

Building Regulation Compliance

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Property Reference: 504 Linton House

Issued on Date: 01.Nov.2016

Survey Reference: 504 design

Prop Type Ref:
Property: 504, London

SAP Rating: 83 B **CO2 Emissions (t/year):** 1.95 **DER:** 16.00 Pass **TER:** 22.94 **Percentage DER<TER:** 30.24 %
Environmental: 85 B **General Requirements Compliance:** Pass **DFEE:** 47.39 Pass **TFEE:** 56.34 **Percentage DFEE<TFEE:** 15.89 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 3.8 **ENE2 Credits:** 3.2 **ENE7 Credits:** 0 **CfSH Level:** 4

Surveyor: Mike Ovenden, Tel: 01908 850109 **Surveyor ID:** H824-0001
Address: Dudley Hill, Shenley Church End, Milton Keynes, Buckinghamshire, MK5 6LL
Client: Synergy, 3

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.06r08
SAP version: SAP 2012, **Regs Region:** England (Part L1A 2013), **Calculation Type:** New Build (As Designed)

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

1a TER and DER

Fuel for main heating:	Electricity	
Fuel factor:	1.55 (electricity)	
Target Carbon Dioxide Emission Rate (TER)	22.94 kg/m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.00 kg/m ²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.34 kWh/m ²	
Dwelling Fabric Energy Efficiency (DFEE)	47.39 kWh/m ²	OK

2 Fabric U-values

Element	Average	Highest	
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings and curtain wall	0.58 (max. 2.00)	0.58 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Heat pump with radiators or underfloor - Electric
	Air-to-water heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 1.82 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

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.61

Maximum	1.5	OK
MVHR efficiency:	78%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK
Based On:		
Overshading:	Average	
Windows facing East:	44.23 m ² , No overhang	
Air change rate:	8.00 ach	
Blinds/curtains:	None	

10 Key features

Party wall U-value	0.00 W/m ² K
Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Roof U-value	0.10 W/m ² K
Window U-value	0.58 W/m ² K
Thermal bridging y-value	0.028 W/m ² K
Photovoltaic array	

Full SAP Calculation Printout

Property Reference: 504 Linton House
Survey Reference: 504 design

Issued on Date: 01.Nov.2016
Prop Type Ref:

Property: 504, London

SAP Rating: 83 B CO2 Emissions (t/year): 1.95 DER: 16.00 Pass TER: 22.94 Percentage DER<TER: 30.24 %
Environmental: 85 B General Requirements Compliance: Pass DFEE: 47.39 Pass TFE: 56.34 Percentage DFEE<TFEE: 15.89 %

CfSH Results Version: November 2010 - June 2014 Addendum ENE1 Credits: 3.8 ENE2 Credits: 3.2 ENE7 Credits: 0 CfSH Level: 4
Surveyor: Mike Ovenden, Tel: 01908 850109 Surveyor ID: H824-0001
Address: Dudley Hill, Shenley Church End, Milton Keynes, Buckinghamshire, MK5 6LL
Client: Synergy, 3

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.06r08
SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

CALCULATION DETAILS for survey reference no '504 design'
SAP2012 - 9.92 input data (DesignData) -

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SAP2012 Input Data (Flat) 01/11/2016

FullRefNo: 504 design

Regs Region: England
SAP Region: Thames Valley
Postcode:
DwellingOrientation: West
Property Type: Flat, End-Terrace
Storeys: 2
Date Built: 2016
Sheltered Sides: 2
Sunlight Shade: Average or unknown
Measurements: Perimeter, Floor Area, Storey Height
1st Storey: 23.45, 112.36, 2.6
2nd Storey: 19.94, 41.34, 2.85
Living Area: 45.35 m2, fraction: 29.5%
Thermal Mass: Simple calculation
Thermal Mass Simple: Low
Thermal MassValue: 100
External Walls: Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1: 48.76, 89.37, 0, Other, CurtainWalling, 0, 0.58, Calculate
External Wall 2: 24.81, 28.43, 0, Other, CurtainWalling, 0, 0.58, Gross
Party Walls: Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall 1: 93.43, 20, PartyWallSteelFrame, Solid, 0, 0
Party Wall 2: 39.81, 20, PartyWallSteelFrame, Solid, 0, 0
External Roofs: Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
penthouse roof: 71.02, 71.02, 0, Other, 0.1
garden room roof: 41.34, 41.34, 0, Other, 0.1
Heat Loss Floors: Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
penthouse floor: 112.36, 0, Other, Ground Floor - Solid, 0, 0.15
Description: Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
Opening Type 1: Manufacturer, Window, Double Low-E Soft 0.05, , , 0.36, , 1,
Openings: Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
1: Window, External Wall 1, East, , None, 0, , 0, 0, 0, 4.16,
2: Window, External Wall 1, East, , None, 0, , 0, 0, 0, 7.29,
3: Window, External Wall 1, East, , None, 0, , 0, 0, 0, 7.29,
4: Window, External Wall 1, East, , None, 0, , 0, 0, 0, 7.29,
5: Window, External Wall 1, East, , None, 0, , 0, 0, 0, 7.29,
6: Window, External Wall 1, East, , None, 0, , 0, 0, 0, 7.29,
1gh: Window, External Wall 2, East, , None, 0, , 0, 0, 0, 3.62,
Conservatory: None
Draught Proofing: 100
Draught Lobby: No
Thermal Bridges: Calculate Bridges
Bridging: 0.028
List of Bridges
0: Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
1: External wall, E1 Steel lintel with perforated steel base plate, , No, 0, 0, 0, 0.00,
2: External wall, E2 Other lintels (including other steel lintels), , No, 0, 0, 0, 0.00,
3: External wall, E3 Sill, , No, 0, 0, 0, 0.00,
4: External wall, E4 Jamb, , No, 0, 0, 0, 0.00,
5: External wall, E5 Ground floor (normal), Table K1 - Approved, No, 19.94, 0.16, 0.16, 3.19,
6: External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
7: External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
8: External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
9: External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
10: External wall, E6 Intermediate floor within a dwelling, Table K1 - Approved, Yes, 19.94, 0.07, 0.07, 1.40,
11: External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, Yes, 23.45, 0.07, 0.07, 1.64,
12: External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
13: External wall, E9 Balcony between dwellings, wall insulation continuous, , No, 0, 0, 0, 0.00,
14: External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation, , No, 0, 0, 0, 0.00,
15: External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
16: External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
17: External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
18: External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
19: External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
20: External wall, E14 Flat roof, Table K1 - Default, Yes, 19.94, 0.08, 0.08, 1.60,
21: External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
22: External wall, E16 Corner (normal), Table K1 - Approved, Yes, 10.9, 0.09, 0.09, 0.98,
23: External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
24: External wall, E18 Party wall between dwellings, Table K1 - Approved, Yes, 10.9, 0.06, 0.06, 0.65,
25: External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
26: Party wall, P1 Party wall - Ground floor, , No, 0, 0, 0, 0.00,
27: Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
28: Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
29: Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), , No, 0, 0, 0, 0.00,
30: Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,

31. Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
32. Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
33. External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
34. External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
35. External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
36. External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
37. External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
38. External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
39. External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
40. External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
41. External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test: True
Designed q50: 5
AsBuilt q50: 15
Property Tested: False
Mechanical Ventilation
MV System Present Yes
Windows In Hot Weather Windows fully open
Cross Ventilation Yes
Night Ventilation No
Air Change Rate 8.00
Approved Installation Yes
DataType Database
Type Balanced mechanical ventilation with heat recovery
Database Ref Number 500320
Configuration 2
HR Duct Insulated No
ManufacturersSFP 0.61
DuctType Rigid
HR Efficiency 78
Wet Rooms 2
Chimneys MHS: 0
Chimneys SHS: 0
Chimneys Other: 0
Chimneys Total: 0
Open Flues MHS: 0
Open Flues SHS: 0
Open Flues Other: 0
Open Flues Total: 0
Intermittent Fans: 0
Passive Vents: 0
Flueless Gas Fires: 0
Cooling System
Cooled Area 153.70
Data Source SAP table
Type Split or Multi-Split
Class A
Control On/Off
Light Fittings: 52
LEL Fittings: 52
Percentage of LEL Fittings: 100
External Lights Fitted: Yes
External LELs Fitted: Yes
Electricity Tariff: Standard
Main Heating 1
Description ashp
Percentage 100
MHS Electricity PET Heat pump air-to-water
SAP Code 224
Boiler Efficiency Type SAP Table
Efficiency 170
Controls by PCDF 0
MHS Controls CHD Time and temperature zone control
Boiler Interlock No
Ctrl SAP Code 2207
MCS Installation CertificateNo
Pumped Pump in heated space
Heat Pump Age 2013 or later
Heat Emitter Radiators and Underfloor
Flow Temperature <= 35°C
Under Floor Heating Yes - Pipes in thin screed
Main Heating 2 None
Heating Systems Interaction Each system heats separate parts of dwelling
Smoke Control Area Unknown
Community Heating None
Secondary Heating None
Water Heating
Type MainHeating1
WHS HWP From main heating 1
Low Water Usage Yes
SAP Code 901
Showers in Property Non-electric only
Supplementary Immersion No
Hot Water Cylinder
Cylinder Type HotWaterCylinder
Cylinder Insulation Type Foam
Cylinder Volume 180.00
Cylinder Stat Yes
Pipeworks Insulated Fully insulated primary pipework
Cylinder in Heated Space Yes
Separate Time Control Yes
Flue Gas Heat Recovery System None
Waste Water Heat Recovery none
PV Unit
Type One Dwelling
PVUnit 1 Cells Peak = 1.31, Orientation = South, Elevation = 30°, Overshading = None Or Little, , Connected to Dwelling = Yes
Wind Turbine None
Terrain Type: Urban
Small Scale Hydro None
Special Features None

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 154 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:Electricity
 Fuel factor:1.55 (electricity)
 Target Carbon Dioxide Emission Rate (TER) 22.94 kg/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 16.00 kg/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.3 kWh/m²
 Dwelling Fabric Energy Efficiency (DFEE)47.4 kWh/m²OK

2 Fabric U-values

Element	Average	Highest	
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings and curtain wall	0.58 (max. 2.00)	0.58 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Heat pump with radiators or underfloor - Electric
Air-to-water heat pump	

Secondary heating system:	None
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5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 1.82 kWh/day	
Permitted by DBSCG 2.10	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.61
Maximum	1.5 OK
MVHR efficiency:	78%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK
Based on:		
Overshading:	Average	
Windows facing East:	44.23 m ² , No overhang	
Air change rate:	8.00 ach	
Blinds/curtains:	None	

10 Key features

Party wall U-value	0.00 W/m ² K
Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Roof U-value	0.10 W/m ² K
Window U-value	0.58 W/m ² K
Thermal bridging y-value	0.028 W/m ² K
Photovoltaic array	

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.3600 (1b)	x 2.6000 (2b)	= 292.1360 (1b) - (3b)
First floor	41.3400 (1c)	x 2.8500 (2c)	= 117.8190 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	409.9550 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)							
Pressure test					Yes							
Measured/design q50					5.0000							
Infiltration rate					0.2500 (18)							
Number of sides sheltered					2 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2125 (21)							
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec.
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												54.6000 (23c)
Effective ac	0.4979	0.4926	0.4873	0.4608	0.4554	0.4289	0.4289	0.4236	0.4395	0.4554	0.4661	0.4767 (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 = 0.58)			44.2300	0.5668	25.0717		(27)					
penthouse floor			112.3600	0.1500	16.8540		(28a)					
External Wall 1	89.3700	40.6100	48.7600	0.5800	28.2808		(29a)					
External Wall 2	28.4300	3.6200	24.8100	0.5800	14.3898		(29a)					
penthouse roof	71.0200		71.0200	0.1000	7.1020		(30)					
garden room roof	41.3400		41.3400	0.1000	4.1340		(30)					
Total net area of external elements Aum(A, m2)			342.5200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		95.8323		(33)					
Party Wall 1			93.4300	0.0000	0.0000		(32)					
Party Wall 2			39.8100	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4579 (36)					
Total fabric heat loss						(33) + (36) =	105.2902 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 67.3635	Feb 66.6448	Mar 65.9261	Apr 62.3326	May 61.6139	Jun 58.0204	Jul 58.0204	Aug 57.3017	Sep 59.4578	Oct 61.6139	Nov 63.0513	Dec 64.4887 (38)
Heat transfer coeff	172.6538	171.9351	171.2164	167.6229	166.9042	163.3107	163.3107	162.5920	164.7481	166.9042	168.3416	169.7790 (39)
Average = Sum(39)m / 12 =												167.4432 (39)
HLP	Jan 1.1233	Feb 1.1186	Mar 1.1140	Apr 1.0906	May 1.0859	Jun 1.0625	Jul 1.0625	Aug 1.0579	Sep 1.0719	Oct 1.0859	Nov 1.0953	Dec 1.1046 (40)
HLP (average)												1.0894 (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												2.9398 (42)
Average daily hot water use (litres/day)												104.0207 (43)
Daily hot water use	Jan 114.4228	Feb 110.2620	Mar 106.1011	Apr 101.9403	May 97.7795	Jun 93.6187	Jul 93.6187	Aug 97.7795	Sep 101.9403	Oct 106.1011	Nov 110.2620	Dec 114.4228 (44)
Energy conte	169.6857	148.4082	153.1440	133.5146	128.1105	110.5496	102.4404	117.5519	118.9559	138.6316	151.3272	164.3316 (45)
Energy content (annual)										Total = Sum(45)m =		1636.6511 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4529	22.2612	22.9716	20.0272	19.2166	16.5824	15.3661	17.6328	17.8434	20.7947	22.6991	24.6497 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)

Enter (49) or (54) in (55)												0.9805 (55)
Total storage loss	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160	30.3965 (56)
If cylinder contains dedicated solar storage	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160	30.3965 (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	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	171.2108	170.8838	192.2905	203.2552	217.9904 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Heat gains from water heating, kWh/month	99.3476	88.1186	93.8475	85.9360	85.5238	78.3001	76.9886	82.0131	81.0952	89.0221	91.8587	97.5673 (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	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.9311	25.6963	20.8977	15.8209	11.8263	9.9843	10.7883	14.0231	18.8218	23.8986	27.8931	29.7352 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.5189	327.8864	319.4004	301.3348	278.5302	257.0971	242.7784	239.4109	247.8969	265.9625	288.7671	310.2002 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991 (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)	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928 (71)
Water heating gains (Table 5)	133.5317	131.1289	126.1391	119.3555	114.9514	108.7501	103.4792	110.2327	112.6322	119.6534	127.5815	131.1389 (72)
Total internal gains	557.0790	554.8089	536.5344	506.6085	475.4052	445.9288	427.1433	433.7640	449.4482	479.6117	514.3390	541.1716 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W		
East					44.2300	19.6403	0.3600	1.0000	0.7700	216.7205 (76)		
Solar gains	216.7205	423.9513	698.1874	1018.2646	1247.9215	1277.4697	1216.2033	1044.7006	812.0208	503.0539	270.2250	178.2204 (83)
Total gains	773.7995	978.7601	1234.7218	1524.8731	1723.3267	1723.3985	1643.3466	1478.4647	1261.4690	982.6656	784.5640	719.3920 (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, nli,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.7284	24.8317	24.9360	25.4705	25.5802	26.1431	26.1431	26.2586	25.9150	25.5802	25.3618	25.1471
alpha	2.6486	2.6554	2.6624	2.6980	2.7053	2.7429	2.7429	2.7506	2.7277	2.7053	2.6908	2.6765
util living area	0.9774	0.9582	0.9151	0.8236	0.6909	0.5349	0.4106	0.4643	0.6926	0.8940	0.9642	0.9811 (86)
MIT	19.0271	19.2858	19.7051	20.2131	20.5784	20.7913	20.8627	20.8470	20.6659	20.1365	19.4932	18.9986 (87)
Th 2	19.9818	19.9856	19.9894	20.0085	20.0124	20.0316	20.0316	20.0354	20.0239	20.0124	20.0047	19.9971 (88)
util rest of house	0.9738	0.9518	0.9023	0.7978	0.6470	0.4706	0.3291	0.3799	0.6324	0.8723	0.9578	0.9782 (89)
MIT 2	17.3153	17.6920	18.2960	19.0212	19.5113	19.7882	19.8623	19.8536	19.6459	18.9350	18.0092	17.2839 (90)
Living area fraction	17.8204	18.1623	18.7118	19.3729	19.8262	20.0841	20.1575	20.1467	19.9469	19.2895	18.4471	17.7898 (92)
MIT	17.8204	18.1623	18.7118	19.3729	19.8262	20.0841	20.1575	20.1467	19.9469	19.2895	18.4471	17.7898 (93)
Temperature adjustment												0.0000
adjusted MIT	17.8204	18.1623	18.7118	19.3729	19.8262	20.0841	20.1575	20.1467	19.9469	19.2895	18.4471	17.7898 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9635	0.9367	0.8821	0.7787	0.6380	0.4743	0.3401	0.3901	0.6272	0.8527	0.9441	0.9692 (94)
Ext temp.	745.5207	916.8214	1089.2005	1187.4228	1099.4289	817.4286	558.8414	576.7621	791.1803	837.9138	740.7425	697.2069 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2334.3412	2280.2537	2090.8566	1755.4953	1356.2963	895.6196	580.9753	609.1857	963.2624	1450.3113	1910.1815	2307.2665 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1182.0824	916.2265	745.2321	409.0122	191.1093	0.0000	0.0000	0.0000	0.0000	455.6238	841.9960	1197.8844 (98)
Space heating per m2												5939.1667 (98)
												(98) / (4) = 38.6413 (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	1535.1202	1208.4988	1235.6988	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8384	0.8860	0.8580	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1286.9704	1070.6726	1060.2799	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2124.9593	2028.7174	1838.0740	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	603.3520	712.7853	578.6788	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1894.8161 (104)

