Rating	84 B	**DER**	17.80	**TER**	18.39
Environmental	86 B	**% DER<TER**	3.22		
CO_2 Emissions (t/year)	1.26	**DFEE**	48.24	**TFEE**	52.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.11		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 81 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.39 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.80 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.2 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North: 5.34 m², No overhang
Windows facing East: 3.71 m², No overhang
Windows facing West: 5.35 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K

ARUN DISTRICT COUNCIL A/45/22/PL

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	40.4400	(1b)	x 2.3300	(2b) =	94.2252	(1b) - (3b)
First floor	40.4400	(1c)	x 2.5600	(2c) =	103.5264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.8800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		197.7516	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2023	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4528	(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) =	0.3849	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4907	0.4811	0.4715	0.4233	0.4137	0.3656	0.3656	0.3560	0.3849	0.4137	0.4330	0.4522	(22b)
Effective ac	0.6204	0.6157	0.6111	0.5896	0.5856	0.5668	0.5668	0.5634	0.5741	0.5856	0.5937	0.6022	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			14.4000	1.3347	19.2200			(27)
150mm Platinum			40.4400	0.1500	6.0660			(28a)
50mm A. Platinum	87.7100	16.3700	71.3400	0.2700	19.2618			(29a)
400mm Mineral wool	40.4400		40.4400	0.1100	4.4484			(30)
Total net area of external elements Aum(A, m2)			168.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.9662			(33)
E-WM-22			40.5200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	203.8300	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.2642	(36)
Total fabric heat loss (33) + (36) =	59.2304	(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	40.4854	40.1804	39.8813	38.4768	38.2140	36.9907	36.9907	36.7641	37.4619	38.2140	38.7456	39.3014	(38)
Heat transfer coeff	99.7159	99.4108	99.1117	97.7072	97.4444	96.2211	96.2211	95.9945	96.6923	97.4444	97.9760	98.5318	(39)
Average = Sum(39)m / 12 =												97.7059	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2329	1.2291	1.2254	1.2081	1.2048	1.1897	1.1897	1.1869	1.1955	1.2048	1.2114	1.2182	(40)
HLP (average)												1.2080	(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	2.4793 (42)
Average daily hot water use (litres/day)	93.0845 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.3929	98.6695	94.9462	91.2228	87.4994	83.7760	83.7760	87.4994	91.2228	94.9462	98.6695	102.3929	(44)
Energy conte	151.8457	132.8053	137.0431	119.4775	114.6415	98.9269	91.6703	105.1930	106.4494	124.0565	135.4174	147.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1464.5812	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7769	19.9208	20.5565	17.9216	17.1962	14.8390	13.7505	15.7790	15.9674	18.6085	20.3126	22.0582	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1210	12.7398	14.0688	13.5744	13.9973	13.5117	13.9409	13.9775	13.5459	14.0392	13.6335	14.1095	(61)
Total heat required for water heating calculated for each month													
	165.9667	145.5450	151.1120	133.0519	128.6388	112.4386	105.6112	119.1705	119.9952	138.0957	149.0508	161.1640	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	165.9667	145.5450	151.1120	133.0519	128.6388	112.4386	105.6112	119.1705	119.9952	138.0957	149.0508	161.1640	(64)
								Total per year (kWh/year) = Sum(64)m =				1629.8406	(64)
Heat gains from water heating, kWh/month													
	54.0190	47.3427	49.0840	43.1199	41.6176	36.2711	33.9656	38.4711	38.7809	44.7586	48.4346	52.4230	(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	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1834	17.9267	14.5790	11.0372	8.2504	6.9654	7.5263	9.7830	13.1307	16.6725	19.4593	20.7443	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.2699	223.5660	217.7799	205.4621	189.9130	175.2990	165.5360	163.2399	169.0260	181.3438	196.8929	211.5069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	(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)													
	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	(71)
Water heating gains (Table 5)													
	72.6061	70.4504	65.9732	59.8887	55.9377	50.3766	45.6527	51.7084	53.8623	60.1594	67.2703	70.4610	(72)
Total internal gains													
	377.2496	375.1333	361.5222	339.5782	317.2913	295.8311	281.9052	287.9215	299.2093	321.3659	346.8127	365.9024	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.3400	10.6334	0.7100	0.7000	0.7700	19.5570	(74)
East	3.7100	19.6403	0.7100	0.7000	0.7700	25.0964	(76)
West	5.3500	19.6403	0.7100	0.7000	0.7700	36.1902	(80)

Solar gains	80.8436	157.2640	260.9493	389.9665	490.3184	508.3664	481.2768	404.3980	305.9896	186.7484	100.5432	66.7028	(83)
Total gains	458.0931	532.3972	622.4715	729.5446	807.6097	804.1975	763.1820	692.3195	605.1988	508.1143	447.3559	432.6052	(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	45.9243	46.0652	46.2042	46.8684	46.9948	47.5923	47.5923	47.7046	47.3603	46.9948	46.7398	46.4762	
alpha	4.0616	4.0710	4.0803	4.1246	4.1330	4.1728	4.1728	4.1803	4.1574	4.1330	4.1160	4.0984	
util living area													
	0.9962	0.9924	0.9811	0.9429	0.8486	0.6871	0.5326	0.5988	0.8433	0.9704	0.9931	0.9970	(86)
MIT	19.3848	19.5664	19.8941	20.3360	20.7031	20.9147	20.9772	20.9635	20.7888	20.3007	19.7685	19.3596	(87)
Th 2	19.8938	19.8968	19.8997	19.9136	19.9162	19.9283	19.9283	19.9305	19.9236	19.9162	19.9109	19.9054	(88)
util rest of house													
	0.9951	0.9902	0.9753	0.9249	0.8017	0.5984	0.4131	0.4766	0.7760	0.9579	0.9907	0.9961	(89)
MIT 2	17.7430	18.0096	18.4867	19.1241	19.6146	19.8661	19.9184	19.9128	19.7393	19.0872	18.3148	17.7137	(90)
Living area fraction									fLA = Living area / (4) =			0.1952	(91)
MIT	18.0635	18.3135	18.7615	19.3607	19.8271	20.0708	20.1251	20.1179	19.9442	19.3241	18.5986	18.0351	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9135	18.1635	18.6115	19.2107	19.6771	19.9208	19.9751	19.9679	19.7942	19.1741	18.4486	17.8851	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9850	0.9658	0.9099	0.7895	0.5977	0.4185	0.4812	0.7662	0.9456	0.9858	0.9935	(94)
Useful gains	454.3969	524.4055	601.1565	663.8085	637.6046	480.6845	319.4117	333.1274	463.7103	480.4693	440.9917	429.8134	(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													
	1357.4807	1318.5345	1200.3897	1007.4322	777.3261	511.9768	324.7531	342.5032	550.5808	835.5004	1111.8935	1348.4131	(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													
	671.8943	533.6547	445.8295	247.4091	103.9528	0.0000	0.0000	0.0000	0.0000	264.1432	483.0493	683.4382	(98)
Space heating												3433.3711	(98)
Space heating per m2											(98) / (4) =	42.4502	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3793.7802	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	671.8943	533.6547	445.8295	247.4091	103.9528	0.0000	0.0000	0.0000	0.0000	264.1432	483.0493	683.4382	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000		(210)
Space heating fuel (main heating system)													
	742.4247	589.6737	492.6293	273.3802	114.8650	0.0000	0.0000	0.0000	0.0000	291.8709	533.7561	755.1803	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	165.9667	145.5450	151.1120	133.0519	128.6388	112.4386	105.6112	119.1705	119.9952	138.0957	149.0508	161.1640	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8476	89.7947	89.6680	89.3546	88.7018	87.3000	87.3000	87.3000	87.3000	89.3753	89.7245	89.8714	(217)
Fuel for water heating, kWh/month													
	184.7202	162.0865	168.5239	148.9033	145.0240	128.7957	120.9750	136.5069	137.4516	154.5123	166.1206	179.3273	(219)
Water heating fuel used												1832.9472	(219)
Annual totals kWh/year													
Space heating fuel - main system												3793.7802	(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)												356.4445	(232)
Total delivered energy for all uses												6058.1719	(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	3793.7802	0.2160	819.4565	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1832.9472	0.2160	395.9166	(264)
Space and water heating			1215.3731	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.4445	0.5190	184.9947	(268)
Total CO2, kg/year			1439.2928	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8000	(273)

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

DER		17.8000	ZC1
Total Floor Area	TFA	80.8800	
Assumed number of occupants	N	2.4793	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2117	ZC2
CO2 emissions from cooking, equation (L16)		2.2070	ZC3
Total CO2 emissions		36.2187	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.2187	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	40.4400 (1b)	x	2.3300 (2b)	=	94.2252	(1b) - (3b)
First floor	40.4400 (1c)	x	2.5600 (2c)	=	103.5264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.8800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.7516	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1517	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4017	(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) =	0.3414	(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	0.4353	0.4268	0.4183	0.3756	0.3671	0.3244	0.3244	0.3158	0.3414	0.3671	0.3841	0.4012	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5705	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			14.4000	1.3258	19.0909			(27)
150mm Platinum			40.4400	0.1300	5.2572			(28a)
50mm A. Platinum	87.7100	16.3700	71.3400	0.1800	12.8412			(29a)
400mm Mineral wool	40.4400		40.4400	0.1300	5.2572			(30)
Total net area of external elements Aum(A, m2)			168.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.4165			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1311	(36)
Total fabric heat loss					(33) + (36) =		53.5476	(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	38.8131	38.5730	38.3376	37.2320	37.0252	36.0623	36.0623	35.8839	36.4332	37.0252	37.4436	37.8811	(38)
Heat transfer coeff	92.3607	92.1206	91.8852	90.7796	90.5728	89.6098	89.6098	89.4315	89.9808	90.5728	90.9912	91.4287	(39)
Average = Sum(39)m / 12 =												90.7786	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1419	1.1390	1.1361	1.1224	1.1198	1.1079	1.1079	1.1057	1.1125	1.1198	1.1250	1.1304	(40)
HLP (average)												1.1224	(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		2.4793 (42)
Average daily hot water use (litres/day)		93.0845 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.3929	98.6695	94.9462	91.2228	87.4994	83.7760	83.7760	87.4994	91.2228	94.9462	98.6695	102.3929	(44)
Energy conte	151.8457	132.8053	137.0431	119.4775	114.6415	98.9269	91.6703	105.1930	106.4494	124.0565	135.4174	147.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1464.5812	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7769	19.9208	20.5565	17.9216	17.1962	14.8390	13.7505	15.7790	15.9674	18.6085	20.3126	22.0582	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.4150	48.3835	44.9866	44.5887	41.3142	42.6913	44.5887	44.9866	48.3835	48.6590	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.8046	178.2203	185.4266	164.4641	159.2303	140.2411	134.3617	149.7818	151.4360	172.4400	184.0763	198.0134	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.8046	178.2203	185.4266	164.4641	159.2303	140.2411	134.3617	149.7818	151.4360	172.4400	184.0763	198.0134	(64)
								Total per year (kWh/year) = Sum(64)m =				2020.4962	(64)
Heat gains from water heating, kWh/month													
	63.2284	55.5115	57.6627	50.9729	49.2655	43.2218	41.1532	46.1239	46.6411	53.3447	57.1910	61.6353	(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	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1834	17.9267	14.5790	11.0372	8.2504	6.9654	7.5263	9.7830	13.1307	16.6725	19.4593	20.7443	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.2699	223.5660	217.7799	205.4621	189.9130	175.2990	165.5360	163.2399	169.0260	181.3438	196.8929	211.5069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	(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)													
	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	(71)
Water heating gains (Table 5)													
	84.9845	82.6064	77.5037	70.7957	66.2171	60.0302	55.3135	61.9945	64.7793	71.6998	79.4320	82.8432	(72)
Total internal gains													
	389.6279	387.2893	373.0527	350.4852	327.5707	305.4848	291.5660	298.2076	310.1262	332.9063	358.9743	378.2846	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.3400	10.6334	0.6300	0.7000	0.7700	17.3534	(74)
East	3.7100	19.6403	0.6300	0.7000	0.7700	22.2686	(76)
West	5.3500	19.6403	0.6300	0.7000	0.7700	32.1124	(80)

Solar gains	71.7344	139.5441	231.5465	346.0266	435.0712	451.0857	427.0484	358.8320	271.5119	165.7063	89.2144	59.1870	(83)
Total gains	461.3623	526.8333	604.5992	696.5118	762.6419	756.5704	718.6144	657.0396	581.6380	498.6127	448.1887	437.4716	(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	60.8123	60.9708	61.1270	61.8714	62.0128	62.6791	62.6791	62.8041	62.4208	62.0128	61.7276	61.4322	
alpha	5.0542	5.0647	5.0751	5.1248	5.1342	5.1786	5.1786	5.1869	5.1614	5.1342	5.1152	5.0955	
util living area													
	0.9984	0.9966	0.9900	0.9622	0.8756	0.7047	0.5373	0.6043	0.8638	0.9817	0.9968	0.9988	(86)
MIT	19.7420	19.8852	20.1458	20.5002	20.7962	20.9528	20.9905	20.9832	20.8615	20.4717	20.0458	19.7192	(87)
Th 2	19.9667	19.9691	19.9715	19.9826	19.9847	19.9944	19.9944	19.9962	19.9906	19.9847	19.9805	19.9761	(88)
util rest of house													
	0.9979	0.9954	0.9863	0.9478	0.8301	0.6147	0.4204	0.4833	0.7964	0.9722	0.9955	0.9984	(89)
MIT 2	18.2863	18.4972	18.8777	19.3913	19.7841	19.9630	19.9908	19.9892	19.8762	19.3601	18.7403	18.2597	(90)
Living area fraction									fLA = Living area / (4) =			0.1952	(91)
MIT	18.5705	18.7681	19.1253	19.6078	19.9817	20.1562	20.1860	20.1832	20.0686	19.5771	18.9952	18.5446	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5705	18.7681	19.1253	19.6078	19.9817	20.1562	20.1860	20.1832	20.0686	19.5771	18.9952	18.5446	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9934	0.9821	0.9410	0.8300	0.6302	0.4433	0.5068	0.8026	0.9669	0.9935	0.9975	(94)
Useful gains	459.8710	523.3308	593.7935	655.4005	632.9607	476.8034	318.5701	333.0021	466.7950	482.1292	445.2872	436.3861	(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													
	1318.0354	1277.5413	1160.0772	972.0470	750.0942	497.8925	321.3402	338.3388	537.0575	813.0796	1082.3592	1311.5110	(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													
	638.4743	506.8295	421.3151	227.9855	87.1473	0.0000	0.0000	0.0000	0.0000	246.2271	458.6918	651.0929	(98)
Space heating												3237.7636	(98)
Space heating per m2											(98) / (4) =	40.0317	(99)

8c. Space cooling requirement

Not applicable

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												3466.5563	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	638.4743	506.8295	421.3151	227.9855	87.1473	0.0000	0.0000	0.0000	0.0000	246.2271	458.6918	651.0929	(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)													
	683.5913	542.6440	451.0868	244.0958	93.3055	0.0000	0.0000	0.0000	0.0000	263.6265	491.1047	697.1016	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.8046	178.2203	185.4266	164.4641	159.2303	140.2411	134.3617	149.7818	151.4360	172.4400	184.0763	198.0134	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7396	87.5357	87.0537	85.8736	83.6039	80.3000	80.3000	80.3000	80.3000	85.9475	87.2570	87.8240	(217)
Fuel for water heating, kWh/month													
	231.1437	203.5974	213.0025	191.5188	190.4578	174.6465	167.3246	186.5277	188.5877	200.6342	210.9589	225.4662	(219)
Water heating fuel used												2383.8661	(219)
Annual totals kWh/year													
Space heating fuel - main system												3466.5563	(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)												356.4445	(232)
Total delivered energy for all uses												6281.8669	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3466.5563	0.2160	748.7762	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2383.8661	0.2160	514.9151	(264)
Space and water heating			1263.6912	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.4445	0.5190	184.9947	(268)
Total CO2, kg/m2/year			1487.6109	(272)
Emissions per m2 for space and water heating			15.6243	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2873	(272b)
Emissions per m2 for pumps and fans			0.4813	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6243 * 1.00) + 2.2873 + 0.4813, rounded to 2 d.p.			18.3900	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4400	(1b)	x 2.3300	(2b) =	94.2252	(1b) - (3b)
First floor	40.4400	(1c)	x 2.5600	(2c) =	103.5264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.8800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		197.7516	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1517	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4022	(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) =	0.3419	(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	0.4359	0.4273	0.4188	0.3761	0.3675	0.3248	0.3248	0.3162	0.3419	0.3675	0.3846	0.4017	(22b)
Effective ac	0.5950	0.5913	0.5877	0.5707	0.5675	0.5527	0.5527	0.5500	0.5584	0.5675	0.5740	0.5807	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			14.4000	1.3347	19.2200			(27)
150mm Platinum			40.4400	0.1500	6.0660			(28a)
50mm A. Platinum	87.7100	16.3700	71.3400	0.2700	19.2618			(29a)
400mm Mineral wool	40.4400		40.4400	0.1100	4.4484			(30)
Total net area of external elements Aum(A, m2)			168.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.9662			(33)
E-WM-22			40.5200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	203.8300	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.2642	(36)
Total fabric heat loss (33) + (36) =	59.2304	(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	38.8285	38.5878	38.3518	37.2435	37.0361	36.0708	36.0708	35.8920	36.4426	37.0361	37.4556	37.8942	(38)
Heat transfer coeff	98.0589	97.8182	97.5822	96.4739	96.2665	95.3012	95.3012	95.1225	95.6730	96.2665	96.6860	97.1246	(39)
Average = Sum(39)m / 12 =												96.4729	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2124	1.2094	1.2065	1.1928	1.1902	1.1783	1.1783	1.1761	1.1829	1.1902	1.1954	1.2008	(40)
HLP (average)												1.1928	(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	2.4793 (42)
Average daily hot water use (litres/day)	93.0845 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.3929	98.6695	94.9462	91.2228	87.4994	83.7760	83.7760	87.4994	91.2228	94.9462	98.6695	102.3929	(44)
Energy conte	151.8457	132.8053	137.0431	119.4775	114.6415	98.9269	91.6703	105.1930	106.4494	124.0565	135.4174	147.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1464.5812	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	32.2672	28.2211	29.1217	25.3890	24.3613	21.0220	19.4799	22.3535	22.6205	26.3620	28.7762	31.2491 (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	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.1834	17.9267	14.5790	11.0372	8.2504	6.9654	7.5263	9.7830	13.1307	16.6725	19.4593	20.7443 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	221.2699	223.5660	217.7799	205.4621	189.9130	175.2990	165.5360	163.2399	169.0260	181.3438	196.8929	211.5069 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967 (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)

	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738 (71)

Water heating gains (Table 5)

	43.3699	41.9957	39.1420	35.2625	32.7437	29.1972	26.1827	30.0451	31.4174	35.4328	39.9669	42.0015 (72)

Total internal gains

	345.0134	343.6786	331.6911	311.9519	291.0973	271.6518	259.4352	263.2582	273.7643	293.6393	316.5093	334.4428 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.3400	10.6334	0.7100	0.7000	0.7700	19.5570	(74)
East	3.7100	19.6403	0.7100	0.7000	0.7700	25.0964	(76)
West	5.3500	19.6403	0.7100	0.7000	0.7700	36.1902	(80)

Solar gains	80.8436	157.2640	260.9493	389.9665	490.3184	508.3664	481.2768	404.3980	305.9896	186.7484	100.5432	66.7028	(83)
Total gains	425.8569	500.9425	592.6403	701.9184	781.4157	780.0181	740.7120	667.6562	579.7538	480.3877	417.0525	401.1456	(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	46.7003	46.8152	46.9284	47.4676	47.5698	48.0516	48.0516	48.1420	47.8649	47.5698	47.3634	47.1495	
alpha	4.1134	4.1210	4.1286	4.1645	4.1713	4.2034	4.2034	4.2095	4.1910	4.1713	4.1576	4.1433	
util living area	0.9971	0.9939	0.9838	0.9483	0.8572	0.6980	0.5424	0.6125	0.8559	0.9751	0.9947	0.9977	(86)
MIT	19.3724	19.5540	19.8824	20.3240	20.6961	20.9115	20.9763	20.9613	20.7786	20.2818	19.7488	19.3436	(87)
Th 2	19.9101	19.9125	19.9148	19.9258	19.9278	19.9374	19.9374	19.9392	19.9337	19.9278	19.9237	19.9193	(88)
util rest of house	0.9963	0.9921	0.9789	0.9318	0.8120	0.6099	0.4223	0.4898	0.7917	0.9644	0.9928	0.9971	(89)
MIT 2	18.4254	18.6081	18.9355	19.3738	19.7155	19.8929	19.9303	19.9262	19.7999	19.3418	18.8116	18.4037	(90)
Living area fraction									fLA = Living area / (4) =			0.1952	(91)
MIT	18.6103	18.7927	19.1203	19.5593	19.9069	20.0918	20.1345	20.1282	19.9909	19.5253	18.9946	18.5872	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6103	18.7927	19.1203	19.5593	19.9069	20.0918	20.1345	20.1282	19.9909	19.5253	18.9946	18.5872	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9896	0.9741	0.9248	0.8110	0.6238	0.4456	0.5131	0.7958	0.9590	0.9906	0.9959	(94)
Useful gains	423.6541	495.7356	577.2711	649.1580	633.7534	486.5779	330.0377	342.6016	461.3601	460.6787	413.1133	399.5187	(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	1403.2535	1358.9631	1231.5215	1028.3460	790.0511	523.3739	336.8415	354.6403	563.6045	859.2106	1150.0384	1397.3523	(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	728.8219	580.0888	486.7623	273.0153	116.2854	0.0000	0.0000	0.0000	0.0000	296.5077	530.5860	742.3882	(98)
Space heating												3754.4557	(98)
Space heating per m2											(98) / (4) =	46.4201	(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	895.8315	705.2290	722.9307	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8510	0.9083	0.8757	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	762.3633	640.5287	633.0846	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1004.3877	956.5409	872.7596	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	174.2576	235.1131	178.3182	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												587.6889 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	43.5644	58.7783	44.5795	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												146.9222 (107)
Space cooling per m2												1.8165 (108)
Energy for space heating												46.4201 (99)
Energy for space cooling												1.8165 (108)
Total												48.2366 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.2 (109)

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	40.4400 (1b)	x	2.3300 (2b)	=	94.2252	(1b) - (3b)
First floor	40.4400 (1c)	x	2.5600 (2c)	=	103.5264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.8800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.7516	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1517	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4017	(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) =	0.3414	(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	0.4353	0.4268	0.4183	0.3756	0.3671	0.3244	0.3244	0.3158	0.3414	0.3671	0.3841	0.4012	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5705	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			14.4000	1.3258	19.0909			(27)
150mm Platinum			40.4400	0.1300	5.2572			(28a)
50mm A. Platinum	87.7100	16.3700	71.3400	0.1800	12.8412			(29a)
400mm Mineral wool	40.4400		40.4400	0.1300	5.2572			(30)
Total net area of external elements Aum(A, m2)			168.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.4165			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1311	(36)
Total fabric heat loss					(33) + (36) =		53.5476	(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	38.8131	38.5730	38.3376	37.2320	37.0252	36.0623	36.0623	35.8839	36.4332	37.0252	37.4436	37.8811	(38)
Heat transfer coeff	92.3607	92.1206	91.8852	90.7796	90.5728	89.6098	89.6098	89.4315	89.9808	90.5728	90.9912	91.4287	(39)
Average = Sum(39)m / 12 =												90.7786	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1419	1.1390	1.1361	1.1224	1.1198	1.1079	1.1079	1.1057	1.1125	1.1198	1.1250	1.1304	(40)
HLP (average)												1.1224	(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												2.4793	(42)
Average daily hot water use (litres/day)												93.0845	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.3929	98.6695	94.9462	91.2228	87.4994	83.7760	83.7760	87.4994	91.2228	94.9462	98.6695	102.3929	(44)
Energy conte	151.8457	132.8053	137.0431	119.4775	114.6415	98.9269	91.6703	105.1930	106.4494	124.0565	135.4174	147.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1464.5812	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.2672	28.2211	29.1217	25.3890	24.3613	21.0220	19.4799	22.3535	22.6205	26.3620	28.7762	31.2491	(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	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	123.9673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1834	17.9267	14.5790	11.0372	8.2504	6.9654	7.5263	9.7830	13.1307	16.6725	19.4593	20.7443	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.2699	223.5660	217.7799	205.4621	189.9130	175.2990	165.5360	163.2399	169.0260	181.3438	196.8929	211.5069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	35.3967	(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)													
	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	-99.1738	(71)
Water heating gains (Table 5)													
	43.3699	41.9957	39.1420	35.2625	32.7437	29.1972	26.1827	30.0451	31.4174	35.4328	39.9669	42.0015	(72)
Total internal gains													
	345.0134	343.6786	331.6911	311.9519	291.0973	271.6518	259.4352	263.2582	273.7643	293.6393	316.5093	334.4428	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.3400	10.6334	0.6300	0.7000	0.7700	17.3534	(74)
East	3.7100	19.6403	0.6300	0.7000	0.7700	22.2686	(76)
West	5.3500	19.6403	0.6300	0.7000	0.7700	32.1124	(80)

Solar gains	71.7344	139.5441	231.5465	346.0266	435.0712	451.0857	427.0484	358.8320	271.5119	165.7063	89.2144	59.1870	(83)
Total gains	416.7478	483.2226	563.2376	657.9785	726.1686	722.7374	686.4837	622.0902	545.2761	459.3456	405.7237	393.6298	(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	60.8123	60.9708	61.1270	61.8714	62.0128	62.6791	62.6791	62.8041	62.4208	62.0128	61.7276	61.4322	
alpha	5.0542	5.0647	5.0751	5.1248	5.1342	5.1786	5.1786	5.1869	5.1614	5.1342	5.1152	5.0955	
util living area													
	0.9990	0.9977	0.9927	0.9697	0.8923	0.7285	0.5600	0.6329	0.8869	0.9870	0.9980	0.9993	(86)
MIT	19.6905	19.8353	20.0999	20.4627	20.7730	20.9450	20.9885	20.9793	20.8395	20.4295	19.9970	19.6684	(87)
Th 2	19.9667	19.9691	19.9715	19.9826	19.9847	19.9944	19.9944	19.9962	19.9906	19.9847	19.9805	19.9761	(88)
util rest of house													
	0.9987	0.9969	0.9899	0.9576	0.8504	0.6387	0.4394	0.5087	0.8256	0.9800	0.9971	0.9990	(89)
MIT 2	18.7680	18.9144	19.1795	19.5438	19.8296	19.9689	19.9914	19.9901	19.8972	19.5178	19.0852	18.7535	(90)
Living area fraction									fLA = Living area / (4) =			0.1952	(91)
MIT	18.9481	19.0942	19.3592	19.7232	20.0137	20.1595	20.1861	20.1832	20.0812	19.6958	19.2632	18.9321	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9481	19.0942	19.3592	19.7232	20.0137	20.1595	20.1861	20.1832	20.0812	19.6958	19.2632	18.9321	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9959	0.9877	0.9537	0.8518	0.6546	0.4632	0.5331	0.8322	0.9773	0.9963	0.9987	(94)
Useful gains	415.9968	481.2491	556.2988	627.5191	618.5322	473.1306	317.9617	331.6316	453.7641	448.9302	404.2047	393.1015	(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													
	1352.9112	1307.5800	1181.5716	982.5235	752.9991	498.1827	321.3474	338.3404	538.1930	823.8343	1106.7471	1346.9363	(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													
	697.0643	555.2944	465.2030	255.6031	100.0434	0.0000	0.0000	0.0000	0.0000	278.9286	505.8305	709.6531	(98)
Space heating												3567.6203	(98)
Space heating per m2											(98) / (4) =	44.1100	(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	842.3326	663.1129	679.6796	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8795	0.9345	0.9057	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	740.7944	619.6849	615.5913	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	937.4363	893.1571	819.5007	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	141.5821	203.4633	151.7086	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												496.7540	(104)

ARUN DISTRICT COUNCIL A/45/22/PL

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	35.3955	50.8658	37.9271	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												124.1885 (107)
Space cooling per m2												1.5355 (108)
Energy for space heating												44.1100 (99)
Energy for space cooling												1.5355 (108)
Total												45.6455 (109)
Target Fabric Energy Efficiency (TFEE)												52.5 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Norbury End-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	DS10 Norbury , EOT, Part L2013 Masonry		

SAP Rating	85 B	**DER**	16.19	**TER**	16.45
Environmental	86 B	**% DER<TER**	1.57		
CO_2 Emissions (t/year)	1.53	**DFEE**	47.28	**TFEE**	49.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	4.46		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 107 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.45 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.19 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.17 (max. 0.20)	0.19 (max. 0.35)	OK
Openings	1.44 (max. 2.00)	1.90 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.24 m², No overhang
Windows facing South West: 4.41 m², No overhang
Windows facing North West: 1.63 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K

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	35.8100	(1b)	x 2.3300	(2b) =	83.4373	(1b) - (3b)
First floor	35.8100	(1c)	x 2.5500	(2c) =	91.3155	(1c) - (3c)
Second floor	35.8100	(1d)	x 2.5400	(2d) =	90.9574	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.4300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		265.7102	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1505	(8)
Pressure test			Yes	
Measured/design AP50			5.0100	
Infiltration rate			0.4010	(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) =		0.3409	(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	0.4346	0.4261	0.4176	0.3750	0.3665	0.3238	0.3238	0.3153	0.3409	0.3665	0.3835	0.4005	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5671	0.5524	0.5524	0.5497	0.5581	0.5671	0.5735	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			13.2800	1.3347	17.7251			(27)
Opening Type 4 (Uw = 1.90)			2.7600	1.7658	4.8736			(27a)
150mm Platinum			35.8100	0.1500	5.3715			(28a)
50mm A. Platinum	103.5500	14.2800	89.2700	0.2700	24.1029			(29a)
Dormer wall	3.7500	0.9700	2.7800	0.3000	0.8340			(29a)
I-Roof Gable	11.0600		11.0600	0.2500	2.7650			(29a)
Dormer roof	1.6500		1.6500	0.1700	0.2805			(30)
Horiz. to I-Roof	17.6200		17.6200	0.1900	3.3478			(30)
I-Roof	20.8600	2.7600	18.1000	0.1600	2.8960			(30)
Total net area of external elements Aum(A, m2)			194.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.1664			(33)
E-WM-22			64.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	175.5700	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.9188	(36)
Total fabric heat loss (33) + (36) =	75.0852	(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	52.1240	51.8024	51.4872	50.0066	49.7296	48.4400	48.4400	48.2012	48.9367	49.7296	50.2900	50.8758	(38)
Heat transfer coeff	127.2092	126.8876	126.5724	125.0918	124.8148	123.5252	123.5252	123.2864	124.0219	124.8148	125.3752	125.9610	(39)
Average = Sum(39)m / 12 =												125.0905	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1841	1.1811	1.1782	1.1644	1.1618	1.1498	1.1498	1.1476	1.1544	1.1618	1.1670	1.1725	(40)
HLP (average)												1.1644	(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	2.7985	(42)
Average daily hot water use (litres/day)	100.6641	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.7305	106.7039	102.6774	98.6508	94.6242	90.5977	90.5977	94.6242	98.6508	102.6774	106.7039	110.7305	(44)
Energy conte	164.2101	143.6192	148.2022	129.2062	123.9765	106.9823	99.1348	113.7586	115.1173	134.1581	146.4440	159.0287	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1583.8378 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.6315	21.5429	22.2303	19.3809	18.5965	16.0473	14.8702	17.0638	17.2676	20.1237	21.9666	23.8543	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1507	12.7700	14.1122	13.6187	14.0381	13.5454	13.9721	14.0149	13.5854	14.0785	13.6643	14.1382	(61)
Total heat required for water heating calculated for each month													
	178.3608	156.3892	162.3144	142.8249	138.0146	120.5277	113.1069	127.7735	128.7026	148.2366	160.1083	173.1669	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.3608	156.3892	162.3144	142.8249	138.0146	120.5277	113.1069	127.7735	128.7026	148.2366	160.1083	173.1669	(64)
								Total per year (kWh/year) = Sum(64)m =				1749.5263	(64)
Heat gains from water heating, kWh/month													
	58.1375	50.9459	52.8053	46.3657	44.7317	38.9580	36.4553	41.3285	41.6728	48.1272	52.1087	56.4116	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.0824	22.2779	18.1176	13.7162	10.2530	8.6560	9.3532	12.1576	16.3179	20.7193	24.1825	25.7795	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.8106	270.5896	263.5865	248.6778	229.8582	212.1704	200.3539	197.5749	204.5780	219.4867	238.3063	255.9941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	(71)
Water heating gains (Table 5)													
	78.1418	75.8123	70.9748	64.3969	60.1232	54.1083	48.9991	55.5490	57.8789	64.6871	72.3732	75.8221	(72)
Total internal gains													
	439.0121	436.6572	420.6563	394.7682	368.2118	342.9121	326.6835	333.2588	346.7521	372.8704	402.8393	425.5729	(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	7.2400	11.2829	0.7100	0.7000	0.7700	28.1352	(75)
Southwest	4.4100	36.7938	0.7100	0.7000	0.7700	55.8860	(79)
Northwest	1.6300	11.2829	0.7100	0.7000	0.7700	6.3343	(81)
Northeast	1.8400	17.0692	0.7600	0.7000	1.0000	15.0378	(82)
Southwest	0.9200	38.8503	0.7600	0.7000	1.0000	17.1134	(82)

Solar gains	122.5068	228.5461	364.4850	536.7613	677.7473	706.1919	666.9908	556.9208	423.4838	266.6500	150.3781	102.4697	(83)
Total gains	561.5189	665.2033	785.1413	931.5295	1045.9591	1049.1040	993.6743	890.1796	770.2359	639.5204	553.2174	528.0426	(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	41.1865	41.2909	41.3937	41.8837	41.9766	42.4148	42.4148	42.4970	42.2450	41.9766	41.7890	41.5946	
alpha	3.7458	3.7527	3.7596	3.7922	3.7984	3.8277	3.8277	3.8331	3.8163	3.7984	3.7859	3.7730	
util living area													
	0.9950	0.9899	0.9761	0.9324	0.8307	0.6691	0.5209	0.5908	0.8319	0.9643	0.9911	0.9960	(86)
MIT	19.2244	19.4289	19.7860	20.2650	20.6672	20.8988	20.9704	20.9528	20.7545	20.2232	19.6400	19.1916	(87)
Th 2	19.9327	19.9351	19.9375	19.9486	19.9507	19.9604	19.9604	19.9622	19.9566	19.9507	19.9465	19.9421	(88)
util rest of house													
	0.9937	0.9874	0.9698	0.9140	0.7854	0.5863	0.4090	0.4761	0.7685	0.9513	0.9884	0.9950	(89)
MIT 2	17.5564	17.8558	18.3750	19.0630	19.6028	19.8816	19.9458	19.9365	19.7318	19.0177	18.1723	17.5145	(90)
Living area fraction										fLA = Living area / (4) =		0.1648	(91)
MIT	17.8312	18.1150	18.6074	19.2610	19.7782	20.0491	20.1146	20.1039	19.9003	19.2163	18.4141	17.7908	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.6812	17.9650	18.4574	19.1110	19.6282	19.8991	19.9646	19.9539	19.7503	19.0663	18.2641	17.6408	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9894	0.9803	0.9573	0.8951	0.7691	0.5810	0.4095	0.4751	0.7534	0.9356	0.9818	0.9915	(94)
Useful gains	555.5810	652.0917	751.6254	833.8410	804.4606	609.4866	406.8874	422.9576	580.2747	598.3431	543.1398	523.5458	(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													
	1702.2126	1657.7882	1513.4827	1277.3169	989.5543	654.5782	415.6164	438.1497	700.7583	1056.7180	1399.7024	1693.0195	(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													
	853.0939	675.8280	566.8218	319.3027	137.7097	0.0000	0.0000	0.0000	0.0000	341.0310	616.7251	870.0884	(98)
Space heating												4380.6006	(98)
Space heating per m2											(98) / (4) =	40.7763	(99)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4840.4426	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	853.0939	675.8280	566.8218	319.3027	137.7097	0.0000	0.0000	0.0000	0.0000	341.0310	616.7251	870.0884	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	942.6452	746.7713	626.3225	352.8206	152.1654	0.0000	0.0000	0.0000	0.0000	376.8298	681.4642	961.4237	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.3608	156.3892	162.3144	142.8249	138.0146	120.5277	113.1069	127.7735	128.7026	148.2366	160.1083	173.1669	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.9300	89.8809	89.7675	89.4862	88.8694	87.3000	87.3000	87.3000	87.3000	89.5060	89.8214	89.9527	(217)
Fuel for water heating, kWh/month													
	198.3329	173.9960	180.8164	159.6055	155.3004	138.0615	129.5612	146.3614	147.4257	165.6164	178.2518	192.5089	(219)
Water heating fuel used												1965.8381	(219)
Annual totals kWh/year													
Space heating fuel - main system												4840.4426	(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)												442.9625	(232)
Total delivered energy for all uses												7324.2431	(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	4840.4426	0.2160	1045.5356	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.8381	0.2160	424.6210	(264)
Space and water heating			1470.1566	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	442.9625	0.5190	229.8975	(268)
Total CO2, kg/year			1738.9792	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.1900	(273)

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

DER		16.1900	ZC1
Total Floor Area	TFA	107.4300	
Assumed number of occupants	N	2.7985	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.7723	ZC2
CO2 emissions from cooking, equation (L16)		1.7329	ZC3
Total CO2 emissions		32.6952	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.6952	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	35.8100 (1b)	x	2.3300 (2b)	=	83.4373	(1b) - (3b)
First floor	35.8100 (1c)	x	2.5500 (2c)	=	91.3155	(1c) - (3c)
Second floor	35.8100 (1d)	x	2.5400 (2d)	=	90.9574	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.4300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	265.7102	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1505	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4005	(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) =	0.3405	(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	0.4341	0.4256	0.4171	0.3745	0.3660	0.3234	0.3234	0.3149	0.3405	0.3660	0.3830	0.4000	(22b)
Effective ac	0.5942	0.5906	0.5870	0.5701	0.5670	0.5523	0.5523	0.5496	0.5580	0.5670	0.5734	0.5800	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			13.2800	1.3258	17.6061			(27)
TER Room Window (Uw = 1.70)			2.7600	1.5918	4.3933			(27a)
150mm Platinum			35.8100	0.1300	4.6553			(28a)
50mm A. Platinum	103.5500	14.2800	89.2700	0.1800	16.0686			(29a)
Dormer wall	3.7500	0.9700	2.7800	0.1800	0.5004			(29a)
I-Roof Gable	11.0600		11.0600	0.1800	1.9908			(29a)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Horiz. to I-Roof	17.6200		17.6200	0.1300	2.2906			(30)
I-Roof	20.8600	2.7600	18.1000	0.1300	2.3530			(30)
Total net area of external elements Aum(A, m2)			194.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.0425			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.1927 (36)
Total fabric heat loss	(33) + (36) =		63.2352 (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	52.1034	51.7826	51.4681	49.9912	49.7149	48.4286	48.4286	48.1903	48.9240	49.7149	50.2739	50.8583	(38)
Heat transfer coeff	115.3386	115.0178	114.7034	113.2264	112.9501	111.6638	111.6638	111.4256	112.1593	112.9501	113.5091	114.0935	(39)
Average = Sum(39)m / 12 =												113.2251	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0736	1.0706	1.0677	1.0540	1.0514	1.0394	1.0394	1.0372	1.0440	1.0514	1.0566	1.0620	(40)
HLP (average)												1.0539	(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		2.7985 (42)
Average daily hot water use (litres/day)		100.6641 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.7305	106.7039	102.6774	98.6508	94.6242	90.5977	90.5977	94.6242	98.6508	102.6774	106.7039	110.7305	(44)
Energy conte	164.2101	143.6192	148.2022	129.2062	123.9765	106.9823	99.1348	113.7586	115.1173	134.1581	146.4440	159.0287	(45)
Energy content (annual)										Total = Sum(45)m =		1583.8378	(45)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
              24.6315    21.5429    22.2303    19.3809    18.5965    16.0473    14.8702    17.0638    17.2676    20.1237    21.9666    23.8543 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     50.9589    46.0274    50.9589    48.6497    48.2195    44.6783    46.1676    48.2195    48.6497    50.9589    49.3151    50.9589 (61)
Total heat required for water heating calculated for each month
              215.1690   189.6466   199.1611   177.8559   172.1959   151.6606   145.3024   161.9781   163.7670   185.1170   195.7591   209.9876 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              215.1690   189.6466   199.1611   177.8559   172.1959   151.6606   145.3024   161.9781   163.7670   185.1170   195.7591   209.9876 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   2167.6001 (64)
Heat gains from water heating, kWh/month
              67.3396    59.2602    62.0169    55.1235    53.2770    46.7412    44.5042    49.8796    50.4389    57.3473    61.0214    65.6168 (65)
```

---

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

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m       139.9244   139.9244   139.9244   139.9244   139.9244   139.9244   139.9244   139.9244   139.9244   139.9244   139.9244   139.9244 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              25.0824    22.2779    18.1176    13.7162    10.2530     8.6560     9.3532    12.1576    16.3179    20.7193    24.1825    25.7795 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              267.8106   270.5896   263.5865   248.6778   229.8582   212.1704   200.3539   197.5749   204.5780   219.4867   238.3063   255.9941 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              36.9924    36.9924    36.9924    36.9924    36.9924    36.9924    36.9924    36.9924    36.9924    36.9924    36.9924    36.9924 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -111.9395  -111.9395  -111.9395  -111.9395  -111.9395  -111.9395  -111.9395  -111.9395  -111.9395  -111.9395  -111.9395  -111.9395 (71)
Water heating gains (Table 5)
              90.5102    88.1849    83.3561    76.5604    71.6089    64.9183    59.8175    67.0425    70.0540    77.0797    84.7519    88.1946 (72)
Total internal gains
              451.3805   449.0297   433.0376   406.9317   379.6975   353.7221   337.5019   344.7523   358.9272   385.2630   415.2181   437.9455 (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                                7.2400           11.2829           0.6300           0.7000           0.7700           24.9651 (75)
Southwest                                4.4100           36.7938           0.6300           0.7000           0.7700           49.5890 (79)
Northwest                                1.6300           11.2829           0.6300           0.7000           0.7700            5.6206 (81)
Northeast                                1.8400           17.0692           0.6300           0.7000           1.0000           12.4656 (82)
Southwest                                0.9200           38.8503           0.6300           0.7000           1.0000           14.1861 (82)
-------------------------------------------------------------------------------------------------------------------------------------

Solar gains    106.8263   199.1058   317.1220   466.4874   588.6601   613.2397   579.2475   483.8665   368.2709   232.1862   131.0951    89.3772 (83)
Total gains    558.2068   648.1355   750.1596   873.4191   968.3576   966.9618   916.7494   828.6188   727.1981   617.4492   546.3131   527.3227 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                        21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          64.6828    64.8632    65.0410    65.8894    66.0505    66.8114    66.8114    66.9543    66.5163    66.0505    65.7253    65.3886
alpha         5.3122     5.3242     5.3361     5.3926     5.4034     5.4541     5.4541     5.4636     5.4344     5.4034     5.3817     5.3592
util living area
               0.9990     0.9976     0.9921     0.9661     0.8760     0.6959     0.5275     0.6007     0.8696     0.9851     0.9978     0.9993 (86)

MIT           19.7868    19.9309    20.1844    20.5318    20.8201    20.9627    20.9931    20.9868    20.8739    20.4957    20.0816    19.7652 (87)
Th 2          20.0224    20.0249    20.0273    20.0386    20.0407    20.0506    20.0506    20.0525    20.0468    20.0407    20.0364    20.0320 (88)
util rest of house
               0.9987     0.9967     0.9892     0.9531     0.8320     0.6098     0.4181     0.4860     0.8059     0.9773     0.9969     0.9990 (89)
MIT 2         18.3916    18.6041    18.9750    19.4799    19.8629    20.0258    20.0480    20.0468    19.9411    19.4372    18.8332    18.3670 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1648 (91)
MIT           18.6215    18.8227    19.1742    19.6532    20.0206    20.1801    20.2037    20.2017    20.0948    19.6116    19.0389    18.5974 (92)
Temperature adjustment                                                                                                             0.0000
adjusted MIT  18.6215    18.8227    19.1742    19.6532    20.0206    20.1801    20.2037    20.2017    20.0948    19.6116    19.0389    18.5974 (93)
```

---

8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9979     0.9952     0.9856     0.9465     0.8309     0.6222     0.4362     0.5047     0.8097     0.9725     0.9955     0.9985 (94)
Useful gains  557.0447   644.9998   739.3621   826.6645   804.6422   601.6781   399.8630   418.2389   588.7899   600.4483   543.8511   526.5105 (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
            1651.8218  1601.3566  1453.7757  1217.5490   939.8101   623.0998   402.4070   423.6059   672.3728  1017.8639  1355.1700  1642.6462 (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
              814.5142   642.6717   531.5237   281.4368   100.5649     0.0000     0.0000     0.0000     0.0000   310.5572   584.1496   830.4049 (98)
Space heating                                                                                                                     4095.8230 (98)
Space heating per m2                                                                                                 (98) / (4) =     38.1255 (99)
```


ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4385.2495	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	814.5142	642.6717	531.5237	281.4368	100.5649	0.0000	0.0000	0.0000	0.0000	310.5572	584.1496	830.4049	(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)													
	872.0708	688.0854	569.0832	301.3242	107.6712	0.0000	0.0000	0.0000	0.0000	332.5023	625.4278	889.0845	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	215.1690	189.6466	199.1611	177.8559	172.1959	151.6606	145.3024	161.9781	163.7670	185.1170	195.7591	209.9876	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0848	87.8814	87.4035	86.2015	83.7499	80.3000	80.3000	80.3000	80.3000	86.3441	87.6334	88.1619	(217)
Fuel for water heating, kWh/month													
	244.2748	215.7983	227.8638	206.3259	205.6074	188.8674	180.9494	201.7162	203.9439	214.3945	223.3842	238.1841	(219)
Water heating fuel used												2551.3100	(219)
Annual totals kWh/year													
Space heating fuel - main system												4385.2495	(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)												442.9625	(232)
Total delivered energy for all uses												7454.5220	(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	4385.2495	0.2160	947.2139	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2551.3100	0.2160	551.0830	(264)
Space and water heating			1498.2969	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	442.9625	0.5190	229.8975	(268)
Total CO2, kg/m2/year			1767.1194	(272)
Emissions per m2 for space and water heating			13.9467	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1400	(272b)
Emissions per m2 for pumps and fans			0.3623	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9467 * 1.00) + 2.1400 + 0.3623, rounded to 2 d.p.			16.4500	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.8100	(1b)	x 2.3300	(2b) =	83.4373	(1b) - (3b)
First floor	35.8100	(1c)	x 2.5500	(2c) =	91.3155	(1c) - (3c)
Second floor	35.8100	(1d)	x 2.5400	(2d) =	90.9574	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.4300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	265.7102	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1505	(8)
Pressure test				Yes	
Measured/design AP50				5.0100	
Infiltration rate				0.4010	(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) =	0.3409	(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	0.4346	0.4261	0.4176	0.3750	0.3665	0.3238	0.3238	0.3153	0.3409	0.3665	0.3835	0.4005	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5671	0.5524	0.5524	0.5497	0.5581	0.5671	0.5735	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			13.2800	1.3347	17.7251			(27)
Opening Type 4 (Uw = 1.90)			2.7600	1.7658	4.8736			(27a)
150mm Platinum			35.8100	0.1500	5.3715			(28a)
50mm A. Platinum	103.5500	14.2800	89.2700	0.2700	24.1029			(29a)
Dormer wall	3.7500	0.9700	2.7800	0.3000	0.8340			(29a)
I-Roof Gable	11.0600		11.0600	0.2500	2.7650			(29a)
Dormer roof	1.6500		1.6500	0.1700	0.2805			(30)
Horiz. to I-Roof	17.6200		17.6200	0.1900	3.3478			(30)
I-Roof	20.8600	2.7600	18.1000	0.1600	2.8960			(30)
Total net area of external elements Aum(A, m2)			194.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.1664			(33)
E-WM-22			64.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	175.5700	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.9188	(36)
Total fabric heat loss (33) + (36) =	75.0852	(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	52.1240	51.8024	51.4872	50.0066	49.7296	48.4400	48.4400	48.2012	48.9367	49.7296	50.2900	50.8758	(38)
Heat transfer coeff	127.2092	126.8876	126.5724	125.0918	124.8148	123.5252	123.5252	123.2864	124.0219	124.8148	125.3752	125.9610	(39)
Average = Sum(39)m / 12 =												125.0905	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1841	1.1811	1.1782	1.1644	1.1618	1.1498	1.1498	1.1476	1.1544	1.1618	1.1670	1.1725	(40)
HLP (average)												1.1644	(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	2.7985	(42)
Average daily hot water use (litres/day)	100.6641	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.7305	106.7039	102.6774	98.6508	94.6242	90.5977	90.5977	94.6242	98.6508	102.6774	106.7039	110.7305	(44)
Energy conte	164.2101	143.6192	148.2022	129.2062	123.9765	106.9823	99.1348	113.7586	115.1173	134.1581	146.4440	159.0287	(45)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1583.8378 (45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.8946	30.5191	31.4930	27.4563	26.3450	22.7337	21.0661	24.1737	24.4624	28.5086	31.1194	33.7936	(65)

---

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	139.9244	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.0824	22.2779	18.1176	13.7162	10.2530	8.6560	9.3532	12.1576	16.3179	20.7193	24.1825	25.7795	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.8106	270.5896	263.5865	248.6778	229.8582	212.1704	200.3539	197.5749	204.5780	219.4867	238.3063	255.9941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	36.9924	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	-111.9395	(71)
Water heating gains (Table 5)													
	46.9014	45.4153	42.3292	38.1338	35.4099	31.5746	28.3147	32.4915	33.9756	38.3180	43.2213	45.4215	(72)
Total internal gains													
	404.7717	403.2602	389.0107	365.5051	340.4985	317.3784	302.9991	307.2013	319.8488	343.5013	370.6874	392.1724	(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	7.2400	11.2829	0.7100	0.7000	0.7700	28.1352	(75)
Southwest	4.4100	36.7938	0.7100	0.7000	0.7700	55.8860	(79)
Northwest	1.6300	11.2829	0.7100	0.7000	0.7700	6.3343	(81)
Northeast	1.8400	17.0692	0.7600	0.7000	1.0000	15.0378	(82)
Southwest	0.9200	38.8503	0.7600	0.7000	1.0000	17.1134	(82)

Solar gains	122.5068	228.5461	364.4850	536.7613	677.7473	706.1919	666.9908	556.9208	423.4838	266.6500	150.3781	102.4697	(83)
Total gains	527.2785	631.8063	753.4958	902.2665	1018.2458	1023.5703	969.9899	864.1221	743.3326	610.1513	521.0655	494.6420	(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	41.1865	41.2909	41.3937	41.8837	41.9766	42.4148	42.4148	42.4970	42.2450	41.9766	41.7890	41.5946	
alpha	3.7458	3.7527	3.7596	3.7922	3.7984	3.8277	3.8277	3.8331	3.8163	3.7984	3.7859	3.7730	
util living area													
	0.9959	0.9915	0.9790	0.9380	0.8400	0.6806	0.5317	0.6047	0.8442	0.9691	0.9927	0.9968	(86)
MIT	19.1863	19.3925	19.7534	20.2397	20.6518	20.8926	20.9683	20.9490	20.7393	20.1942	19.6046	19.1542	(87)
Th 2	19.9327	19.9351	19.9375	19.9486	19.9507	19.9604	19.9604	19.9622	19.9566	19.9507	19.9465	19.9421	(88)
util rest of house													
	0.9949	0.9894	0.9734	0.9208	0.7960	0.5978	0.4183	0.4888	0.7831	0.9575	0.9905	0.9960	(89)
MIT 2	18.2724	18.4794	18.8389	19.3205	19.7007	19.9029	19.9496	19.9430	19.7919	19.2861	18.7002	18.2474	(90)
Living area fraction										fLA = Living area / (4) =		0.1648	(91)
MIT	18.4230	18.6299	18.9895	19.4720	19.8574	20.0659	20.1175	20.1087	19.9480	19.4357	18.8492	18.3968	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4230	18.6299	18.9895	19.4720	19.8574	20.0659	20.1175	20.1087	19.9480	19.4357	18.8492	18.3968	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9857	0.9667	0.9113	0.7916	0.6069	0.4363	0.5064	0.7825	0.9499	0.9873	0.9943	(94)
Useful gains	523.4924	622.7825	728.4354	822.2000	806.0107	621.1941	423.1711	437.5584	581.6737	579.5908	514.4338	491.8316	(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													
	1796.5726	1742.1519	1580.8301	1322.4653	1018.1657	675.1808	434.4963	457.2340	725.2790	1102.8297	1473.0579	1788.2444	(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													
	947.1717	752.2162	634.1816	360.1911	157.8434	0.0000	0.0000	0.0000	0.0000	389.2897	690.2093	964.5311	(98)
Space heating												4895.6342	(98)
Space heating per m2											(98) / (4) =	45.5705	(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

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1161.1370	914.0865	936.9767	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8260	0.8861	0.8483	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	959.0956	809.9295	794.8019	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1267.1653	1204.4822	1089.4826	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	221.8102	293.5472	219.2424	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												734.5999	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	55.4526	73.3868	54.8106	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												183.6500	(107)
Space cooling per m2												1.7095	(108)
Energy for space heating												45.5705	(99)
Energy for space cooling												1.7095	(108)
Total												47.2799	(109)
Dwelling Fabric Energy Efficiency (DFEE)												47.3	(109)

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	35.8100 (1b)	x	2.3300 (2b)	=	83.4373	(1b) - (3b)
First floor	35.8100 (1c)	x	2.5500 (2c)	=	91.3155	(1c) - (3c)
Second floor	35.8100 (1d)	x	2.5400 (2d)	=	90.9574	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.4300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	265.7102	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1505	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4005	(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) =	0.3405	(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	0.4341	0.4256	0.4171	0.3745	0.3660	0.3234	0.3234	0.3149	0.3405	0.3660	0.3830	0.4000	(22b)
Effective ac	0.5942	0.5906	0.5870	0.5701	0.5670	0.5523	0.5523	0.5496	0.5580	0.5670	0.5734	0.5800	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			13.2800	1.3258	17.6061			(27)
TER Room Window (Uw = 1.70)			2.7600	1.5918	4.3933			(27a)
150mm Platinum			35.8100	0.1300	4.6553			(28a)
50mm A. Platinum	103.5500	14.2800	89.2700	0.1800	16.0686			(29a)
Dormer wall	3.7500	0.9700	2.7800	0.1800	0.5004			(29a)
I-Roof Gable	11.0600		11.0600	0.1800	1.9908			(29a)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Horiz. to I-Roof	17.6200		17.6200	0.1300	2.2906			(30)
I-Roof	20.8600	2.7600	18.1000	0.1300	2.3530			(30)
Total net area of external elements Aum(A, m2)			194.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.0425			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.1927 (36)
Total fabric heat loss	(33) + (36) =	63.2352 (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	52.1034	51.7826	51.4681	49.9912	49.7149	48.4286	48.4286	48.1903	48.9240	49.7149	50.2739	50.8583	(38)
Heat transfer coeff	115.3386	115.0178	114.7034	113.2264	112.9501	111.6638	111.6638	111.4256	112.1593	112.9501	113.5091	114.0935	(39)
Average = Sum(39)m / 12 =												113.2251	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0736	1.0706	1.0677	1.0540	1.0514	1.0394	1.0394	1.0372	1.0440	1.0514	1.0566	1.0620	(40)
HLP (average)												1.0539	(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	2.7985 (42)
Average daily hot water use (litres/day)	100.6641 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.7305	106.7039	102.6774	98.6508	94.6242	90.5977	90.5977	94.6242	98.6508	102.6774	106.7039	110.7305	(44)
Energy conte	164.2101	143.6192	148.2022	129.2062	123.9765	106.9823	99.1348	113.7586	115.1173	134.1581	146.4440	159.0287	(45)
Energy content (annual)										Total = Sum(45)m =		1583.8378	(45)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (46)
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Primary loss    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (59)
Heat gains from water heating, kWh/month
               34.8946   30.5191   31.4930   27.4563   26.3450   22.7337   21.0661   24.1737   24.4624   28.5086   31.1194   33.7936 (65)


-------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         139.9244  139.9244  139.9244  139.9244  139.9244  139.9244  139.9244  139.9244  139.9244  139.9244  139.9244  139.9244 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               25.0824   22.2779   18.1176   13.7162   10.2530    8.6560    9.3532   12.1576   16.3179   20.7193   24.1825   25.7795 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              267.8106  270.5896  263.5865  248.6778  229.8582  212.1704  200.3539  197.5749  204.5780  219.4867  238.3063  255.9941 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.9924   36.9924   36.9924   36.9924   36.9924   36.9924   36.9924   36.9924   36.9924   36.9924   36.9924   36.9924 (69)
Pumps, fans     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -111.9395 -111.9395 -111.9395 -111.9395 -111.9395 -111.9395 -111.9395 -111.9395 -111.9395 -111.9395 -111.9395 -111.9395 (71)
Water heating gains (Table 5)
               46.9014   45.4153   42.3292   38.1338   35.4099   31.5746   28.3147   32.4915   33.9756   38.3180   43.2213   45.4215 (72)
Total internal gains
              404.7717  403.2602  389.0107  365.5051  340.4985  317.3784  302.9991  307.2013  319.8488  343.5013  370.6874  392.1724 (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                              7.2400            11.2829            0.6300           0.7000           0.7700           24.9651 (75)
Southwest                              4.4100            36.7938            0.6300           0.7000           0.7700           49.5890 (79)
Northwest                              1.6300            11.2829            0.6300           0.7000           0.7700            5.6206 (81)
Northeast                              1.8400            17.0692            0.6300           0.7000           1.0000           12.4656 (82)
Southwest                              0.9200            38.8503            0.6300           0.7000           1.0000           14.1861 (82)
-------------------------------------------------------------------------------------------------------------

Solar gains   106.8263  199.1058  317.1220  466.4874  588.6601  613.2397  579.2475  483.8665  368.2709  232.1862  131.0951   89.3772 (83)
Total gains   511.5980  602.3659  706.1327  831.9925  929.1586  930.6182  882.2466  791.0679  688.1196  575.6875  501.7825  481.5496 (84)


-------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           64.6828   64.8632   65.0410   65.8894   66.0505   66.8114   66.8114   66.9543   66.5163   66.0505   65.7253   65.3886
alpha          5.3122    5.3242    5.3361    5.3926    5.4034    5.4541    5.4541    5.4636    5.4344    5.4034    5.3817    5.3592
util living area
                0.9994    0.9983    0.9940    0.9722    0.8907    0.7163    0.5465    0.6253    0.8896    0.9891    0.9986    0.9995 (86)

MIT            19.7456   19.8908   20.1468   20.5007   20.8016   20.9572   20.9918   20.9840   20.8558   20.4612   20.0424   19.7247 (87)
Th 2           20.0224   20.0249   20.0273   20.0386   20.0407   20.0506   20.0506   20.0525   20.0468   20.0407   20.0364   20.0320 (88)
util rest of house
                0.9991    0.9977    0.9918    0.9612    0.8496    0.6301    0.4340    0.5078    0.8311    0.9832    0.9980    0.9994 (89)
MIT 2          18.8679   19.0149   19.2718   19.6280   19.9048   20.0308   20.0485   20.0477   19.9621   19.5954   19.1759   18.8547 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1648 (91)
MIT            19.0126   19.1592   19.4159   19.7718   20.0526   20.1834   20.2039   20.2020   20.1093   19.7380   19.3187   18.9981 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT   19.0126   19.1592   19.4159   19.7718   20.0526   20.1834   20.2039   20.2020   20.1093   19.7380   19.3187   18.9981 (93)


-------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9988    0.9969    0.9899    0.9573    0.8502    0.6430    0.4527    0.5272    0.8357    0.9807    0.9973    0.9991 (94)
Useful gains  510.9855  600.5217  698.9803  796.4771  789.9598  598.4260  399.3824  417.0328  575.0603  564.5633  500.4338  481.1355 (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
            1696.9248 1640.0602 1481.5014 1230.9714  943.4245  623.4667  402.4276  423.6376  674.0000 1032.1397 1386.9286 1688.3619 (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
              882.3389  698.5699  582.1957  312.8359  114.1777    0.0000    0.0000    0.0000    0.0000  347.8769  638.2763  898.1765 (98)
Space heating                                                                                                            4474.4477 (98)
Space heating per m2                                                                                        (98) / (4) =     41.6499 (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
```


ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	1049.6394	826.3119	846.8342	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8856	0.9396	0.9090	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	929.5293	776.4001	769.7848	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1165.1397	1108.1531	1009.1912	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	169.6394	246.8242	178.1184	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												594.5820 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	42.4099	61.7061	44.5296	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												148.6455 (107)
Space cooling per m2												1.3836 (108)
Energy for space heating												41.6499 (99)
Energy for space cooling												1.3836 (108)
Total												43.0335 (109)
Target Fabric Energy Efficiency (TFEE)												49.5 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Radleigh Detached PV	**Issued on Date**	23/02/2022
Assessment Reference	2	**Prop Type Ref**	
Property	DS01 Radleigh (Hipped Roof), Detached, Part L2013 Masonry, Barratt Developments		

SAP Rating	88 B	**DER**	13.35	**TER**	16.53
Environmental	88 B	**% DER<TER**	19.25		
CO_2 Emissions (t/year)	1.37	**DFEE**	48.42	**TFEE**	52.53
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.83		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Detached House, total floor area 121 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.53 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.35 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.4 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.70 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.15 m², No overhang
Windows facing East: 0.66 m², Overhang width less than twice window, ratio 0.29
Windows facing South: 10.67 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.038 W/m²K
Photovoltaic array 1.10 kW

ARUN DISTRICT COUNCIL A/45/22/PL

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	60.3700 (1b)	x	2.3100 (2b)	=	139.4547	(1b) - (3b)
First floor	60.3700 (1c)	x	2.5600 (2c)	=	154.5472	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.7400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.0019	(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							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1701	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4206	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3259	(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	0.4156	0.4074	0.3993	0.3585	0.3504	0.3096	0.3096	0.3015	0.3259	0.3504	0.3667	0.3830	(22b)
Effective ac	0.5864	0.5830	0.5797	0.5643	0.5614	0.5479	0.5479	0.5454	0.5531	0.5614	0.5672	0.5733	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			18.4800	1.3347	24.6657			(27)
Opening Type 3			1.9700	1.7000	3.3490			(26a)
150mm Platinum			60.3700	0.1500	9.0555			(28a)
50 mm A. Platinum	154.6800	22.4200	132.2600	0.2700	35.7102			(29a)
400mm Mineral wool	60.3700		60.3700	0.1100	6.6407			(30)
Total net area of external elements Aum(A, m2)			275.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.3911			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	149.4500	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4504	(36)
Total fabric heat loss (33) + (36) =	91.8414	(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	56.8881	56.5628	56.2439	54.7461	54.4659	53.1614	53.1614	52.9198	53.6639	54.4659	55.0328	55.6255	(38)
Heat transfer coeff	148.7295	148.4042	148.0853	146.5876	146.3073	145.0028	145.0028	144.7613	145.5053	146.3073	146.8742	147.4669	(39)
Average = Sum(39)m / 12 =												146.5862	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2318	1.2291	1.2265	1.2141	1.2118	1.2010	1.2010	1.1990	1.2051	1.2118	1.2165	1.2214	(40)
HLP (average)												1.2141	(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	2.8661 (42)
Average daily hot water use (litres/day)	102.2706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4976	108.4068	104.3160	100.2251	96.1343	92.0435	92.0435	96.1343	100.2251	104.3160	108.4068	112.4976	(44)
Energy conte	166.8307	145.9112	150.5673	131.2682	125.9550	108.6896	100.7169	115.5741	116.9544	136.2991	148.7811	161.5666	(45)
Energy content (annual)										Total = Sum(45)m =		1609.1141	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0246	21.8867	22.5851	19.6902	18.8932	16.3034	15.1075	17.3361	17.5432	20.4449	22.3172	24.2350	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1570	12.7755	14.1179	13.6278	14.0472	13.5529	13.9790	14.0232	13.5935	14.0837	13.6699	14.1443	(61)
Total heat required for water heating calculated for each month													
	180.9877	158.6867	164.6852	144.8961	140.0021	122.2425	114.6959	129.5973	130.5479	150.3827	162.4510	175.7110	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	180.9877	158.6867	164.6852	144.8961	140.0021	122.2425	114.6959	129.5973	130.5479	150.3827	162.4510	175.7110	(64)
								Total per year (kWh/year) = Sum(64)m =				1774.8860	(64)
Heat gains from water heating, kWh/month													
	59.0104	51.7093	53.5931	47.0536	45.3918	39.5275	36.9831	41.9342	42.2857	48.8404	52.8872	57.2570	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.8564	23.8536	19.3990	14.6863	10.9782	9.2683	10.0147	13.0175	17.4720	22.1847	25.8928	27.6028	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	286.1734	289.1430	281.6598	265.7288	245.6188	226.7182	214.0915	211.1219	218.6052	234.5362	254.6461	273.5467	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	(71)
Water heating gains (Table 5)													
	79.3151	76.9484	72.0337	65.3523	61.0105	54.8993	49.7085	56.3631	58.7302	65.6456	73.4544	76.9583	(72)
Total internal gains													
	461.3368	458.9370	442.0845	414.7593	386.5994	359.8777	342.8066	349.4945	363.7993	391.3585	422.9853	447.0997	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1500	10.6334	0.7100	0.7000	0.7700	26.1859	(74)
East	0.6600	19.6403	0.7100	0.7000	0.7700	4.4646	(76)
South	10.6700	46.7521	0.7100	0.7000	0.7700	171.8125	(78)

Solar gains	202.4630	340.1609	457.8518	562.6727	631.8517	629.5496	605.8947	552.9066	493.3941	373.4322	241.5269	173.9632	(83)
Total gains	663.7999	799.0979	899.9363	977.4320	1018.4511	989.4273	948.7013	902.4011	857.1933	764.7906	664.5123	621.0629	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.7014	33.7752	33.8480	34.1938	34.2593	34.5675	34.5675	34.6252	34.4481	34.2593	34.1271	33.9899	
alpha	3.2468	3.2517	3.2565	3.2796	3.2840	3.3045	3.3045	3.3083	3.2965	3.2840	3.2751	3.2660	
util living area													
	0.9899	0.9809	0.9649	0.9310	0.8634	0.7425	0.6000	0.6410	0.8239	0.9452	0.9828	0.9918	(86)
MIT	18.9613	19.2069	19.5707	20.0316	20.4599	20.7824	20.9226	20.9015	20.6653	20.1039	19.4441	18.9168	(87)
Th 2	19.8946	19.8968	19.8989	19.9088	19.9106	19.9192	19.9192	19.9208	19.9159	19.9106	19.9069	19.9030	(88)
util rest of house													
	0.9877	0.9768	0.9569	0.9138	0.8255	0.6648	0.4793	0.5242	0.7623	0.9281	0.9783	0.9900	(89)
MIT 2	17.1750	17.5330	18.0605	18.7253	19.3181	19.7321	19.8754	19.8604	19.5985	18.8385	17.8867	17.1151	(90)
Living area fraction									fLA = Living area / (4) =			0.2292	(91)
MIT	17.5843	17.9166	18.4066	19.0247	19.5798	19.9728	20.1154	20.0990	19.8430	19.1285	18.2436	17.5280	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.4343	17.7666	18.2566	18.8747	19.4298	19.8228	19.9654	19.9490	19.6930	18.9785	18.0936	17.3780	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9799	0.9649	0.9401	0.8923	0.8050	0.6568	0.4849	0.5276	0.7470	0.9079	0.9671	0.9835	(94)
Useful gains	650.4894	771.0538	845.9889	872.1595	819.8599	649.8976	460.0497	476.1155	640.2810	694.3624	642.6725	610.8002	(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													
	1953.4619	1909.4584	1740.9843	1462.1634	1130.9199	757.3271	487.9882	513.7611	813.8117	1225.8311	1614.6784	1943.3217	(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													
	969.4115	765.0079	665.8766	424.8028	231.4286	0.0000	0.0000	0.0000	0.0000	395.4127	699.8442	991.3960	(98)
Space heating												5143.1804	(98)
Space heating per m2											(98) / (4) =	42.5972	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5683.0722	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	969.4115	765.0079	665.8766	424.8028	231.4286	0.0000	0.0000	0.0000	0.0000	395.4127	699.8442	991.3960	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	1071.1730	845.3126	735.7752	469.3954	255.7222	0.0000	0.0000	0.0000	0.0000	436.9201	773.3085	1095.4652	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.9877	158.6867	164.6852	144.8961	140.0021	122.2425	114.6959	129.5973	130.5479	150.3827	162.4510	175.7110	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.9811	89.9337	89.8470	89.6641	89.2667	87.3000	87.3000	87.3000	87.3000	89.5951	89.8793	90.0033	(217)
Fuel for water heating, kWh/month													
	201.1397	176.4486	183.2952	161.5988	156.8359	140.0257	131.3813	148.4505	149.5394	167.8470	180.7434	195.2272	(219)
Water heating fuel used												1992.5327	(219)
Annual totals kWh/year													
Space heating fuel - main system												5683.0722	(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)												474.2918	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 908 * 0.80) =										-639.1294		-639.1294	(233)
Total delivered energy for all uses												7585.7673	(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	5683.0722	0.2160	1227.5436	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1992.5327	0.2160	430.3871	(264)
Space and water heating			1657.9307	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	474.2918	0.5190	246.1574	(268)
Energy saving/generation technologies				
PV Unit	-639.1294	0.5190	-331.7082	(269)
Total CO2, kg/year			1611.3050	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3500	(273)

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

DER		13.3500	ZC1
Total Floor Area	TFA	120.7400	
Assumed number of occupants	N	2.8661	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0451	ZC2
CO2 emissions from cooking, equation (L16)		1.5553	ZC3
Total CO2 emissions		28.9504	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.9504	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	60.3700	(1b)	x 2.3100	(2b) =	139.4547	(1b) - (3b)
First floor	60.3700	(1c)	x 2.5600	(2c) =	154.5472	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.7400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		294.0019	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							4 * 10 =		40.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1361	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3861	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2992	(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	0.3815	0.3740	0.3665	0.3291	0.3216	0.2842	0.2842	0.2768	0.2992	0.3216	0.3366	0.3516	(22b)
Effective ac	0.5728	0.5699	0.5672	0.5542	0.5517	0.5404	0.5404	0.5383	0.5448	0.5517	0.5566	0.5618	(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			1.9700	1.0000	1.9700			(26)
TER Semi-glazed door			1.9700	1.2000	2.3640			(26a)
TER Opening Type (Uw = 1.40)			18.4800	1.3258	24.5000			(27)
150mm Platinum			60.3700	0.1300	7.8481			(28a)
50 mm A. Platinum	154.6800	22.4200	132.2600	0.1800	23.8068			(29a)
400mm Mineral wool	60.3700		60.3700	0.1300	7.8481			(30)
Total net area of external elements Aum(A, m2)			275.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.3370			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1860	(36)
Total fabric heat loss					(33) + (36) =		80.5230	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5695	55.2954	55.0267	53.7647	53.5285	52.4294	52.4294	52.2258	52.8527	53.5285	54.0062	54.5056	(38)
Heat transfer coeff	136.0925	135.8184	135.5497	134.2877	134.0515	132.9524	132.9524	132.7488	133.3757	134.0515	134.5292	135.0286	(39)
Average = Sum(39)m / 12 =												134.2865	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1272	1.1249	1.1227	1.1122	1.1102	1.1011	1.1011	1.0995	1.1047	1.1102	1.1142	1.1183	(40)
HLP (average)												1.1122	(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	2.8661	(42)
Average daily hot water use (litres/day)	102.2706	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4976	108.4068	104.3160	100.2251	96.1343	92.0435	92.0435	96.1343	100.2251	104.3160	108.4068	112.4976	(44)
Energy conte	166.8307	145.9112	150.5673	131.2682	125.9550	108.6896	100.7169	115.5741	116.9544	136.2991	148.7811	161.5666	(45)
Energy content (annual)										Total = Sum(45)m =		1609.1141	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0246	21.8867	22.5851	19.6902	18.8932	16.3034	15.1075	17.3361	17.5432	20.4449	22.3172	24.2350	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	48.9890	45.3913	46.9044	48.9890	49.3151	50.9589	49.3151	50.9589 (61)

Total heat required for water heating calculated for each month

	217.7896	191.9386	201.5262	180.5833	174.9440	154.0809	147.6212	164.5631	166.2695	187.2580	198.0962	212.5255 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	217.7896	191.9386	201.5262	180.5833	174.9440	154.0809	147.6212	164.5631	166.2695	187.2580	198.0962	212.5255 (64)

Total per year (kWh/year) = Sum(64)m = 2197.1960 (64)

Heat gains from water heating, kWh/month

	68.2109	60.0223	62.8034	55.9754	54.1273	47.4871	45.2144	50.6756	51.2161	58.0592	61.7985	66.4606 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.8564	23.8536	19.3990	14.6863	10.9782	9.2683	10.0147	13.0175	17.4720	22.1847	25.8928	27.6028 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	286.1734	289.1430	281.6598	265.7288	245.6188	226.7182	214.0915	211.1219	218.6052	234.5362	254.6461	273.5467 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451 (71)

Water heating gains (Table 5)

	91.6814	89.3189	84.4131	77.7437	72.7517	65.9543	60.7721	68.1124	71.1335	78.0365	85.8312	89.3288 (72)

Total internal gains

	473.7031	471.3075	454.4638	427.1507	398.3406	370.9327	353.8702	361.2437	376.2026	403.7493	435.3621	459.4702 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1500	10.6334	0.6300	0.7000	0.7700	23.2354	(74)
East	0.6600	19.6403	0.6300	0.7000	0.7700	3.9615	(76)
South	10.6700	46.7521	0.6300	0.7000	0.7700	152.4534	(78)