Cooled fraction	fc = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kwh	0.0000	0.0000	0.0000	0.0000	0.0000	150.8380	178.1963	144.6697	0.0000	0.0000	0.0000 (107)
Space cooling											473.7040 (107)
Space cooling per m2											3.0820 (108)

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 %)												170.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3493.6275 (211)
Cooling System Energy Efficiency Ratio (see Table 10c)												4.0000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1182.0824	916.2265	745.2321	409.0122	191.1093	0.0000	0.0000	0.0000	0.0000	455.6238	841.9960	1197.8844 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	695.3426	538.9567	438.3718	240.5954	112.4173	0.0000	0.0000	0.0000	0.0000	268.0140	495.2918	704.6379 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	171.2108	170.8838	192.2905	203.2552	217.9904 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	131.3792	115.8084	121.6487	109.0839	106.9231	95.5750	91.8231	100.7122	100.5199	113.1120	119.5619	128.2297 (219)
Water heating fuel used												1334.3772 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	37.7095	44.5491	36.1674	0.0000	0.0000	0.0000	0.0000 (221)
Cooling												118.4260 (221)
Annual totals kWh/year												
Space heating fuel - main system												3493.6275 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7625)												
mechanical ventilation fans (SFP = 0.7625)												381.3606 (230a)
central heating pump												30.0000 (230c)
Total electricity for the above, kWh/year												411.3606 (231)
Electricity for lighting (calculated in Appendix L)												510.9321 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 1.31 * 1000 * 1.00) =										-1131.3418		-1131.3418 (233)
Total delivered energy for all uses												4737.3817 (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	3493.6275	0.5190	1813.1927 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1334.3772	0.5190	692.5418 (264)
Space and water heating			2505.7344 (265)
Space cooling	118.4260	0.5190	61.4631 (266)
Pumps and fans	411.3606	0.5190	213.4962 (267)
Energy for lighting	510.9321	0.5190	265.1738 (268)
Energy saving/generation technologies			
PV Unit	-1131.3418	0.5190	-587.1664 (269)
Total CO2, kg/year			2458.7011 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.0000 (273)

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

DER			16.0000 ZC1
Total Floor Area		TFA	153.7000
Assumed number of occupants		N	2.9398
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			12.5116 ZC2
CO2 emissions from cooking, equation (L16)			1.2333 ZC3
Total CO2 emissions			29.7449 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			29.7449 ZC8

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF STANDARD ENE7 CO2 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.3600 (1b)	x 2.6000 (2b)	= 292.1360 (1b) - (3b)
First floor	41.3400 (1c)	x 2.8500 (2c)	= 117.8100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	409.9550 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												54.6000 (23c)
Effective ac	0.4979	0.4926	0.4873	0.4608	0.4554	0.4289	0.4289	0.4236	0.4395	0.4554	0.4661	0.4767 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.58)			44.2300	0.5668	25.0717		(27)
penthouse floor			112.3600	0.1500	16.8540		(28a)
External Wall 1	89.3700	40.6100	48.7600	0.5800	28.2808		(29a)
External Wall 2	28.4300	3.6200	24.8100	0.5800	14.3898		(29a)
penthouse roof	71.0200		71.0200	0.1000	7.1020		(30)
garden room roof	41.3400		41.3400	0.1000	4.1340		(30)
Total net area of external elements Aum(A, m ²)			342.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.8323		(33)
Party Wall 1			93.4300	0.0000	0.0000		(32)
Party Wall 2			39.8100	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4579 (36)
Total fabric heat loss						(33) + (36) =	105.2902 (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	67.3635	66.6448	65.9261	62.3326	61.6139	58.0204	58.0204	57.3017	59.4578	61.6139	63.0513	64.4887 (38)
Heat transfer coeff	172.6538	171.9351	171.2164	167.6229	166.9042	163.3107	163.3107	162.5920	164.7481	166.9042	168.3416	169.7790 (39)
Average = Sum(39)m / 12 =												167.4432 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1233	1.1186	1.1140	1.0906	1.0859	1.0625	1.0625	1.0579	1.0719	1.0859	1.0953	1.1046 (40)
HLP (average)												1.0894 (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												2.9398 (42)
Average daily hot water use (litres/day)												104.0207 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.4228	110.2620	106.1011	101.9403	97.7795	93.6187	93.6187	97.7795	101.9403	106.1011	110.2620	114.4228 (44)
Energy conte	169.6857	148.4082	153.1440	133.5146	128.1105	110.5496	102.4404	117.5519	118.9559	138.6316	151.3272	164.3316 (45)
Energy content (annual)										Total = Sum(45)m =		1636.6511 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4529	22.2612	22.9716	20.0272	19.2166	16.5824	15.3661	17.6328	17.8434	20.7947	22.6991	24.6497 (46)
Water storage loss:												
Store volume												150.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0191 (51)
Volume factor from Table 2a												0.9283 (52)
Temperature factor from Table 2b												0.5400 (53)