Solar gains	179.6503	301.8329	406.2629	499.2729	560.6571	558.6144	537.6248	490.6073	437.8004	331.3553	214.3126	154.3617 (83)
Total gains	653.3534	773.1404	860.7267	926.4236	958.9978	929.5471	891.4951	851.8510	814.0030	735.1046	649.6748	613.8319 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.6105	61.7348	61.8572	62.4385	62.5485	63.0656	63.0656	63.1623	62.8654	62.5485	62.3264	62.0959	
alpha	5.1074	5.1157	5.1238	5.1626	5.1699	5.2044	5.2044	5.2108	5.1910	5.1699	5.1551	5.1397	
util living area	0.9988	0.9968	0.9918	0.9756	0.9259	0.7996	0.6290	0.6758	0.8852	0.9824	0.9972	0.9991	(86)
MIT	19.7345	19.8935	20.1309	20.4352	20.7189	20.9155	20.9810	20.9726	20.8434	20.4735	20.0432	19.7051	(87)
Th 2	19.9787	19.9806	19.9824	19.9909	19.9925	19.9999	19.9999	20.0013	19.9970	19.9925	19.9892	19.9859	(88)
util rest of house	0.9984	0.9957	0.9887	0.9656	0.8930	0.7150	0.4996	0.5487	0.8237	0.9733	0.9960	0.9988	(89)
MIT 2	18.2839	18.5175	18.8643	19.3085	19.6996	19.9386	19.9923	19.9890	19.8638	19.3686	18.7429	18.2460	(90)

Living area fraction fLA = Living area / (4) = 0.2292 (91)

MIT	18.6163	18.8328	19.1546	19.5667	19.9332	20.1625	20.2189	20.2144	20.0883	19.6218	19.0409	18.5803	(92)

Temperature adjustment 0.0000

adjusted MIT	18.6163	18.8328	19.1546	19.5667	19.9332	20.1625	20.2189	20.2144	20.0883	19.6218	19.0409	18.5803	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9939	0.9852	0.9600	0.8906	0.7303	0.5294	0.5777	0.8304	0.9686	0.9944	0.9982	(94)
Useful gains	651.7137	768.4270	848.0148	889.3985	854.1294	678.8741	472.0007	492.1423	675.9565	712.0580	646.0228	612.7027	(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	1948.3434	1892.3327	1715.3215	1432.4089	1103.6689	739.5423	481.1397	506.3629	798.6911	1209.3905	1606.3951	1941.7570	(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	964.6925	755.2647	645.2762	390.9675	185.6574	0.0000	0.0000	0.0000	0.0000	370.0154	691.4681	988.8164	(98)

Space heating 4992.1580 (98)

Space heating per m2 (98) / (4) = 41.3463 (99)

8c. Space cooling requirement

Not applicable

elmhurst energy
ARUN DISTRICT COUNCIL A/45/22/PL

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												5344.9229	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	964.6925	755.2647	645.2762	390.9675	185.6574	0.0000	0.0000	0.0000	0.0000	370.0154	691.4681	988.8164	(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)													
	1032.8614	808.6345	690.8738	418.5947	198.7767	0.0000	0.0000	0.0000	0.0000	396.1621	740.3298	1058.6899	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.7896	191.9386	201.5262	180.5833	174.9440	154.0809	147.6212	164.5631	166.2695	187.2580	198.0962	212.5255	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3532	88.1532	87.7727	86.9448	85.2010	80.3000	80.3000	80.3000	80.3000	86.7342	87.9369	88.4323	(217)
Fuel for water heating, kWh/month													
	246.4988	217.7330	229.6002	207.6988	205.3310	191.8815	183.8371	204.9353	207.0604	215.8986	225.2707	240.3257	(219)
Water heating fuel used												2576.0711	(219)
Annual totals kWh/year													
Space heating fuel - main system												5344.9229	(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)												474.2918	(232)
Total delivered energy for all uses												8470.2858	(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	5344.9229	0.2160	1154.5034	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2576.0711	0.2160	556.4314	(264)
Space and water heating			1710.9347	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	474.2918	0.5190	246.1574	(268)
Total CO2, kg/m2/year			1996.0172	(272)
Emissions per m2 for space and water heating			14.1704	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0387	(272b)
Emissions per m2 for pumps and fans			0.3224	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1704 * 1.00) + 2.0387 + 0.3224, rounded to 2 d.p.			16.5300	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.3700 (1b)	x	2.3100 (2b)	=	139.4547	(1b) - (3b)
First floor	60.3700 (1c)	x	2.5600 (2c)	=	154.5472	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.7400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.0019	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1361	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3866	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2996	(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	0.3820	0.3745	0.3670	0.3295	0.3220	0.2846	0.2846	0.2771	0.2996	0.3220	0.3370	0.3520	(22b)
Effective ac	0.5729	0.5701	0.5673	0.5543	0.5519	0.5405	0.5405	0.5384	0.5449	0.5519	0.5568	0.5620	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.9700	1.0000	1.9700			(26)
Opening Type 2 (Uw = 1.41)			18.4800	1.3347	24.6657			(27)
Opening Type 3			1.9700	1.7000	3.3490			(26a)
150mm Platinum			60.3700	0.1500	9.0555			(28a)
50 mm A. Platinum	154.6800	22.4200	132.2600	0.2700	35.7102			(29a)
400mm Mineral wool	60.3700		60.3700	0.1100	6.6407			(30)
Total net area of external elements Aum(A, m2)			275.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.3911			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	149.4500	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4504	(36)
Total fabric heat loss (33) + (36) =	91.8414	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5878	55.3129	55.0436	53.7783	53.5415	52.4395	52.4395	52.2354	52.8640	53.5415	54.0204	54.5211	(38)
Heat transfer coeff	147.4292	147.1544	146.8850	145.6197	145.3830	144.2809	144.2809	144.0769	144.7054	145.3830	145.8619	146.3625	(39)
Average = Sum(39)m / 12 =												145.6186	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2210	1.2188	1.2165	1.2061	1.2041	1.1950	1.1950	1.1933	1.1985	1.2041	1.2081	1.2122	(40)
HLP (average)												1.2061	(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	2.8661 (42)
Average daily hot water use (litres/day)	102.2706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4976	108.4068	104.3160	100.2251	96.1343	92.0435	92.0435	96.1343	100.2251	104.3160	108.4068	112.4976	(44)
Energy conte	166.8307	145.9112	150.5673	131.2682	125.9550	108.6896	100.7169	115.5741	116.9544	136.2991	148.7811	161.5666	(45)
Energy content (annual)										Total = Sum(45)m =		1609.1141	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.4515	31.0061	31.9955	27.8945	26.7654	23.0965	21.4023	24.5595	24.8528	28.9636	31.6160	34.3329	(65)

---

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.8564	23.8536	19.3990	14.6863	10.9782	9.2683	10.0147	13.0175	17.4720	22.1847	25.8928	27.6028	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	286.1734	289.1430	281.6598	265.7288	245.6188	226.7182	214.0915	211.1219	218.6052	234.5362	254.6461	273.5467	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	(71)
Water heating gains (Table 5)													
	47.6499	46.1401	43.0048	38.7424	35.9750	32.0785	28.7666	33.0101	34.5178	38.9295	43.9111	46.1464	(72)
Total internal gains													
	426.6716	425.1286	410.0555	385.1494	358.5640	334.0569	318.8647	323.1414	336.5869	361.6423	390.4420	413.2878	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1500	10.6334	0.7100	0.7000	0.7700	26.1859	(74)
East	0.6600	19.6403	0.7100	0.7000	0.7700	4.4646	(76)
South	10.6700	46.7521	0.7100	0.7000	0.7700	171.8125	(78)

Solar gains	202.4630	340.1609	457.8518	562.6727	631.8517	629.5496	605.8947	552.9066	493.3941	373.4322	241.5269	173.9632	(83)
Total gains	629.1346	765.2895	867.9073	947.8221	990.4156	963.6065	924.7593	876.0480	829.9810	735.0745	631.9689	587.2510	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.9986	34.0621	34.1246	34.4211	34.4771	34.7405	34.7405	34.7897	34.6386	34.4771	34.3639	34.2464	
alpha	3.2666	3.2708	3.2750	3.2947	3.2985	3.3160	3.3160	3.3193	3.3092	3.2985	3.2909	3.2831	
util living area													
	0.9913	0.9831	0.9680	0.9356	0.8701	0.7517	0.6095	0.6524	0.8333	0.9501	0.9851	0.9931	(86)
MIT	18.9425	19.1893	19.5548	20.0166	20.4488	20.7757	20.9197	20.8971	20.6545	20.0854	19.4222	18.8958	(87)
Th 2	19.9032	19.9050	19.9068	19.9152	19.9167	19.9240	19.9240	19.9254	19.9212	19.9167	19.9136	19.9102	(88)
util rest of house													
	0.9894	0.9794	0.9606	0.9193	0.8335	0.6750	0.4885	0.5357	0.7736	0.9344	0.9812	0.9915	(89)
MIT 2	18.0253	18.2716	18.6344	19.0919	19.5018	19.7914	19.8927	19.8818	19.6957	19.1661	18.5109	17.9840	(90)
Living area fraction									fLA = Living area / (4) =			0.2292	(91)
MIT	18.2355	18.4819	18.8453	19.3038	19.7188	20.0169	20.1281	20.1145	19.9154	19.3768	18.7198	18.1929	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2355	18.4819	18.8453	19.3038	19.7188	20.0169	20.1281	20.1145	19.9154	19.3768	18.7198	18.1929	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9854	0.9728	0.9512	0.9079	0.8256	0.6825	0.5135	0.5583	0.7732	0.9242	0.9752	0.9881	(94)
Useful gains	619.9330	744.5017	825.5786	860.4976	817.6916	657.6186	474.8287	489.1340	641.7543	679.3346	616.3222	580.2845	(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													
	2054.4973	1998.6377	1813.3406	1514.9968	1165.8040	781.5594	509.0322	535.1747	841.5251	1275.9957	1694.8816	2048.0428	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1067.3158	842.7794	734.8950	471.2394	258.9957	0.0000	0.0000	0.0000	0.0000	443.9158	776.5627	1092.0122	(98)
Space heating												5687.7160	(98)
Space heating per m2											(98) / (4) =	47.1071	(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	1356.2408	1067.6790	1094.9841	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7334	0.8092	0.7835	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	994.6452	864.0163	857.9049	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1241.8572	1193.9169	1139.3010	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	177.9927	245.4460	209.3587	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												632.7974 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	44.4982	61.3615	52.3397	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												158.1994 (107)
Space cooling per m2												1.3102 (108)
Energy for space heating												47.1071 (99)
Energy for space cooling												1.3102 (108)
Total												48.4174 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.4 (109)

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	60.3700 (1b)	x	2.3100 (2b)	=	139.4547	(1b) - (3b)
First floor	60.3700 (1c)	x	2.5600 (2c)	=	154.5472	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.7400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.0019	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1361	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3861	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2992	(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	0.3815	0.3740	0.3665	0.3291	0.3216	0.2842	0.2842	0.2768	0.2992	0.3216	0.3366	0.3516	(22b)
Effective ac	0.5728	0.5699	0.5672	0.5542	0.5517	0.5404	0.5404	0.5383	0.5448	0.5517	0.5566	0.5618	(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			1.9700	1.0000	1.9700			(26)
TER Semi-glazed door			1.9700	1.2000	2.3640			(26a)
TER Opening Type (Uw = 1.40)			18.4800	1.3258	24.5000			(27)
150mm Platinum			60.3700	0.1300	7.8481			(28a)
50 mm A. Platinum	154.6800	22.4200	132.2600	0.1800	23.8068			(29a)
400mm Mineral wool	60.3700		60.3700	0.1300	7.8481			(30)
Total net area of external elements Aum(A, m2)			275.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.3370			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1860	(36)
Total fabric heat loss					(33) + (36) =		80.5230	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5695	55.2954	55.0267	53.7647	53.5285	52.4294	52.4294	52.2258	52.8527	53.5285	54.0062	54.5056	(38)
Heat transfer coeff	136.0925	135.8184	135.5497	134.2877	134.0515	132.9524	132.9524	132.7488	133.3757	134.0515	134.5292	135.0286	(39)
Average = Sum(39)m / 12 =												134.2865	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1272	1.1249	1.1227	1.1122	1.1102	1.1011	1.1011	1.0995	1.1047	1.1102	1.1142	1.1183	(40)
HLP (average)												1.1122	(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												2.8661	(42)
Average daily hot water use (litres/day)												102.2706	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4976	108.4068	104.3160	100.2251	96.1343	92.0435	92.0435	96.1343	100.2251	104.3160	108.4068	112.4976	(44)
Energy conte	166.8307	145.9112	150.5673	131.2682	125.9550	108.6896	100.7169	115.5741	116.9544	136.2991	148.7811	161.5666	(45)
Energy content (annual)										Total = Sum(45)m =		1609.1141	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.4515	31.0061	31.9955	27.8945	26.7654	23.0965	21.4023	24.5595	24.8528	28.9636	31.6160	34.3329	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	143.3064	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.8564	23.8536	19.3990	14.6863	10.9782	9.2683	10.0147	13.0175	17.4720	22.1847	25.8928	27.6028	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	286.1734	289.1430	281.6598	265.7288	245.6188	226.7182	214.0915	211.1219	218.6052	234.5362	254.6461	273.5467	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	37.3306	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	-114.6451	(71)

Water heating gains (Table 5)

	47.6499	46.1401	43.0048	38.7424	35.9750	32.0785	28.7666	33.0101	34.5178	38.9295	43.9111	46.1464	(72)

Total internal gains

	426.6716	425.1286	410.0555	385.1494	358.5640	334.0569	318.8647	323.1414	336.5869	361.6423	390.4420	413.2878	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1500	10.6334	0.6300	0.7000	0.7700	23.2354	(74)
East	0.6600	19.6403	0.6300	0.7000	0.7700	3.9615	(76)
South	10.6700	46.7521	0.6300	0.7000	0.7700	152.4534	(78)

Solar gains	179.6503	301.8329	406.2629	499.2729	560.6571	558.6144	537.6248	490.6073	437.8004	331.3553	214.3126	154.3617	(83)
Total gains	606.3219	726.9615	816.3184	884.4223	919.2211	892.6713	856.4895	813.7487	774.3873	692.9976	604.7546	567.6495	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.6105	61.7348	61.8572	62.4385	62.5485	63.0656	63.0656	63.1623	62.8654	62.5485	62.3264	62.0959	
alpha	5.1074	5.1157	5.1238	5.1626	5.1699	5.2044	5.2044	5.2108	5.1910	5.1699	5.1551	5.1397	
util living area	0.9991	0.9976	0.9935	0.9798	0.9359	0.8181	0.6502	0.7000	0.9014	0.9863	0.9980	0.9994	(86)
MIT	19.6980	19.8580	20.0975	20.4061	20.6972	20.9053	20.9779	20.9678	20.8257	20.4432	20.0085	19.6691	(87)
Th 2	19.9787	19.9806	19.9824	19.9909	19.9925	19.9999	19.9999	20.0013	19.9970	19.9925	19.9892	19.9859	(88)
util rest of house	0.9988	0.9968	0.9910	0.9713	0.9062	0.7359	0.5186	0.5717	0.8449	0.9790	0.9971	0.9992	(89)
MIT 2	18.7851	18.9463	19.1862	19.4972	19.7741	19.9520	19.9938	19.9912	19.8933	19.5375	19.1038	18.7620	(90)
Living area fraction									fLA = Living area / (4) =			0.2292	(91)
MIT	18.9943	19.1552	19.3950	19.7055	19.9857	20.1705	20.2193	20.2150	20.1070	19.7451	19.3111	18.9699	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9943	19.1552	19.3950	19.7055	19.9857	20.1705	20.2193	20.2150	20.1070	19.7451	19.3111	18.9699	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9958	0.9891	0.9682	0.9059	0.7517	0.5492	0.6014	0.8524	0.9765	0.9963	0.9989	(94)
Useful gains	605.3690	723.9287	807.4378	856.2863	832.7309	671.0339	470.4025	489.3850	660.0833	676.7323	602.5372	567.0128	(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	1999.7852	1936.1211	1747.9145	1451.0408	1110.7085	740.6084	481.1945	506.4393	801.1883	1225.9106	1642.7503	1994.3565	(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	1037.4457	814.5933	699.7147	428.2233	206.8153	0.0000	0.0000	0.0000	0.0000	408.5887	748.9535	1061.9437	(98)
Space heating												5406.2781	(98)
Space heating per m2											(98) / (4) =	44.7762	(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	1249.7521	983.8474	1008.8909	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8056	0.8861	0.8613	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1006.7994	871.8363	869.0013	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1158.9460	1114.1210	1066.4836	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	109.5455	180.2598	146.9268	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											436.7322	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	27.3864	45.0650	36.7317	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											109.1830	(107)
Space cooling per m2											0.9043	(108)
Energy for space heating											44.7762	(99)
Energy for space cooling											0.9043	(108)
Total											45.6805	(109)
Target Fabric Energy Efficiency (TFEE)											52.5	(109)

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Type 51 End-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Type 51, EOT, Barratt Developments plc		

SAP Rating	83 B	**DER**	18.74	**TER**	19.26
Environmental	86 B	**% DER<TER**	2.70		
CO_2 Emissions (t/year)	1.20	**DFEE**	51.10	**TFEE**	54.07
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.50		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 77 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) 19.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.74 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.49 (max. 2.00)	1.70 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 1.32 m², No overhang
Windows facing East: 4.12 m², No overhang
Windows facing West: 4.95 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K

ARUN DISTRICT COUNCIL A/45/22/PL

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	38.4300	(1b)	x 2.3100	(2b) =	88.7733	(1b) - (3b)
First floor	38.4300	(1c)	x 2.5600	(2c) =	98.3808	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		187.1541	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1603	(8)
Pressure test			Yes	
Measured/design AP50			5.0100	
Infiltration rate			0.4108	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3184	(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	0.4059	0.3980	0.3900	0.3502	0.3422	0.3024	0.3024	0.2945	0.3184	0.3422	0.3582	0.3741	(22b)
Effective ac	0.5824	0.5792	0.5760	0.5613	0.5586	0.5457	0.5457	0.5434	0.5507	0.5586	0.5641	0.5700	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			4.2800	1.7000	7.2760			(26a)
Opening Type 2 (Uw = 1.41)			10.3900	1.3347	13.8678			(27)
150mm Platinum			38.4300	0.1500	5.7645			(28a)
50mm Alreflex Plat	85.4100	14.6700	70.7400	0.2700	19.0998			(29a)
400mm Mineral Wool	38.4300		38.4300	0.1100	4.2273			(30)
Total net area of external elements Aum(A, m2)			162.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.2354			(33)
E-WM-22			39.9100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	160.9000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.6530	(36)
Total fabric heat loss (33) + (36) =	58.8884	(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	35.9686	35.7710	35.5773	34.6677	34.4975	33.7052	33.7052	33.5585	34.0104	34.4975	34.8418	35.2017	(38)
Heat transfer coeff	94.8569	94.6594	94.4657	93.5561	93.3859	92.5936	92.5936	92.4469	92.8988	93.3859	93.7302	94.0901	(39)
Average = Sum(39)m / 12 =												93.5552	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2342	1.2316	1.2291	1.2172	1.2150	1.2047	1.2047	1.2028	1.2087	1.2150	1.2195	1.2242	(40)
HLP (average)												1.2172	(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	2.4006 (42)
Average daily hot water use (litres/day)	91.2138 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3352	96.6867	93.0381	89.3896	85.7410	82.0925	82.0925	85.7410	89.3896	93.0381	96.6867	100.3352	(44)
Energy conte	148.7942	130.1364	134.2891	117.0765	112.3377	96.9389	89.8281	103.0791	104.3102	121.5634	132.6960	144.0993	(45)
Energy content (annual)										Total = Sum(45)m =		1435.1488	(45)
Distribution loss (46)m = 0.15 x (45)m	22.3191	19.5205	20.1434	17.5615	16.8507	14.5408	13.4742	15.4619	15.6465	18.2345	19.9044	21.6149	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1137	12.7273	14.0564	13.5640	13.9877	13.5038	13.9335	13.9687	13.5366	14.0280	13.6207	14.1024	(61)
Total heat required for water heating calculated for each month													
	162.9079	142.8636	148.3455	130.6405	126.3254	110.4427	103.7617	117.0478	117.8467	135.5914	146.3167	158.2017	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.9079	142.8636	148.3455	130.6405	126.3254	110.4427	103.7617	117.0478	117.8467	135.5914	146.3167	158.2017	(64)
								Total per year (kWh/year) = Sum(64)m =				1600.2916	(64)
Heat gains from water heating, kWh/month													
	53.0025	46.4522	48.1652	42.3189	40.8492	35.6081	33.3512	37.7660	38.0673	43.9268	47.5266	51.4386	(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	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5048	18.2122	14.8111	11.2130	8.3818	7.0763	7.6462	9.9388	13.3398	16.9380	19.7691	21.0747	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	212.7531	214.9608	209.3975	197.5537	182.6031	168.5517	159.1644	156.9567	162.5201	174.3638	189.3144	203.3659	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	(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)													
	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	(71)
Water heating gains (Table 5)													
	71.2399	69.1252	64.7382	58.7763	54.9049	49.4557	44.8269	50.7607	52.8712	59.0415	66.0092	69.1379	(72)
Total internal gains													
	366.5065	364.3070	350.9555	329.5517	307.8985	287.0924	273.6463	279.6650	290.7399	312.3520	337.1015	355.5872	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.7100	0.7000	0.7700	4.8343	(74)
East	4.1200	19.6403	0.7100	0.7000	0.7700	27.8698	(76)
West	4.9500	19.6403	0.7100	0.7000	0.7700	33.4844	(80)

Solar gains	66.1885	129.2604	213.3575	313.4897	387.2586	398.0195	378.2613	322.6932	248.7603	153.4134	82.4652	54.4848	(83)
Total gains	432.6950	493.5674	564.3130	643.0415	695.1571	685.1120	651.9075	602.3582	539.5002	465.7654	419.5667	410.0720	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.2147	36.2903	36.3647	36.7183	36.7852	37.0999	37.0999	37.1588	36.9780	36.7852	36.6500	36.5098	
alpha	3.4143	3.4194	3.4243	3.4479	3.4523	3.4733	3.4733	3.4773	3.4652	3.4523	3.4433	3.4340	
util living area													
	0.9913	0.9856	0.9712	0.9331	0.8528	0.7171	0.5728	0.6276	0.8377	0.9572	0.9862	0.9928	(86)
MIT	19.0759	19.2706	19.6296	20.1101	20.5387	20.8301	20.9429	20.9208	20.6831	20.1207	19.5137	19.0403	(87)
Th 2	19.8928	19.8948	19.8968	19.9062	19.9080	19.9162	19.9162	19.9178	19.9131	19.9080	19.9044	19.9007	(88)
util rest of house													
	0.9893	0.9822	0.9641	0.9155	0.8117	0.6354	0.4521	0.5088	0.7764	0.9426	0.9824	0.9911	(89)
MIT 2	17.3287	17.6133	18.1345	18.8259	19.4122	19.7763	19.8860	19.8717	19.6156	18.8534	17.9750	17.2817	(90)
Living area fraction									fLA = Living area / (4) =			0.4398	(91)
MIT	18.0970	18.3421	18.7920	19.3906	19.9076	20.2397	20.3508	20.3330	20.0851	19.4107	18.6517	18.0551	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9470	18.1921	18.6420	19.2406	19.7576	20.0897	20.2008	20.1830	19.9351	19.2607	18.5017	17.9051	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9841	0.9748	0.9532	0.9021	0.8051	0.6498	0.4858	0.5403	0.7779	0.9310	0.9753	0.9866	(94)
Useful gains	425.8087	481.1396	537.9006	580.0696	559.6463	445.1895	316.7134	325.4564	419.6696	433.6182	409.2155	404.5675	(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													
	1294.5146	1258.2231	1146.9989	967.4304	752.4640	508.3133	333.4101	349.7311	542.0694	808.7896	1068.6802	1289.5121	(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													
	646.3172	522.2001	453.1692	278.8998	143.4564	0.0000	0.0000	0.0000	0.0000	279.1276	474.8146	658.3988	(98)
Space heating												3456.3836	(98)
Space heating per m2											(98) / (4) =	44.9699	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3819.2083	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	646.3172	522.2001	453.1692	278.8998	143.4564	0.0000	0.0000	0.0000	0.0000	279.1276	474.8146	658.3988	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000		(210)
Space heating fuel (main heating system)													
	714.1626	577.0167	500.7394	308.1766	158.5153	0.0000	0.0000	0.0000	0.0000	308.4282	524.6570	727.5124	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.9079	142.8636	148.3455	130.6405	126.3254	110.4427	103.7617	117.0478	117.8467	135.5914	146.3167	158.2017	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8371	89.7930	89.6892	89.4540	88.9729	87.3000	87.3000	87.3000	87.3000	89.4283	89.7253	89.8619	(217)
Fuel for water heating, kWh/month													
	181.3370	159.1034	165.3995	146.0420	141.9819	126.5094	118.8564	134.0753	134.9905	151.6204	163.0720	176.0498	(219)
Water heating fuel used												1799.0376	(219)
Annual totals kWh/year													
Space heating fuel - main system												3819.2083	(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)												362.1207	(232)
Total delivered energy for all uses												6055.3667	(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	3819.2083	0.2160	824.9490	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1799.0376	0.2160	388.5921	(264)
Space and water heating			1213.5411	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	362.1207	0.5190	187.9407	(268)
Total CO2, kg/year			1440.4068	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.7400	(273)

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

DER		18.7400	ZC1
Total Floor Area	TFA	76.8600	
Assumed number of occupants	N	2.4006	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4029	ZC2
CO2 emissions from cooking, equation (L16)		2.2979	ZC3
Total CO2 emissions		37.4408	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		37.4408	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	38.4300 (1b)	x	2.3100 (2b)	=	88.7733	(1b) - (3b)
First floor	38.4300 (1c)	x	2.5600 (2c)	=	98.3808	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.1541	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1603	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4103	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180	(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	0.4054	0.3975	0.3895	0.3498	0.3418	0.3021	0.3021	0.2941	0.3180	0.3418	0.3577	0.3736	(22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5584	0.5456	0.5456	0.5433	0.5506	0.5584	0.5640	0.5698	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			10.3900	1.3258	13.7746			(27)
150mm Platinum			38.4300	0.1300	4.9959			(28a)
50mm Alreflex Plat	85.4100	14.6700	70.7400	0.1800	12.7332			(29a)
400mm Mineral Wool	38.4300		38.4300	0.1300	4.9959			(30)
Total net area of external elements Aum(A, m2)			162.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6356			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1133	(36)
Total fabric heat loss (33) + (36) =	50.7490	(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	35.9562	35.7591	35.5659	34.6585	34.4887	33.6983	33.6983	33.5520	34.0028	34.4887	34.8321	35.1912	(38)
Heat transfer coeff	86.7051	86.5080	86.3149	85.4074	85.2376	84.4473	84.4473	84.3009	84.7517	85.2376	85.5811	85.9402	(39)
Average = Sum(39)m / 12 =												85.4066	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1281	1.1255	1.1230	1.1112	1.1090	1.0987	1.0987	1.0968	1.1027	1.1090	1.1135	1.1181	(40)
HLP (average)												1.1112	(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	2.4006 (42)
Average daily hot water use (litres/day)	91.2138 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3352	96.6867	93.0381	89.3896	85.7410	82.0925	82.0925	85.7410	89.3896	93.0381	96.6867	100.3352	(44)
Energy conte	148.7942	130.1364	134.2891	117.0765	112.3377	96.9389	89.8281	103.0791	104.3102	121.5634	132.6960	144.0993	(45)
Energy content (annual)										Total = Sum(45)m =		1435.1488	(45)
Distribution loss (46)m = 0.15 x (45)m	22.3191	19.5205	20.1434	17.5615	16.8507	14.5408	13.4742	15.4619	15.6465	18.2345	19.9044	21.6149	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.5024	47.4112	44.0825	43.6927	40.4839	41.8334	43.6927	44.0825	47.4112	47.6811	50.9589	(61)
Total heat required for water heating calculated for each month													
	199.7531	174.6387	181.7003	161.1590	156.0304	137.4228	131.6615	146.7718	148.3927	168.9746	180.3771	195.0582	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	199.7531	174.6387	181.7003	161.1590	156.0304	137.4228	131.6615	146.7718	148.3927	168.9746	180.3771	195.0582	(64)
								Total per year (kWh/year) = Sum(64)m =				1981.9403	(64)
Heat gains from water heating, kWh/month													
	62.2138	54.3959	56.5039	49.9486	48.2754	42.3532	40.3262	45.1970	45.7038	52.2726	56.0417	60.6527	(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	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5048	18.2122	14.8111	11.2130	8.3818	7.0763	7.6462	9.9388	13.3398	16.9380	19.7691	21.0747	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	212.7531	214.9608	209.3975	197.5537	182.6031	168.5517	159.1644	156.9567	162.5201	174.3638	189.3144	203.3659	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	(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)													
	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	(71)
Water heating gains (Table 5)													
	83.6207	80.9463	75.9461	69.3730	64.8864	58.8238	54.2019	60.7486	63.4774	70.2589	77.8357	81.5225	(72)
Total internal gains													
	378.8873	376.1280	362.1634	340.1484	317.8800	296.4605	283.0213	289.6529	301.3461	323.5695	348.9280	367.9718	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896	(74)
East	4.1200	19.6403	0.6300	0.7000	0.7700	24.7296	(76)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115	(80)

Solar gains	58.7306	114.6959	189.3172	278.1670	343.6238	353.1723	335.6403	286.3334	220.7310	136.1274	73.1734	48.3457	(83)
Total gains	437.6180	490.8239	551.4807	618.3154	661.5038	649.6328	618.6615	575.9863	522.0771	459.6969	422.1013	416.3175	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5592	61.6995	61.8376	62.4946	62.6190	63.2051	63.2051	63.3148	62.9781	62.6190	62.3677	62.1072	
alpha	5.1039	5.1133	5.1225	5.1663	5.1746	5.2137	5.2137	5.2210	5.1985	5.1746	5.1578	5.1405	
util living area													
	0.9984	0.9969	0.9915	0.9705	0.9035	0.7533	0.5830	0.6428	0.8822	0.9836	0.9969	0.9988	(86)
MIT	19.7597	19.8911	20.1346	20.4667	20.7599	20.9370	20.9866	20.9783	20.8469	20.4653	20.0543	19.7366	(87)
Th 2	19.9780	19.9800	19.9821	19.9917	19.9935	20.0019	20.0019	20.0034	19.9986	19.9935	19.9899	19.9860	(88)
util rest of house													
	0.9979	0.9958	0.9884	0.9587	0.8645	0.6650	0.4598	0.5184	0.8200	0.9751	0.9956	0.9984	(89)
MIT 2	18.3201	18.5135	18.8695	19.3527	19.7500	19.9582	19.9967	19.9941	19.8690	19.3580	18.7596	18.2921	(90)
Living area fraction										fLA = Living area / (4) =		0.4398	(91)
MIT	18.9532	19.1193	19.4258	19.8426	20.1941	20.3886	20.4320	20.4269	20.2990	19.8450	19.3289	18.9273	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9532	19.1193	19.4258	19.8426	20.1941	20.3886	20.4320	20.4269	20.2990	19.8450	19.3289	18.9273	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9945	0.9861	0.9566	0.8734	0.7015	0.5144	0.5735	0.8413	0.9734	0.9945	0.9978	(94)
Useful gains	436.3711	488.1255	543.8297	591.4504	577.7529	455.7040	318.2485	330.3109	439.2252	447.4815	419.7637	415.3963	(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													
	1270.5042	1230.0843	1115.6920	934.5776	724.0204	488.8329	323.6060	339.4726	525.3787	788.0182	1046.5668	1265.6704	(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													
	620.5950	498.5963	425.4656	247.0516	108.8230	0.0000	0.0000	0.0000	0.0000	253.3594	451.2982	632.6040	(98)
Space heating												3237.7931	(98)
Space heating per m2											(98) / (4) =	42.1259	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												3466.5879	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	620.5950	498.5963	425.4656	247.0516	108.8230	0.0000	0.0000	0.0000	0.0000	253.3594	451.2982	632.6040	(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)													
	664.4486	533.8291	455.5306	264.5092	116.5128	0.0000	0.0000	0.0000	0.0000	271.2627	483.1887	677.3062	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.7531	174.6387	181.7003	161.1590	156.0304	137.4228	131.6615	146.7718	148.3927	168.9746	180.3771	195.0582	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7136	87.5437	87.1207	86.1234	84.1636	80.3000	80.3000	80.3000	80.3000	86.0687	87.2657	87.7975	(217)
Fuel for water heating, kWh/month													
	227.7333	199.4875	208.5615	187.1257	185.3893	171.1368	163.9621	182.7793	184.7979	196.3253	206.6987	222.1684	(219)
Water heating fuel used												2336.1656	(219)
Annual totals kWh/year													
Space heating fuel - main system												3466.5879	(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)												362.1207	(232)
Total delivered energy for all uses												6239.8743	(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	3466.5879	0.2160	748.7830	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2336.1656	0.2160	504.6118	(264)
Space and water heating			1253.3948	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	362.1207	0.5190	187.9407	(268)
Total CO2, kg/m2/year			1480.2604	(272)
Emissions per m2 for space and water heating			16.3075	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4452	(272b)
Emissions per m2 for pumps and fans			0.5064	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3075 * 1.00) + 2.4452 + 0.5064, rounded to 2 d.p.			19.2600	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.4300 (1b)	x	2.3100 (2b)	=	88.7733	(1b) - (3b)
First floor	38.4300 (1c)	x	2.5600 (2c)	=	98.3808	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.1541	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1603	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4108	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3184	(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	0.4059	0.3980	0.3900	0.3502	0.3422	0.3024	0.3024	0.2945	0.3184	0.3422	0.3582	0.3741	(22b)
Effective ac	0.5824	0.5792	0.5760	0.5613	0.5586	0.5457	0.5457	0.5434	0.5507	0.5586	0.5641	0.5700	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			4.2800	1.7000	7.2760			(26a)
Opening Type 2 (Uw = 1.41)			10.3900	1.3347	13.8678			(27)
150mm Platinum			38.4300	0.1500	5.7645			(28a)
50mm Alreflex Plat	85.4100	14.6700	70.7400	0.2700	19.0998			(29a)
400mm Mineral Wool	38.4300		38.4300	0.1100	4.2273			(30)
Total net area of external elements Aum(A, m2)			162.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.2354			(33)
E-WM-22			39.9100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	160.9000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.6530	(36)
Total fabric heat loss (33) + (36) =	58.8884	(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	35.9686	35.7710	35.5773	34.6677	34.4975	33.7052	33.7052	33.5585	34.0104	34.4975	34.8418	35.2017	(38)
Heat transfer coeff	94.8569	94.6594	94.4657	93.5561	93.3859	92.5936	92.5936	92.4469	92.8988	93.3859	93.7302	94.0901	(39)
Average = Sum(39)m / 12 =												93.5552	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2342	1.2316	1.2291	1.2172	1.2150	1.2047	1.2047	1.2028	1.2087	1.2150	1.2195	1.2242	(40)
HLP (average)												1.2172	(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	2.4006	(42)
Average daily hot water use (litres/day)	91.2138	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3352	96.6867	93.0381	89.3896	85.7410	82.0925	82.0925	85.7410	89.3896	93.0381	96.6867	100.3352	(44)
Energy conte	148.7942	130.1364	134.2891	117.0765	112.3377	96.9389	89.8281	103.0791	104.3102	121.5634	132.6960	144.0993	(45)
Energy content (annual)										Total = Sum(45)m =		1435.1488	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	31.6188	27.6540	28.5364	24.8788	23.8718	20.5995	19.0885	21.9043	22.1659	25.8322	28.1979	30.6211 (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	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.5048	18.2122	14.8111	11.2130	8.3818	7.0763	7.6462	9.9388	13.3398	16.9380	19.7691	21.0747	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	212.7531	214.9608	209.3975	197.5537	182.6031	168.5517	159.1644	156.9567	162.5201	174.3638	189.3144	203.3659	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	(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)

	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	(71)

Water heating gains (Table 5)

	42.4984	41.1518	38.3554	34.5538	32.0857	28.6104	25.6566	29.4413	30.7860	34.7207	39.1638	41.1574	(72)

Total internal gains

	334.7650	333.3335	321.5727	302.3293	282.0794	263.2471	251.4759	255.3455	265.6547	285.0313	307.2560	324.6067	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.7100	0.7000	0.7700	4.8343	(74)
East	4.1200	19.6403	0.7100	0.7000	0.7700	27.8698	(76)
West	4.9500	19.6403	0.7100	0.7000	0.7700	33.4844	(80)

Solar gains	66.1885	129.2604	213.3575	313.4897	387.2586	398.0195	378.2613	322.6932	248.7603	153.4134	82.4652	54.4848	(83)
Total gains	400.9535	462.5939	534.9303	615.8190	669.3380	661.2667	629.7372	578.0388	514.4150	438.4447	389.7213	379.0915	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.2147	36.2903	36.3647	36.7183	36.7852	37.0999	37.0999	37.1588	36.9780	36.7852	36.6500	36.5098	
alpha	3.4143	3.4194	3.4243	3.4479	3.4523	3.4733	3.4733	3.4773	3.4652	3.4523	3.4433	3.4340	
util living area	0.9931	0.9881	0.9753	0.9401	0.8641	0.7321	0.5883	0.6462	0.8527	0.9637	0.9890	0.9943	(86)
MIT	19.0246	19.2217	19.5856	20.0748	20.5144	20.8180	20.9380	20.9131	20.6608	20.0817	19.4663	18.9899	(87)
Th 2	19.8928	19.8948	19.8968	19.9062	19.9080	19.9162	19.9162	19.9178	19.9131	19.9080	19.9044	19.9007	(88)
util rest of house	0.9915	0.9853	0.9691	0.9240	0.8248	0.6513	0.4661	0.5266	0.7945	0.9510	0.9859	0.9930	(89)
MIT 2	18.0913	18.2887	18.6507	19.1356	19.5491	19.8129	19.8935	19.8828	19.6929	19.1511	18.5404	18.0625	(90)
Living area fraction									fLA = Living area / (4) =			0.4398	(91)
MIT	18.5017	18.6990	19.0618	19.5487	19.9736	20.2549	20.3528	20.3359	20.1186	19.5603	18.9475	18.4704	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5017	18.6990	19.0618	19.5487	19.9736	20.2549	20.3528	20.3359	20.1186	19.5603	18.9475	18.4704	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9887	0.9812	0.9630	0.9176	0.8275	0.6787	0.5181	0.5761	0.8072	0.9458	0.9822	0.9906	(94)
Useful gains	396.4379	453.9185	515.1558	565.0695	553.8674	448.8322	326.2548	333.0158	415.2418	414.6950	382.7818	375.5418	(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	1347.1340	1306.2075	1186.6637	996.2466	772.6387	523.6085	347.4892	363.8605	559.1172	836.7686	1110.4716	1342.6992	(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	707.3179	572.7382	499.6018	310.4475	162.7658	0.0000	0.0000	0.0000	0.0000	314.0227	523.9367	719.5651	(98)
Space heating												3810.3958	(98)
Space heating per m2										(98) / (4) =		49.5758	(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	870.3798	685.1926	702.5963	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7731	0.8421	0.8087	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	672.8838	577.0183	568.2042	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	862.9042	824.2702	765.5417	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	136.8147	183.9554	146.8191	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											467.5892	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.2037	45.9888	36.7048	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											116.8973	(107)
Space cooling per m2											1.5209	(108)
Energy for space heating											49.5758	(99)
Energy for space cooling											1.5209	(108)
Total											51.0967	(109)
Dwelling Fabric Energy Efficiency (DFEE)											51.1	(109)

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	38.4300 (1b)	x	2.3100 (2b)	=	88.7733	(1b) - (3b)
First floor	38.4300 (1c)	x	2.5600 (2c)	=	98.3808	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.1541	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1603	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4103	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180	(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	0.4054	0.3975	0.3895	0.3498	0.3418	0.3021	0.3021	0.2941	0.3180	0.3418	0.3577	0.3736	(22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5584	0.5456	0.5456	0.5433	0.5506	0.5584	0.5640	0.5698	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			10.3900	1.3258	13.7746			(27)
150mm Platinum			38.4300	0.1300	4.9959			(28a)
50mm Alreflex Plat	85.4100	14.6700	70.7400	0.1800	12.7332			(29a)
400mm Mineral Wool	38.4300		38.4300	0.1300	4.9959			(30)
Total net area of external elements Aum(A, m2)			162.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6356			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1133	(36)
Total fabric heat loss (33) + (36) =	50.7490	(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	35.9562	35.7591	35.5659	34.6585	34.4887	33.6983	33.6983	33.5520	34.0028	34.4887	34.8321	35.1912	(38)
Heat transfer coeff	86.7051	86.5080	86.3149	85.4074	85.2376	84.4473	84.4473	84.3009	84.7517	85.2376	85.5811	85.9402	(39)
Average = Sum(39)m / 12 =												85.4066	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1281	1.1255	1.1230	1.1112	1.1090	1.0987	1.0987	1.0968	1.1027	1.1090	1.1135	1.1181	(40)
HLP (average)												1.1112	(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	2.4006 (42)
Average daily hot water use (litres/day)	91.2138 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3352	96.6867	93.0381	89.3896	85.7410	82.0925	82.0925	85.7410	89.3896	93.0381	96.6867	100.3352	(44)
Energy conte	148.7942	130.1364	134.2891	117.0765	112.3377	96.9389	89.8281	103.0791	104.3102	121.5634	132.6960	144.0993	(45)
Energy content (annual)										Total = Sum(45)m =		1435.1488	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.6188	27.6540	28.5364	24.8788	23.8718	20.5995	19.0885	21.9043	22.1659	25.8322	28.1979	30.6211	(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	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5048	18.2122	14.8111	11.2130	8.3818	7.0763	7.6462	9.9388	13.3398	16.9380	19.7691	21.0747	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	212.7531	214.9608	209.3975	197.5537	182.6031	168.5517	159.1644	156.9567	162.5201	174.3638	189.3144	203.3659	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	(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)													
	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	(71)
Water heating gains (Table 5)													
	42.4984	41.1518	38.3554	34.5538	32.0857	28.6104	25.6566	29.4413	30.7860	34.7207	39.1638	41.1574	(72)
Total internal gains													
	334.7650	333.3335	321.5727	302.3293	282.0794	263.2471	251.4759	255.3455	265.6547	285.0313	307.2560	324.6067	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896	(74)
East	4.1200	19.6403	0.6300	0.7000	0.7700	24.7296	(76)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115	(80)

Solar gains	58.7306	114.6959	189.3172	278.1670	343.6238	353.1723	335.6403	286.3334	220.7310	136.1274	73.1734	48.3457	(83)
Total gains	393.4956	448.0294	510.8900	580.4962	625.7032	616.4194	587.1162	541.6790	486.3856	421.1587	380.4294	372.9524	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5592	61.6995	61.8376	62.4946	62.6190	63.2051	63.2051	63.3148	62.9781	62.6190	62.3677	62.1072	
alpha	5.1039	5.1133	5.1225	5.1663	5.1746	5.2137	5.2137	5.2210	5.1985	5.1746	5.1578	5.1405	
util living area													
	0.9991	0.9979	0.9940	0.9771	0.9193	0.7793	0.6102	0.6753	0.9052	0.9887	0.9981	0.9993	(86)
MIT	19.7059	19.8393	20.0867	20.4262	20.7323	20.9259	20.9836	20.9729	20.8219	20.4213	20.0038	19.6836	(87)
Th 2	19.9780	19.9800	19.9821	19.9917	19.9935	20.0019	20.0019	20.0034	19.9986	19.9935	19.9899	19.9860	(88)
util rest of house													
	0.9987	0.9972	0.9917	0.9676	0.8846	0.6927	0.4832	0.5484	0.8500	0.9826	0.9973	0.9991	(89)
MIT 2	18.7924	18.9272	19.1752	19.5171	19.8046	19.9659	19.9975	19.9952	19.8920	19.5172	19.0996	18.7766	(90)
Living area fraction									fLA = Living area / (4) =			0.4398	(91)
MIT	19.1941	19.3283	19.5761	19.9169	20.2125	20.3881	20.4311	20.4251	20.3009	19.9148	19.4972	19.1754	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1941	19.3283	19.5761	19.9169	20.2125	20.3881	20.4311	20.4251	20.3009	19.9148	19.4972	19.1754	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9966	0.9905	0.9667	0.8933	0.7288	0.5397	0.6049	0.8693	0.9820	0.9968	0.9988	(94)
Useful gains	392.8600	446.5026	506.0298	561.1729	558.9143	449.2392	316.8653	327.6596	422.8172	413.5728	379.1970	372.4973	(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													
	1291.3979	1248.1665	1128.6587	940.9266	725.5897	488.7859	323.5270	339.3219	525.5392	793.9730	1060.9679	1286.9925	(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													
	668.5122	538.7181	463.2359	273.4226	124.0065	0.0000	0.0000	0.0000	0.0000	283.0177	490.8750	680.3844	(98)
Space heating												3522.1725	(98)
Space heating per m2											(98) / (4) =	45.8258	(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	793.8046	624.9100	640.6872	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8477	0.9143	0.8854	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	672.8765	571.3668	567.2764	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	810.4853	774.4534	723.0432	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	99.0783	151.0965	115.8905	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												366.0653	(104)

ARUN DISTRICT COUNCIL A/45/22/PL

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	24.7696	37.7741	28.9726	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												91.5163 (107)
Space cooling per m2												1.1907 (108)
Energy for space heating												45.8258 (99)
Energy for space cooling												1.1907 (108)
Total												47.0165 (109)
Target Fabric Energy Efficiency (TFEE)												54.1 (109)

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Type 51 Mid-Terrace PV	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Type 51, Mid Terr, Barratt Developments plc		

SAP Rating	92 A	**DER**	8.47	**TER**	18.08
Environmental	94 A	**% DER<TER**	53.16		
CO_2 Emissions (t/year)	0.41	**DFEE**	43.00	**TFEE**	47.56
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.58		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 77 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.08 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.47 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)47.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.70 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.95 m², No overhang
Windows facing West: 4.12 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Photovoltaic array 1.93 kW

ARUN DISTRICT COUNCIL A/45/22/PL

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	38.4300 (1b)	x	2.3100 (2b)	=	88.7733	(1b) - (3b)
First floor	38.4300 (1c)	x	2.5600 (2c)	=	98.3808	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.1541	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1603	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4108	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3800	(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	0.4845	0.4750	0.4655	0.4180	0.4085	0.3610	0.3610	0.3515	0.3800	0.4085	0.4275	0.4465	(22b)
Effective ac	0.6174	0.6128	0.6083	0.5874	0.5834	0.5652	0.5652	0.5618	0.5722	0.5834	0.5914	0.5997	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			4.2800	1.7000	7.2760			(26a)
Opening Type 2 (Uw = 1.41)			9.0700	1.3347	12.1059			(27)
150mm Platinum			38.4300	0.1200	4.6116			(28a)
50mm Alreflex Plat	43.8100	13.3500	30.4600	0.2700	8.2242			(29a)
400mm Mineral Wool	38.4300		38.4300	0.1100	4.2273			(30)
Total net area of external elements Aum(A, m2)			120.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.4450			(33)
E-WM-22			83.1800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	175.8000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.4100	(36)
Total fabric heat loss (33) + (36) =	44.8550	(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	38.1288	37.8473	37.5714	36.2756	36.0331	34.9045	34.9045	34.6955	35.3392	36.0331	36.5236	37.0364	(38)
Heat transfer coeff	82.9838	82.7023	82.4264	81.1306	80.8881	79.7595	79.7595	79.5505	80.1942	80.8881	81.3786	81.8914	(39)
Average = Sum(39)m / 12 =												81.1294	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0797	1.0760	1.0724	1.0556	1.0524	1.0377	1.0377	1.0350	1.0434	1.0524	1.0588	1.0655	(40)
HLP (average)												1.0555	(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	2.4006 (42)
Average daily hot water use (litres/day)	91.2138 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3352	96.6867	93.0381	89.3896	85.7410	82.0925	82.0925	85.7410	89.3896	93.0381	96.6867	100.3352	(44)
Energy conte	148.7942	130.1364	134.2891	117.0765	112.3377	96.9389	89.8281	103.0791	104.3102	121.5634	132.6960	144.0993	(45)
Energy content (annual)										Total = Sum(45)m =		1435.1488	(45)
Distribution loss (46)m = 0.15 x (45)m	22.3191	19.5205	20.1434	17.5615	16.8507	14.5408	13.4742	15.4619	15.6465	18.2345	19.9044	21.6149	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1137	12.7273	14.0564	13.5640	13.9877	13.5038	13.9335	13.9687	13.5366	14.0280	13.6207	14.1024	(61)
Total heat required for water heating calculated for each month													
	162.9079	142.8636	148.3455	130.6405	126.3254	110.4427	103.7617	117.0478	117.8467	135.5914	146.3167	158.2017	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h													
	162.9079	142.8636	148.3455	130.6405	126.3254	110.4427	103.7617	117.0478	117.8467	135.5914	146.3167	158.2017	(64)
										Total per year (kWh/year) = Sum(64)m =		1600.2916	(64)
Heat gains from water heating, kWh/month													
	53.0025	46.4522	48.1652	42.3189	40.8492	35.6081	33.3512	37.7660	38.0673	43.9268	47.5266	51.4386	(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	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1309	18.7683	15.2634	11.5554	8.6378	7.2924	7.8797	10.2423	13.7472	17.4552	20.3728	21.7182	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	212.7531	214.9608	209.3975	197.5537	182.6031	168.5517	159.1644	156.9567	162.5201	174.3638	189.3144	203.3659	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	(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)													
	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	(71)
Water heating gains (Table 5)													
	71.2399	69.1252	64.7382	58.7763	54.9049	49.4557	44.8269	50.7607	52.8712	59.0415	66.0092	69.1379	(72)
Total internal gains													
	367.1327	364.8631	351.4078	329.8941	308.1545	287.3085	273.8798	279.9685	291.1472	312.8692	337.7051	356.2307	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.9500	19.6403	0.7100	0.7000	0.7700	33.4844	(76)
West	4.1200	19.6403	0.7100	0.7000	0.7700	27.8698	(80)

Solar gains	61.3542	120.0218	197.6588	288.2736	353.2901	361.6553	344.3106	295.7577	229.8854	142.4160	76.5015	50.4547	(83)
Total gains	428.4869	484.8849	549.0666	618.1677	661.4446	648.9638	618.1904	575.7262	521.0326	455.2852	414.2066	406.6854	(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	45.2297	45.3836	45.5355	46.2628	46.4015	47.0581	47.0581	47.1817	46.8030	46.4015	46.1218	45.8330	
alpha	4.0153	4.0256	4.0357	4.0842	4.0934	4.1372	4.1372	4.1454	4.1202	4.0934	4.0748	4.0555	
util living area	0.9938	0.9890	0.9761	0.9381	0.8517	0.6988	0.5427	0.5964	0.8281	0.9611	0.9894	0.9950	(86)
MIT	19.4413	19.6155	19.9277	20.3438	20.6912	20.9066	20.9747	20.9630	20.8004	20.3403	19.8228	19.4177	(87)
Th 2	20.0175	20.0205	20.0234	20.0373	20.0399	20.0520	20.0520	20.0543	20.0473	20.0399	20.0346	20.0291	(88)
util rest of house	0.9923	0.9864	0.9700	0.9216	0.8115	0.6217	0.4365	0.4898	0.7676	0.9476	0.9863	0.9937	(89)
MIT 2	17.9268	18.1824	18.6367	19.2386	19.7099	19.9766	20.0389	20.0333	19.8626	19.2448	18.4952	17.9002	(90)
Living area fraction										fLA = Living area / (4) =		0.4398	(91)
MIT	18.5928	18.8126	19.2045	19.7247	20.1415	20.3856	20.4504	20.4421	20.2750	19.7265	19.0790	18.5676	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4428	18.6626	19.0545	19.5747	19.9915	20.2356	20.3004	20.2921	20.1250	19.5765	18.9290	18.4176	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9888	0.9812	0.9621	0.9119	0.8092	0.6377	0.4655	0.5180	0.7732	0.9392	0.9814	0.9908	(94)
Useful gains	423.6966	475.7911	528.2398	563.7201	535.2415	413.8550	287.7375	298.2129	402.8690	427.5859	406.5052	402.9513	(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	1173.6247	1138.2015	1034.8199	866.0414	670.6806	449.4907	295.1440	309.6197	483.1697	726.0942	962.6293	1164.2970	(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	557.9465	445.1398	376.8956	217.6714	100.7667	0.0000	0.0000	0.0000	0.0000	222.0902	400.4093	566.4412	(98)
Space heating												2887.3607	(98)
Space heating per m2											(98) / (4) =	37.5665	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3190.4538	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	557.9465	445.1398	376.8956	217.6714	100.7667	0.0000	0.0000	0.0000	0.0000	222.0902	400.4093	566.4412	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	616.5155	491.8672	416.4592	240.5209	111.3445	0.0000	0.0000	0.0000	0.0000	245.4035	442.4412	625.9019	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.9079	142.8636	148.3455	130.6405	126.3254	110.4427	103.7617	117.0478	117.8467	135.5914	146.3167	158.2017	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7565	89.7011	89.5727	89.2727	88.6915	87.3000	87.3000	87.3000	87.3000	89.2597	89.6208	89.7815	(217)
Fuel for water heating, kWh/month													
	181.4999	159.2663	165.6147	146.3387	142.4323	126.5094	118.8564	134.0753	134.9905	151.9067	163.2619	176.2074	(219)
Water heating fuel used												1800.9595	(219)
Annual totals kWh/year													
Space heating fuel - main system												3190.4538	(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)												373.1788	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.93 * 1029 * 0.80) =										-1271.2514		-1271.2514	(233)
Total delivered energy for all uses												4168.3406	(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	3190.4538	0.2160	689.1380	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.9595	0.2160	389.0072	(264)
Space and water heating			1078.1453	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	373.1788	0.5190	193.6798	(268)
Energy saving/generation technologies				
PV Unit	-1271.2514	0.5190	-659.7795	(269)
Total CO2, kg/year			650.9706	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.4700	(273)

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

DER		8.4700	ZC1
Total Floor Area	TFA	76.8600	
Assumed number of occupants	N	2.4006	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4029	ZC2
CO2 emissions from cooking, equation (L16)		2.2979	ZC3
Total CO2 emissions		27.1708	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.1708	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	38.4300 (1b)	x	2.3100 (2b)	=	88.7733	(1b) - (3b)
First floor	38.4300 (1c)	x	2.5600 (2c)	=	98.3808	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.1541	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1603	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4103	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3795	(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	0.4839	0.4744	0.4649	0.4175	0.4080	0.3605	0.3605	0.3511	0.3795	0.4080	0.4270	0.4459	(22b)
Effective ac	0.6171	0.6125	0.6081	0.5871	0.5832	0.5650	0.5650	0.5616	0.5720	0.5832	0.5911	0.5994	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			9.0700	1.3258	12.0246			(27)
150mm Platinum			38.4300	0.1300	4.9959			(28a)
50mm Alreflex Plat	43.8100	13.3500	30.4600	0.1800	5.4828			(29a)
400mm Mineral Wool	38.4300		38.4300	0.1300	4.9959			(30)
Total net area of external elements Aum(A, m2)			120.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.6352			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.3141	(36)
Total fabric heat loss (33) + (36) =	40.9493	(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	38.1111	37.8304	37.5551	36.2625	36.0206	34.8947	34.8947	34.6862	35.3284	36.0206	36.5099	37.0214	(38)
Heat transfer coeff	79.0605	78.7797	78.5045	77.2118	76.9699	75.8441	75.8441	75.6356	76.2777	76.9699	77.4592	77.9707	(39)
Average = Sum(39)m / 12 =												77.2106	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0286	1.0250	1.0214	1.0046	1.0014	0.9868	0.9868	0.9841	0.9924	1.0014	1.0078	1.0145	(40)
HLP (average)												1.0046	(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	2.4006 (42)
Average daily hot water use (litres/day)	91.2138 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3352	96.6867	93.0381	89.3896	85.7410	82.0925	82.0925	85.7410	89.3896	93.0381	96.6867	100.3352	(44)
Energy conte	148.7942	130.1364	134.2891	117.0765	112.3377	96.9389	89.8281	103.0791	104.3102	121.5634	132.6960	144.0993	(45)
Energy content (annual)										Total = Sum(45)m =		1435.1488	(45)
Distribution loss (46)m = 0.15 x (45)m	22.3191	19.5205	20.1434	17.5615	16.8507	14.5408	13.4742	15.4619	15.6465	18.2345	19.9044	21.6149	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.5024	47.4112	44.0825	43.6927	40.4839	41.8334	43.6927	44.0825	47.4112	47.6811	50.9589	(61)
Total heat required for water heating calculated for each month													
	199.7531	174.6387	181.7003	161.1590	156.0304	137.4228	131.6615	146.7718	148.3927	168.9746	180.3771	195.0582	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	199.7531	174.6387	181.7003	161.1590	156.0304	137.4228	131.6615	146.7718	148.3927	168.9746	180.3771	195.0582	(64)
								Total per year (kWh/year) = Sum(64)m =				1981.9403	(64)
Heat gains from water heating, kWh/month													
	62.2138	54.3959	56.5039	49.9486	48.2754	42.3532	40.3262	45.1970	45.7038	52.2726	56.0417	60.6527	(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	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1309	18.7683	15.2634	11.5554	8.6378	7.2924	7.8797	10.2423	13.7472	17.4552	20.3728	21.7182	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	212.7531	214.9608	209.3975	197.5537	182.6031	168.5517	159.1644	156.9567	162.5201	174.3638	189.3144	203.3659	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	(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)													
	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	(71)
Water heating gains (Table 5)													
	83.6207	80.9463	75.9461	69.3730	64.8864	58.8238	54.2019	60.7486	63.4774	70.2589	77.8357	81.5225	(72)
Total internal gains													
	379.5135	376.6842	362.6157	340.4908	318.1360	296.6766	283.2547	289.9564	301.7535	324.0867	349.5317	368.6153	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115	(76)
West	4.1200	19.6403	0.6300	0.7000	0.7700	24.7296	(80)

Solar gains	54.4410	106.4982	175.3874	255.7921	313.4828	320.9054	305.5150	262.4329	203.9828	126.3691	67.8816	44.7697	(83)
Total gains	433.9545	483.1824	538.0031	596.2829	631.6188	617.5821	588.7698	552.3893	505.7363	450.4558	417.4132	413.3850	(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	67.5116	67.7522	67.9897	69.1280	69.3453	70.3747	70.3747	70.5687	69.9746	69.3453	68.9072	68.4552	
alpha	5.5008	5.5168	5.5326	5.6085	5.6230	5.6916	5.6916	5.7046	5.6650	5.6230	5.5938	5.5637	
util living area													
	0.9985	0.9970	0.9916	0.9693	0.8967	0.7326	0.5569	0.6124	0.8664	0.9824	0.9969	0.9989	(86)
MIT	19.8917	20.0164	20.2432	20.5528	20.8123	20.9585	20.9926	20.9878	20.8891	20.5504	20.1714	19.8762	(87)
Th 2	20.0595	20.0626	20.0655	20.0795	20.0821	20.0944	20.0944	20.0966	20.0897	20.0821	20.0768	20.0713	(88)
util rest of house													
	0.9980	0.9959	0.9886	0.9575	0.8579	0.6496	0.4475	0.5010	0.8036	0.9735	0.9957	0.9985	(89)
MIT 2	18.5719	18.7563	19.0886	19.5422	19.8921	20.0657	20.0915	20.0913	19.9967	19.5463	18.9937	18.5580	(90)
Living area fraction									fLA = Living area / (4) =			0.4398	(91)
MIT	19.1523	19.3104	19.5963	19.9866	20.2968	20.4583	20.4878	20.4856	20.3891	19.9879	19.5116	19.1377	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1523	19.3104	19.5963	19.9866	20.2968	20.4583	20.4878	20.4856	20.3891	19.9879	19.5116	19.1377	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9948	0.9866	0.9560	0.8680	0.6846	0.4959	0.5503	0.8266	0.9724	0.9947	0.9980	(94)
Useful gains	432.8071	480.6801	530.7706	570.0681	548.2648	422.8082	291.9622	303.9585	418.0559	438.0133	415.1838	412.5464	(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													
	1174.2291	1135.2505	1028.1211	856.0189	661.6926	444.3169	294.8651	309.0153	479.7204	722.5840	961.3926	1164.7014	(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													
	551.6180	439.8713	370.0288	205.8845	84.3903	0.0000	0.0000	0.0000	0.0000	211.7206	393.2703	559.6033	(98)
Space heating												2816.3872	(98)
Space heating per m2											(98) / (4) =	36.6431	(99)

8c. Space cooling requirement

Not applicable

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

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3015.4038	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	551.6180	439.8713	370.0288	205.8845	84.3903	0.0000	0.0000	0.0000	0.0000	211.7206	393.2703	559.6033	(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)													
	590.5974	470.9543	396.1764	220.4331	90.3536	0.0000	0.0000	0.0000	0.0000	226.6816	421.0603	599.1471	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.7531	174.6387	181.7003	161.1590	156.0304	137.4228	131.6615	146.7718	148.3927	168.9746	180.3771	195.0582	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4750	87.2802	86.8044	85.6689	83.5777	80.3000	80.3000	80.3000	80.3000	85.6200	86.9607	87.5536	(217)
Fuel for water heating, kWh/month													
	228.3546	200.0899	209.3216	188.1185	186.6891	171.1368	163.9621	182.7793	184.7979	197.3541	207.4236	222.7871	(219)
Water heating fuel used												2342.8145	(219)
Annual totals kWh/year													
Space heating fuel - main system												3015.4038	(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)												373.1788	(232)
Total delivered energy for all uses												5806.3971	(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	3015.4038	0.2160	651.3272	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2342.8145	0.2160	506.0479	(264)
Space and water heating			1157.3752	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	373.1788	0.5190	193.6798	(268)
Total CO2, kg/m2/year			1389.9799	(272)
Emissions per m2 for space and water heating			15.0582	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5199	(272b)
Emissions per m2 for pumps and fans			0.5064	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0582 * 1.00) + 2.5199 + 0.5064, rounded to 2 d.p.			18.0800	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.4300 (1b)	x	2.3100 (2b)	=	88.7733	(1b) - (3b)
First floor	38.4300 (1c)	x	2.5600 (2c)	=	98.3808	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.1541	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1603	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4108	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3800	(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	0.4845	0.4750	0.4655	0.4180	0.4085	0.3610	0.3610	0.3515	0.3800	0.4085	0.4275	0.4465	(22b)
Effective ac	0.6174	0.6128	0.6083	0.5874	0.5834	0.5652	0.5652	0.5618	0.5722	0.5834	0.5914	0.5997	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			4.2800	1.7000	7.2760			(26a)
Opening Type 2 (Uw = 1.41)			9.0700	1.3347	12.1059			(27)
150mm Platinum			38.4300	0.1200	4.6116			(28a)
50mm Alreflex Plat	43.8100	13.3500	30.4600	0.2700	8.2242			(29a)
400mm Mineral Wool	38.4300		38.4300	0.1100	4.2273			(30)
Total net area of external elements Aum(A, m2)			120.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.4450			(33)
E-WM-22			83.1800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	175.8000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.4100	(36)
Total fabric heat loss (33) + (36) =	44.8550	(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	38.1288	37.8473	37.5714	36.2756	36.0331	34.9045	34.9045	34.6955	35.3392	36.0331	36.5236	37.0364	(38)
Heat transfer coeff	82.9838	82.7023	82.4264	81.1306	80.8881	79.7595	79.7595	79.5505	80.1942	80.8881	81.3786	81.8914	(39)
Average = Sum(39)m / 12 =												81.1294	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0797	1.0760	1.0724	1.0556	1.0524	1.0377	1.0377	1.0350	1.0434	1.0524	1.0588	1.0655	(40)
HLP (average)												1.0555	(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	2.4006 (42)
Average daily hot water use (litres/day)	91.2138 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3352	96.6867	93.0381	89.3896	85.7410	82.0925	82.0925	85.7410	89.3896	93.0381	96.6867	100.3352	(44)
Energy conte	148.7942	130.1364	134.2891	117.0765	112.3377	96.9389	89.8281	103.0791	104.3102	121.5634	132.6960	144.0993	(45)
Energy content (annual)										Total = Sum(45)m =		1435.1488	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	31.6188	27.6540	28.5364	24.8788	23.8718	20.5995	19.0885	21.9043	22.1659	25.8322	28.1979	30.6211 (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	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.1309	18.7683	15.2634	11.5554	8.6378	7.2924	7.8797	10.2423	13.7472	17.4552	20.3728	21.7182 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	212.7531	214.9608	209.3975	197.5537	182.6031	168.5517	159.1644	156.9567	162.5201	174.3638	189.3144	203.3659 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029 (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)

	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233 (71)

Water heating gains (Table 5)

	42.4984	41.1518	38.3554	34.5538	32.0857	28.6104	25.6566	29.4413	30.7860	34.7207	39.1638	41.1574 (72)

Total internal gains

	335.3911	333.8896	322.0250	302.6717	282.3353	263.4632	251.7094	255.6490	266.0620	285.5485	307.8597	325.2502 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.9500	19.6403	0.7100	0.7000	0.7700	33.4844	(76)
West	4.1200	19.6403	0.7100	0.7000	0.7700	27.8698	(80)

Solar gains	61.3542	120.0218	197.6588	288.2736	353.2901	361.6553	344.3106	295.7577	229.8854	142.4160	76.5015	50.4547 (83)
Total gains	396.7453	453.9114	519.6838	590.9453	635.6255	625.1185	596.0200	551.4068	495.9474	427.9645	384.3612	375.7049 (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	45.2297	45.3836	45.5355	46.2628	46.4015	47.0581	47.0581	47.1817	46.8030	46.4015	46.1218	45.8330	
alpha	4.0153	4.0256	4.0357	4.0842	4.0934	4.1372	4.1372	4.1454	4.1202	4.0934	4.0748	4.0555	
util living area	0.9953	0.9913	0.9801	0.9458	0.8649	0.7165	0.5598	0.6172	0.8461	0.9681	0.9918	0.9962	(86)
MIT	19.3910	19.5674	19.8845	20.3096	20.6691	20.8973	20.9717	20.9580	20.7809	20.3022	19.7762	19.3683	(87)
Th 2	20.0175	20.0205	20.0234	20.0373	20.0399	20.0520	20.0520	20.0543	20.0473	20.0399	20.0346	20.0291	(88)
util rest of house	0.9941	0.9892	0.9749	0.9310	0.8268	0.6398	0.4516	0.5090	0.7887	0.9566	0.9895	0.9953	(89)
MIT 2	18.5401	18.7179	19.0344	19.4601	19.7963	19.9948	20.0419	20.0378	19.9068	19.4610	18.9375	18.5264	(90)
Living area fraction									fLA = Living area / (4) =			0.4398	(91)
MIT	18.9143	19.0915	19.4082	19.8336	20.1801	20.3917	20.4508	20.4424	20.2912	19.8309	19.3063	18.8966	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9143	19.0915	19.4082	19.8336	20.1801	20.3917	20.4508	20.4424	20.2912	19.8309	19.3063	18.8966	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9865	0.9708	0.9272	0.8330	0.6690	0.4987	0.5555	0.8051	0.9535	0.9871	0.9939	(94)
Useful gains	393.7284	447.7816	504.5244	547.9444	529.4898	418.1998	297.2217	306.2894	399.3081	408.0817	379.4009	373.3981	(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	1212.7508	1173.6689	1063.9797	887.0521	685.9385	461.9419	307.1349	321.5787	496.4989	746.6732	993.3329	1203.5281	(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	609.3527	487.7962	416.2348	244.1576	116.3979	0.0000	0.0000	0.0000	0.0000	251.9120	442.0310	617.6168	(98)
Space heating												3185.4989	(98)
Space heating per m2											(98) / (4) =	41.4455	(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	749.7393	590.2203	604.5837	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8400	0.9009	0.8754	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	629.8163	531.7238	529.2426	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	820.9408	785.1713	734.8174	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	137.6096	188.5650	152.9476	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												479.1222	(104)

CALCULATION OF 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	34.4024	47.1412	38.2369	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												119.7805 (107)
Space cooling per m2												1.5584 (108)
Energy for space heating												41.4455 (99)
Energy for space cooling												1.5584 (108)
Total												43.0039 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.0 (109)

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	38.4300 (1b)	x	2.3100 (2b)	=	88.7733	(1b) - (3b)
First floor	38.4300 (1c)	x	2.5600 (2c)	=	98.3808	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.1541	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1603	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4103	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3795	(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	0.4839	0.4744	0.4649	0.4175	0.4080	0.3605	0.3605	0.3511	0.3795	0.4080	0.4270	0.4459	(22b)
Effective ac	0.6171	0.6125	0.6081	0.5871	0.5832	0.5650	0.5650	0.5616	0.5720	0.5832	0.5911	0.5994	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			9.0700	1.3258	12.0246			(27)
150mm Platinum			38.4300	0.1300	4.9959			(28a)
50mm Alreflex Plat	43.8100	13.3500	30.4600	0.1800	5.4828			(29a)
400mm Mineral Wool	38.4300		38.4300	0.1300	4.9959			(30)
Total net area of external elements Aum(A, m2)			120.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.6352			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.3141	(36)
Total fabric heat loss (33) + (36) =	40.9493	(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	38.1111	37.8304	37.5551	36.2625	36.0206	34.8947	34.8947	34.6862	35.3284	36.0206	36.5099	37.0214	(38)
Heat transfer coeff	79.0605	78.7797	78.5045	77.2118	76.9699	75.8441	75.8441	75.6356	76.2777	76.9699	77.4592	77.9707	(39)
Average = Sum(39)m / 12 =												77.2106	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0286	1.0250	1.0214	1.0046	1.0014	0.9868	0.9868	0.9841	0.9924	1.0014	1.0078	1.0145	(40)
HLP (average)												1.0046	(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	2.4006 (42)
Average daily hot water use (litres/day)	91.2138 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3352	96.6867	93.0381	89.3896	85.7410	82.0925	82.0925	85.7410	89.3896	93.0381	96.6867	100.3352	(44)
Energy conte	148.7942	130.1364	134.2891	117.0765	112.3377	96.9389	89.8281	103.0791	104.3102	121.5634	132.6960	144.0993	(45)
Energy content (annual)										Total = Sum(45)m =		1435.1488	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.6188	27.6540	28.5364	24.8788	23.8718	20.5995	19.0885	21.9043	22.1659	25.8322	28.1979	30.6211	(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	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	120.0291	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1309	18.7683	15.2634	11.5554	8.6378	7.2924	7.8797	10.2423	13.7472	17.4552	20.3728	21.7182	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	212.7531	214.9608	209.3975	197.5537	182.6031	168.5517	159.1644	156.9567	162.5201	174.3638	189.3144	203.3659	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	35.0029	(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)													
	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	-96.0233	(71)
Water heating gains (Table 5)													
	42.4984	41.1518	38.3554	34.5538	32.0857	28.6104	25.6566	29.4413	30.7860	34.7207	39.1638	41.1574	(72)
Total internal gains													
	335.3911	333.8896	322.0250	302.6717	282.3353	263.4632	251.7094	255.6490	266.0620	285.5485	307.8597	325.2502	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115	(76)
West	4.1200	19.6403	0.6300	0.7000	0.7700	24.7296	(80)

Solar gains	54.4410	106.4982	175.3874	255.7921	313.4828	320.9054	305.5150	262.4329	203.9828	126.3691	67.8816	44.7697	(83)
Total gains	389.8322	440.3878	497.4124	558.4637	595.8181	584.3687	557.2245	518.0819	470.0448	411.9176	375.7413	370.0199	(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	67.5116	67.7522	67.9897	69.1280	69.3453	70.3747	70.3747	70.5687	69.9746	69.3453	68.9072	68.4552	
alpha	5.5008	5.5168	5.5326	5.6085	5.6230	5.6916	5.6916	5.7046	5.6650	5.6230	5.5938	5.5637	
util living area													
	0.9991	0.9981	0.9942	0.9768	0.9151	0.7618	0.5855	0.6471	0.8936	0.9883	0.9982	0.9994	(86)
MIT	19.8369	19.9637	20.1945	20.5120	20.7857	20.9494	20.9906	20.9840	20.8663	20.5059	20.1199	19.8222	(87)
Th 2	20.0595	20.0626	20.0655	20.0795	20.0821	20.0944	20.0944	20.0966	20.0897	20.0821	20.0768	20.0713	(88)
util rest of house													
	0.9988	0.9974	0.9920	0.9675	0.8806	0.6798	0.4720	0.5322	0.8376	0.9821	0.9974	0.9992	(89)
MIT 2	18.9892	19.1182	19.3505	19.6742	19.9308	20.0698	20.0918	20.0917	20.0102	19.6736	19.2861	18.9841	(90)
Living area fraction										fLA = Living area / (4) =		0.4398	(91)
MIT	19.3620	19.4900	19.7216	20.0427	20.3068	20.4566	20.4870	20.4841	20.3867	20.0396	19.6528	19.3527	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3620	19.4900	19.7216	20.0427	20.3068	20.4566	20.4870	20.4841	20.3867	20.0396	19.6528	19.3527	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9969	0.9910	0.9670	0.8902	0.7146	0.5223	0.5832	0.8583	0.9818	0.9970	0.9989	(94)
Useful gains	389.2682	439.0190	492.9511	540.0440	530.3684	417.5779	291.0512	302.1668	403.4493	404.4062	374.6095	369.6217	(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													
	1190.8096	1149.3974	1037.9576	860.3455	662.4639	444.1897	294.8095	308.9062	479.5325	726.5684	972.3264	1181.4635	(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													
	596.3468	477.3743	405.4848	230.6170	98.2791	0.0000	0.0000	0.0000	0.0000	239.6887	430.3561	604.0103	(98)
Space heating												3082.1572	(98)
Space heating per m2											(98) / (4) =	40.1009	(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	712.9341	561.2460	574.8302	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8828	0.9405	0.9190	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	629.4078	527.8725	528.2905	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	773.3110	739.8259	695.8663	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	103.6103	157.6933	124.6764	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												385.9801	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
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   25.9026   39.4233   31.1691    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              96.4950 (107)
Space cooling per m2                                                                                                        1.2555 (108)
Energy for space heating                                                                                                   40.1009 (99)
Energy for space cooling                                                                                                    1.2555 (108)
Total                                                                                                                      41.3564 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                        47.6 (109)
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Type 52 End-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Type 52, EOT, Barratt Developments plc		