Enter (49) or (54) in (55)	1.4364 (55)											
Total storage loss	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282 (56)
If cylinder contains dedicated solar storage	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282 (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	237.4763	209.6384	220.9346	199.1184	195.9011	176.1534	170.2310	185.3425	184.5597	206.4222	216.9310	232.1221 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	237.4763	209.6384	220.9346	199.1184	195.9011	176.1534	170.2310	185.3425	184.5597	206.4222	216.9310	232.1221 (64)
Heat gains from water heating, kWh/month	110.6530	98.3299	105.1528	96.8767	96.8292	89.2408	88.2939	93.3185	92.0359	100.3275	102.7993	108.8727 (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	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.9311	25.6963	20.8977	15.8209	11.8263	9.9843	10.7883	14.0231	18.8218	23.8986	27.8931	29.7352 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.5189	327.8864	319.4004	301.3348	278.5302	257.0971	242.7784	239.4109	247.8969	265.9625	288.7671	310.2002 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991 (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)	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928 (71)
Water heating gains (Table 5)	148.7271	146.3243	141.3345	134.5509	130.1468	123.9455	118.6746	125.4281	127.8276	134.8488	142.7769	146.3343 (72)
Total internal gains	572.2744	570.0042	551.7298	521.8039	490.6005	461.1241	442.3387	448.9594	464.6436	494.8071	529.5344	556.3670 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East	44.2300	19.6403	0.3600	1.0000	0.7700	216.7205 (76)						
Solar gains	216.7205	423.9513	698.1874	1018.2646	1247.9215	1277.4697	1216.2033	1044.7006	812.0208	503.0539	270.2250	178.2204 (83)
Total gains	788.9949	993.9555	1249.9172	1540.0685	1738.5221	1738.5939	1658.5420	1493.6600	1276.6643	997.8610	799.7594	734.5874 (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, n _{li} ,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.7284	24.8317	24.9360	25.4705	25.5802	26.1431	26.1431	26.2586	25.9150	25.5802	25.3618	25.1471
alpha	2.6486	2.6554	2.6624	2.6980	2.7053	2.7429	2.7429	2.7506	2.7277	2.7053	2.6908	2.6765
util living area	0.9763	0.9567	0.9131	0.8207	0.6875	0.5314	0.4074	0.4604	0.6880	0.8909	0.9627	0.9802 (86)
MIT	18.5210	18.8645	19.4211	20.0930	20.5757	20.8546	20.9485	20.9277	20.6912	19.9933	19.1397	18.4819 (87)
Th 2	19.9818	19.9856	19.9894	20.0085	20.0124	20.0316	20.0316	20.0354	20.0239	20.0124	20.0047	19.9971 (88)
util rest of house	0.9727	0.9502	0.9000	0.7946	0.6435	0.4673	0.3263	0.3765	0.6276	0.8687	0.9560	0.9771 (89)
MIT 2	17.7057	18.0475	18.5949	19.2510	19.6930	19.9421	20.0085	20.0008	19.8152	19.1753	18.3366	17.6774 (90)
Living area fraction	0.9727	0.9502	0.9000	0.7946	0.6435	0.4673	0.3263	0.3765	0.6276	0.8687	0.9560	0.9771 (89)
MIT	17.9462	18.2886	18.8387	19.4994	19.9535	20.2114	20.2858	20.2743	20.0737	19.4167	18.5736	17.9148 (92)
Temperature adjustment	17.9462	18.2886	18.8387	19.4994	19.9535	20.2114	20.2858	20.2743	20.0737	19.4167	18.5736	17.9148 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9626	0.9359	0.8817	0.7794	0.6407	0.4797	0.3483	0.3981	0.6310	0.8525	0.9432	0.9683 (94)
Ext temp.	759.5027	930.2762	1102.0908	1200.3239	1113.8093	834.0821	577.5993	594.6591	805.5763	850.6612	754.3105	711.3208 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.0000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2356.0707	2301.9627	2112.5878	1776.7084	1377.5358	916.3938	601.9371	629.9330	984.1511	1471.5397	1931.4784	2328.4827 (97)
Space heating kwh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1187.8465	921.7733	751.8098	414.9969	196.2125	0.0000	0.0000	0.0000	0.0000	461.9336	847.5609	1203.1685 (98)
Space heating per m2												5985.3021 (98)
												(98) / (4) = 38.9415 (99)

8c. Space cooling requirement

Not applicable

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

DER	15.8300 ZC1											
Total Floor Area	TFA											153.7000
Assumed number of occupants	N											2.9398
CO2 emission factor in Table 12 for electricity displaced from grid	EF											0.5190
CO2 emissions from appliances, equation (L14)	12.5116 ZC2											
CO2 emissions from cooking, equation (L16)	1.2333 ZC3											
Total CO2 emissions	29.5749 ZC4											
Residual CO2 emissions offset from biofuel CHP	0.0000 ZC5											
Additional allowable electricity generation, kWh/m ² /year	0.0000 ZC6											

Resulting CO2 emissions offset from additional allowable electricity generation
Net CO2 emissions

0.0000 ZC7
29.5749 ZC8

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.3600 (1b)	x 2.6000 (2b)	= 292.1360 (1b) - (3b)
First floor	41.3400 (1c)	x 2.8500 (2c)	= 117.8190 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 409.9550 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0976 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.3476 (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) =	0.2954 (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	0.3767	0.3693	0.3619	0.3250	0.3176	0.2807	0.2807	0.2733	0.2954	0.3176	0.3324	0.3471 (22b)
Effective ac	0.5709	0.5682	0.5655	0.5528	0.5504	0.5394	0.5394	0.5373	0.5436	0.5504	0.5552	0.5603 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type Curtain (Uw = 1.50)			38.4000	1.4151	54.3396		(27)
penthouse floor			112.3600	0.1300	14.6068		(28a)
External Wall 1	89.3700	35.2600	54.1100	0.1800	9.7398		(29a)
External Wall 2	28.4300	3.1400	25.2900	0.1800	4.5522		(29a)
penthouse roof	71.0200		71.0200	0.1300	9.2326		(30)
garden room roof	41.3400		41.3400	0.1300	5.3742		(30)
Total net area of external elements Aum(A, m ²)			342.5200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.8452		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0621 (36)
Total fabric heat loss						(33) + (36) =	105.9073 (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	77.2403	76.8676	76.5023	74.7864	74.4654	72.9709	72.9709	72.6942	73.5466	74.4654	75.1148	75.7938 (38)
Heat transfer coeff	183.1476	182.7749	182.4096	180.6937	180.3727	178.8783	178.8783	178.6015	179.4539	180.3727	181.0222	181.7011 (39)
Average = Sum(39)m / 12 =												180.6922 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1916	1.1892	1.1868	1.1756	1.1735	1.1638	1.1638	1.1620	1.1676	1.1735	1.1778	1.1822 (40)
HLP (average)												1.1756 (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												2.9398 (42)
Average daily hot water use (litres/day)												104.0207 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.4228	110.2620	106.1011	101.9403	97.7795	93.6187	93.6187	97.7795	101.9403	106.1011	110.2620	114.4228 (44)
Energy content (annual)	169.6857	148.4082	153.1440	133.5146	128.1105	110.5496	102.4404	117.5519	118.9559	138.6316	151.3272	164.3316 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4529	22.2612	22.9716	20.0272	19.2166	16.5824	15.3661	17.6328	17.8434	20.7947	22.6991	24.6497 (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	218.9284	192.8855	202.3866	181.1688	177.3531	158.2038	151.6831	166.7946	166.6101	187.8742	198.9814	213.5742 (62)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	218.9284	192.8855	202.3866	181.1688	177.3531	158.2038	151.6831	166.7946	166.6101	187.8742	198.9814	213.5742	0.0000 (63)
Heat gains from water heating, kWh/month	95.8146	84.9275	90.3145	82.5170	81.9909	74.8811	73.4556	78.4801	77.6762	85.4891	88.4397	94.0344	0.0000 (63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)
Total per year (kWh/year) = Sum(64)m =													2216.4439 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.9311	25.6963	20.8977	15.8209	11.8263	9.9843	10.7883	14.0231	18.8218	23.8986	27.8931	29.7352	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.5189	327.8864	319.4004	301.3348	278.5302	257.0971	242.7784	239.4109	247.8969	265.9625	288.7671	310.2002	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	(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)	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	(71)
Water heating gains (Table 5)	128.7831	126.3803	121.3905	114.6069	110.2028	104.0015	98.7306	105.4841	107.8836	114.9048	122.8329	126.3903	(72)
Total internal gains	552.3304	550.0602	531.7858	501.8599	470.6565	441.1801	422.3947	429.0154	444.6996	474.8631	509.5904	536.4230	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d		Gains W
East					38.4000	19.6403	0.6300		0.7000		0.7700		230.4891 (76)
Solar gains	230.4891	450.8855	742.5443	1082.9565	1327.2039	1358.6294	1293.4705	1111.0721	863.6097	535.0137	287.3928	189.5430	(83)
Total gains	782.8195	1000.9458	1274.3301	1584.8164	1797.8604	1799.8095	1715.8652	1540.0875	1308.3093	1009.8768	796.9832	725.9660	(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, n _{li} ,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2787	58.3976	58.5145	59.0702	59.1753	59.6697	59.6697	59.7622	59.4783	59.1753	58.9630	58.7427	
alpha	4.8852	4.8932	4.9010	4.9380	4.9450	4.9780	4.9780	4.9841	4.9652	4.9450	4.9309	4.9162	
util living area	0.9990	0.9966	0.9853	0.9341	0.8017	0.6100	0.4535	0.5223	0.8086	0.9778	0.9976	0.9993	(86)
MIT	19.6194	19.8199	20.1567	20.5706	20.8564	20.9714	20.9946	20.9896	20.8902	20.4595	19.9536	19.5864	(87)
Th 2	19.9267	19.9287	19.9306	19.9395	19.9412	19.9491	19.9491	19.9505	19.9460	19.9412	19.9378	19.9343	(88)
util rest of house	0.9987	0.9954	0.9801	0.9114	0.7442	0.5207	0.3479	0.4088	0.7294	0.9665	0.9966	0.9991	(89)
MIT 2	18.0791	18.3732	18.8630	19.4493	19.8089	19.9314	19.9472	19.9465	19.8614	19.3096	18.5758	18.0359	(90)
Living area fraction	18.5336	18.8000	19.2447	19.7801	20.1180	20.2383	20.2562	20.2543	20.1650	19.6489	18.9823	18.4934	(92)
MIT	18.5336	18.8000	19.2447	19.7801	20.1180	20.2383	20.2562	20.2543	20.1650	19.6489	18.9823	18.4934	(93)
Temperature adjustment													0.0000
adjusted MIT	18.5336	18.8000	19.2447	19.7801	20.1180	20.2383	20.2562	20.2543	20.1650	19.6489	18.9823	18.4934	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9980	0.9936	0.9756	0.9073	0.7547	0.5461	0.3792	0.4425	0.7478	0.9623	0.9953	0.9986	(94)
Ext temp.	781.2826	994.5588	1243.1888	1437.9777	1356.8610	982.9458	650.6854	681.4407	978.2944	971.8363	793.2203	724.9723	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2606.8425	2540.5781	2324.7576	1965.9732	1518.3755	1008.5640	654.0220	688.3756	1088.3824	1632.1677	2150.9636	2597.1256	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1358.2166	1038.9250	804.6872	380.1567	120.1668	0.0000	0.0000	0.0000	0.0000	491.2866	977.5752	1392.8821	(98)
Space heating per m ²													6563.8960 (98)
													(98) / (4) = 42.7059 (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													7020.2097 (211)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating efficiency (main heating system 1)	1358.2166	1038.9250	804.6872	380.1567	120.1668	0.0000	0.0000	0.0000	0.0000	491.2866	977.5752	1392.8821	(98)
Space heating fuel (main heating system)	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	1452.6380	1111.1497	860.6280	406.5847	128.5206	0.0000	0.0000	0.0000	0.0000	525.4402	1045.5349	1489.7134	(211)

Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	218.9284	192.8855	202.3866	181.1688	177.3531	158.2038	151.6831	166.7946	166.6101	187.8742	198.9814	213.5742 (64)
Efficiency of water heater (217)m	88.8463	88.6389	88.1253	86.7460	83.8018	79.8000	79.8000	79.8000	79.8000	87.2633	88.4933	79.8000 (216)
Fuel for water heating, kWh/month	246.4124	217.6080	229.6577	208.8499	211.6340	198.2504	190.0791	209.0158	208.7845	215.2959	224.8549	240.2005 (219)
Water heating fuel used												2600.6431 (219)
Annual totals kWh/year												
Space heating fuel - main system												7020.2097 (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)												510.9321 (232)
Total delivered energy for all uses												10206.7849 (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	7020.2097	0.2160	1516.3653 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2600.6431	0.2160	561.7389 (264)
Space and water heating			2078.1042 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	510.9321	0.5190	265.1738 (268)
Total CO2, kg/m2/year			2382.2030 (272)
Emissions per m2 for space and water heating			13.5205 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.7253 (272b)
Emissions per m2 for pumps and fans			0.2533 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5205 * 1.55) + 1.7253 + 0.2533, rounded to 2 d.p.			22.9400 (273)

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.3600 (1b)	x 2.6000 (2b)	= 292.1360 (1b) - (3b)
First floor	41.3400 (1c)	x 2.8500 (2c)	= 117.8190 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 409.9550 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0976 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.3476 (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) =	0.2954 (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	0.3767	0.3693	0.3619	0.3250	0.3176	0.2807	0.2807	0.2733	0.2954	0.3176	0.3324	0.3471 (22b)
Effective ac	0.5709	0.5682	0.5655	0.5528	0.5504	0.5394	0.5394	0.5373	0.5436	0.5504	0.5552	0.5603 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.58)			44.2300	0.5668	25.0717		(27)
penthouse floor			112.3600	0.1500	16.8540		(28a)
External Wall 1	89.3700	40.6100	48.7600	0.5800	28.2808		(29a)
External Wall 2	28.4300	3.6200	24.8100	0.5800	14.3898		(29a)
penthouse roof	71.0200		71.0200	0.1000	7.1020		(30)
garden room roof	41.3400		41.3400	0.1000	4.1340		(30)
Total net area of external elements Aum(A, m ²)			342.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.8323		(33)
Party Wall 1			93.4300	0.0000	0.0000		(32)
Party Wall 2			39.8100	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4579 (36)
Total fabric heat loss						(33) + (36) =	105.2902 (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	77.2403	76.8676	76.5023	74.7864	74.4654	72.9709	72.9709	72.6942	73.5466	74.4654	75.1148	76.7938 (38)
Heat transfer coeff	182.5305	182.1578	181.7925	180.0767	179.7556	178.2612	178.2612	177.9844	178.8368	179.7556	180.4051	181.0840 (39)
Average = Sum(39)m / 12 =												180.0751 (39)
HLP	1.1876	1.1852	1.1828	1.1716	1.1695	1.1598	1.1598	1.1580	1.1635	1.1695	1.1737	1.1782 (40)
HLP (average)												1.1716 (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												2.9398 (42)
Average daily hot water use (litres/day)												104.0207 (43)
Daily hot water use	114.4228	110.2620	106.1011	101.9403	97.7795	93.6187	93.6187	97.7795	101.9403	106.1011	110.2620	114.4228 (44)
Energy conte	169.6857	148.4082	153.1440	133.5146	128.1105	110.5496	102.4404	117.5519	118.9559	138.6316	151.3272	164.3316 (45)
Energy content (annual)												Total = Sum(45)m = 1636.6511 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.0582	31.5367	32.5431	28.3719	27.2235	23.4918	21.7686	24.9798	25.2781	29.4592	32.1570	34.9205 (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	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.9311	25.6963	20.8977	15.8209	11.8263	9.9843	10.7883	14.0231	18.8218	23.8986	27.8931	29.7352 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.5189	327.8864	319.4004	301.3348	278.5302	257.0971	242.7784	239.4109	247.8969	265.9625	288.7671	310.2002 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991 (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)	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928 (71)
Water heating gains (Table 5)	48.4653	46.9297	43.7407	39.4054	36.5907	32.6275	29.2589	33.5750	35.1085	39.5957	44.6625	46.9361 (72)
Total internal gains	469.0126	467.6097	451.1361	423.6583	394.0445	366.8061	349.9229	354.1063	368.9245	396.5541	428.4201	453.9688 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
East				44.2300	19.6403		0.3600		1.0000	0.7700	216.7205 (76)	
Solar gains	216.7205	423.9513	698.1874	1018.2646	1247.9215	1277.4697	1216.2033	1044.7006	812.0208	503.0539	270.2250	178.2204 (83)
Total gains	685.7331	891.5609	1149.3234	1441.9229	1641.9660	1644.2758	1566.1262	1398.8070	1180.9453	899.6080	698.6451	632.1892 (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, n _{li} ,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.3903	23.4382	23.4853	23.7090	23.7514	23.9505	23.9505	23.9877	23.8734	23.7514	23.6659	23.5771
alpha	2.5594	2.5625	2.5657	2.5806	2.5834	2.5967	2.5967	2.5992	2.5916	2.5834	2.5777	2.5718
util living area	0.9829	0.9666	0.9293	0.8490	0.7274	0.5814	0.4556	0.5147	0.7372	0.9154	0.9730	0.9860 (86)
MIT	18.2757	18.6217	19.1979	19.8985	20.4488	20.7859	20.9179	20.8855	20.5796	19.7924	18.8927	18.2155 (87)
Th 2	19.9300	19.9319	19.9338	19.9428	19.9445	19.9523	19.9523	19.9537	19.9493	19.9445	19.9411	19.9375 (88)
util rest of house	0.9801	0.9613	0.9179	0.8246	0.6831	0.5113	0.3616	0.4188	0.6766	0.8964	0.9678	0.9837 (89)
MIT 2	17.4276	17.7716	18.3394	19.0293	19.5283	19.8208	19.9161	19.8996	19.6634	18.9362	18.0498	17.3729 (90)
Living area fraction	17.6778	18.0224	18.5927	19.2794	19.7999	20.1056	20.2117	20.1905	fLA = Living area / (4) =	19.9337	19.1888	18.2985
MIT	17.6778	18.0224	18.5927	19.2794	19.7999	20.1056	20.2117	20.1905	19.9337	19.1888	18.2985	17.6215 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6778	18.0224	18.5927	19.2794	19.7999	20.1056	20.2117	20.1905	19.9337	19.1888	18.2985	17.6215 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9718	0.9484	0.8997	0.8066	0.6764	0.5222	0.3860	0.4418	0.6755	0.8792	0.9567	0.9766 (94)
Useful gains	666.4093	845.5353	1034.0385	1163.1228	1110.5889	858.6466	604.5148	618.0622	797.7751	790.9029	668.3711	617.4158 (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	2441.8572	2390.3533	2198.3663	1869.0899	1456.0093	981.4312	643.8200	674.6500	1043.2867	1543.8868	2020.2627	2430.4205 (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	1320.9332	1038.1177	866.2599	508.2963	256.9928	0.0000	0.0000	0.0000	0.0000	560.2200	973.3620	1348.8755 (98)
Space heating												6873.0574 (98)
Space heating per m2											(98) / (4) =	44.7174 (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	1675.6551	1319.1327	1352.6816	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7901	0.8453	0.8095	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1323.9219	1115.0108	1095.0418	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2048.8367	1954.4970	1761.4163	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	521.9387	624.5777	495.7826	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1642.2990 (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	130.4847	156.1444	123.9456	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												410.5747 (107)
Space cooling per m2												2.6713 (108)
Energy for space heating												44.7174 (99)
Energy for space cooling												2.6713 (108)
Total												47.3886 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.4 (109)