SAP Rating	84 B	**DER**	17.70	**TER**	18.28
Environmental	86 B	**% DER<TER**	3.18		
CO_2 Emissions (t/year)	1.24	**DFEE**	48.62	**TFEE**	51.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.79		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 85 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.28 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.70 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.49 (max. 2.00)	1.70 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 1.32 m², No overhang
Windows facing East: 4.40 m², No overhang
Windows facing West: 4.95 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K

ARUN DISTRICT COUNCIL A/45/22/PL

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	42.2800 (1b)	x	2.3100 (2b)	=	97.6668	(1b) - (3b)
First floor	42.2800 (1c)	x	2.5600 (2c)	=	108.2368	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	205.9036	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1457	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3962	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3071	(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	0.3915	0.3838	0.3761	0.3378	0.3301	0.2917	0.2917	0.2840	0.3071	0.3301	0.3454	0.3608	(22b)
Effective ac	0.5766	0.5737	0.5707	0.5570	0.5545	0.5425	0.5425	0.5403	0.5471	0.5545	0.5597	0.5651	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			4.2800	1.7000	7.2760			(26a)
Opening Type 2 (Uw = 1.41)			10.6700	1.3347	14.2415			(27)
150mm Platinum			42.2800	0.1500	6.3420			(28a)
50mm Alreflex Plat	89.5600	14.9500	74.6100	0.2700	20.1447			(29a)
400mm Mineral Wool	42.2800		42.2800	0.1100	4.6508			(30)
Total net area of external elements Aum(A, m2)			174.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.6550			(33)
E-WM-22			44.7800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	166.5000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.9844	(36)
Total fabric heat loss (33) + (36) =	61.6394	(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	39.1812	38.9790	38.7808	37.8499	37.6757	36.8649	36.8649	36.7148	37.1773	37.6757	38.0281	38.3965	(38)
Heat transfer coeff	100.8206	100.6184	100.4202	99.4893	99.3151	98.5043	98.5043	98.3542	98.8166	99.3151	99.6675	100.0358	(39)
Average = Sum(39)m / 12 =												99.4884	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1923	1.1899	1.1876	1.1766	1.1745	1.1649	1.1649	1.1631	1.1686	1.1745	1.1787	1.1830	(40)
HLP (average)												1.1765	(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	2.5437 (42)
Average daily hot water use (litres/day)	94.6132 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0745	100.2900	96.5055	92.7209	88.9364	85.1519	85.1519	88.9364	92.7209	96.5055	100.2900	104.0745	(44)
Energy conte	154.3395	134.9863	139.2938	121.4397	116.5243	100.5516	93.1758	106.9206	108.1976	126.0939	137.6413	149.4696	(45)
Energy content (annual)										Total = Sum(45)m =		1488.6339	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1509	20.2479	20.8941	18.2160	17.4786	15.0827	13.9764	16.0381	16.2296	18.9141	20.6462	22.4204	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1270	12.7492	14.0792	13.5830	14.0053	13.5183	13.9470	13.9848	13.5536	14.0486	13.6431	14.1153	(61)
Total heat required for water heating calculated for each month													
	168.4665	147.7356	153.3730	135.0227	130.5296	114.0699	107.1228	120.9054	121.7512	140.1425	151.2845	163.5848	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	168.4665	147.7356	153.3730	135.0227	130.5296	114.0699	107.1228	120.9054	121.7512	140.1425	151.2845	163.5848	(64)
								Total per year (kWh/year) = Sum(64)m =				1653.9883	(64)
Heat gains from water heating, kWh/month													
	54.8496	48.0703	49.8350	43.7745	42.2456	36.8130	34.4677	39.0473	39.3641	45.4384	49.1765	53.2274	(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	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.3807	19.8784	16.1662	12.2388	9.1487	7.7237	8.3457	10.8481	14.5603	18.4876	21.5778	23.0028	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.7066	231.0799	225.0993	212.3675	196.2958	181.1907	171.0996	168.7263	174.7068	187.4387	203.5104	218.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	(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)													
	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	(71)
Water heating gains (Table 5)													
	73.7226	71.5331	66.9825	60.7979	56.7818	51.1291	46.3276	52.4829	54.6724	61.0731	68.3007	71.5423	(72)
Total internal gains													
	388.9657	386.6471	372.4037	349.5599	326.3820	304.1992	289.9285	296.2130	308.0952	331.1551	357.5446	377.3162	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.7100	0.7000	0.7700	4.8343	(74)
East	4.4000	19.6403	0.7100	0.7000	0.7700	29.7639	(76)
West	4.9500	19.6403	0.7100	0.7000	0.7700	33.4844	(80)

Solar gains	68.0826	132.9656	219.4594	322.3890	398.1650	409.1842	388.8905	331.8236	255.8571	157.8099	84.8269	56.0424	(83)
Total gains	457.0482	519.6127	591.8632	671.9489	724.5470	713.3834	678.8190	628.0366	563.9523	488.9650	442.3715	433.3586	(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	38.7907	38.8686	38.9454	39.3098	39.3787	39.7028	39.7028	39.7634	39.5774	39.3787	39.2395	39.0950	
alpha	3.5860	3.5912	3.5964	3.6207	3.6252	3.6469	3.6469	3.6509	3.6385	3.6252	3.6160	3.6063	
util living area													
	0.9932	0.9885	0.9763	0.9426	0.8675	0.7339	0.5872	0.6426	0.8520	0.9639	0.9890	0.9944	(86)
MIT	19.1634	19.3468	19.6868	20.1448	20.5574	20.8393	20.9476	20.9266	20.6975	20.1576	19.5796	19.1294	(87)
Th 2	19.9262	19.9281	19.9300	19.9388	19.9405	19.9482	19.9482	19.9496	19.9452	19.9405	19.9371	19.9336	(88)
util rest of house													
	0.9916	0.9857	0.9703	0.9269	0.8288	0.6539	0.4672	0.5249	0.7937	0.9511	0.9858	0.9931	(89)
MIT 2	17.4714	17.7396	18.2342	18.8949	19.4617	19.8153	19.9204	19.9068	19.6592	18.9241	18.0862	17.4264	(90)
Living area fraction									fLA = Living area / (4) =			0.2265	(91)
MIT	17.8545	18.1036	18.5631	19.1779	19.7099	20.0472	20.1530	20.1377	19.8943	19.2035	18.4244	17.8121	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.7045	17.9536	18.4131	19.0279	19.5599	19.8972	20.0030	19.9877	19.7443	19.0535	18.2744	17.6621	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9781	0.9581	0.9092	0.8120	0.6495	0.4740	0.5297	0.7801	0.9359	0.9783	0.9886	(94)
Useful gains	450.8071	508.2130	567.0864	610.9409	588.3328	463.3315	321.7582	332.6400	439.9148	457.6243	432.7740	428.4073	(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													
	1351.4545	1313.4292	1196.3207	1007.6205	780.6023	521.7936	335.2097	352.8677	557.7535	839.5556	1113.7251	1346.6929	(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													
	670.0817	541.1053	468.1504	285.6093	143.0485	0.0000	0.0000	0.0000	0.0000	284.1569	490.2848	683.2045	(98)
Space heating												3565.6412	(98)
Space heating per m2											(98) / (4) =	42.1670	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3939.9351	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	670.0817	541.1053	468.1504	285.6093	143.0485	0.0000	0.0000	0.0000	0.0000	284.1569	490.2848	683.2045	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	740.4217	597.9065	517.2932	315.5904	158.0646	0.0000	0.0000	0.0000	0.0000	313.9855	541.7511	754.9221	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	168.4665	147.7356	153.3730	135.0227	130.5296	114.0699	107.1228	120.9054	121.7512	140.1425	151.2845	163.5848	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8384	89.7941	89.6887	89.4475	88.9445	87.3000	87.3000	87.3000	87.3000	89.4174	89.7245	89.8637	(217)
Fuel for water heating, kWh/month													
	187.5216	164.5270	171.0058	150.9519	146.7540	130.6642	122.7065	138.4942	139.4630	156.7284	168.6100	182.0367	(219)
Water heating fuel used												1859.4634	(219)
Annual totals kWh/year													
Space heating fuel - main system												3939.9351	(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)												395.2509	(232)
Total delivered energy for all uses												6269.6494	(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	3939.9351	0.2160	851.0260	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1859.4634	0.2160	401.6441	(264)
Space and water heating			1252.6701	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	395.2509	0.5190	205.1352	(268)
Total CO2, kg/year			1496.7303	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.7000	(273)

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

DER		17.7000	ZC1
Total Floor Area	TFA	84.5600	
Assumed number of occupants	N	2.5437	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.0273	ZC2
CO2 emissions from cooking, equation (L16)		2.1292	ZC3
Total CO2 emissions		35.8565	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.8565	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	42.2800 (1b)	x	2.3100 (2b)	=	97.6668	(1b) - (3b)
First floor	42.2800 (1c)	x	2.5600 (2c)	=	108.2368	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	205.9036	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1457	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3957	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(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	0.3910	0.3833	0.3757	0.3373	0.3297	0.2913	0.2913	0.2837	0.3067	0.3297	0.3450	0.3603	(22b)
Effective ac	0.5764	0.5735	0.5706	0.5569	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5595	0.5649	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			10.6700	1.3258	14.1458			(27)
150mm Platinum			42.2800	0.1300	5.4964			(28a)
50mm Alreflex Plat	89.5600	14.9500	74.6100	0.1800	13.4298			(29a)
400mm Mineral Wool	42.2800		42.2800	0.1300	5.4964			(30)
Total net area of external elements Aum(A, m2)			174.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.7044			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.5670	(36)
Total fabric heat loss (33) + (36) =	53.2714	(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	39.1681	38.9664	38.7687	37.8401	37.6664	36.8577	36.8577	36.7079	37.1692	37.6664	38.0179	38.3853	(38)
Heat transfer coeff	92.4395	92.2378	92.0401	91.1116	90.9378	90.1291	90.1291	89.9793	90.4406	90.9378	91.2893	91.6567	(39)
Average = Sum(39)m / 12 =												91.1107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0932	1.0908	1.0885	1.0775	1.0754	1.0659	1.0659	1.0641	1.0695	1.0754	1.0796	1.0839	(40)
HLP (average)												1.0775	(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	2.5437	(42)
Average daily hot water use (litres/day)	94.6132	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0745	100.2900	96.5055	92.7209	88.9364	85.1519	85.1519	88.9364	92.7209	96.5055	100.2900	104.0745	(44)
Energy conte	154.3395	134.9863	139.2938	121.4397	116.5243	100.5516	93.1758	106.9206	108.1976	126.0939	137.6413	149.4696	(45)
Energy content (annual)										Total = Sum(45)m =		1488.6339	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1509	20.2479	20.8941	18.2160	17.4786	15.0827	13.9764	16.0381	16.2296	18.9141	20.6462	22.4204	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	49.1781	45.7254	45.3210	41.9927	43.3925	45.3210	45.7254	49.1781	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	205.2984	181.0137	188.4719	167.1651	161.8453	142.5443	136.5683	152.2416	153.9230	175.2720	186.9564	200.4285	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	205.2984	181.0137	188.4719	167.1651	161.8453	142.5443	136.5683	152.2416	153.9230	175.2720	186.9564	200.4285	(64)
								Total per year (kWh/year) = Sum(64)m =				2051.7284	(64)
Heat gains from water heating, kWh/month													
	64.0576	56.3898	58.6097	51.8100	50.0746	43.9316	41.8291	46.8814	47.4070	54.2207	58.0945	62.4384	(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	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.3807	19.8784	16.1662	12.2388	9.1487	7.7237	8.3457	10.8481	14.5603	18.4876	21.5778	23.0028	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.7066	231.0799	225.0993	212.3675	196.2958	181.1907	171.0996	168.7263	174.7068	187.4387	203.5104	218.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	(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)													
	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	(71)
Water heating gains (Table 5)													
	86.0989	83.9134	78.7765	71.9584	67.3045	61.0161	56.2219	63.0126	65.8431	72.8773	80.6868	83.9225	(72)
Total internal gains													
	401.3420	399.0273	384.1977	360.7204	336.9047	314.0862	299.8229	306.7427	319.2659	342.9594	369.9307	389.6965	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896	(74)
East	4.4000	19.6403	0.6300	0.7000	0.7700	26.4102	(76)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115	(80)

Solar gains	60.4113	117.9836	194.7316	286.0635	353.3013	363.0789	345.0718	294.4350	227.0281	140.0285	75.2689	49.7278	(83)
Total gains	461.7533	517.0109	578.9293	646.7839	690.2061	677.1651	644.8947	601.1777	546.2941	482.9879	445.1996	439.4242	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5250	63.6639	63.8007	64.4509	64.5740	65.1535	65.1535	65.2619	64.9290	64.5740	64.3254	64.0675	
alpha	5.2350	5.2443	5.2534	5.2967	5.3049	5.3436	5.3436	5.3508	5.3286	5.3049	5.2884	5.2712	
util living area													
	0.9987	0.9974	0.9929	0.9746	0.9134	0.7679	0.5965	0.6564	0.8923	0.9859	0.9974	0.9990	(86)
MIT	19.7851	19.9117	20.1466	20.4686	20.7576	20.9359	20.9866	20.9782	20.8460	20.4713	20.0720	19.7625	(87)
Th 2	20.0064	20.0084	20.0103	20.0193	20.0210	20.0288	20.0288	20.0303	20.0258	20.0210	20.0175	20.0140	(88)
util rest of house													
	0.9983	0.9965	0.9903	0.9643	0.8774	0.6821	0.4743	0.5337	0.8338	0.9786	0.9964	0.9987	(89)
MIT 2	18.3776	18.5640	18.9077	19.3774	19.7718	19.9835	20.0235	20.0206	19.8930	19.3876	18.8053	18.3500	(90)
Living area fraction									fLA = Living area / (4) =			0.2265	(91)
MIT	18.6964	18.8692	19.1883	19.6245	19.9950	20.1992	20.2416	20.2375	20.1088	19.6330	19.0922	18.6699	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6964	18.8692	19.1883	19.6245	19.9950	20.1992	20.2416	20.2375	20.1088	19.6330	19.0922	18.6699	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9950	0.9872	0.9589	0.8763	0.6986	0.5021	0.5614	0.8398	0.9745	0.9949	0.9980	(94)
Useful gains	460.5692	514.4261	571.5209	620.2239	604.8103	473.0446	323.7925	337.5025	458.7648	470.6607	442.9252	438.5539	(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													
	1330.7925	1288.4867	1167.8326	977.1268	754.3319	504.6530	328.2174	345.2959	543.4432	821.4406	1094.7577	1326.2626	(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													
	647.4462	520.1687	443.6559	256.9701	111.2440	0.0000	0.0000	0.0000	0.0000	260.9803	469.3194	660.4553	(98)
Space heating												3370.2399	(98)
Space heating per m2											(98) / (4) =	39.8562	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												3608.3939	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	647.4462	520.1687	443.6559	256.9701	111.2440	0.0000	0.0000	0.0000	0.0000	260.9803	469.3194	660.4553	(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)													
	693.1972	556.9258	475.0063	275.1286	119.1049	0.0000	0.0000	0.0000	0.0000	279.4222	502.4833	707.1256	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	205.2984	181.0137	188.4719	167.1651	161.8453	142.5443	136.5683	152.2416	153.9230	175.2720	186.9564	200.4285	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7430	87.5570	87.1324	86.1302	84.1289	80.3000	80.3000	80.3000	80.3000	86.0515	87.2729	87.8281	(217)
Fuel for water heating, kWh/month													
	233.9768	206.7381	216.3052	194.0841	192.3778	177.5147	170.0726	189.5911	191.6849	203.6827	214.2204	228.2054	(219)
Water heating fuel used												2418.4537	(219)
Annual totals kWh/year													
Space heating fuel - main system												3608.3939	(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)												395.2509	(232)
Total delivered energy for all uses												6497.0985	(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	3608.3939	0.2160	779.4131	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2418.4537	0.2160	522.3860	(264)
Space and water heating			1301.7991	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	395.2509	0.5190	205.1352	(268)
Total CO2, kg/m2/year			1545.8593	(272)
Emissions per m2 for space and water heating			15.3950	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4259	(272b)
Emissions per m2 for pumps and fans			0.4603	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3950 * 1.00) + 2.4259 + 0.4603, rounded to 2 d.p.			18.2800	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.2800	(1b)	x 2.3100	(2b) =	97.6668	(1b) - (3b)
First floor	42.2800	(1c)	x 2.5600	(2c) =	108.2368	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		205.9036	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1457	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3962	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3071	(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	0.3915	0.3838	0.3761	0.3378	0.3301	0.2917	0.2917	0.2840	0.3071	0.3301	0.3454	0.3608	(22b)
Effective ac	0.5766	0.5737	0.5707	0.5570	0.5545	0.5425	0.5425	0.5403	0.5471	0.5545	0.5597	0.5651	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			4.2800	1.7000	7.2760			(26a)
Opening Type 2 (Uw = 1.41)			10.6700	1.3347	14.2415			(27)
150mm Platinum			42.2800	0.1500	6.3420			(28a)
50mm Alreflex Plat	89.5600	14.9500	74.6100	0.2700	20.1447			(29a)
400mm Mineral Wool	42.2800		42.2800	0.1100	4.6508			(30)
Total net area of external elements Aum(A, m2)			174.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.6550			(33)
E-WM-22			44.7800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	166.5000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.9844	(36)
Total fabric heat loss (33) + (36) =	61.6394	(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	39.1812	38.9790	38.7808	37.8499	37.6757	36.8649	36.8649	36.7148	37.1773	37.6757	38.0281	38.3965	(38)
Heat transfer coeff	100.8206	100.6184	100.4202	99.4893	99.3151	98.5043	98.5043	98.3542	98.8166	99.3151	99.6675	100.0358	(39)
Average = Sum(39)m / 12 =												99.4884	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1923	1.1899	1.1876	1.1766	1.1745	1.1649	1.1649	1.1631	1.1686	1.1745	1.1787	1.1830	(40)
HLP (average)												1.1765	(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	2.5437 (42)
Average daily hot water use (litres/day)	94.6132 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0745	100.2900	96.5055	92.7209	88.9364	85.1519	85.1519	88.9364	92.7209	96.5055	100.2900	104.0745	(44)
Energy conte	154.3395	134.9863	139.2938	121.4397	116.5243	100.5516	93.1758	106.9206	108.1976	126.0939	137.6413	149.4696	(45)
Energy content (annual)										Total = Sum(45)m =		1488.6339	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	32.7971	28.6846	29.5999	25.8059	24.7614	21.3672	19.7999	22.7206	22.9920	26.7949	29.2488	31.7623 (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	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.3807	19.8784	16.1662	12.2388	9.1487	7.7237	8.3457	10.8481	14.5603	18.4876	21.5778	23.0028 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	228.7066	231.0799	225.0993	212.3675	196.2958	181.1907	171.0996	168.7263	174.7068	187.4387	203.5104	218.6155 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186 (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)

	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485 (71)

Water heating gains (Table 5)

	44.0822	42.6854	39.7848	35.8416	33.2815	29.6767	26.6127	30.5385	31.9333	36.0147	40.6233	42.6912 (72)

Total internal gains

	356.3252	354.7994	342.2061	321.6036	299.8816	279.7468	267.2137	271.2686	282.3561	303.0967	326.8672	345.4652 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.7100	0.7000	0.7700	4.8343	(74)
East	4.4000	19.6403	0.7100	0.7000	0.7700	29.7639	(76)
West	4.9500	19.6403	0.7100	0.7000	0.7700	33.4844	(80)

Solar gains	68.0826	132.9656	219.4594	322.3890	398.1650	409.1842	388.8905	331.8236	255.8571	157.8099	84.8269	56.0424 (83)
Total gains	424.4078	487.7650	561.6655	643.9926	698.0466	688.9310	656.1042	603.0921	538.2132	460.9066	411.6941	401.5076 (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	38.7907	38.8686	38.9454	39.3098	39.3787	39.7028	39.7028	39.7634	39.5774	39.3787	39.2395	39.0950	
alpha	3.5860	3.5912	3.5964	3.6207	3.6252	3.6469	3.6469	3.6509	3.6385	3.6252	3.6160	3.6063	
util living area	0.9946	0.9906	0.9798	0.9489	0.8781	0.7487	0.6027	0.6612	0.8663	0.9696	0.9912	0.9956	(86)
MIT	19.1159	19.3012	19.6457	20.1113	20.5340	20.8277	20.9429	20.9193	20.6761	20.1210	19.5355	19.0827	(87)
Th 2	19.9262	19.9281	19.9300	19.9388	19.9405	19.9482	19.9482	19.9496	19.9452	19.9405	19.9371	19.9336	(88)
util rest of house	0.9934	0.9883	0.9745	0.9346	0.8414	0.6698	0.4815	0.5429	0.8112	0.9585	0.9887	0.9946	(89)
MIT 2	18.2029	18.3888	18.7319	19.1946	19.5938	19.8498	19.9272	19.9170	19.7334	19.2117	18.6298	18.1754	(90)
Living area fraction									fLA = Living area / (4) =			0.2265	(91)
MIT	18.4097	18.5955	18.9388	19.4022	19.8068	20.0713	20.1573	20.1440	19.9469	19.4176	18.8349	18.3809	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4097	18.5955	18.9388	19.4022	19.8068	20.0713	20.1573	20.1440	19.9469	19.4176	18.8349	18.3809	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9908	0.9844	0.9681	0.9255	0.8359	0.6801	0.5074	0.5669	0.8113	0.9513	0.9850	0.9924	(94)
Useful gains	420.5002	480.1378	543.7635	596.0266	583.5166	468.5187	332.8794	341.9046	436.6639	438.4442	405.5285	398.4623	(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	1422.5460	1378.0152	1249.1099	1044.8560	805.1234	538.9454	350.4058	368.2350	577.7708	875.7200	1169.5925	1418.5955	(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	745.5221	603.3737	524.7777	323.1572	164.8755	0.0000	0.0000	0.0000	0.0000	325.3332	550.1261	758.9791	(98)
Space heating												3996.1446	(98)
Space heating per m2											(98) / (4) =	47.2581	(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	925.9405	728.9319	747.4916	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7741	0.8449	0.8113	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	716.7922	615.8733	606.4135	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	901.3673	861.0771	801.0150	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	132.8941	182.4316	144.7835	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												460.1092 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	33.2235	45.6079	36.1959	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												115.0273 (107)
Space cooling per m2												1.3603 (108)
Energy for space heating												47.2581 (99)
Energy for space cooling												1.3603 (108)
Total												48.6184 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.6 (109)

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	42.2800 (1b)	x	2.3100 (2b)	=	97.6668	(1b) - (3b)
First floor	42.2800 (1c)	x	2.5600 (2c)	=	108.2368	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	205.9036	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1457	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3957	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(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	0.3910	0.3833	0.3757	0.3373	0.3297	0.2913	0.2913	0.2837	0.3067	0.3297	0.3450	0.3603	(22b)
Effective ac	0.5764	0.5735	0.5706	0.5569	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5595	0.5649	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			10.6700	1.3258	14.1458			(27)
150mm Platinum			42.2800	0.1300	5.4964			(28a)
50mm Alreflex Plat	89.5600	14.9500	74.6100	0.1800	13.4298			(29a)
400mm Mineral Wool	42.2800		42.2800	0.1300	5.4964			(30)
Total net area of external elements Aum(A, m2)			174.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.7044			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5670	(36)
Total fabric heat loss					(33) + (36) =		53.2714	(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	39.1681	38.9664	38.7687	37.8401	37.6664	36.8577	36.8577	36.7079	37.1692	37.6664	38.0179	38.3853	(38)
Heat transfer coeff	92.4395	92.2378	92.0401	91.1116	90.9378	90.1291	90.1291	89.9793	90.4406	90.9378	91.2893	91.6567	(39)
Average = Sum(39)m / 12 =												91.1107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0932	1.0908	1.0885	1.0775	1.0754	1.0659	1.0659	1.0641	1.0695	1.0754	1.0796	1.0839	(40)
HLP (average)												1.0775	(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												2.5437	(42)
Average daily hot water use (litres/day)												94.6132	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0745	100.2900	96.5055	92.7209	88.9364	85.1519	85.1519	88.9364	92.7209	96.5055	100.2900	104.0745	(44)
Energy conte	154.3395	134.9863	139.2938	121.4397	116.5243	100.5516	93.1758	106.9206	108.1976	126.0939	137.6413	149.4696	(45)
Energy content (annual)										Total = Sum(45)m =		1488.6339	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.7971	28.6846	29.5999	25.8059	24.7614	21.3672	19.7999	22.7206	22.9920	26.7949	29.2488	31.7623	(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	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.3807	19.8784	16.1662	12.2388	9.1487	7.7237	8.3457	10.8481	14.5603	18.4876	21.5778	23.0028	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.7066	231.0799	225.0993	212.3675	196.2958	181.1907	171.0996	168.7263	174.7068	187.4387	203.5104	218.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	(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)													
	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	(71)
Water heating gains (Table 5)													
	44.0822	42.6854	39.7848	35.8416	33.2815	29.6767	26.6127	30.5385	31.9333	36.0147	40.6233	42.6912	(72)
Total internal gains													
	356.3252	354.7994	342.2061	321.6036	299.8816	279.7468	267.2137	271.2686	282.3561	303.0967	326.8672	345.4652	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896	(74)
East	4.4000	19.6403	0.6300	0.7000	0.7700	26.4102	(76)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115	(80)

Solar gains	60.4113	117.9836	194.7316	286.0635	353.3013	363.0789	345.0718	294.4350	227.0281	140.0285	75.2689	49.7278	(83)
Total gains	416.7365	472.7829	536.9377	607.6671	653.1830	642.8257	612.2855	565.7036	509.3843	443.1252	402.1361	395.1930	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5250	63.6639	63.8007	64.4509	64.5740	65.1535	65.1535	65.2619	64.9290	64.5740	64.3254	64.0675	
alpha	5.2350	5.2443	5.2534	5.2967	5.3049	5.3436	5.3436	5.3508	5.3286	5.3049	5.2884	5.2712	
util living area													
	0.9992	0.9983	0.9950	0.9804	0.9281	0.7934	0.6238	0.6889	0.9139	0.9904	0.9984	0.9994	(86)
MIT	19.7349	19.8626	20.1010	20.4297	20.7303	20.9247	20.9835	20.9727	20.8213	20.4293	20.0241	19.7130	(87)
Th 2	20.0064	20.0084	20.0103	20.0193	20.0210	20.0288	20.0288	20.0303	20.0258	20.0210	20.0175	20.0140	(88)
util rest of house													
	0.9990	0.9977	0.9931	0.9722	0.8963	0.7098	0.4982	0.5641	0.8626	0.9852	0.9978	0.9992	(89)
MIT 2	18.8442	18.9733	19.2125	19.5439	19.8281	19.9916	20.0243	20.0218	19.9170	19.5479	19.1422	18.8285	(90)
Living area fraction									fLA = Living area / (4) =			0.2265	(91)
MIT	19.0459	19.1747	19.4137	19.7445	20.0325	20.2029	20.2415	20.2371	20.1218	19.7475	19.3420	19.0288	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0459	19.1747	19.4137	19.7445	20.0325	20.2029	20.2415	20.2371	20.1218	19.7475	19.3420	19.0288	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9970	0.9915	0.9692	0.8967	0.7264	0.5270	0.5926	0.8687	0.9831	0.9971	0.9989	(94)
Useful gains	416.1512	471.3721	532.3776	588.9726	585.7346	466.9339	322.6601	335.2446	442.5180	435.6540	400.9776	394.7761	(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													
	1363.1049	1316.6700	1188.5787	988.0626	757.7352	504.9816	328.2057	345.2613	544.6118	831.8515	1117.5592	1359.1571	(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													
	704.5335	568.0402	488.2136	287.3448	127.9684	0.0000	0.0000	0.0000	0.0000	294.7709	515.9388	717.4995	(98)
Space heating												3704.3097	(98)
Space heating per m2											(98) / (4) =	43.8069	(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	847.2134	666.9552	683.8428	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8425	0.9117	0.8822	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	713.7700	608.0612	603.2735	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	847.4780	809.8605	757.3141	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	96.2698	150.1387	114.6062	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												361.0146	(104)

ARUN DISTRICT COUNCIL A/45/22/PL

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	24.0674	37.5347	28.6515	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												90.2536 (107)
Space cooling per m2												1.0673 (108)
Energy for space heating												43.8069 (99)
Energy for space cooling												1.0673 (108)
Total												44.8742 (109)
Target Fabric Energy Efficiency (TFEE)												51.6 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Type 52 Mid-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Type 52, Mid Terr, Barratt Developments plc		

SAP Rating	85 B	**DER**	15.98	**TER**	17.03
Environmental	88 B	**% DER<TER**	6.19		
CO_2 Emissions (t/year)	1.17	**DFEE**	40.18	**TFEE**	44.63
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.97		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 85 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.03 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.98 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)44.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.2 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.70 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.40 m², No overhang
Windows facing West: 4.95 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K

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	42.2800 (1b)	x	2.3100 (2b)	=	97.6668	(1b) - (3b)
First floor	42.2800 (1c)	x	2.5600 (2c)	=	108.2368	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	205.9036	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1457	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3962	(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) =	0.3368	(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	0.4294	0.4210	0.4125	0.3704	0.3620	0.3199	0.3199	0.3115	0.3368	0.3620	0.3789	0.3957	(22b)
Effective ac	0.5922	0.5886	0.5851	0.5686	0.5655	0.5512	0.5512	0.5485	0.5567	0.5655	0.5718	0.5783	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			4.2800	1.7000	7.2760			(26a)
Opening Type 2 (Uw = 1.41)			9.3500	1.3347	12.4796			(27)
150mm Platinum			42.2800	0.1200	5.0736			(28a)
50mm Alreflex Plat	44.7700	13.6300	31.1400	0.2700	8.4078			(29a)
400mm Mineral Wool	42.2800		42.2800	0.1100	4.6508			(30)
Total net area of external elements Aum(A, m2)			129.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.8878			(33)
E-WM-22			89.5700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	181.1000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.7499	(36)
Total fabric heat loss (33) + (36) =	46.6378	(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	40.2378	39.9946	39.7562	38.6364	38.4269	37.4515	37.4515	37.2709	37.8272	38.4269	38.8507	39.2938	(38)
Heat transfer coeff	86.8756	86.6324	86.3940	85.2742	85.0646	84.0893	84.0893	83.9087	84.4650	85.0646	85.4885	85.9316	(39)
Average = Sum(39)m / 12 =												85.2731	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0274	1.0245	1.0217	1.0084	1.0060	0.9944	0.9944	0.9923	0.9989	1.0060	1.0110	1.0162	(40)
HLP (average)												1.0084	(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	2.5437	(42)
Average daily hot water use (litres/day)	94.6132	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0745	100.2900	96.5055	92.7209	88.9364	85.1519	85.1519	88.9364	92.7209	96.5055	100.2900	104.0745	(44)
Energy conte	154.3395	134.9863	139.2938	121.4397	116.5243	100.5516	93.1758	106.9206	108.1976	126.0939	137.6413	149.4696	(45)
Energy content (annual)										Total = Sum(45)m =		1488.6339	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1509	20.2479	20.8941	18.2160	17.4786	15.0827	13.9764	16.0381	16.2296	18.9141	20.6462	22.4204	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1270	12.7492	14.0792	13.5830	14.0053	13.5183	13.9470	13.9848	13.5536	14.0486	13.6431	14.1153	(61)
Total heat required for water heating calculated for each month													
	168.4665	147.7356	153.3730	135.0227	130.5296	114.0699	107.1228	120.9054	121.7512	140.1425	151.2845	163.5848	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	168.4665	147.7356	153.3730	135.0227	130.5296	114.0699	107.1228	120.9054	121.7512	140.1425	151.2845	163.5848	(64)
								Total per year (kWh/year) = Sum(64)m =				1653.9883	(64)
Heat gains from water heating, kWh/month													
	54.8496	48.0703	49.8350	43.7745	42.2456	36.8130	34.4677	39.0473	39.3641	45.4384	49.1765	53.2274	(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	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0423	20.4660	16.6441	12.6006	9.4191	7.9520	8.5924	11.1688	14.9907	19.0341	22.2156	23.6827	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.7066	231.0799	225.0993	212.3675	196.2958	181.1907	171.0996	168.7263	174.7068	187.4387	203.5104	218.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	(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)													
	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	(71)
Water heating gains (Table 5)													
	73.7226	71.5331	66.9825	60.7979	56.7818	51.1291	46.3276	52.4829	54.6724	61.0731	68.3007	71.5423	(72)
Total internal gains													
	389.6273	387.2347	372.8816	349.9217	326.6524	304.4275	290.1752	296.5337	308.5256	331.7016	358.1824	377.9962	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.4000	19.6403	0.7100	0.7000	0.7700	29.7639	(76)
West	4.9500	19.6403	0.7100	0.7000	0.7700	33.4844	(80)

Solar gains	63.2483	123.7270	203.7608	297.1729	364.1966	372.8200	354.9398	304.8881	236.9822	146.8125	78.8631	52.0123	(83)
Total gains	452.8755	510.9617	576.6423	647.0946	690.8490	677.2475	645.1151	601.4218	545.5078	478.5141	437.0456	430.0085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.9647	49.1022	49.2377	49.8843	50.0071	50.5871	50.5871	50.6960	50.3621	50.0071	49.7592	49.5026	
alpha	4.2643	4.2735	4.2825	4.3256	4.3338	4.3725	4.3725	4.3797	4.3575	4.3338	4.3173	4.3002	
util living area													
	0.9952	0.9913	0.9802	0.9459	0.8631	0.7104	0.5509	0.6055	0.8392	0.9667	0.9915	0.9962	(86)
MIT	19.5380	19.7007	19.9937	20.3837	20.7137	20.9160	20.9785	20.9678	20.8160	20.3798	19.8921	19.5119	(87)
Th 2	20.0606	20.0630	20.0653	20.0763	20.0784	20.0880	20.0880	20.0898	20.0843	20.0784	20.0742	20.0698	(88)
util rest of house													
	0.9940	0.9891	0.9750	0.9311	0.8249	0.6349	0.4466	0.5008	0.7811	0.9548	0.9891	0.9952	(89)
MIT 2	18.0929	18.3314	18.7581	19.3224	19.7711	20.0200	20.0768	20.0715	19.9132	19.3265	18.6193	18.0610	(90)
Living area fraction										fLA = Living area / (4) =		0.2265	(91)
MIT	18.4202	18.6415	19.0380	19.5627	19.9846	20.2229	20.2810	20.2745	20.1176	19.5651	18.9075	18.3896	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2702	18.4915	18.8880	19.4127	19.8346	20.0729	20.1310	20.1245	19.9676	19.4151	18.7575	18.2396	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9906	0.9838	0.9661	0.9176	0.8132	0.6336	0.4518	0.5050	0.7724	0.9432	0.9838	0.9923	(94)
Useful gains	448.6104	502.6974	557.0764	593.7468	561.7783	429.0741	291.4490	303.7232	421.3403	451.3202	429.9699	426.7176	(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													
	1213.6685	1177.4651	1070.2444	896.4635	691.9634	460.2144	296.9202	312.5196	495.6091	749.8491	996.5845	1206.4427	(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													
	569.2032	453.4439	381.7970	217.9560	96.8577	0.0000	0.0000	0.0000	0.0000	222.1055	407.9626	580.1154	(98)
Space heating												2929.4413	(98)
Space heating per m2											(98) / (4) =	34.6433	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3236.9517	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	569.2032	453.4439	381.7970	217.9560	96.8577	0.0000	0.0000	0.0000	0.0000	222.1055	407.9626	580.1154	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	628.9539	501.0429	421.8752	240.8354	107.0251	0.0000	0.0000	0.0000	0.0000	245.4204	450.7873	641.0115	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	168.4665	147.7356	153.3730	135.0227	130.5296	114.0699	107.1228	120.9054	121.7512	140.1425	151.2845	163.5848	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7487	89.6921	89.5592	89.2486	88.6350	87.3000	87.3000	87.3000	87.3000	89.2346	89.6114	89.7762	(217)
Fuel for water heating, kWh/month													
	187.7091	164.7142	171.2532	151.2883	147.2664	130.6642	122.7065	138.4942	139.4630	157.0495	168.8227	182.2141	(219)
Water heating fuel used												1861.6454	(219)
Annual totals kWh/year													
Space heating fuel - main system												3236.9517	(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)												406.9346	(232)
Total delivered energy for all uses												5580.5318	(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	3236.9517	0.2160	699.1816	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1861.6454	0.2160	402.1154	(264)
Space and water heating			1101.2970	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	406.9346	0.5190	211.1991	(268)
Total CO2, kg/year			1351.4211	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9800	(273)