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.3600 (1b)	x 2.6000 (2b)	= 292.1360 (1b) - (3b)
First floor	41.3400 (1c)	x 2.8500 (2c)	= 117.8190 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 409.9550 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0976 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.3476 (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) =	0.2954 (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	0.3767	0.3693	0.3619	0.3250	0.3176	0.2807	0.2807	0.2733	0.2954	0.3176	0.3324	0.3471 (22b)
Effective ac	0.5709	0.5682	0.5655	0.5528	0.5504	0.5394	0.5394	0.5373	0.5436	0.5504	0.5552	0.5603 (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 Opening Type Curtain (Uw = 1.50)			38.4000	1.4151	54.3396		(27)
penthouse floor			112.3600	0.1300	14.6068		(28a)
External Wall 1	89.3700	35.2600	54.1100	0.1800	9.7398		(29a)
External Wall 2	28.4300	3.1400	25.2900	0.1800	4.5522		(29a)
penthouse roof	71.0200		71.0200	0.1300	9.2326		(30)
garden room roof	41.3400		41.3400	0.1300	5.3742		(30)
Total net area of external elements Aum(A, m2)			342.5200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.8452		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0621 (36)
Total fabric heat loss						(33) + (36) =	105.9073 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	77.2403	76.8676	76.5023	74.7864	74.4654	72.9709	72.9709	72.6942	73.5466	74.4654	75.1148	75.7938 (38)
Heat transfer coeff	183.1476	182.7749	182.4096	180.6937	180.3727	178.8783	178.8783	178.6015	179.4539	180.3727	181.0222	181.7011 (39)
Average = Sum(39)m / 12 =												180.6922 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1916	1.1892	1.1868	1.1756	1.1735	1.1638	1.1638	1.1620	1.1676	1.1735	1.1778	1.1822 (40)
HLP (average)												1.1756 (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												2.9398 (42)
Average daily hot water use (litres/day)												104.0207 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	114.4228	110.2620	106.1011	101.9403	97.7795	93.6187	93.6187	97.7795	101.9403	106.1011	110.2620	114.4228 (44)
Energy conte	169.6857	148.4082	153.1440	133.5146	128.1105	110.5496	102.4404	117.5519	118.9559	138.6316	151.3272	164.3316 (45)
Energy content (annual)										Total = Sum(45)m =		1636.6511 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.0582	31.5367	32.5431	28.3719	27.2235	23.4918	21.7686	24.9798	25.2781	29.4592	32.1570	34.9205 (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	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910	146.9910 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.9311	25.6963	20.8977	15.8209	11.8263	9.9843	10.7883	14.0231	18.8218	23.8986	27.8931	29.7352 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.5189	327.8864	319.4004	301.3348	278.5302	257.0971	242.7784	239.4109	247.8969	265.9625	288.7671	310.2002 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991	37.6991 (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)	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928 (71)
Water heating gains (Table 5)	48.4653	46.9297	43.7407	39.4054	36.5907	32.6275	29.2589	33.5750	35.1085	39.5957	44.6625	46.9361 (72)
Total internal gains	469.0126	467.6097	451.1361	423.6583	394.0445	366.8061	349.9229	354.1063	368.9245	396.5541	428.4201	453.9688 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
East	38.4000		19.6403		0.6300		0.7000		0.7700		230.4891 (76)	
Solar gains	230.4891	450.8855	742.5443	1082.9565	1327.2039	1358.6294	1293.4705	1111.0721	863.6097	535.0137	287.3928	189.5430 (83)
Total gains	699.5017	918.4952	1193.6804	1506.6149	1721.2484	1725.4355	1643.3935	1465.1784	1232.5342	931.5678	715.8129	643.5118 (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, n _{li} ,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2787	58.3976	58.5145	59.0702	59.1753	59.6697	59.6697	59.7622	59.4783	59.1753	58.9630	58.7427	
alpha	4.8852	4.8932	4.9010	4.9380	4.9450	4.9780	4.9780	4.9841	4.9652	4.9450	4.9309	4.9162	
util living area	0.9994	0.9977	0.9888	0.9445	0.8209	0.6318	0.4725	0.5465	0.8343	0.9839	0.9985	0.9996 (86)	
MIT	19.5691	19.7706	20.1110	20.5357	20.8391	20.9667	20.9935	20.9873	20.8721	20.4164	19.9048	19.5364 (87)	
Th 2	19.9267	19.9287	19.9306	19.9395	19.9412	19.9491	19.9491	19.9505	19.9460	19.9412	19.9378	19.9343 (88)	
util rest of house	0.9992	0.9969	0.9847	0.9245	0.7656	0.5410	0.3630	0.4290	0.7590	0.9754	0.9979	0.9995 (89)	
MIT 2	18.6150	18.8176	19.1570	19.5735	19.8385	19.9348	19.9475	19.9471	19.8769	19.4689	18.9593	18.5883 (90)	
Living area fraction	18.8965	19.0988	19.4385	19.8574	20.1338	20.2393	20.2562	20.2540	f _{LA} = Living area / (4) =				0.2951 (91)
MIT	18.8965	19.0988	19.4385	19.8574	20.1338	20.2393	20.2562	20.2540	20.1705	19.7485	19.2382	18.8680 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.8965	19.0988	19.4385	19.8574	20.1338	20.2393	20.2562	20.2540	20.1705	19.7485	19.2382	18.8680 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9989	0.9960	0.9822	0.9227	0.7766	0.5671	0.3955	0.4640	0.7772	0.9733	0.9973	0.9993 (94)
Useful gains	698.7626	914.8051	1172.4106	1390.1628	1336.7422	978.5683	649.9792	679.7887	957.8740	906.7340	713.8969	643.0605 (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	2673.3148	2595.1897	2360.1042	1979.9348	1521.2198	1008.7451	654.0062	688.3343	1089.3774	1650.1367	2197.2904	2665.1963 (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	1469.0668	1129.2185	883.6441	424.6358	137.2513	0.0000	0.0000	0.0000	0.0000	553.0916	1068.0434	1504.4691 (98)
Space heating												7169.4205 (98)
Space heating per m ²										(98) / (4) =		46.6455 (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	1681.4557	1323.6991	1357.3715	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9160	0.9563	0.9312	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1540.1476	1265.8219	1263.9355	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2143.6986	2044.8094	1838.9933	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	434.5567	579.5667	427.8430	0.0000	0.0000	0.0000	0.0000 (104)	
Space cooling												1441.9664 (104)	
Cooled fraction									f _C = 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	108.6392	144.8917	106.9607	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												360.4916 (107)	
Space cooling per m ²												2.3454 (108)	
Energy for space heating												46.6455 (99)	
Energy for space cooling												2.3454 (108)	
Total												48.9910 (109)	
Target Fabric Energy Efficiency (TFEE)												56.3 (109)	