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

DER		15.9800	ZC1
Total Floor Area	TFA	84.5600	
Assumed number of occupants	N	2.5437	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.0273	ZC2
CO2 emissions from cooking, equation (L16)		2.1292	ZC3
Total CO2 emissions		34.1365	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.1365	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	42.2800 (1b)	x	2.3100 (2b)	=	97.6668	(1b) - (3b)
First floor	42.2800 (1c)	x	2.5600 (2c)	=	108.2368	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	205.9036	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1457	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3957	(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) =	0.3363	(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	0.4288	0.4204	0.4120	0.3700	0.3616	0.3195	0.3195	0.3111	0.3363	0.3616	0.3784	0.3952	(22b)
Effective ac	0.5920	0.5884	0.5849	0.5684	0.5654	0.5510	0.5510	0.5484	0.5566	0.5654	0.5716	0.5781	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			9.3500	1.3258	12.3958			(27)
150mm Platinum			42.2800	0.1300	5.4964			(28a)
50mm Alreflex Plat	44.7700	13.6300	31.1400	0.1800	5.6052			(29a)
400mm Mineral Wool	42.2800		42.2800	0.1300	5.4964			(30)
Total net area of external elements Aum(A, m2)			129.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.1298			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.7549	(36)
Total fabric heat loss (33) + (36) =	42.8847	(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	40.2220	39.9794	39.7416	38.6246	38.4156	37.4428	37.4428	37.2626	37.8175	38.4156	38.8384	39.2804	(38)
Heat transfer coeff	83.1067	82.8641	82.6263	81.5093	81.3003	80.3275	80.3275	80.1473	80.7022	81.3003	81.7231	82.1651	(39)
Average = Sum(39)m / 12 =												81.5083	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9828	0.9799	0.9771	0.9639	0.9615	0.9499	0.9499	0.9478	0.9544	0.9615	0.9665	0.9717	(40)
HLP (average)												0.9639	(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	2.5437 (42)
Average daily hot water use (litres/day)	94.6132 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0745	100.2900	96.5055	92.7209	88.9364	85.1519	85.1519	88.9364	92.7209	96.5055	100.2900	104.0745	(44)
Energy conte	154.3395	134.9863	139.2938	121.4397	116.5243	100.5516	93.1758	106.9206	108.1976	126.0939	137.6413	149.4696	(45)
Energy content (annual)										Total = Sum(45)m =		1488.6339	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1509	20.2479	20.8941	18.2160	17.4786	15.0827	13.9764	16.0381	16.2296	18.9141	20.6462	22.4204	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	49.1781	45.7254	45.3210	41.9927	43.3925	45.3210	45.7254	49.1781	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	205.2984	181.0137	188.4719	167.1651	161.8453	142.5443	136.5683	152.2416	153.9230	175.2720	186.9564	200.4285	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	205.2984	181.0137	188.4719	167.1651	161.8453	142.5443	136.5683	152.2416	153.9230	175.2720	186.9564	200.4285	(64)
								Total per year (kWh/year) = Sum(64)m =				2051.7284	(64)
Heat gains from water heating, kWh/month													
	64.0576	56.3898	58.6097	51.8100	50.0746	43.9316	41.8291	46.8814	47.4070	54.2207	58.0945	62.4384	(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	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0423	20.4660	16.6441	12.6006	9.4191	7.9520	8.5924	11.1688	14.9907	19.0341	22.2156	23.6827	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.7066	231.0799	225.0993	212.3675	196.2958	181.1907	171.0996	168.7263	174.7068	187.4387	203.5104	218.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	(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)													
	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	(71)
Water heating gains (Table 5)													
	86.0989	83.9134	78.7765	71.9584	67.3045	61.0161	56.2219	63.0126	65.8431	72.8773	80.6868	83.9225	(72)
Total internal gains													
	402.0036	399.6149	384.6756	361.0822	337.1752	314.3145	300.0696	307.0633	319.6963	343.5059	370.5685	390.3764	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.4000	19.6403	0.6300	0.7000	0.7700	26.4102	(76)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115	(80)

Solar gains	56.1217	109.7859	180.8018	263.6886	323.1603	330.8121	314.9466	270.5345	210.2800	130.2703	69.9772	46.1517	(83)
Total gains	458.1253	509.4009	565.4774	624.7708	660.3355	645.1266	615.0162	577.5978	529.9763	473.7761	440.5457	436.5282	(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	70.6588	70.8657	71.0696	72.0436	72.2288	73.1035	73.1035	73.2679	72.7641	72.2288	71.8551	71.4686	
alpha	5.7106	5.7244	5.7380	5.8029	5.8153	5.8736	5.8736	5.8845	5.8509	5.8153	5.7903	5.7646	
util living area													
	0.9988	0.9975	0.9928	0.9729	0.9044	0.7429	0.5650	0.6211	0.8743	0.9846	0.9975	0.9991	(86)
MIT	19.9343	20.0533	20.2699	20.5649	20.8172	20.9598	20.9932	20.9885	20.8923	20.5640	20.1997	19.9161	(87)
Th 2	20.0977	20.1001	20.1024	20.1135	20.1156	20.1253	20.1253	20.1270	20.1215	20.1156	20.1114	20.1070	(88)
util rest of house													
	0.9984	0.9966	0.9903	0.9624	0.8680	0.6621	0.4578	0.5120	0.8146	0.9768	0.9964	0.9988	(89)
MIT 2	18.6623	18.8380	19.1552	19.5869	19.9285	20.0971	20.1225	20.1220	20.0300	19.5920	19.0606	18.6426	(90)
Living area fraction									fLA = Living area / (4) =			0.2265	(91)
MIT	18.9504	19.1132	19.4077	19.8084	20.1298	20.2925	20.3197	20.3182	20.2253	19.8121	19.3186	18.9310	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9504	19.1132	19.4077	19.8084	20.1298	20.2925	20.3197	20.3182	20.2253	19.8121	19.3186	18.9310	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9953	0.9875	0.9578	0.8686	0.6786	0.4822	0.5367	0.8227	0.9732	0.9951	0.9982	(94)
Useful gains	457.0477	507.0081	558.4094	598.4104	573.5986	437.8008	296.5650	310.0023	436.0125	461.0764	438.3820	435.7465	(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													
	1217.5463	1177.7636	1066.5132	889.1375	685.3452	457.2636	298.7938	314.0341	494.3250	748.9466	998.5392	1210.3737	(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													
	565.8110	450.7477	378.0293	209.3235	83.1395	0.0000	0.0000	0.0000	0.0000	214.1755	403.3132	576.3226	(98)
Space heating												2880.8623	(98)
Space heating per m2											(98) / (4) =	34.0689	(99)

8c. Space cooling requirement

Not applicable

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

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3084.4350	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	565.8110	450.7477	378.0293	209.3235	83.1395	0.0000	0.0000	0.0000	0.0000	214.1755	403.3132	576.3226	(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)													
	605.7933	482.5992	404.7422	224.1151	89.0145	0.0000	0.0000	0.0000	0.0000	229.3099	431.8129	617.0478	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	205.2984	181.0137	188.4719	167.1651	161.8453	142.5443	136.5683	152.2416	153.9230	175.2720	186.9564	200.4285	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4709	87.2555	86.7691	85.6185	83.4646	80.3000	80.3000	80.3000	80.3000	85.5569	86.9366	87.5583	(217)
Fuel for water heating, kWh/month													
	234.7049	207.4526	217.2109	195.2442	193.9088	177.5147	170.0726	189.5911	191.6849	204.8602	215.0490	228.9086	(219)
Water heating fuel used												2426.2024	(219)
Annual totals kWh/year													
Space heating fuel - main system												3084.4350	(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)												406.9346	(232)
Total delivered energy for all uses												5992.5721	(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	3084.4350	0.2160	666.2380	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2426.2024	0.2160	524.0597	(264)
Space and water heating			1190.2977	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	406.9346	0.5190	211.1991	(268)
Total CO2, kg/m2/year			1440.4218	(272)
Emissions per m2 for space and water heating			14.0764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4976	(272b)
Emissions per m2 for pumps and fans			0.4603	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0764 * 1.00) + 2.4976 + 0.4603, rounded to 2 d.p.			17.0300	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.2800 (1b)	x	2.3100 (2b)	=	97.6668	(1b) - (3b)
First floor	42.2800 (1c)	x	2.5600 (2c)	=	108.2368	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	205.9036	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1457	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3962	(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) =	0.3368	(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	0.4294	0.4210	0.4125	0.3704	0.3620	0.3199	0.3199	0.3115	0.3368	0.3620	0.3789	0.3957	(22b)
Effective ac	0.5922	0.5886	0.5851	0.5686	0.5655	0.5512	0.5512	0.5485	0.5567	0.5655	0.5718	0.5783	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			4.2800	1.7000	7.2760			(26a)
Opening Type 2 (Uw = 1.41)			9.3500	1.3347	12.4796			(27)
150mm Platinum			42.2800	0.1200	5.0736			(28a)
50mm Alreflex Plat	44.7700	13.6300	31.1400	0.2700	8.4078			(29a)
400mm Mineral Wool	42.2800		42.2800	0.1100	4.6508			(30)
Total net area of external elements Aum(A, m2)			129.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.8878			(33)
E-WM-22			89.5700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	181.1000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.7499	(36)
Total fabric heat loss (33) + (36) =	46.6378	(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	40.2378	39.9946	39.7562	38.6364	38.4269	37.4515	37.4515	37.2709	37.8272	38.4269	38.8507	39.2938	(38)
Heat transfer coeff	86.8756	86.6324	86.3940	85.2742	85.0646	84.0893	84.0893	83.9087	84.4650	85.0646	85.4885	85.9316	(39)
Average = Sum(39)m / 12 =												85.2731	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0274	1.0245	1.0217	1.0084	1.0060	0.9944	0.9944	0.9923	0.9989	1.0060	1.0110	1.0162	(40)
HLP (average)												1.0084	(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	2.5437	(42)
Average daily hot water use (litres/day)	94.6132	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0745	100.2900	96.5055	92.7209	88.9364	85.1519	85.1519	88.9364	92.7209	96.5055	100.2900	104.0745	(44)
Energy conte	154.3395	134.9863	139.2938	121.4397	116.5243	100.5516	93.1758	106.9206	108.1976	126.0939	137.6413	149.4696	(45)
Energy content (annual)										Total = Sum(45)m =		1488.6339	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	32.7971	28.6846	29.5999	25.8059	24.7614	21.3672	19.7999	22.7206	22.9920	26.7949	29.2488	31.7623 (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	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.0423	20.4660	16.6441	12.6006	9.4191	7.9520	8.5924	11.1688	14.9907	19.0341	22.2156	23.6827 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	228.7066	231.0799	225.0993	212.3675	196.2958	181.1907	171.0996	168.7263	174.7068	187.4387	203.5104	218.6155 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186 (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)

	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485 (71)

Water heating gains (Table 5)

	44.0822	42.6854	39.7848	35.8416	33.2815	29.6767	26.6127	30.5385	31.9333	36.0147	40.6233	42.6912 (72)

Total internal gains

	356.9868	355.3870	342.6839	321.9654	300.1521	279.9751	267.4604	271.5892	282.7865	303.6432	327.5050	346.1452 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.4000	19.6403	0.7100	0.7000	0.7700	29.7639	(76)
West	4.9500	19.6403	0.7100	0.7000	0.7700	33.4844	(80)

Solar gains	63.2483	123.7270	203.7608	297.1729	364.1966	372.8200	354.9398	304.8881	236.9822	146.8125	78.8631	52.0123 (83)
Total gains	420.2351	479.1140	546.4447	619.1383	664.3486	652.7951	622.4002	576.4773	519.7687	450.4557	406.3681	398.1574 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.9647	49.1022	49.2377	49.8843	50.0071	50.5871	50.5871	50.6960	50.3621	50.0071	49.7592	49.5026	
alpha	4.2643	4.2735	4.2825	4.3256	4.3338	4.3725	4.3725	4.3797	4.3575	4.3338	4.3173	4.3002	
util living area	0.9964	0.9932	0.9836	0.9530	0.8759	0.7280	0.5680	0.6264	0.8567	0.9729	0.9936	0.9972	(86)
MIT	19.4913	19.6558	19.9531	20.3513	20.6927	20.9073	20.9758	20.9633	20.7976	20.3441	19.8487	19.4660	(87)
Th 2	20.0606	20.0630	20.0653	20.0763	20.0784	20.0880	20.0880	20.0898	20.0843	20.0784	20.0742	20.0698	(88)
util rest of house	0.9955	0.9914	0.9793	0.9397	0.8399	0.6531	0.4618	0.5201	0.8018	0.9629	0.9917	0.9964	(89)
MIT 2	18.6706	18.8363	19.1331	19.5312	19.8510	20.0362	20.0793	20.0754	19.9537	19.5310	19.0379	18.6525	(90)
Living area fraction									fLA = Living area / (4) =			0.2265	(91)
MIT	18.8565	19.0219	19.3188	19.7169	20.0416	20.2335	20.2823	20.2765	20.1448	19.7152	19.2215	18.8368	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8565	19.0219	19.3188	19.7169	20.0416	20.2335	20.2823	20.2765	20.1448	19.7152	19.2215	18.8368	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9888	0.9748	0.9334	0.8383	0.6660	0.4854	0.5432	0.8060	0.9579	0.9892	0.9951	(94)
Useful gains	417.6701	473.7703	532.6753	577.9157	556.8944	434.7827	302.1184	313.1510	418.9424	431.4711	401.9974	396.2183	(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	1264.6030	1223.4111	1107.4694	922.4012	709.5783	473.7152	309.6443	325.2685	510.5766	775.3773	1036.2474	1257.7597	(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	630.1181	503.7586	427.6468	248.0295	113.5968	0.0000	0.0000	0.0000	0.0000	255.8662	456.6600	640.9868	(98)
Space heating												3276.6629	(98)
Space heating per m2											(98) / (4) =	38.7496	(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	790.4396	622.2609	637.7061	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8462	0.9073	0.8821	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	668.9015	564.5683	562.4970	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	859.4345	822.0113	770.3336	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	137.1838	191.5376	154.6304	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												483.3518	(104)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF 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	34.2959	47.8844	38.6576	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												120.8379 (107)
Space cooling per m2												1.4290 (108)
Energy for space heating												38.7496 (99)
Energy for space cooling												1.4290 (108)
Total												40.1786 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.2 (109)

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	42.2800 (1b)	x	2.3100 (2b)	=	97.6668	(1b) - (3b)
First floor	42.2800 (1c)	x	2.5600 (2c)	=	108.2368	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	205.9036	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1457	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3957	(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) =	0.3363	(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	0.4288	0.4204	0.4120	0.3700	0.3616	0.3195	0.3195	0.3111	0.3363	0.3616	0.3784	0.3952	(22b)
Effective ac	0.5920	0.5884	0.5849	0.5684	0.5654	0.5510	0.5510	0.5484	0.5566	0.5654	0.5716	0.5781	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			9.3500	1.3258	12.3958			(27)
150mm Platinum			42.2800	0.1300	5.4964			(28a)
50mm Alreflex Plat	44.7700	13.6300	31.1400	0.1800	5.6052			(29a)
400mm Mineral Wool	42.2800		42.2800	0.1300	5.4964			(30)
Total net area of external elements Aum(A, m2)			129.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.1298			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.7549	(36)
Total fabric heat loss (33) + (36) =	42.8847	(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	40.2220	39.9794	39.7416	38.6246	38.4156	37.4428	37.4428	37.2626	37.8175	38.4156	38.8384	39.2804	(38)
Heat transfer coeff	83.1067	82.8641	82.6263	81.5093	81.3003	80.3275	80.3275	80.1473	80.7022	81.3003	81.7231	82.1651	(39)
Average = Sum(39)m / 12 =												81.5083	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9828	0.9799	0.9771	0.9639	0.9615	0.9499	0.9499	0.9478	0.9544	0.9615	0.9665	0.9717	(40)
HLP (average)												0.9639	(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	2.5437	(42)
Average daily hot water use (litres/day)	94.6132	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0745	100.2900	96.5055	92.7209	88.9364	85.1519	85.1519	88.9364	92.7209	96.5055	100.2900	104.0745	(44)
Energy conte	154.3395	134.9863	139.2938	121.4397	116.5243	100.5516	93.1758	106.9206	108.1976	126.0939	137.6413	149.4696	(45)
Energy content (annual)										Total = Sum(45)m =		1488.6339	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.7971	28.6846	29.5999	25.8059	24.7614	21.3672	19.7999	22.7206	22.9920	26.7949	29.2488	31.7623	(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	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	127.1857	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0423	20.4660	16.6441	12.6006	9.4191	7.9520	8.5924	11.1688	14.9907	19.0341	22.2156	23.6827	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.7066	231.0799	225.0993	212.3675	196.2958	181.1907	171.0996	168.7263	174.7068	187.4387	203.5104	218.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	35.7186	(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)													
	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	-101.7485	(71)
Water heating gains (Table 5)													
	44.0822	42.6854	39.7848	35.8416	33.2815	29.6767	26.6127	30.5385	31.9333	36.0147	40.6233	42.6912	(72)
Total internal gains													
	356.9868	355.3870	342.6839	321.9654	300.1521	279.9751	267.4604	271.5892	282.7865	303.6432	327.5050	346.1452	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.4000	19.6403	0.6300	0.7000	0.7700	26.4102	(76)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115	(80)

Solar gains	56.1217	109.7859	180.8018	263.6886	323.1603	330.8121	314.9466	270.5345	210.2800	130.2703	69.9772	46.1517	(83)
Total gains	413.1085	465.1729	523.4857	585.6540	623.3124	610.7872	582.4070	542.1237	493.0665	433.9135	397.4822	392.2969	(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	70.6588	70.8657	71.0696	72.0436	72.2288	73.1035	73.1035	73.2679	72.7641	72.2288	71.8551	71.4686	
alpha	5.7106	5.7244	5.7380	5.8029	5.8153	5.8736	5.8736	5.8845	5.8509	5.8153	5.7903	5.7646	
util living area													
	0.9993	0.9984	0.9951	0.9797	0.9219	0.7719	0.5937	0.6559	0.9006	0.9898	0.9985	0.9995	(86)
MIT	19.8830	20.0032	20.2235	20.5258	20.7913	20.9509	20.9912	20.9849	20.8701	20.5215	20.1508	19.8655	(87)
Th 2	20.0977	20.1001	20.1024	20.1135	20.1156	20.1253	20.1253	20.1270	20.1215	20.1156	20.1114	20.1070	(88)
util rest of house													
	0.9991	0.9979	0.9933	0.9715	0.8899	0.6924	0.4826	0.5435	0.8478	0.9845	0.9979	0.9993	(89)
MIT 2	19.0665	19.1885	19.4099	19.7168	19.9666	20.1011	20.1228	20.1223	20.0433	19.7171	19.3453	19.0567	(90)
Living area fraction									fLA = Living area / (4) =			0.2265	(91)
MIT	19.2514	19.3730	19.5941	19.9000	20.1534	20.2936	20.3195	20.3177	20.2305	19.8993	19.5277	19.2399	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2514	19.3730	19.5941	19.9000	20.1534	20.2936	20.3195	20.3177	20.2305	19.8993	19.5277	19.2399	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9973	0.9919	0.9690	0.8915	0.7089	0.5080	0.5692	0.8555	0.9827	0.9973	0.9991	(94)
Useful gains	412.5960	463.9119	519.2607	567.4957	555.6930	433.0134	295.8603	308.5514	421.8099	426.4218	396.4221	391.9377	(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													
	1242.5645	1199.2930	1081.9188	896.6048	687.2648	457.3504	298.7756	313.9906	494.7461	756.0358	1015.6331	1235.7517	(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													
	617.4966	494.1761	418.6176	236.9586	97.8894	0.0000	0.0000	0.0000	0.0000	245.2329	445.8319	627.7976	(98)
Space heating												3184.0006	(98)
Space heating per m2											(98) / (4) =	37.6537	(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	755.0783	594.4234	609.1196	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8829	0.9416	0.9200	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	666.6551	559.6944	560.3713	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	810.3343	775.2659	730.1801	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	103.4490	160.3852	126.3377	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												390.1720	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	25.8623	40.0963	31.5844	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											97.5430	(107)
Space cooling per m2											1.1535	(108)
Energy for space heating											37.6537	(99)
Energy for space cooling											1.1535	(108)
Total											38.8073	(109)
Target Fabric Energy Efficiency (TFEE)											44.6	(109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Type 54 End-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Type 54, EOT, Barratt Developments plc		

SAP Rating	84 B	**DER**	16.50	**TER**	17.26
Environmental	86 B	**% DER<TER**	4.41		
CO_2 Emissions (t/year)	1.38	**DFEE**	47.48	**TFEE**	51.32
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.50		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 101 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.50 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.48 (max. 2.00)	1.70 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 1.32 m², No overhang
Windows facing East: 6.60 m², No overhang
Windows facing West: 6.05 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K

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	50.4300 (1b)	x	2.3100 (2b)	=	116.4933	(1b) - (3b)
First floor	50.4300 (1c)	x	2.5600 (2c)	=	129.1008	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.5941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1222	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3727	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2888	(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	0.3682	0.3610	0.3538	0.3177	0.3105	0.2744	0.2744	0.2671	0.2888	0.3105	0.3249	0.3393	(22b)
Effective ac	0.5678	0.5652	0.5626	0.5505	0.5482	0.5376	0.5376	0.5357	0.5417	0.5482	0.5528	0.5576	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			4.2800	1.7000	7.2760			(26a)
Opening Type 2 (Uw = 1.41)			13.9700	1.3347	18.6461			(27)
150mm Platinum			50.4300	0.1400	7.0602			(28a)
50mm Alreflex Plat	98.0200	18.2500	79.7700	0.2700	21.5379			(29a)
400mm Mineral Wool	50.4300		50.4300	0.1100	5.5473			(30)
Total net area of external elements Aum(A, m2)			198.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.0675			(33)
E-WM-22			46.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	157.5000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0811	(36)
Total fabric heat loss (33) + (36) =	70.1485	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0176	45.8042	45.5951	44.6128	44.4290	43.5735	43.5735	43.4150	43.9030	44.4290	44.8008	45.1895	(38)
Heat transfer coeff	116.1661	115.9528	115.7436	114.7613	114.5775	113.7220	113.7220	113.5635	114.0515	114.5775	114.9493	115.3380	(39)
Average = Sum(39)m / 12 =												114.7604	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1518	1.1496	1.1476	1.1378	1.1360	1.1275	1.1275	1.1260	1.1308	1.1360	1.1397	1.1435	(40)
HLP (average)												1.1378	(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	2.7473 (42)
Average daily hot water use (litres/day)	99.4495 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3944	105.4164	101.4384	97.4605	93.4825	89.5045	89.5045	93.4825	97.4605	101.4384	105.4164	109.3944	(44)
Energy conte	162.2287	141.8863	146.4139	127.6472	122.4806	105.6914	97.9386	112.3860	113.7282	132.5393	144.6770	157.1099	(45)
Energy content (annual)										Total = Sum(45)m =		1564.7272	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3343	21.2829	21.9621	19.1471	18.3721	15.8537	14.6908	16.8579	17.0592	19.8809	21.7016	23.5665	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1459	12.7658	14.1080	13.6114	14.0314	13.5398	13.9669	14.0087	13.5788	14.0747	13.6600	14.1336	(61)
Total heat required for water heating calculated for each month													
	176.3747	154.6521	160.5219	141.2586	136.5119	119.2312	111.9056	126.3947	127.3071	146.6140	158.3370	171.2435	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	176.3747	154.6521	160.5219	141.2586	136.5119	119.2312	111.9056	126.3947	127.3071	146.6140	158.3370	171.2435	(64)
								Total per year (kWh/year) = Sum(64)m =				1730.3523	(64)
Heat gains from water heating, kWh/month													
	57.4775	50.3686	52.2096	45.8455	44.2326	38.5274	36.0563	40.8705	41.2093	47.5880	51.5201	55.7724	(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	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.7056	21.9433	17.8455	13.5102	10.0990	8.5260	9.2127	11.9750	16.0728	20.4081	23.8193	25.3923	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.7106	260.3849	253.6459	239.2994	221.1896	204.1689	192.7980	190.1237	196.8627	211.2092	229.3190	246.3397	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	(71)
Water heating gains (Table 5)													
	77.2548	74.9533	70.1742	63.6744	59.4525	53.5102	48.4628	54.9335	57.2352	63.9623	71.5557	74.9630	(72)
Total internal gains													
	426.8812	424.4917	408.8758	383.6942	357.9512	333.4153	317.6836	324.2424	337.3809	362.7898	391.9042	413.9052	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.7100	0.7000	0.7700	4.8343	(74)
East	6.6000	19.6403	0.7100	0.7000	0.7700	44.6458	(76)
West	6.0500	19.6403	0.7100	0.7000	0.7700	40.9253	(80)

Solar gains	90.4055	176.6340	291.3750	427.2736	526.7050	540.7677	514.1633	439.4311	339.4979	209.6261	112.6609	74.3997	(83)
Total gains	517.2867	601.1257	700.2508	810.9678	884.6562	874.1830	831.8470	763.6735	676.8788	572.4159	504.5652	488.3049	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.9855	38.0554	38.1241	38.4505	38.5121	38.8019	38.8019	38.8560	38.6897	38.5121	38.3876	38.2582	
alpha	3.5324	3.5370	3.5416	3.5634	3.5675	3.5868	3.5868	3.5904	3.5793	3.5675	3.5592	3.5505	
util living area													
	0.9931	0.9876	0.9731	0.9330	0.8473	0.7055	0.5586	0.6170	0.8364	0.9606	0.9886	0.9944	(86)
MIT	19.1237	19.3242	19.6872	20.1657	20.5826	20.8529	20.9528	20.9322	20.7079	20.1524	19.5498	19.0857	(87)
Th 2	19.9588	19.9605	19.9622	19.9701	19.9715	19.9784	19.9784	19.9797	19.9758	19.9715	19.9685	19.9654	(88)
util rest of house													
	0.9915	0.9848	0.9667	0.9161	0.8071	0.6272	0.4458	0.5049	0.7777	0.9475	0.9856	0.9931	(89)
MIT 2	17.4422	17.7352	18.2624	18.9501	19.5194	19.8556	19.9526	19.9391	19.6973	18.9435	18.0707	17.3908	(90)
Living area fraction									fLA = Living area / (4) =			0.2430	(91)
MIT	17.8508	18.1213	18.6087	19.2455	19.7778	20.0980	20.1956	20.1804	19.9429	19.2373	18.4301	17.8027	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.7008	17.9713	18.4587	19.0955	19.6278	19.9480	20.0456	20.0304	19.7929	19.0873	18.2801	17.6527	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9767	0.9537	0.8977	0.7913	0.6246	0.4538	0.5110	0.7651	0.9318	0.9779	0.9886	(94)
Useful gains	510.1892	587.1441	667.8069	727.9833	699.9949	546.0510	377.4606	390.2410	517.8653	533.3960	493.4121	482.7569	(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													
	1556.7240	1515.6565	1384.1398	1170.0494	908.3459	608.1833	391.8441	412.2867	649.2845	972.4511	1285.1455	1551.6054	(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													
	778.6219	623.9604	532.9517	318.2876	155.0131	0.0000	0.0000	0.0000	0.0000	326.6570	570.0481	795.2232	(98)
Space heating												4100.7631	(98)
Space heating per m2											(98) / (4) =	40.6580	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4531.2300	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	778.6219	623.9604	532.9517	318.2876	155.0131	0.0000	0.0000	0.0000	0.0000	326.6570	570.0481	795.2232	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	860.3557	689.4590	588.8969	351.6990	171.2852	0.0000	0.0000	0.0000	0.0000	360.9470	629.8874	878.6997	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	176.3747	154.6521	160.5219	141.2586	136.5119	119.2312	111.9056	126.3947	127.3071	146.6140	158.3370	171.2435	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8915	89.8459	89.7386	89.4917	88.9728	87.3000	87.3000	87.3000	87.3000	89.4839	89.7846	89.9160	(217)
Fuel for water heating, kWh/month													
	196.2085	172.1305	178.8772	157.8455	153.4310	136.5765	128.1851	144.7820	145.8271	163.8440	176.3522	190.4483	(219)
Water heating fuel used												1944.5078	(219)
Annual totals kWh/year													
Space heating fuel - main system												4531.2300	(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)												436.3094	(232)
Total delivered energy for all uses												6987.0471	(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	4531.2300	0.2160	978.7457	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1944.5078	0.2160	420.0137	(264)
Space and water heating			1398.7594	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	436.3094	0.5190	226.4446	(268)
Total CO2, kg/year			1664.1289	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.5000	(273)

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

DER		16.5000	ZC1
Total Floor Area	TFA	100.8600	
Assumed number of occupants	N	2.7473	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.1412	ZC2
CO2 emissions from cooking, equation (L16)		1.8336	ZC3
Total CO2 emissions		33.4748	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.4748	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	50.4300 (1b)	x	2.3100 (2b)	=	116.4933	(1b) - (3b)
First floor	50.4300 (1c)	x	2.5600 (2c)	=	129.1008	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.5941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1629	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4129	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3200	(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	0.4080	0.4000	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760	(22b)
Effective ac	0.5832	0.5800	0.5768	0.5619	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			13.9700	1.3258	18.5208			(27)
150mm Platinum			50.4300	0.1300	6.5559			(28a)
50mm Alreflex Plat	98.0200	18.2500	79.7700	0.1800	14.3586			(29a)
400mm Mineral Wool	50.4300		50.4300	0.1300	6.5559			(30)
Total net area of external elements Aum(A, m2)			198.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.1272			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4030	(36)
Total fabric heat loss (33) + (36) =	61.5303	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.2676	47.0057	46.7490	45.5432	45.3176	44.2674	44.2674	44.0729	44.6719	45.3176	45.7740	46.2511	(38)
Heat transfer coeff	108.7978	108.5359	108.2792	107.0734	106.8478	105.7977	105.7977	105.6032	106.2022	106.8478	107.3042	107.7814	(39)
Average = Sum(39)m / 12 =												107.0724	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0787	1.0761	1.0736	1.0616	1.0594	1.0490	1.0490	1.0470	1.0530	1.0594	1.0639	1.0686	(40)
HLP (average)												1.0616	(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	2.7473 (42)
Average daily hot water use (litres/day)	99.4495 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3944	105.4164	101.4384	97.4605	93.4825	89.5045	89.5045	93.4825	97.4605	101.4384	105.4164	109.3944	(44)
Energy conte	162.2287	141.8863	146.4139	127.6472	122.4806	105.6914	97.9386	112.3860	113.7282	132.5393	144.6770	157.1099	(45)
Energy content (annual)										Total = Sum(45)m =		1564.7272	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3343	21.2829	21.9621	19.1471	18.3721	15.8537	14.6908	16.8579	17.0592	19.8809	21.7016	23.5665	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.0627	47.6377	44.1392	45.6105	47.6377	48.0627	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	213.1876	187.9137	197.3729	175.7099	170.1182	149.8306	143.5491	160.0237	161.7909	183.4982	193.9921	208.0688	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	213.1876	187.9137	197.3729	175.7099	170.1182	149.8306	143.5491	160.0237	161.7909	183.4982	193.9921	208.0688	(64)
								Total per year (kWh/year) = Sum(64)m =				2145.0558	(64)
Heat gains from water heating, kWh/month													
	66.6808	58.6840	61.4224	54.4584	52.6342	46.1772	43.9672	49.2778	49.8303	56.8090	60.4339	64.9788	(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	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.7056	21.9433	17.8455	13.5102	10.0990	8.5260	9.2127	11.9750	16.0728	20.4081	23.8193	25.3923	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.7106	260.3849	253.6459	239.2994	221.1896	204.1689	192.7980	190.1237	196.8627	211.2092	229.3190	246.3397	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	(71)
Water heating gains (Table 5)													
	89.6247	87.3274	82.5569	75.6366	70.7449	64.1350	59.0957	66.2335	69.2088	76.3562	83.9359	87.3370	(72)
Total internal gains													
	439.2512	436.8658	421.2585	395.6564	369.2437	344.0401	328.3166	335.5425	349.3545	375.1837	404.2845	426.2793	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896	(74)
East	6.6000	19.6403	0.6300	0.7000	0.7700	39.6153	(76)
West	6.0500	19.6403	0.6300	0.7000	0.7700	36.3140	(80)

Solar gains	80.2190	156.7316	258.5440	379.1301	467.3579	479.8361	456.2294	389.9178	301.2446	186.0062	99.9668	66.0166	(83)
Total gains	519.4701	593.5974	679.8025	774.7865	836.6016	823.8762	784.5460	725.4602	650.5991	561.1900	504.2512	492.2959	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.3778	64.5332	64.6862	65.4146	65.5527	66.2034	66.2034	66.3253	65.9513	65.5527	65.2739	64.9850	
alpha	5.2919	5.3022	5.3124	5.3610	5.3702	5.4136	5.4136	5.4217	5.3968	5.3702	5.3516	5.3323	
util living area													
	0.9991	0.9978	0.9933	0.9735	0.9058	0.7511	0.5785	0.6424	0.8892	0.9872	0.9980	0.9993	(86)
MIT	19.7755	19.9097	20.1551	20.4877	20.7766	20.9447	20.9890	20.9813	20.8538	20.4724	20.0651	19.7535	(87)
Th 2	20.0183	20.0204	20.0225	20.0323	20.0342	20.0427	20.0427	20.0443	20.0394	20.0342	20.0304	20.0265	(88)
util rest of house													
	0.9987	0.9971	0.9908	0.9628	0.8681	0.6653	0.4603	0.5223	0.8303	0.9804	0.9972	0.9991	(89)
MIT 2	18.3722	18.5699	18.9290	19.4141	19.8064	20.0042	20.0384	20.0361	19.9137	19.3993	18.8047	18.3460	(90)
Living area fraction									fLA = Living area / (4) =			0.2430	(91)
MIT	18.7132	18.8955	19.2269	19.6750	20.0422	20.2328	20.2694	20.2658	20.1421	19.6601	19.1110	18.6880	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7132	18.8955	19.2269	19.6750	20.0422	20.2328	20.2694	20.2658	20.1421	19.6601	19.1110	18.6880	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9880	0.9578	0.8685	0.6837	0.4892	0.5516	0.8378	0.9768	0.9960	0.9985	(94)
Useful gains	518.4653	591.1099	671.6391	742.0834	726.5536	563.2912	383.8199	400.1334	545.0685	548.1660	502.2227	491.5801	(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													
	1568.1251	1519.0153	1378.0626	1153.7169	891.3439	595.9347	388.2176	408.2400	641.6882	968.0521	1288.8290	1561.5415	(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													
	780.9469	623.5524	525.5791	296.3761	122.6040	0.0000	0.0000	0.0000	0.0000	312.3953	566.3565	796.0513	(98)
Space heating												4023.8616	(98)
Space heating per m2											(98) / (4) =	39.8955	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												4308.2030	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	780.9469	623.5524	525.5791	296.3761	122.6040	0.0000	0.0000	0.0000	0.0000	312.3953	566.3565	796.0513	(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)													
	836.1316	667.6150	562.7185	317.3192	131.2677	0.0000	0.0000	0.0000	0.0000	334.4703	606.3774	852.3033	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	213.1876	187.9137	197.3729	175.7099	170.1182	149.8306	143.5491	160.0237	161.7909	183.4982	193.9921	208.0688	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0257	87.8415	87.3988	86.3572	84.2421	80.3000	80.3000	80.3000	80.3000	86.3797	87.5892	88.1037	(217)
Fuel for water heating, kWh/month													
	242.1879	213.9237	225.8301	203.4687	201.9396	186.5886	178.7661	199.2823	201.4831	212.4322	221.4794	236.1634	(219)
Water heating fuel used												2523.5449	(219)
Annual totals kWh/year													
Space heating fuel - main system												4308.2030	(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)												436.3094	(232)
Total delivered energy for all uses												7343.0574	(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	4308.2030	0.2160	930.5719	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2523.5449	0.2160	545.0857	(264)
Space and water heating			1475.6576	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	436.3094	0.5190	226.4446	(268)
Total CO2, kg/m2/year			1741.0271	(272)
Emissions per m2 for space and water heating			14.6308	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2451	(272b)
Emissions per m2 for pumps and fans			0.3859	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6308 * 1.00) + 2.2451 + 0.3859, rounded to 2 d.p.			17.2600	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4300 (1b)	x	2.3100 (2b)	=	116.4933	(1b) - (3b)
First floor	50.4300 (1c)	x	2.5600 (2c)	=	129.1008	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.5941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1629	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4134	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3204	(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	0.4085	0.4005	0.3924	0.3524	0.3444	0.3043	0.3043	0.2963	0.3204	0.3444	0.3604	0.3764	(22b)
Effective ac	0.5834	0.5802	0.5770	0.5621	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5649	0.5708	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			4.2800	1.7000	7.2760			(26a)
Opening Type 2 (Uw = 1.41)			13.9700	1.3347	18.6461			(27)
150mm Platinum			50.4300	0.1400	7.0602			(28a)
50mm Alreflex Plat	98.0200	18.2500	79.7700	0.2700	21.5379			(29a)
400mm Mineral Wool	50.4300		50.4300	0.1100	5.5473			(30)
Total net area of external elements Aum(A, m2)			198.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.0675			(33)
E-WM-22			46.2300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	157.5000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0811	(36)
Total fabric heat loss (33) + (36) =	70.1485	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.2839	47.0214	46.7641	45.5554	45.3292	44.2765	44.2765	44.0815	44.6820	45.3292	45.7867	46.2650	(38)
Heat transfer coeff	117.4324	117.1699	116.9126	115.7039	115.4777	114.4250	114.4250	114.2301	114.8305	115.4777	115.9352	116.4135	(39)
Average = Sum(39)m / 12 =												115.7028	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1643	1.1617	1.1592	1.1472	1.1449	1.1345	1.1345	1.1326	1.1385	1.1449	1.1495	1.1542	(40)
HLP (average)												1.1472	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7473 (42)
Average daily hot water use (litres/day)	99.4495 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3944	105.4164	101.4384	97.4605	93.4825	89.5045	89.5045	93.4825	97.4605	101.4384	105.4164	109.3944	(44)
Energy conte	162.2287	141.8863	146.4139	127.6472	122.4806	105.6914	97.9386	112.3860	113.7282	132.5393	144.6770	157.1099	(45)
Energy content (annual)										Total = Sum(45)m =		1564.7272	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.4736	30.1508	31.1130	27.1250	26.0271	22.4594	20.8120	23.8820	24.1673	28.1646	30.7439	33.3858	(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	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.7056	21.9433	17.8455	13.5102	10.0990	8.5260	9.2127	11.9750	16.0728	20.4081	23.8193	25.3923	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.7106	260.3849	253.6459	239.2994	221.1896	204.1689	192.7980	190.1237	196.8627	211.2092	229.3190	246.3397	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	(71)
Water heating gains (Table 5)													
	46.3355	44.8673	41.8185	37.6737	34.9827	31.1936	27.9731	32.0995	33.5656	37.8556	42.6998	44.8735	(72)
Total internal gains													
	392.9619	391.4057	377.5201	354.6935	330.4815	308.0987	294.1939	298.4084	310.7113	333.6831	360.0483	380.8157	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.7100	0.7000	0.7700	4.8343	(74)
East	6.6000	19.6403	0.7100	0.7000	0.7700	44.6458	(76)
West	6.0500	19.6403	0.7100	0.7000	0.7700	40.9253	(80)

Solar gains	90.4055	176.6340	291.3750	427.2736	526.7050	540.7677	514.1633	439.4311	339.4979	209.6261	112.6609	74.3997	(83)
Total gains	483.3674	568.0397	668.8951	781.9671	857.1864	848.8664	808.3573	737.8395	650.2092	543.3092	472.7093	455.2154	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.5759	37.6601	37.7429	38.1372	38.2119	38.5635	38.5635	38.6293	38.4273	38.2119	38.0611	37.9048	
alpha	3.5051	3.5107	3.5162	3.5425	3.5475	3.5709	3.5709	3.5753	3.5618	3.5475	3.5374	3.5270	
util living area													
	0.9944	0.9896	0.9766	0.9396	0.8585	0.7203	0.5739	0.6349	0.8507	0.9662	0.9907	0.9955	(86)
MIT	19.0587	19.2623	19.6319	20.1238	20.5546	20.8403	20.9477	20.9246	20.6843	20.1091	19.4953	19.0246	(87)
Th 2	19.9487	19.9508	19.9528	19.9625	19.9643	19.9728	19.9728	19.9743	19.9695	19.9643	19.9606	19.9568	(88)
util rest of house													
	0.9932	0.9872	0.9710	0.9240	0.8199	0.6424	0.4590	0.5214	0.7946	0.9547	0.9882	0.9945	(89)
MIT 2	18.1685	18.3726	18.7405	19.2283	19.6329	19.8810	19.9531	19.9432	19.7618	19.2228	18.6129	18.1404	(90)
Living area fraction										fLA = Living area / (4) =		0.2430	(91)
MIT	18.3848	18.5888	18.9571	19.4459	19.8568	20.1141	20.1948	20.1817	19.9860	19.4382	18.8273	18.3553	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3848	18.5888	18.9571	19.4459	19.8568	20.1141	20.1948	20.1817	19.9860	19.4382	18.8273	18.3553	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9905	0.9830	0.9639	0.9144	0.8153	0.6542	0.4854	0.5463	0.7957	0.9470	0.9843	0.9922	(94)
Useful gains	478.7622	558.3586	644.7257	715.0358	698.8720	555.3088	392.3694	403.0757	517.3419	514.5313	465.3025	451.6791	(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													
	1654.0121	1603.9166	1456.3894	1220.2037	941.9340	630.9501	411.3337	431.9829	675.8891	1020.6159	1359.6114	1647.8661	(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													
	874.3859	702.6150	603.8778	363.7209	180.8381	0.0000	0.0000	0.0000	0.0000	376.5269	643.9025	889.9632	(98)
Space heating												4635.8302	(98)
Space heating per m2											(98) / (4) =	45.9630	(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	1075.5951	846.7450	868.1484	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7894	0.8562	0.8221	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	849.0468	725.0248	713.6744	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1098.4829	1048.9114	968.6029	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	179.5939	240.9716	189.6668	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling                                                                                                  610.2323 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   44.8985   60.2429   47.4167    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                  152.5581 (107)
Space cooling per m2                                                                                             1.5126 (108)
Energy for space heating                                                                                        45.9630 (99)
Energy for space cooling                                                                                         1.5126 (108)
Total                                                                                                           47.4756 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                          47.5 (109)