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.3600 (1b)	x 2.6000 (2b)	= 292.1360 (1b) - (3b)
First floor	41.3400 (1c)	x 2.8500 (2c)	= 117.8190 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	409.9550 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2231	0.2125	0.2125	0.1966	0.1966	0.1753	0.1806	0.1700	0.1753	0.1859	0.1859	0.2019 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												54.6000 (23c)
Effective ac	0.4501	0.4395	0.4395	0.4236	0.4236	0.4023	0.4076	0.3970	0.4023	0.4129	0.4129	0.4289 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.58)			44.2300	0.5668	25.0717		(27)
penthouse floor			112.3600	0.1500	16.8540		(28a)
External Wall 1	89.3700	40.6100	48.7600	0.5800	28.2808		(29a)
External Wall 2	28.4300	3.6200	24.8100	0.5800	14.3898		(29a)
penthouse roof	71.0200		71.0200	0.1000	7.1020		(30)
garden room roof	41.3400		41.3400	0.1000	4.1340		(30)
Total net area of external elements Aum(A, m ²)			342.5200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		95.8323		(33)
Party Wall 1			93.4300	0.0000	0.0000		(32)
Party Wall 2			39.8100	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4579 (36)
Total fabric heat loss						(33) + (36) =	105.2902 (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	60.8952	59.4578	59.4578	57.3017	57.3017	54.4269	55.1456	53.7082	54.4269	55.8643	55.8643	58.0204 (38)
Heat transfer coeff	166.1855	164.7481	164.7481	162.5920	162.5920	159.7171	160.4358	158.9984	159.7171	161.1545	161.1545	163.3107 (39)
Average = Sum(39)m / 12 =												162.1128 (39)
HLP	1.0812	1.0719	1.0719	1.0579	1.0579	1.0391	1.0438	1.0345	1.0391	1.0485	1.0485	1.0625 (40)
HLP (average)												1.0547 (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												2.9398 (42)
Average daily hot water use (litres/day)												104.0207 (43)
Daily hot water use	114.4228	110.2620	106.1011	101.9403	97.7795	93.6187	93.6187	97.7795	101.9403	106.1011	110.2620	114.4228 (44)
Energy conte	169.6857	148.4082	153.1440	133.5146	128.1105	110.5496	102.4404	117.5519	118.9559	138.6316	151.3272	164.3316 (45)
Energy content (annual)										Total = Sum(45)m =		1636.6511 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4529	22.2612	22.9716	20.0272	19.2166	16.5824	15.3661	17.6328	17.8434	20.7947	22.6991	24.6497 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)

Enter (49) or (54) in (55)	0.9805 (55)										
Total storage loss	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160 (56)
If cylinder contains dedicated solar storage	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120 (59)
Total heat required for water heating calculated for each month	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	171.2108	170.8838	192.2905	203.2552 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	171.2108	170.8838	192.2905	203.2552 (64)
RHI water heating demand	Total per year (kwh/year) = Sum(64)m =										2268.4412 (64)
Heat gains from water heating, kwh/month	99.3476	88.1186	93.8475	85.9360	85.5238	78.3001	76.9886	82.0131	81.0952	89.0221	91.8587 (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	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.3277	64.2409	52.2442	39.5522	29.5657	24.9606	26.9708	35.0577	47.0544	59.7464	69.7329	74.3379 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	484.3565	489.3826	476.7170	449.7534	415.7167	383.7270	362.3559	357.3298	369.9954	396.9590	430.9957	462.9854 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787 (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)	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928 (71)
Water heating gains (Table 5)	133.5317	131.1289	126.1391	119.3555	114.9514	108.7501	103.4792	110.2327	112.6322	119.6534	127.5815	131.1389 (72)
Total internal gains	807.5911	802.1275	772.4754	726.0363	677.6089	634.8129	610.1811	619.9953	647.0571	693.7339	745.6852	785.8374 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		FF	Access factor Table 6d		Gains W
East				44.2300	22.3313		0.3600		1.0000			0.7700		246.4149 (76)
Solar gains	246.4149	433.6027	704.0942	1055.2354	1257.3575	1376.4078	1296.6318	1140.7285	886.6462	549.0564	314.7648	200.6734 (83)		
Total gains	1054.0060	1235.7302	1476.5696	1781.2716	1934.9665	2011.2207	1906.8129	1760.7238	1533.7034	1242.7903	1060.4500	986.5109 (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, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.6908	25.9150	25.9150	26.2586	26.2586	26.7313	26.6115	26.8521	26.7313	26.4929	26.4929	26.1431
alpha	2.7127	2.7277	2.7277	2.7506	2.7506	2.7821	2.7741	2.7901	2.7821	2.7662	2.7662	2.7429
util living area	0.9486	0.9226	0.8614	0.7382	0.5768	0.3782	0.2562	0.2825	0.5349	0.8024	0.9186	0.9552 (86)
MIT	19.4342	19.6498	20.0336	20.4612	20.7361	20.8690	20.8951	20.8934	20.8074	20.4352	19.8902	19.4148 (87)
Th 2	20.0162	20.0239	20.0239	20.0354	20.0354	20.0508	20.0470	20.0547	20.0508	20.0431	20.0431	20.0316 (88)
util rest of house	0.9410	0.9116	0.8420	0.7042	0.5250	0.3123	0.1794	0.2017	0.4647	0.7668	0.9050	0.9485 (89)
MIT 2	17.9263	18.2395	18.7819	19.3734	19.7236	19.8843	19.9019	19.9092	19.8271	19.3614	18.6026	17.9094 (90)
Living area fraction	f _{LA} = Living area / (4) =											0.2951 (91)
MIT	18.3712	18.6556	19.1512	19.6944	20.0224	20.1748	20.1950	20.1996	20.1163	19.6782	18.9825	18.3536 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3712	18.6556	19.1512	19.6944	20.0224	20.1748	20.1950	20.1996	20.1163	19.6782	18.9825	18.3536 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9247	0.8926	0.8217	0.6911	0.5243	0.3211	0.1915	0.2143	0.4698	0.7513	0.8863	0.9334 (94)
Ext temp.	974.6311	1102.9593	1213.3059	1230.9932	1014.4928	645.8069	365.0907	377.3287	720.5785	933.6920	939.8682	920.8285 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	2205.4791	2150.8920	1935.9929	1592.4877	1141.7817	666.7898	368.1984	381.5329	785.2210	1301.8443	1769.8797	2164.4512 (97)
Space heating kwh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	915.7509	704.2108	537.6791	260.2761	94.7029	0.0000	0.0000	0.0000	0.0000	273.9054	597.6082	925.2553 (98)
RHI space heating demand	4309.3886 (98)											4309 (98)

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.3600 (1b)	x 2.6000 (2b)	= 292.1360 (1b) - (3b)
First floor	41.3400 (1c)	x 2.8500 (2c)	= 117.8190 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	409.9550 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												54.6000 (23c)
Effective ac	0.4979	0.4926	0.4873	0.4608	0.4554	0.4289	0.4289	0.4236	0.4395	0.4554	0.4661	0.4767 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.58)			44.2300	0.5668	25.0717		(27)
penthouse floor			112.3600	0.1500	16.8540		(28a)
External Wall 1	89.3700	40.6100	48.7600	0.5800	28.2808		(29a)
External Wall 2	28.4300	3.6200	24.8100	0.5800	14.3898		(29a)
penthouse roof	71.0200		71.0200	0.1000	7.1020		(30)
garden room roof	41.3400		41.3400	0.1000	4.1340		(30)
Total net area of external elements Aum(A, m ²)			342.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.8323		(33)
Party Wall 1			93.4300	0.0000	0.0000		(32)
Party Wall 2			39.8100	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4579 (36)
Total fabric heat loss						(33) + (36) =	105.2902 (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	67.3635	66.6448	65.9261	62.3326	61.6139	58.0204	58.0204	57.3017	59.4578	61.6139	63.0513	64.4887 (38)
Heat transfer coeff	172.6538	171.9351	171.2164	167.6229	166.9042	163.3107	163.3107	162.5920	164.7481	166.9042	168.3416	169.7790 (39)
Average = Sum(39)m / 12 =												167.4432 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1233	1.1186	1.1140	1.0906	1.0859	1.0625	1.0625	1.0579	1.0719	1.0859	1.0953	1.1046 (40)
HLP (average)												1.0894 (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												2.9398 (42)
Average daily hot water use (litres/day)												104.0207 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.4228	110.2620	106.1011	101.9403	97.7795	93.6187	93.6187	97.7795	101.9403	106.1011	110.2620	114.4228 (44)
Energy conte	169.6857	148.4082	153.1440	133.5146	128.1105	110.5496	102.4404	117.5519	118.9559	138.6316	151.3272	164.3316 (45)
Energy content (annual)										Total = Sum(45)m =		1636.6511 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4529	22.2612	22.9716	20.0272	19.2166	16.5824	15.3661	17.6328	17.8434	20.7947	22.6991	24.6497 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)