-------------------------------------------------------------------------------------------------
```

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	50.4300 (1b)	x	2.3100 (2b)	=	116.4933	(1b) - (3b)
First floor	50.4300 (1c)	x	2.5600 (2c)	=	129.1008	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.5941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1629	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4129	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3200	(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	0.4080	0.4000	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760	(22b)
Effective ac	0.5832	0.5800	0.5768	0.5619	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			13.9700	1.3258	18.5208			(27)
150mm Platinum			50.4300	0.1300	6.5559			(28a)
50mm Alreflex Plat	98.0200	18.2500	79.7700	0.1800	14.3586			(29a)
400mm Mineral Wool	50.4300		50.4300	0.1300	6.5559			(30)
Total net area of external elements Aum(A, m2)			198.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.1272			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4030	(36)
Total fabric heat loss (33) + (36) =	61.5303	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.2676	47.0057	46.7490	45.5432	45.3176	44.2674	44.2674	44.0729	44.6719	45.3176	45.7740	46.2511	(38)
Heat transfer coeff	108.7978	108.5359	108.2792	107.0734	106.8478	105.7977	105.7977	105.6032	106.2022	106.8478	107.3042	107.7814	(39)
Average = Sum(39)m / 12 =												107.0724	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0787	1.0761	1.0736	1.0616	1.0594	1.0490	1.0490	1.0470	1.0530	1.0594	1.0639	1.0686	(40)
HLP (average)												1.0616	(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	2.7473 (42)
Average daily hot water use (litres/day)	99.4495 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3944	105.4164	101.4384	97.4605	93.4825	89.5045	89.5045	93.4825	97.4605	101.4384	105.4164	109.3944	(44)
Energy conte	162.2287	141.8863	146.4139	127.6472	122.4806	105.6914	97.9386	112.3860	113.7282	132.5393	144.6770	157.1099	(45)
Energy content (annual)										Total = Sum(45)m =		1564.7272	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.4736	30.1508	31.1130	27.1250	26.0271	22.4594	20.8120	23.8820	24.1673	28.1646	30.7439	33.3858	(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	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	137.3673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.7056	21.9433	17.8455	13.5102	10.0990	8.5260	9.2127	11.9750	16.0728	20.4081	23.8193	25.3923	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.7106	260.3849	253.6459	239.2994	221.1896	204.1689	192.7980	190.1237	196.8627	211.2092	229.3190	246.3397	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	36.7367	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	-109.8938	(71)
Water heating gains (Table 5)													
	46.3355	44.8673	41.8185	37.6737	34.9827	31.1936	27.9731	32.0995	33.5656	37.8556	42.6998	44.8735	(72)
Total internal gains													
	392.9619	391.4057	377.5201	354.6935	330.4815	308.0987	294.1939	298.4084	310.7113	333.6831	360.0483	380.8157	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896	(74)
East	6.6000	19.6403	0.6300	0.7000	0.7700	39.6153	(76)
West	6.0500	19.6403	0.6300	0.7000	0.7700	36.3140	(80)

Solar gains	80.2190	156.7316	258.5440	379.1301	467.3579	479.8361	456.2294	389.9178	301.2446	186.0062	99.9668	66.0166	(83)
Total gains	473.1809	548.1373	636.0641	733.8236	797.8394	787.9349	750.4234	688.3262	611.9559	519.6894	460.0151	446.8323	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.3778	64.5332	64.6862	65.4146	65.5527	66.2034	66.2034	66.3253	65.9513	65.5527	65.2739	64.9850	
alpha	5.2919	5.3022	5.3124	5.3610	5.3702	5.4136	5.4136	5.4217	5.3968	5.3702	5.3516	5.3323	
util living area													
	0.9994	0.9985	0.9951	0.9788	0.9195	0.7738	0.6017	0.6706	0.9089	0.9909	0.9987	0.9996	(86)
MIT	19.7320	19.8673	20.1151	20.4537	20.7538	20.9360	20.9867	20.9771	20.8326	20.4355	20.0236	19.7107	(87)
Th 2	20.0183	20.0204	20.0225	20.0323	20.0342	20.0427	20.0427	20.0443	20.0394	20.0342	20.0304	20.0265	(88)
util rest of house													
	0.9992	0.9980	0.9932	0.9701	0.8854	0.6892	0.4803	0.5483	0.8562	0.9860	0.9982	0.9994	(89)
MIT 2	18.8510	18.9878	19.2364	19.5780	19.8599	20.0117	20.0391	20.0373	19.9381	19.5649	19.1523	18.8364	(90)
Living area fraction									fLA = Living area / (4) =			0.2430	(91)
MIT	19.0651	19.2015	19.4499	19.7908	20.0771	20.2363	20.2694	20.2656	20.1555	19.7765	19.3640	19.0488	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0651	19.2015	19.4499	19.7908	20.0771	20.2363	20.2694	20.2656	20.1555	19.7765	19.3640	19.0488	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9974	0.9917	0.9673	0.8872	0.7079	0.5102	0.5783	0.8638	0.9842	0.9977	0.9992	(94)
Useful gains	472.6626	546.7137	630.8142	709.8511	707.8419	557.7706	382.8514	398.0928	528.6273	511.4680	458.9345	446.4746	(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													
	1606.4093	1552.2259	1402.2084	1166.1116	895.0753	596.3063	388.2164	408.2249	643.1081	980.4868	1315.9805	1600.4278	(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													
	843.5076	675.7042	573.9173	328.5076	139.3016	0.0000	0.0000	0.0000	0.0000	348.9499	617.0731	858.5412	(98)
Space heating												4385.5024	(98)
Space heating per m2											(98) / (4) =	43.4811	(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	994.4980	782.9027	802.5842	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8574	0.9222	0.8924	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	852.7114	721.9717	716.1973	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1027.2641	981.1965	910.7301	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	125.6780	192.8633	144.7324	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												463.2737	(104)

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	31.4195	48.2158	36.1831	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												115.8184 (107)
Space cooling per m2												1.1483 (108)
Energy for space heating												43.4811 (99)
Energy for space cooling												1.1483 (108)
Total												44.6294 (109)
Target Fabric Energy Efficiency (TFEE)												51.3 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Type 55 End-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Type 55 DS02 (Gable), EOT , Affordable Range, Part L2013 Timber Frame		

SAP Rating	84 B	**DER**	16.12	**TER**	17.05
Environmental	87 B	**% DER<TER**	5.44		
CO_2 Emissions (t/year)	1.28	**DFEE**	43.95	**TFEE**	46.84
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.16		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 87 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.05 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.12 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)46.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.70 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

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

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Midlands): Slight OK
Based on:
Overshading: Average
Windows facing East: 2.20 m², No overhang
Windows facing South: 7.00 m², No overhang
Windows facing West: 3.85 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K

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	43.7100	(1b)	x 2.3000	(2b) =	100.5330	(1b) - (3b)
First floor	43.7100	(1c)	x 2.5700	(2c) =	112.3347	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		212.8677	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1409	(8)
Pressure test			Yes	
Measured/design AP50			5.0100	
Infiltration rate			0.3914	(18)
Number of sides sheltered			4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2740	(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	0.3494	0.3425	0.3357	0.3014	0.2946	0.2603	0.2603	0.2535	0.2740	0.2946	0.3083	0.3220	(22b)
Effective ac	0.5610	0.5587	0.5563	0.5454	0.5434	0.5339	0.5339	0.5321	0.5375	0.5434	0.5475	0.5518	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			13.0500	1.3347	17.4181			(27)
Opening Type 2			2.1200	1.0000	2.1200			(26)
Opening Type 8			2.1200	1.7000	3.6040			(26a)
130mm TE Platinum GF			43.7100	0.1600	6.9936			(28a)
140mm TF Proc Ref	90.8400	17.2900	73.5500	0.2700	19.8585			(29a)
400mm mineral	43.7100		43.7100	0.1100	4.8081			(30)
Total net area of external elements Aum(A, m2)			178.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.8023			(33)
E-WT-1/2			44.9300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	106.5900	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.5380	(36)
Total fabric heat loss (33) + (36) =	65.3403	(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	39.4099	39.2434	39.0803	38.3139	38.1705	37.5030	37.5030	37.3794	37.7601	38.1705	38.4606	38.7638	(38)
Heat transfer coeff	104.7501	104.5837	104.4205	103.6542	103.5108	102.8433	102.8433	102.7197	103.1004	103.5108	103.8008	104.1041	(39)
Average = Sum(39)m / 12 =												103.6535	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1982	1.1963	1.1945	1.1857	1.1841	1.1764	1.1764	1.1750	1.1794	1.1841	1.1874	1.1908	(40)
HLP (average)												1.1857	(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	2.5887	(42)
Average daily hot water use (litres/day)	95.6824	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.2507	101.4234	97.5961	93.7688	89.9415	86.1142	86.1142	89.9415	93.7688	97.5961	101.4234	105.2507	(44)
Energy conte	156.0837	136.5118	140.8680	122.8121	117.8411	101.6879	94.2288	108.1289	109.4204	127.5189	139.1968	151.1587	(45)
Energy content (annual)										Total = Sum(45)m =		1505.4571	(45)
Distribution loss (46)m = 0.15 x (45)m	23.4126	20.4768	21.1302	18.4218	17.6762	15.2532	14.1343	16.2193	16.4131	19.1278	20.8795	22.6738	(46)
Water storage loss:													
Total storage loss													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1312	12.7529	14.0865	13.5892	14.0109	13.5230	13.9513	13.9900	13.5590	14.0552	13.6469	14.1193	(61)
Total heat required for water heating calculated for each month													
	170.2149	149.2647	154.9545	136.4013	131.8521	115.2109	108.1801	122.1189	122.9794	141.5741	152.8437	165.2781	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.2149	149.2647	154.9545	136.4013	131.8521	115.2109	108.1801	122.1189	122.9794	141.5741	152.8437	165.2781	(64)
								Total per year (kWh/year) = Sum(64)m =				1670.8726	(64)
Heat gains from water heating, kWh/month													
	55.4306	48.5784	50.3602	44.2323	42.6849	37.1920	34.8189	39.4504	39.7720	45.9138	49.6947	53.7901	(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	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.0983	19.6275	15.9622	12.0844	9.0332	7.6262	8.2404	10.7112	14.3765	18.2543	21.3055	22.7125	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.2503	236.6811	230.5556	217.5151	201.0539	185.5826	175.2469	172.8161	178.9416	191.9821	208.4433	223.9146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	(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)													
	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	(71)
Water heating gains (Table 5)													
	74.5035	72.2893	67.6885	61.4338	57.3722	51.6555	46.7996	53.0247	55.2389	61.7121	69.0204	72.2985	(72)
Total internal gains													
	395.6831	393.4289	379.0372	355.8643	332.2903	309.6954	295.1179	301.3830	313.3881	336.7795	363.6002	383.7566	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.2000	19.6403	0.7100	0.7000	0.7700	14.8819	(76)
South	7.0000	46.7521	0.7100	0.7000	0.7700	112.7168	(78)
West	3.8500	19.6403	0.7100	0.7000	0.7700	26.0434	(80)

Solar gains	153.6421	264.6596	366.9941	458.0577	512.6047	507.7613	490.0779	450.1757	398.9822	294.1058	184.6369	131.0527	(83)
Total gains	549.3252	658.0886	746.0314	813.9220	844.8950	817.4567	785.1959	751.5587	712.3703	630.8854	548.2371	514.8093	(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	24.7099	24.7492	24.7879	24.9711	25.0057	25.1680	25.1680	25.1983	25.1052	25.0057	24.9358	24.8632	
alpha	2.6473	2.6499	2.6525	2.6647	2.6670	2.6779	2.6779	2.6799	2.6737	2.6670	2.6624	2.6575	
util living area													
	0.9676	0.9478	0.9161	0.8605	0.7729	0.6453	0.5120	0.5465	0.7273	0.8841	0.9514	0.9723	(86)
MIT	18.6440	18.9479	19.3909	19.9241	20.3981	20.7454	20.9016	20.8796	20.6237	19.9918	19.2114	18.5790	(87)
Th 2	19.9214	19.9229	19.9244	19.9315	19.9328	19.9389	19.9389	19.9400	19.9365	19.9328	19.9301	19.9273	(88)
util rest of house													
	0.9624	0.9396	0.9025	0.8365	0.7304	0.5728	0.4091	0.4455	0.6639	0.8591	0.9424	0.9679	(89)
MIT 2	16.7827	17.2213	17.8576	18.6151	19.2636	19.7083	19.8757	19.8578	19.5693	18.7256	17.6121	16.6920	(90)
Living area fraction									fLA = Living area / (4) =			0.1783	(91)
MIT	17.1146	17.5292	18.1310	18.8486	19.4659	19.8933	20.0586	20.0400	19.7573	18.9514	17.8973	17.0285	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.9646	17.3792	17.9810	18.6986	19.3159	19.7433	19.9086	19.8900	19.6073	18.8014	17.7473	16.8785	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9409	0.9120	0.8696	0.8019	0.7016	0.5579	0.4059	0.4403	0.6411	0.8246	0.9156	0.9484	(94)
Useful gains	516.8354	600.1745	648.7604	652.6920	592.8162	456.0570	318.7349	330.8906	456.6728	520.2053	501.9571	488.2384	(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													
	1326.6208	1305.1232	1198.8542	1015.6616	788.3313	528.9502	340.2723	358.4907	567.8091	848.9334	1105.2035	1319.8858	(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													
	602.4803	473.7255	409.2697	261.3381	145.4632	0.0000	0.0000	0.0000	0.0000	244.5737	434.3374	618.7456	(98)
Space heating												3189.9336	(98)
Space heating per m2											(98) / (4) =	36.4897	(99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3524.7886	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.4803	473.7255	409.2697	261.3381	145.4632	0.0000	0.0000	0.0000	0.0000	244.5737	434.3374	618.7456	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	665.7241	523.4536	452.2318	288.7714	160.7329	0.0000	0.0000	0.0000	0.0000	270.2472	479.9309	683.6968	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	170.2149	149.2647	154.9545	136.4013	131.8521	115.2109	108.1801	122.1189	122.9794	141.5741	152.8437	165.2781	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7751	89.7121	89.5980	89.3765	88.9498	87.3000	87.3000	87.3000	87.3000	89.2999	89.6447	89.8061	(217)
Fuel for water heating, kWh/month	189.6014	166.3819	172.9440	152.6143	148.2320	131.9712	123.9177	139.8842	140.8699	158.5378	170.4995	184.0389	(219)
Water heating fuel used												1879.4929	(219)
Annual totals kWh/year													
Space heating fuel - main system												3524.7886	(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)												390.2628	(232)
Total delivered energy for all uses												5869.5442	(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	3524.7886	0.2160	761.3543	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1879.4929	0.2160	405.9705	(264)
Space and water heating			1167.3248	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	390.2628	0.5190	202.5464	(268)
Total CO2, kg/year			1408.7962	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.1200	(273)

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

DER		16.1200	ZC1
Total Floor Area	TFA	87.4200	
Assumed number of occupants	N	2.5887	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.8787	ZC2
CO2 emissions from cooking, equation (L16)		2.0719	ZC3
Total CO2 emissions		34.0707	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.0707	ZC8

ARUN DISTRICT COUNCIL A/45/22/PL

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	43.7100	(1b)	x 2.3000	(2b) =	100.5330	(1b) - (3b)
First floor	43.7100	(1c)	x 2.5700	(2c) =	112.3347	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		212.8677	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1409	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3909	(18)
Number of sides sheltered			4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2737	(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	0.3489	0.3421	0.3352	0.3010	0.2942	0.2600	0.2600	0.2531	0.2737	0.2942	0.3079	0.3215	(22b)
Effective ac	0.5609	0.5585	0.5562	0.5453	0.5433	0.5338	0.5338	0.5320	0.5374	0.5433	0.5474	0.5517	(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 Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.0500	1.3258	17.3011			(27)
130mm TE Platinum GF			43.7100	0.1300	5.6823			(28a)
140mm TF Proc Ref	90.8400	17.2900	73.5500	0.1800	13.2390			(29a)
400mm mineral	43.7100		43.7100	0.1300	5.6823			(30)
Total net area of external elements Aum(A, m2)			178.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5687			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2601	(36)
Total fabric heat loss					(33) + (36) =		56.8288	(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	39.3989	39.2329	39.0702	38.3057	38.1627	37.4970	37.4970	37.3737	37.7534	38.1627	38.4521	38.7545	(38)
Heat transfer coeff	96.2278	96.0617	95.8990	95.1346	94.9916	94.3258	94.3258	94.2025	94.5822	94.9916	95.2809	95.5834	(39)
Average = Sum(39)m / 12 =												95.1339	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1008	1.0989	1.0970	1.0882	1.0866	1.0790	1.0790	1.0776	1.0819	1.0866	1.0899	1.0934	(40)
HLP (average)												1.0882	(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	2.5887	(42)
Average daily hot water use (litres/day)	95.6824	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.2507	101.4234	97.5961	93.7688	89.9415	86.1142	86.1142	89.9415	93.7688	97.5961	101.4234	105.2507	(44)
Energy conte	156.0837	136.5118	140.8680	122.8121	117.8411	101.6879	94.2288	108.1289	109.4204	127.5189	139.1968	151.1587	(45)
Energy content (annual)										Total = Sum(45)m =		1505.4571	(45)
Distribution loss (46)m = 0.15 x (45)m	23.4126	20.4768	21.1302	18.4218	17.6762	15.2532	14.1343	16.2193	16.4131	19.1278	20.8795	22.6738	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	49.7339	46.2421	45.8332	42.4673	43.8828	45.8332	46.2421	49.7339	49.3151	50.9589 (61)

Total heat required for water heating calculated for each month

	207.0426	182.5392	190.6018	169.0542	163.6743	144.1552	138.1117	153.9621	155.6625	177.2528	188.5119	202.1176 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	207.0426	182.5392	190.6018	169.0542	163.6743	144.1552	138.1117	153.9621	155.6625	177.2528	188.5119	202.1176 (64)

Total per year (kWh/year) = Sum(64)m = 2072.6860 (64)

Heat gains from water heating, kWh/month

	64.6376	56.8970	59.2721	52.3956	50.6405	44.4281	42.3018	47.4112	47.9428	54.8335	58.6117	63.0000 (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	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.0983	19.6275	15.9622	12.0844	9.0332	7.6262	8.2404	10.7112	14.3765	18.2543	21.3055	22.7125 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	234.2503	236.6811	230.5556	217.5151	201.0539	185.5826	175.2469	172.8161	178.9416	191.9821	208.4433	223.9146 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437 (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)

	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494 (71)

Water heating gains (Table 5)

	86.8784	84.6682	79.6668	72.7716	68.0652	61.7056	56.8572	63.7247	66.5872	73.7009	81.4052	84.6774 (72)

Total internal gains

	408.0581	405.8078	391.0155	367.2021	342.9833	319.7455	305.1756	312.0830	324.7364	348.7683	375.9850	396.1355 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.2000	19.6403	0.6300	0.7000	0.7700	13.2051	(76)
South	7.0000	46.7521	0.6300	0.7000	0.7700	100.0163	(78)
West	3.8500	19.6403	0.6300	0.7000	0.7700	23.1089	(80)

Solar gains	136.3303	234.8388	325.6427	406.4455	454.8464	450.5488	434.8579	399.4516	354.0265	260.9671	163.8327	116.2862 (83)
Total gains	544.3884	640.6466	716.6582	773.6477	797.8297	770.2943	740.0334	711.5346	678.7629	609.7355	539.8177	512.4216 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0882	63.1972	63.3045	63.8131	63.9092	64.3603	64.3603	64.4445	64.1858	63.9092	63.7151	63.5135	
alpha	5.2059	5.2131	5.2203	5.2542	5.2606	5.2907	5.2907	5.2963	5.2791	5.2606	5.2477	5.2342	
util living area	0.9976	0.9941	0.9845	0.9557	0.8798	0.7242	0.5490	0.5910	0.8238	0.9682	0.9946	0.9983	(86)
MIT	19.8467	20.0135	20.2570	20.5526	20.8028	20.9501	20.9904	20.9860	20.8983	20.5679	20.1446	19.8122	(87)
Th 2	20.0002	20.0018	20.0033	20.0104	20.0118	20.0180	20.0180	20.0192	20.0156	20.0118	20.0091	20.0062	(88)
util rest of house	0.9968	0.9921	0.9791	0.9394	0.8359	0.6359	0.4326	0.4740	0.7500	0.9533	0.9925	0.9977	(89)
MIT 2	18.4631	18.7071	19.0607	19.4849	19.8165	19.9842	20.0144	20.0134	19.9353	19.5139	18.9047	18.4170	(90)

Living area fraction fLA = Living area / (4) = 0.1783 (91)

MIT	18.7098	18.9401	19.2740	19.6753	19.9924	20.1564	20.1885	20.1868	20.1070	19.7018	19.1258	18.6658	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7098	18.9401	19.2740	19.6753	19.9924	20.1564	20.1885	20.1868	20.1070	19.7018	19.1258	18.6658	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9891	0.9738	0.9325	0.8349	0.6493	0.4534	0.4948	0.7578	0.9471	0.9897	0.9965	(94)
Useful gains	541.8366	633.6380	697.8802	721.4051	666.0744	500.1484	335.5362	352.0771	514.3414	577.4889	534.2683	510.6311	(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	1386.6273	1348.7140	1225.0181	1025.1039	787.7063	524.1150	338.4868	356.7292	568.1555	864.5977	1145.8275	1382.6940	(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	628.5243	480.5311	392.1906	218.6632	90.4941	0.0000	0.0000	0.0000	0.0000	213.6089	440.3227	648.8148	(98)

Space heating 3113.1496 (98)

Space heating per m2 (98) / (4) = 35.6114 (99)

8c. Space cooling requirement

Not applicable

ARUN DISTRICT COUNCIL A/45/22/PL

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												3333.1366	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	628.5243	480.5311	392.1906	218.6632	90.4941	0.0000	0.0000	0.0000	0.0000	213.6089	440.3227	648.8148	(98)
Space heating efficiency (main heating system 1)													
	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)													
	672.9382	514.4872	419.9043	234.1147	96.8888	0.0000	0.0000	0.0000	0.0000	228.7033	471.4376	694.6625	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	207.0426	182.5392	190.6018	169.0542	163.6743	144.1552	138.1117	153.9621	155.6625	177.2528	188.5119	202.1176	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6677	87.3746	86.8283	85.7000	83.6266	80.3000	80.3000	80.3000	80.3000	85.5219	87.1152	87.7776	(217)
Fuel for water heating, kWh/month													
	236.1674	208.9157	219.5159	197.2628	195.7205	179.5208	171.9946	191.7337	193.8512	207.2601	216.3937	230.2611	(219)
Water heating fuel used												2448.5974	(219)
Annual totals kWh/year													
Space heating fuel - main system												3333.1366	(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)												390.2628	(232)
Total delivered energy for all uses												6246.9968	(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	3333.1366	0.2160	719.9575	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2448.5974	0.2160	528.8970	(264)
Space and water heating			1248.8546	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	390.2628	0.5190	202.5464	(268)
Total CO2, kg/m2/year			1490.3259	(272)
Emissions per m2 for space and water heating			14.2857	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3169	(272b)
Emissions per m2 for pumps and fans			0.4453	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2857 * 1.00) + 2.3169 + 0.4453, rounded to 2 d.p.			17.0500	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	43.7100	(1b)	x 2.3000	(2b) =	100.5330	(1b) - (3b)
First floor	43.7100	(1c)	x 2.5700	(2c) =	112.3347	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		212.8677	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3914	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2740	(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	0.3494	0.3425	0.3357	0.3014	0.2946	0.2603	0.2603	0.2535	0.2740	0.2946	0.3083	0.3220	(22b)
Effective ac	0.5610	0.5587	0.5563	0.5454	0.5434	0.5339	0.5339	0.5321	0.5375	0.5434	0.5475	0.5518	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			13.0500	1.3347	17.4181			(27)
Opening Type 2			2.1200	1.0000	2.1200			(26)
Opening Type 8			2.1200	1.7000	3.6040			(26a)
130mm TE Platinum GF			43.7100	0.1600	6.9936			(28a)
140mm TF Proc Ref	90.8400	17.2900	73.5500	0.2700	19.8585			(29a)
400mm mineral	43.7100		43.7100	0.1100	4.8081			(30)
Total net area of external elements Aum(A, m2)			178.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.8023			(33)
E-WT-1/2			44.9300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	106.5900	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.5380	(36)
Total fabric heat loss (33) + (36) =	65.3403	(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	39.4099	39.2434	39.0803	38.3139	38.1705	37.5030	37.5030	37.3794	37.7601	38.1705	38.4606	38.7638	(38)
Heat transfer coeff	104.7501	104.5837	104.4205	103.6542	103.5108	102.8433	102.8433	102.7197	103.1004	103.5108	103.8008	104.1041	(39)
Average = Sum(39)m / 12 =												103.6535	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1982	1.1963	1.1945	1.1857	1.1841	1.1764	1.1764	1.1750	1.1794	1.1841	1.1874	1.1908	(40)
HLP (average)												1.1857	(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	2.5887	(42)
Average daily hot water use (litres/day)	95.6824	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.2507	101.4234	97.5961	93.7688	89.9415	86.1142	86.1142	89.9415	93.7688	97.5961	101.4234	105.2507	(44)
Energy conte	156.0837	136.5118	140.8680	122.8121	117.8411	101.6879	94.2288	108.1289	109.4204	127.5189	139.1968	151.1587	(45)
Energy content (annual)										Total = Sum(45)m =		1505.4571	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.1678	29.0088	29.9344	26.0976	25.0412	21.6087	20.0236	22.9774	23.2518	27.0978	29.5793	32.1212	(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	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.0983	19.6275	15.9622	12.0844	9.0332	7.6262	8.2404	10.7112	14.3765	18.2543	21.3055	22.7125	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.2503	236.6811	230.5556	217.5151	201.0539	185.5826	175.2469	172.8161	178.9416	191.9821	208.4433	223.9146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	(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)													
	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	(71)
Water heating gains (Table 5)													
	44.5804	43.1678	40.2345	36.2466	33.6576	30.0121	26.9135	30.8836	32.2942	36.4217	41.0824	43.1737	(72)
Total internal gains													
	362.7600	361.3074	348.5832	327.6772	305.5757	285.0519	272.2318	276.2419	287.4434	308.4891	332.6622	351.6318	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.2000	19.6403	0.7100	0.7000	0.7700	14.8819	(76)
South	7.0000	46.7521	0.7100	0.7000	0.7700	112.7168	(78)
West	3.8500	19.6403	0.7100	0.7000	0.7700	26.0434	(80)

Solar gains	153.6421	264.6596	366.9941	458.0577	512.6047	507.7613	490.0779	450.1757	398.9822	294.1058	184.6369	131.0527	(83)
Total gains	516.4021	625.9671	715.5774	785.7348	818.1804	792.8132	762.3097	726.4176	686.4256	602.5949	517.2991	482.6844	(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	24.7099	24.7492	24.7879	24.9711	25.0057	25.1680	25.1680	25.1983	25.1052	25.0057	24.9358	24.8632	
alpha	2.6473	2.6499	2.6525	2.6647	2.6670	2.6779	2.6779	2.6799	2.6737	2.6670	2.6624	2.6575	
util living area													
	0.9718	0.9531	0.9228	0.8690	0.7834	0.6574	0.5236	0.5601	0.7407	0.8937	0.9572	0.9761	(86)
MIT	18.5866	18.8954	19.3462	19.8899	20.3748	20.7330	20.8961	20.8720	20.6049	19.9543	19.1600	18.5219	(87)
Th 2	19.9214	19.9229	19.9244	19.9315	19.9328	19.9389	19.9389	19.9400	19.9365	19.9328	19.9301	19.9273	(88)
util rest of house													
	0.9672	0.9456	0.9100	0.8459	0.7419	0.5851	0.4196	0.4581	0.6783	0.8701	0.9491	0.9722	(89)
MIT 2	17.7220	18.0273	18.4705	19.0014	19.4563	19.7729	19.8930	19.8799	19.6715	19.0743	18.2976	17.6622	(90)
Living area fraction										fLA = Living area / (4) =		0.1783	(91)
MIT	17.8761	18.1821	18.6267	19.1598	19.6201	19.9442	20.0719	20.0568	19.8380	19.2312	18.4514	17.8155	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8761	18.1821	18.6267	19.1598	19.6201	19.9442	20.0719	20.0568	19.8380	19.2312	18.4514	17.8155	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9553	0.9297	0.8907	0.8260	0.7280	0.5855	0.4336	0.4703	0.6717	0.8510	0.9341	0.9616	(94)
Useful gains	493.3187	581.9721	637.3737	649.0540	595.6570	464.2088	330.5257	341.6527	461.0889	512.7830	483.2035	464.1456	(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													
	1422.1032	1389.0897	1266.2732	1063.4734	819.8150	549.6104	357.0605	375.6289	591.5875	893.4220	1178.2869	1417.4298	(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													
	691.0157	542.3831	467.9012	298.3820	166.7736	0.0000	0.0000	0.0000	0.0000	283.1954	500.4601	709.2434	(98)
Space heating												3659.3545	(98)
Space heating per m2											(98) / (4) =	41.8595	(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	966.7270	761.0404	780.6696	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7489	0.8146	0.7941	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	723.9417	619.9222	619.9612	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1024.4497	986.7912	946.6712	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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	216.3657	272.9506	243.0723	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												732.3885 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	54.0914	68.2376	60.7681	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												183.0971 (107)
Space cooling per m2												2.0945 (108)
Energy for space heating												41.8595 (99)
Energy for space cooling												2.0945 (108)
Total												43.9539 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.0 (109)

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	43.7100	(1b)	x 2.3000	(2b) =	100.5330	(1b) - (3b)
First floor	43.7100	(1c)	x 2.5700	(2c) =	112.3347	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.4200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	212.8677	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3909	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2737	(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	0.3489	0.3421	0.3352	0.3010	0.2942	0.2600	0.2600	0.2531	0.2737	0.2942	0.3079	0.3215	(22b)
Effective ac	0.5609	0.5585	0.5562	0.5453	0.5433	0.5338	0.5338	0.5320	0.5374	0.5433	0.5474	0.5517	(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 Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.0500	1.3258	17.3011			(27)
130mm TE Platinum GF			43.7100	0.1300	5.6823			(28a)
140mm TF Proc Ref	90.8400	17.2900	73.5500	0.1800	13.2390			(29a)
400mm mineral	43.7100		43.7100	0.1300	5.6823			(30)
Total net area of external elements Aum(A, m2)			178.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5687			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2601	(36)
Total fabric heat loss					(33) + (36) =		56.8288	(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	39.3989	39.2329	39.0702	38.3057	38.1627	37.4970	37.4970	37.3737	37.7534	38.1627	38.4521	38.7545	(38)
Heat transfer coeff	96.2278	96.0617	95.8990	95.1346	94.9916	94.3258	94.3258	94.2025	94.5822	94.9916	95.2809	95.5834	(39)
Average = Sum(39)m / 12 =												95.1339	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1008	1.0989	1.0970	1.0882	1.0866	1.0790	1.0790	1.0776	1.0819	1.0866	1.0899	1.0934	(40)
HLP (average)												1.0882	(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	2.5887	(42)
Average daily hot water use (litres/day)	95.6824	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.2507	101.4234	97.5961	93.7688	89.9415	86.1142	86.1142	89.9415	93.7688	97.5961	101.4234	105.2507	(44)
Energy conte	156.0837	136.5118	140.8680	122.8121	117.8411	101.6879	94.2288	108.1289	109.4204	127.5189	139.1968	151.1587	(45)
Energy content (annual)										Total = Sum(45)m =		1505.4571	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

33.1678	29.0088	29.9344	26.0976	25.0412	21.6087	20.0236	22.9774	23.2518	27.0978	29.5793	32.1212	(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	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	129.4367	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

22.0983	19.6275	15.9622	12.0844	9.0332	7.6262	8.2404	10.7112	14.3765	18.2543	21.3055	22.7125	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

234.2503	236.6811	230.5556	217.5151	201.0539	185.5826	175.2469	172.8161	178.9416	191.9821	208.4433	223.9146	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	35.9437	(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)

-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	-103.5494	(71)

Water heating gains (Table 5)

44.5804	43.1678	40.2345	36.2466	33.6576	30.0121	26.9135	30.8836	32.2942	36.4217	41.0824	43.1737	(72)

Total internal gains

362.7600	361.3074	348.5832	327.6772	305.5757	285.0519	272.2318	276.2419	287.4434	308.4891	332.6622	351.6318	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.2000	19.6403	0.6300	0.7000	0.7700	13.2051	(76)
South	7.0000	46.7521	0.6300	0.7000	0.7700	100.0163	(78)
West	3.8500	19.6403	0.6300	0.7000	0.7700	23.1089	(80)

Solar gains	136.3303	234.8388	325.6427	406.4455	454.8464	450.5488	434.8579	399.4516	354.0265	260.9671	163.8327	116.2862	(83)
Total gains	499.0903	596.1463	674.2259	734.1227	760.4221	735.6007	707.0897	675.6936	641.4698	569.4563	496.4949	467.9179	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0882	63.1972	63.3045	63.8131	63.9092	64.3603	64.3603	64.4445	64.1858	63.9092	63.7151	63.5135	
alpha	5.2059	5.2131	5.2203	5.2542	5.2606	5.2907	5.2907	5.2963	5.2791	5.2606	5.2477	5.2342	
util living area	0.9984	0.9957	0.9881	0.9637	0.8961	0.7480	0.5720	0.6180	0.8479	0.9759	0.9964	0.9989	(86)
MIT	19.7981	19.9666	20.2143	20.5180	20.7804	20.9418	20.9885	20.9829	20.8817	20.5303	20.0988	19.7643	(87)
Th 2	20.0002	20.0018	20.0033	20.0104	20.0118	20.0180	20.0180	20.0192	20.0156	20.0118	20.0091	20.0062	(88)
util rest of house	0.9979	0.9943	0.9838	0.9499	0.8556	0.6604	0.4520	0.4978	0.7782	0.9640	0.9949	0.9985	(89)
MIT 2	18.9024	19.0714	19.3181	19.6197	19.8608	19.9905	20.0150	20.0142	19.9500	19.6367	19.2096	18.8734	(90)
Living area fraction									fLA = Living area / (4) =			0.1783	(91)
MIT	19.0621	19.2310	19.4779	19.7799	20.0248	20.1602	20.1886	20.1869	20.1162	19.7961	19.3682	19.0323	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0621	19.2310	19.4779	19.7799	20.0248	20.1602	20.1886	20.1869	20.1162	19.7961	19.3682	19.0323	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9927	0.9809	0.9459	0.8563	0.6742	0.4736	0.5193	0.7864	0.9606	0.9935	0.9980	(94)
Useful gains	497.6908	591.8165	661.3462	694.3807	651.1142	495.9334	334.8818	350.9189	504.4701	547.0434	493.2858	466.9700	(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	1420.5249	1376.6623	1244.5704	1035.0509	790.7868	524.4670	338.4983	356.7400	569.0240	873.5508	1168.9217	1417.7197	(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	686.5886	527.4164	433.9188	245.2826	103.9164	0.0000	0.0000	0.0000	0.0000	242.9215	486.4578	707.3578	(98)
Space heating												3433.8598	(98)
Space heating per m2											(98) / (4) =	39.2800	(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	886.6624	698.0108	715.9390	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8715	0.9326	0.9164	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	772.7581	650.9887	656.0772	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.5779	922.2483	887.3834	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	133.0702	201.8171	172.0919	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											506.9792	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	33.2676	50.4543	43.0230	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											126.7448	(107)
Space cooling per m2											1.4498	(108)
Energy for space heating											39.2800	(99)
Energy for space cooling											1.4498	(108)
Total											40.7299	(109)
Target Fabric Energy Efficiency (TFEE)											46.8	(109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Woodcroft End-Terrace	**Issued on Date**	23/02/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Woodcroft House Type, EOT, Barratt Developments PLC, 2016 Classic Range		

SAP Rating	85 B	**DER**	15.03	**TER**	15.15
Environmental	87 B	**% DER<TER**	0.81		
CO_2 Emissions (t/year)	1.59	**DFEE**	43.68	**TFEE**	46.64
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.35		

Assessor Details	Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk	**Assessor ID**	T759-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 119 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.15 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.03 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)46.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.49 (max. 2.00)	1.90 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H15

Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: Measured cylinder loss: 0.96 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock: Yes OK

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

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.83 m², No overhang
Windows facing East: 0.66 m², No overhang
Windows facing South: 6.61 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K

ARUN DISTRICT COUNCIL A/45/22/PL

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	48.7700	(1b)	x 2.3600	(2b) =	115.0972	(1b) - (3b)
First floor	37.9000	(1c)	x 2.5500	(2c) =	96.6450	(1c) - (3c)
Second floor	31.9600	(1d)	x 2.6900	(2d) =	85.9724	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	297.7146	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1344	(8)
Pressure test			Yes	
Measured/design AP50			5.0100	
Infiltration rate			0.3849	(18)
Number of sides sheltered			4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2694	(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	0.3435	0.3367	0.3300	0.2963	0.2896	0.2559	0.2559	0.2492	0.2694	0.2896	0.3031	0.3165	(22b)
Effective ac	0.5590	0.5567	0.5545	0.5439	0.5419	0.5328	0.5328	0.5310	0.5363	0.5419	0.5459	0.5501	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			11.1000	1.3347	14.8154			(27)
Opening Type 6			1.9700	1.0000	1.9700			(26)
Opening Type 8 (Uw = 1.90)			4.3600	1.7658	7.6989			(27a)
150mm TE Platinum GF			48.7700	0.1400	6.8278			(28a)
50mm Alreflex Plat	101.0000	12.1000	88.9000	0.2700	24.0030			(29a)
Dormer	3.0400	0.9700	2.0700	0.3000	0.6210			(29a)
iRoofExposed	18.0400		18.0400	0.2200	3.9688			(29a)
Wall to Roof Space	11.9200		11.9200	0.1500	1.7880			(29a)
Ceiling to Roofspace	5.9400		5.9400	0.1500	0.8910			(30)
Dormer Roof	1.3500		1.3500	0.1700	0.2295			(30)
GF Mono Pitch	9.6200	2.1800	7.4400	0.1600	1.1904			(30)
iRoof	15.0300	2.1800	12.8500	0.1600	2.0560			(30)
Uninsulated Ceil	18.4900		18.4900	0.2000	3.6980			(30)
Total net area of external elements Aum(A, m2)			233.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7578			(33)
EWM20/22			57.7100	0.0000	0.0000			(32)
iRoof			8.0800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	150.4400	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6534	(36)
Total fabric heat loss (33) + (36) =	81.4112	(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	54.9185	54.6935	54.4729	53.4367	53.2429	52.3405	52.3405	52.1733	52.6881	53.2429	53.6351	54.0451	(38)
Heat transfer coeff	136.3297	136.1047	135.8841	134.8480	134.6541	133.7517	133.7517	133.5846	134.0993	134.6541	135.0463	135.4563	(39)
Average = Sum(39)m / 12 =												134.8470	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1492	1.1473	1.1454	1.1367	1.1351	1.1275	1.1275	1.1261	1.1304	1.1351	1.1384	1.1418	(40)
HLP (average)												1.1367	(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	2.8579	(42)
Average daily hot water use (litres/day)	102.0742	(43)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	112.2816	108.1987	104.1157	100.0327	95.9498	91.8668	91.8668	95.9498	100.0327	104.1157	108.1987	112.2816	(44)
Energy conte	166.5104	145.6311	150.2782	131.0162	125.7132	108.4809	100.5235	115.3522	116.7299	136.0374	148.4955	161.2565	(45)
Energy content (annual)										Total = Sum(45)m =		1606.0250	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9766	21.8447	22.5417	19.6524	18.8570	16.2721	15.0785	17.3028	17.5095	20.4056	22.2743	24.1885	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.5184	(55)
Total storage loss													
	16.0704	14.5152	16.0704	15.5520	16.0704	15.5520	16.0704	16.0704	15.5520	16.0704	15.5520	16.0704	(56)
If cylinder contains dedicated solar storage													
	16.0704	14.5152	16.0704	15.5520	16.0704	15.5520	16.0704	16.0704	15.5520	16.0704	15.5520	16.0704	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	205.8432	181.1575	189.6110	169.0802	165.0460	146.5449	139.8563	154.6850	154.7939	175.3702	186.5595	200.5893	(62)
WWHRS	-30.3570	-26.7111	-27.2617	-22.4247	-20.8190	-17.1727	-14.5302	-17.5939	-18.1088	-22.3899	-25.9410	-29.3426	eq.(G10)
Total of WWHRS savings												-272.6528	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	175.4862	154.4464	162.3493	146.6555	144.2270	129.3722	125.3261	137.0911	136.6851	152.9803	160.6185	171.2466	(64)
									Total per year (kWh/year) = Sum(64)m =			1796.4843	(64)
Heat gains from water heating, kWh/month													
	86.8310	76.8435	81.4338	74.0141	73.2659	66.5211	64.8903	69.8208	69.2639	76.6987	79.8259	85.0840	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1986	24.1575	19.6462	14.8734	11.1181	9.3863	10.1423	13.1833	17.6946	22.4674	26.2228	27.9545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	283.4188	286.3598	278.9486	263.1709	243.2545	224.5359	212.0307	209.0897	216.5009	232.2786	252.1950	270.9136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	(71)
Water heating gains (Table 5)													
	116.7083	114.3504	109.4540	102.7973	98.4756	92.3904	87.2182	93.8452	96.1998	103.0896	110.8694	114.3602	(72)
Total internal gains													
	496.1936	493.7356	476.9167	449.7097	421.7162	395.1806	378.2591	384.9862	399.2633	426.7035	458.1550	482.0963	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.8300	10.6334	0.7100	0.7000	0.7700	14.0269	(74)
East	0.6600	19.6403	0.7100	0.7000	0.7700	4.4646	(76)
South	6.6100	46.7521	0.7100	0.7000	0.7700	106.4368	(78)
South	4.3600	38.4912	0.7100	0.7000	1.0000	82.0390	(82)

Solar gains	206.9673	361.0645	513.8374	665.2653	767.9140	771.4810	740.0603	662.6754	566.4630	404.6682	249.5196	176.0352	(83)
Total gains	703.1608	854.8001	990.7541	1114.9750	1189.6302	1166.6616	1118.3194	1047.6616	965.7264	831.3717	707.6747	658.1315	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.3634	36.4235	36.4827	36.7630	36.8159	37.0643	37.0643	37.1107	36.9682	36.8159	36.7090	36.5979	
alpha	3.4242	3.4282	3.4322	3.4509	3.4544	3.4710	3.4710	3.4740	3.4645	3.4544	3.4473	3.4399	
util living area													
	0.9876	0.9754	0.9507	0.8958	0.7950	0.6447	0.4978	0.5447	0.7591	0.9256	0.9781	0.9900	(86)
MIT	19.1714	19.4304	19.8103	20.2661	20.6444	20.8793	20.9630	20.9490	20.7768	20.2682	19.6266	19.1194	(87)
Th 2	19.9609	19.9624	19.9639	19.9710	19.9723	19.9785	19.9785	19.9796	19.9761	19.9723	19.9696	19.9668	(88)
util rest of house													
	0.9849	0.9703	0.9402	0.8729	0.7493	0.5667	0.3935	0.4397	0.6916	0.9044	0.9727	0.9879	(89)
MIT 2	17.5192	17.8952	18.4423	19.0884	19.5943	19.8794	19.9584	19.9497	19.7717	19.1056	18.1878	17.4473	(90)
Living area fraction									fLA = Living area / (4) =			0.2516	(91)
MIT	17.9350	18.2815	18.7865	19.3848	19.8585	20.1310	20.2112	20.2011	20.0246	19.3981	18.5499	17.8681	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.7850	18.1315	18.6365	19.2348	19.7085	19.9810	20.0612	20.0511	19.8746	19.2481	18.3999	17.7181	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9767	0.9576	0.9224	0.8529	0.7360	0.5669	0.4024	0.4475	0.6839	0.8851	0.9608	0.9808	(94)
Useful gains	686.7661	818.5599	913.9109	950.9660	875.5883	661.4320	449.9816	468.8121	660.4863	735.8152	679.9250	645.5173	(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)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Heat loss rate W													
	1838.4013	1800.8721	1649.1632	1393.6201	1078.3839	719.7173	462.9360	487.7365	774.3737	1164.5045	1526.0060	1831.1055	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	856.8167	660.1138	547.0277	318.7110	150.8799	0.0000	0.0000	0.0000	0.0000	318.9448	609.1784	882.0776	(98)
Space heating												4343.7499	(98)
Space heating per m2											(98) / (4) =	36.6159	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4805.0330	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	856.8167	660.1138	547.0277	318.7110	150.8799	0.0000	0.0000	0.0000	0.0000	318.9448	609.1784	882.0776	(98)
Space heating efficiency (main heating system 1)													
	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)													
	947.8060	730.2144	605.1192	352.5564	166.9025	0.0000	0.0000	0.0000	0.0000	352.8151	673.8699	975.7495	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	175.4862	154.4464	162.3493	146.6555	144.2270	129.3722	125.3261	137.0911	136.6851	152.9803	160.6185	171.2466	(64)
Efficiency of water heater												79.7000	(216)
(217)m	88.3829	88.1560	87.7052	86.7306	84.8338	79.7000	79.7000	79.7000	79.7000	86.6299	87.9367	88.4690	(217)
Fuel for water heating, kWh/month													
	198.5522	175.1968	185.1080	169.0932	170.0113	162.3240	157.2473	172.0089	171.4994	176.5907	182.6524	193.5668	(219)
Water heating fuel used												2113.8509	(219)
Annual totals kWh/year													
Space heating fuel - main system												4805.0330	(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)												480.3350	(232)
Total delivered energy for all uses												7474.2190	(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	4805.0330	0.2160	1037.8871	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2113.8509	0.2160	456.5918	(264)
Space and water heating			1494.4789	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.3350	0.5190	249.2939	(268)
Total CO2, kg/year			1782.6978	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.0300	(273)

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

DER		15.0300	ZC1
Total Floor Area	TFA	118.6300	
Assumed number of occupants	N	2.8579	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.1573	ZC2
CO2 emissions from cooking, equation (L16)		1.5813	ZC3
Total CO2 emissions		30.7686	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.7686	ZC8

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	48.7700 (1b)	x	2.3600 (2b)	=	115.0972	(1b) - (3b)
First floor	37.9000 (1c)	x	2.5500 (2c)	=	96.6450	(1c) - (3c)
Second floor	31.9600 (1d)	x	2.6900 (2d)	=	85.9724	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	297.7146	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1344	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3844	(18)
Number of sides sheltered			4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2690	(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	0.3430	0.3363	0.3296	0.2960	0.2892	0.2556	0.2556	0.2489	0.2690	0.2892	0.3027	0.3161	(22b)
Effective ac	0.5588	0.5566	0.5543	0.5438	0.5418	0.5327	0.5327	0.5310	0.5362	0.5418	0.5458	0.5500	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			11.1000	1.3258	14.7159			(27)
TER Room Window (Uw = 1.70)			4.3600	1.5918	6.9401			(27a)
150mm TE Platinum GF			48.7700	0.1300	6.3401			(28a)
50mm Alreflex Plat	101.0000	12.1000	88.9000	0.1800	16.0020			(29a)
Dormer	3.0400	0.9700	2.0700	0.1800	0.3726			(29a)
iRoofExposed	18.0400		18.0400	0.1800	3.2472			(29a)
Wall to Roof Space	11.9200		11.9200	0.1800	2.1456			(29a)
Ceiling to Roofspace	5.9400		5.9400	0.1300	0.7722			(30)
Dormer Roof	1.3500		1.3500	0.1300	0.1755			(30)
GF Mono Pitch	9.6200	2.1800	7.4400	0.1300	0.9672			(30)
iRoof	15.0300	2.1800	12.8500	0.1300	1.6705			(30)
Uninsulated Ceil	18.4900		18.4900	0.1300	2.4037			(30)
Total net area of external elements Aum(A, m2)			233.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.7226			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0251	(36)
Total fabric heat loss					(33) + (36) =		70.7477	(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	54.9035	54.6790	54.4590	53.4255	53.2322	52.3321	52.3321	52.1654	52.6788	53.2322	53.6233	54.0323	(38)
Heat transfer coeff	125.6512	125.4267	125.2067	124.1732	123.9799	123.0798	123.0798	122.9131	123.4265	123.9799	124.3710	124.7800	(39)
Average = Sum(39)m / 12 =												124.1723	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0592	1.0573	1.0554	1.0467	1.0451	1.0375	1.0375	1.0361	1.0404	1.0451	1.0484	1.0518	(40)
HLP (average)												1.0467	(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	2.8579	(42)
Average daily hot water use (litres/day)	102.0742	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	112.2816	108.1987	104.1157	100.0327	95.9498	91.8668	91.8668	95.9498	100.0327	104.1157	108.1987	112.2816	(44)
Energy conte	166.5104	145.6311	150.2782	131.0162	125.7132	108.4809	100.5235	115.3522	116.7299	136.0374	148.4955	161.2565	(45)
Energy content (annual)										Total = Sum(45)m =		1606.0250	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9766	21.8447	22.5417	19.6524	18.8570	16.2721	15.0785	17.3028	17.5095	20.4056	22.2743	24.1885	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	213.1053	187.7168	196.8731	176.1081	172.3081	153.5728	147.1184	161.9471	161.8217	182.6323	193.5873	207.8514	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	213.1053	187.7168	196.8731	176.1081	172.3081	153.5728	147.1184	161.9471	161.8217	182.6323	193.5873	207.8514	(64)
								Total per year (kWh/year) = Sum(64)m =				2154.6424	(64)
Heat gains from water heating, kWh/month													
	92.6406	82.0909	87.2434	79.6364	79.0756	72.1434	70.7000	75.6305	74.8862	82.5084	85.4482	90.8937	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1986	24.1575	19.6462	14.8734	11.1181	9.3863	10.1423	13.1833	17.6946	22.4674	26.2228	27.9545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	283.4188	286.3598	278.9486	263.1709	243.2545	224.5359	212.0307	209.0897	216.5009	232.2786	252.1950	270.9136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	(71)
Water heating gains (Table 5)													
	124.5170	122.1591	117.2627	110.6061	106.2843	100.1991	95.0269	101.6539	104.0085	110.8983	118.6781	122.1689	(72)
Total internal gains													
	504.0023	501.5443	484.7254	457.5184	429.5249	402.9893	386.0678	392.7949	407.0720	434.5122	465.9637	489.9050	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.8300	10.6334	0.6300	0.7000	0.7700	12.4464	(74)
East	0.6600	19.6403	0.6300	0.7000	0.7700	3.9615	(76)
South	6.6100	46.7521	0.6300	0.7000	0.7700	94.4439	(78)
South	4.3600	38.4912	0.6300	0.7000	1.0000	72.7952	(82)

Solar gains	183.6470	320.3812	455.9402	590.3059	681.3885	684.5536	656.6733	588.0078	502.6362	359.0718	221.4047	156.2003	(83)
Total gains	687.6493	821.9255	940.6656	1047.8242	1110.9133	1087.5429	1042.7411	980.8027	909.7083	793.5840	687.3685	646.1052	(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	65.5640	65.6814	65.7968	66.3444	66.4478	66.9338	66.9338	67.0245	66.7458	66.4478	66.2389	66.0218	
alpha	5.3709	5.3788	5.3865	5.4230	5.4299	5.4623	5.4623	5.4683	5.4497	5.4299	5.4159	5.4015	
util living area													
	0.9983	0.9953	0.9858	0.9524	0.8597	0.6851	0.5123	0.5641	0.8158	0.9712	0.9959	0.9988	(86)
MIT	19.8635	20.0326	20.2845	20.5929	20.8403	20.9656	20.9940	20.9902	20.9115	20.5814	20.1577	19.8304	(87)
Th 2	20.0343	20.0359	20.0374	20.0446	20.0459	20.0522	20.0522	20.0534	20.0498	20.0459	20.0432	20.0404	(88)
util rest of house													
	0.9978	0.9937	0.9809	0.9355	0.8130	0.5993	0.4057	0.4543	0.7425	0.9576	0.9943	0.9984	(89)
MIT 2	18.5123	18.7601	19.1262	19.5676	19.8904	20.0294	20.0500	20.0493	19.9801	19.5598	18.9488	18.4684	(90)
Living area fraction									fLA = Living area / (4) =			0.2516	(91)
MIT	18.8523	19.0803	19.4177	19.8256	20.1294	20.2650	20.2875	20.2861	20.2145	19.8169	19.2530	18.8111	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8523	19.0803	19.4177	19.8256	20.1294	20.2650	20.2875	20.2861	20.2145	19.8169	19.2530	18.8111	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9915	0.9767	0.9307	0.8176	0.6196	0.4326	0.4821	0.7567	0.9533	0.9923	0.9976	(94)
Useful gains	685.3994	814.9190	918.7359	975.2370	908.2423	673.8524	451.1211	472.8092	688.3436	756.5456	682.0823	644.5658	(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													
	1828.5082	1778.5835	1617.3804	1356.6627	1045.0755	697.2442	453.8596	477.6473	754.6910	1142.7074	1511.4854	1823.1700	(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													

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	850.4729	647.5825	519.7915	274.6265	101.8039	0.0000	0.0000	0.0000	0.0000	287.3044	597.1703	876.8815 (98)
Space heating												4155.6336 (98)
Space heating per m2											(98) / (4) =	35.0302 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.5000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4444.5279 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	850.4729	647.5825	519.7915	274.6265	101.8039	0.0000	0.0000	0.0000	0.0000	287.3044	597.1703	876.8815	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	909.5967	692.6017	555.9268	293.7182	108.8811	0.0000	0.0000	0.0000	0.0000	307.2774	638.6848	937.8412	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	213.1053	187.7168	196.8731	176.1081	172.3081	153.5728	147.1184	161.9471	161.8217	182.6323	193.5873	207.8514	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.1322	87.8527	87.2849	85.9948	83.4650	79.8000	79.8000	79.8000	79.8000	86.0176	87.6237	88.2330	(217)
Fuel for water heating, kWh/month													
	241.8018	213.6721	225.5523	204.7891	206.4435	192.4471	184.3589	202.9412	202.7841	212.3196	220.9303	235.5709	(219)
Water heating fuel used												2543.6110	(219)
Annual totals kWh/year													
Space heating fuel - main system												4444.5279	(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)												480.3350	(232)
Total delivered energy for all uses												7543.4739	(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	4444.5279	0.2160	960.0180	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2543.6110	0.2160	549.4200	(264)
Space and water heating			1509.4380	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.3350	0.5190	249.2939	(268)
Total CO2, kg/m2/year			1797.6569	(272)
Emissions per m2 for space and water heating			12.7239	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1014	(272b)
Emissions per m2 for pumps and fans			0.3281	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.7239 * 1.00) + 2.1014 + 0.3281, rounded to 2 d.p.			15.1500	(273)

ARUN DISTRICT COUNCIL A/45/22/PL

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.7700	(1b)	x 2.3600	(2b) =	115.0972	(1b) - (3b)
First floor	37.9000	(1c)	x 2.5500	(2c) =	96.6450	(1c) - (3c)
Second floor	31.9600	(1d)	x 2.6900	(2d) =	85.9724	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		297.7146	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1344	(8)
Pressure test			Yes	
Measured/design AP50			5.0100	
Infiltration rate			0.3849	(18)
Number of sides sheltered			4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2694	(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	0.3435	0.3367	0.3300	0.2963	0.2896	0.2559	0.2559	0.2492	0.2694	0.2896	0.3031	0.3165	(22b)
Effective ac	0.5590	0.5567	0.5545	0.5439	0.5419	0.5328	0.5328	0.5310	0.5363	0.5419	0.5459	0.5501	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.41)			11.1000	1.3347	14.8154			(27)
Opening Type 6			1.9700	1.0000	1.9700			(26)
Opening Type 8 (Uw = 1.90)			4.3600	1.7658	7.6989			(27a)
150mm TE Platinum GF			48.7700	0.1400	6.8278			(28a)
50mm Alreflex Plat	101.0000	12.1000	88.9000	0.2700	24.0030			(29a)
Dormer	3.0400	0.9700	2.0700	0.3000	0.6210			(29a)
iRoofExposed	18.0400		18.0400	0.2200	3.9688			(29a)
Wall to Roof Space	11.9200		11.9200	0.1500	1.7880			(29a)
Ceiling to Roofspace	5.9400		5.9400	0.1500	0.8910			(30)
Dormer Roof	1.3500		1.3500	0.1700	0.2295			(30)
GF Mono Pitch	9.6200	2.1800	7.4400	0.1600	1.1904			(30)
iRoof	15.0300	2.1800	12.8500	0.1600	2.0560			(30)
Uninsulated Ceil	18.4900		18.4900	0.2000	3.6980			(30)
Total net area of external elements Aum(A, m2)			233.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7578			(33)
EWM20/22			57.7100	0.0000	0.0000			(32)
iRoof			8.0800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	150.4400	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6534	(36)
Total fabric heat loss (33) + (36) =	81.4112	(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	54.9185	54.6935	54.4729	53.4367	53.2429	52.3405	52.3405	52.1733	52.6881	53.2429	53.6351	54.0451	(38)
Heat transfer coeff	136.3297	136.1047	135.8841	134.8480	134.6541	133.7517	133.7517	133.5846	134.0993	134.6541	135.0463	135.4563	(39)
Average = Sum(39)m / 12 =												134.8470	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1492	1.1473	1.1454	1.1367	1.1351	1.1275	1.1275	1.1261	1.1304	1.1351	1.1384	1.1418	(40)
HLP (average)												1.1367	(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	2.8579	(42)
Average daily hot water use (litres/day)	102.0742	(43)

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	112.2816	108.1987	104.1157	100.0327	95.9498	91.8668	91.8668	95.9498	100.0327	104.1157	108.1987	112.2816	(44)
Energy conte	166.5104	145.6311	150.2782	131.0162	125.7132	108.4809	100.5235	115.3522	116.7299	136.0374	148.4955	161.2565	(45)
Energy content (annual)										Total = Sum(45)m =		1606.0250	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.3835	30.9466	31.9341	27.8409	26.7141	23.0522	21.3612	24.5123	24.8051	28.9080	31.5553	34.2670	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1986	24.1575	19.6462	14.8734	11.1181	9.3863	10.1423	13.1833	17.6946	22.4674	26.2228	27.9545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	283.4188	286.3598	278.9486	263.1709	243.2545	224.5359	212.0307	209.0897	216.5009	232.2786	252.1950	270.9136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	(71)
Water heating gains (Table 5)													
	47.5584	46.0515	42.9222	38.6680	35.9060	32.0169	28.7114	32.9467	34.4515	38.8548	43.8268	46.0578	(72)
Total internal gains													
	424.0437	422.4367	407.3849	382.5803	356.1465	331.8071	316.7523	321.0877	334.5150	359.4687	388.1125	410.7938	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.8300	10.6334	0.7100	0.7000	0.7700	14.0269	(74)
East	0.6600	19.6403	0.7100	0.7000	0.7700	4.4646	(76)
South	6.6100	46.7521	0.7100	0.7000	0.7700	106.4368	(78)
South	4.3600	38.4912	0.7100	0.7000	1.0000	82.0390	(82)

Solar gains	206.9673	361.0645	513.8374	665.2653	767.9140	771.4810	740.0603	662.6754	566.4630	404.6682	249.5196	176.0352	(83)
Total gains	631.0110	783.5012	921.2223	1047.8456	1124.0605	1103.2881	1056.8126	983.7631	900.9781	764.1368	637.6321	586.8290	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.3634	36.4235	36.4827	36.7630	36.8159	37.0643	37.0643	37.1107	36.9682	36.8159	36.7090	36.5979	
alpha	3.4242	3.4282	3.4322	3.4509	3.4544	3.4710	3.4710	3.4740	3.4645	3.4544	3.4473	3.4399	
util living area													
	0.9910	0.9809	0.9594	0.9098	0.8154	0.6696	0.5220	0.5726	0.7862	0.9399	0.9839	0.9930	(86)
MIT	19.0916	19.3549	19.7431	20.2135	20.6106	20.8638	20.9571	20.9405	20.7481	20.2086	19.5515	19.0397	(87)
Th 2	19.9609	19.9624	19.9639	19.9710	19.9723	19.9785	19.9785	19.9796	19.9761	19.9723	19.9696	19.9668	(88)
util rest of house													
	0.9891	0.9768	0.9505	0.8892	0.7720	0.5917	0.4145	0.4649	0.7214	0.9219	0.9798	0.9914	(89)
MIT 2	18.2147	18.4769	18.8604	19.3203	19.6867	19.9011	19.9623	19.9553	19.8158	19.3255	18.6794	18.1675	(90)
Living area fraction									fLA = Living area / (4) =			0.2516	(91)
MIT	18.4354	18.6979	19.0825	19.5450	19.9192	20.1433	20.2127	20.2032	20.0504	19.5477	18.8988	18.3869	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4354	18.6979	19.0825	19.5450	19.9192	20.1433	20.2127	20.2032	20.0504	19.5477	18.8988	18.3869	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9703	0.9410	0.8791	0.7694	0.6053	0.4403	0.4899	0.7268	0.9126	0.9740	0.9882	(94)
Useful gains	621.6653	760.2104	866.8436	921.1282	864.9043	667.7678	465.3181	481.9551	654.7943	697.3790	621.0782	579.9047	(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													
	1927.0720	1877.9524	1709.7640	1435.4625	1106.7481	741.4279	483.1994	508.0502	797.9449	1204.8496	1593.3850	1921.7103	(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													
	971.2226	751.1226	627.1328	370.3207	179.9318	0.0000	0.0000	0.0000	0.0000	377.5581	700.0609	998.3034	(98)
Space heating												4975.6528	(98)
Space heating per m2											(98) / (4) =	41.9426	(99)

8c. Space cooling requirement

ARUN DISTRICT COUNCIL A/45/22/PL

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1257.2659	989.7625	1015.2427	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8001	0.8652	0.8392	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1005.9660	856.3680	851.9502	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1339.0017	1285.1307	1209.9630	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	239.7857	318.9994	266.3615	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												825.1467	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	59.9464	79.7499	66.5904	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												206.2867	(107)
Space cooling per m2												1.7389	(108)
Energy for space heating												41.9426	(99)
Energy for space cooling												1.7389	(108)
Total												43.6815	(109)
Dwelling Fabric Energy Efficiency (DFEE)												43.7	(109)

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	48.7700 (1b)	x	2.3600 (2b)	=	115.0972	(1b) - (3b)
First floor	37.9000 (1c)	x	2.5500 (2c)	=	96.6450	(1c) - (3c)
Second floor	31.9600 (1d)	x	2.6900 (2d)	=	85.9724	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	297.7146	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1344	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3844	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2690	(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	0.3430	0.3363	0.3296	0.2960	0.2892	0.2556	0.2556	0.2489	0.2690	0.2892	0.3027	0.3161	(22b)
Effective ac	0.5588	0.5566	0.5543	0.5438	0.5418	0.5327	0.5327	0.5310	0.5362	0.5418	0.5458	0.5500	(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			1.9700	1.0000	1.9700			(26)
TER Opening Type (Uw = 1.40)			11.1000	1.3258	14.7159			(27)
TER Room Window (Uw = 1.70)			4.3600	1.5918	6.9401			(27a)
150mm TE Platinum GF			48.7700	0.1300	6.3401			(28a)
50mm Alreflex Plat	101.0000	12.1000	88.9000	0.1800	16.0020			(29a)
Dormer	3.0400	0.9700	2.0700	0.1800	0.3726			(29a)
iRoofExposed	18.0400		18.0400	0.1800	3.2472			(29a)
Wall to Roof Space	11.9200		11.9200	0.1800	2.1456			(29a)
Ceiling to Roofspace	5.9400		5.9400	0.1300	0.7722			(30)
Dormer Roof	1.3500		1.3500	0.1300	0.1755			(30)
GF Mono Pitch	9.6200	2.1800	7.4400	0.1300	0.9672			(30)
iRoof	15.0300	2.1800	12.8500	0.1300	1.6705			(30)
Uninsulated Ceil	18.4900		18.4900	0.1300	2.4037			(30)
Total net area of external elements Aum(A, m2)			233.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.7226			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0251	(36)
Total fabric heat loss					(33) + (36) =		70.7477	(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	54.9035	54.6790	54.4590	53.4255	53.2322	52.3321	52.3321	52.1654	52.6788	53.2322	53.6233	54.0323	(38)
Heat transfer coeff	125.6512	125.4267	125.2067	124.1732	123.9799	123.0798	123.0798	122.9131	123.4265	123.9799	124.3710	124.7800	(39)
Average = Sum(39)m / 12 =												124.1723	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0592	1.0573	1.0554	1.0467	1.0451	1.0375	1.0375	1.0361	1.0404	1.0451	1.0484	1.0518	(40)
HLP (average)												1.0467	(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	2.8579	(42)
Average daily hot water use (litres/day)	102.0742	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	112.2816	108.1987	104.1157	100.0327	95.9498	91.8668	91.8668	95.9498	100.0327	104.1157	108.1987	112.2816	(44)
Energy conte	166.5104	145.6311	150.2782	131.0162	125.7132	108.4809	100.5235	115.3522	116.7299	136.0374	148.4955	161.2565	(45)
Energy content (annual)										Total = Sum(45)m =		1606.0250	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.3835	30.9466	31.9341	27.8409	26.7141	23.0522	21.3612	24.5123	24.8051	28.9080	31.5553	34.2670	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	142.8931	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1986	24.1575	19.6462	14.8734	11.1181	9.3863	10.1423	13.1833	17.6946	22.4674	26.2228	27.9545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	283.4188	286.3598	278.9486	263.1709	243.2545	224.5359	212.0307	209.0897	216.5009	232.2786	252.1950	270.9136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	37.2893	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	-114.3145	(71)
Water heating gains (Table 5)													
	47.5584	46.0515	42.9222	38.6680	35.9060	32.0169	28.7114	32.9467	34.4515	38.8548	43.8268	46.0578	(72)
Total internal gains													
	424.0437	422.4367	407.3849	382.5803	356.1465	331.8071	316.7523	321.0877	334.5150	359.4687	388.1125	410.7938	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.8300	10.6334	0.6300	0.7000	0.7700	12.4464	(74)
East	0.6600	19.6403	0.6300	0.7000	0.7700	3.9615	(76)
South	6.6100	46.7521	0.6300	0.7000	0.7700	94.4439	(78)
South	4.3600	38.4912	0.6300	0.7000	1.0000	72.7952	(82)

Solar gains	183.6470	320.3812	455.9402	590.3059	681.3885	684.5536	656.6733	588.0078	502.6362	359.0718	221.4047	156.2003	(83)
Total gains	607.6907	742.8179	863.3251	972.8862	1037.5350	1016.3607	973.4255	909.0955	837.1512	718.5404	609.5172	566.9941	(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	65.5640	65.6814	65.7968	66.3444	66.4478	66.9338	66.9338	67.0245	66.7458	66.4478	66.2389	66.0218	
alpha	5.3709	5.3788	5.3865	5.4230	5.4299	5.4623	5.4623	5.4683	5.4497	5.4299	5.4159	5.4015	
util living area													
	0.9991	0.9971	0.9903	0.9644	0.8854	0.7214	0.5461	0.6036	0.8521	0.9811	0.9977	0.9994	(86)
MIT	19.7996	19.9703	20.2263	20.5448	20.8108	20.9559	20.9919	20.9865	20.8883	20.5283	20.0961	19.7670	(87)
Th 2	20.0343	20.0359	20.0374	20.0446	20.0459	20.0522	20.0522	20.0534	20.0498	20.0459	20.0432	20.0404	(88)
util rest of house													
	0.9988	0.9961	0.9869	0.9510	0.8433	0.6353	0.4338	0.4886	0.7847	0.9715	0.9968	0.9992	(89)
MIT 2	18.9314	19.1029	19.3583	19.6745	19.9170	20.0317	20.0501	20.0494	19.9872	19.6642	19.2348	18.9037	(90)
Living area fraction										fLA = Living area / (4) =		0.2516	(91)
MIT	19.1499	19.3212	19.5767	19.8935	20.1419	20.2643	20.2871	20.2852	20.2140	19.8816	19.4515	19.1210	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1499	19.3212	19.5767	19.8935	20.1419	20.2643	20.2871	20.2852	20.2140	19.8816	19.4515	19.1210	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9951	0.9847	0.9484	0.8481	0.6558	0.4623	0.5178	0.7980	0.9694	0.9960	0.9989	(94)
Useful gains	606.6996	739.1552	850.1138	922.6473	879.9699	666.5465	450.0290	470.7316	668.0306	696.5529	607.0490	566.3529	(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													
	1865.9010	1808.8002	1637.2924	1365.0948	1046.6257	697.1556	453.8049	477.5444	754.6254	1150.7299	1536.1729	1861.8356	(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													
	936.8459	718.8014	585.6609	318.5622	123.9919	0.0000	0.0000	0.0000	0.0000	337.9077	668.9692	963.8391	(98)
Space heating												4654.5783	(98)
Space heating per m2											(98) / (4) =	39.2361	(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

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1156.9500	910.7905	934.1396	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8744	0.9347	0.9133	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1011.6717	851.3294	853.1106	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1244.7788	1194.7152	1128.8563	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	167.8371	255.4790	205.1548	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												628.4708	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	41.9593	63.8697	51.2887	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												157.1177	(107)
Space cooling per m2												1.3244	(108)
Energy for space heating												39.2361	(99)
Energy for space cooling												1.3244	(108)
Total												40.5605	(109)
Target Fabric Energy Efficiency (TFEE)												46.6	(109)