Enter (49) or (54) in (55)	0.9805 (55)										
Total storage loss	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160 (56)
If cylinder contains dedicated solar storage	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	30.3965 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	23.2624 (59)
Total heat required for water heating calculated for each month	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	171.2108	170.8838	192.2905	203.2552 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	171.2108	170.8838	192.2905	203.2552 (64)
Heat gains from water heating, kWh/month	99.3476	88.1186	93.8475	85.9360	85.5238	78.3001	76.9886	82.0131	81.0952	89.0221	91.8587 (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	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.3277	64.2409	52.2442	39.5522	29.5657	24.9606	26.9708	35.0577	47.0544	59.7464	69.7329	74.3379 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	484.3565	489.3826	476.7170	449.7534	415.7167	383.7270	362.3559	357.3298	369.9954	396.9590	430.9957	462.9854 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787 (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)	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928 (71)
Water heating gains (Table 5)	133.5317	131.1289	126.1391	119.3555	114.9514	108.7501	103.4792	110.2327	112.6322	119.6534	127.5815	131.1389 (72)
Total internal gains	807.5911	802.1275	772.4754	726.0363	677.6089	634.8129	610.1811	619.9953	647.0571	693.7339	745.6852	785.8374 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
East	44.2300	19.6403	0.3600	1.0000	0.7700	216.7205 (76)
Solar gains	216.7205	423.9513	698.1874	1018.2646	1247.9215	1277.4697 (83)
Total gains	1024.3116	1226.0787	1470.6628	1744.3009	1925.5305	1912.2826 (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, n _{li} ,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.7284	24.8317	24.9360	25.4705	25.5802	26.1431	26.1431	26.2586	25.9150	25.5802	25.3618	25.1471
alpha	2.6486	2.6554	2.6624	2.6980	2.7053	2.7429	2.7429	2.7506	2.7277	2.7053	2.6908	2.6765
util living area	0.9574	0.9325	0.8815	0.7820	0.6475	0.4938	0.3744	0.4205	0.6353	0.8482	0.9372	0.9630 (86)
MIT	19.2246	19.4669	19.8520	20.3093	20.6285	20.8114	20.8708	20.8592	20.7135	20.2582	19.6670	19.1957 (87)
Th 2	19.9818	19.9856	19.9894	20.0085	20.0124	20.0316	20.0316	20.0354	20.0239	20.0124	20.0047	19.9971 (88)
util rest of house	0.9512	0.9229	0.8649	0.7530	0.6025	0.4318	0.2984	0.3415	0.5737	0.8203	0.9267	0.9576 (89)
MIT 2	17.5998	17.9502	18.5002	19.1475	19.5704	19.8075	19.8679	19.8627	19.6974	19.0977	18.2565	17.5686 (90)
Living area fraction	18.0792	18.3977	18.8991	19.4903	19.8826	20.1037	20.1638	20.1567	f _{LA} = Living area / (4) =	19.4401	18.6727	0.2951 (91)
MIT	18.0792	18.3977	18.8991	19.4903	19.8826	20.1037	20.1638	20.1567	19.9972	19.4401	18.6727	18.0487 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT	18.0792	18.3977	18.8991	19.4903	19.8826	20.1037	20.1638	20.1567	19.9972	19.4401	18.6727	18.0487 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	958.6759	1108.4070	1240.6589	1283.7284	1147.9780	834.9691	564.5519	585.6953	834.3605	959.0036	923.2145	909.6913 (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	2379.0348	2320.7256	2122.9229	1775.1824	1365.7094	898.8129	582.0129	610.8089	971.5548	1475.4459	1948.1604	2351.2146 (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	1056.7470	814.6781	656.4044	353.8469	161.9922	0.0000	0.0000	0.0000	0.0000	384.2331	737.9611	1072.4934 (98)
Space heating												5238.3562 (98)
Space heating per m2										(98) / (4) =		34.0817 (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	1535.1202	1208.4988	1235.6988	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8384	0.8860	0.8580	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1286.9704	1070.6726	1060.2799	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2124.9593	2028.7174	1838.0740	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	603.3520	712.7853	578.6788	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1894.8161 (104)

Cooled fraction	fc = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kwh	0.0000	0.0000	0.0000	0.0000	0.0000	150.8380	178.1963	144.6697	0.0000	0.0000	0.0000 (107)
Space cooling											473.7040 (107)
Space cooling per m2											3.0820 (108)

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 %)												170.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3081.3860 (211)
Cooling System Energy Efficiency Ratio (see Table 10c)												4.0000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1056.7470	814.6781	656.4044	353.8469	161.9922	0.0000	0.0000	0.0000	0.0000	384.2331	737.9611	1072.4934 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	621.6159	479.2224	386.1202	208.1452	95.2895	0.0000	0.0000	0.0000	0.0000	226.0195	434.0947	630.8785 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	171.2108	170.8838	192.2905	203.2552	217.9904 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kwh/month	131.3792	115.8084	121.6487	109.0839	106.9231	95.5750	91.8231	100.7122	100.5199	113.1120	119.5619	128.2297 (219)
Water heating fuel used												1334.3772 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	37.7095	44.5491	36.1674	0.0000	0.0000	0.0000	0.0000 (221)
Cooling												118.4260 (221)
Annual totals kwh/year												
Space heating fuel - main system												3081.3860 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7625)												
mechanical ventilation fans (SFP = 0.7625)												381.3606 (230a)
central heating pump												30.0000 (230c)
Total electricity for the above, kwh/year												411.3606 (231)
Electricity for lighting (calculated in Appendix L)												510.9321 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.31 * 1000 * 1.00) =											-1131.3418	-1131.3418 (233)
Total delivered energy for all uses												4325.1401 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kwh/year	Fuel price p/kwh	Fuel cost £/year
Space heating - main system 1	3081.3860	13.1900	406.4348 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1334.3772	13.1900	176.0043 (247)
Space cooling	118.4260	13.1900	15.6204 (248)
Mechanical ventilation fans	381.3606	13.1900	50.3015 (249)
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)
Energy for lighting	510.9321	13.1900	67.3919 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1131.3418	13.1900	-149.2240 (252)
Total energy cost			570.4860 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =		1.2059 (257)
SAP value			83.1783
SAP rating (Section 12)			83 (258)
SAP band			B

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

	Energy kwh/year	Emission factor kg CO2/kwh	Emissions kg CO2/year
Space heating - main system 1	3081.3860	0.5190	1599.2393 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1334.3772	0.5190	692.5418 (264)
Space and water heating			2291.7811 (265)
Space cooling	118.4260	0.5190	61.4631 (266)
Pumps and fans	411.3606	0.5190	213.4962 (267)
Energy for lighting	510.9321	0.5190	265.1738 (268)
Energy saving/generation technologies			
PV Unit	-1131.3418	0.5190	-587.1664 (269)
Total kg/year			2244.7477 (272)
CO2 emissions per m2			14.6000 (273)
EI value			84.8618
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 1.7000 = 8.321$, stars = 2
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 1.7000 = 0.3274$, stars = 4
Water heating energy efficiency	$13.19 / 1.7000 = 7.759$, stars = 2
Water heating environmental impact	$0.519 / 1.7000 = 0.3053$, stars = 4

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.3600 (1b)	x 2.6000 (2b)	= 292.1360 (1b) - (3b)
First floor	41.3400 (1c)	x 2.8500 (2c)	= 117.8190 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 409.9550 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2231	0.2125	0.2125	0.1966	0.1966	0.1753	0.1806	0.1700	0.1753	0.1859	0.1859	0.2019 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												54.6000 (23c)
Effective ac	0.4501	0.4395	0.4395	0.4236	0.4236	0.4023	0.4076	0.3970	0.4023	0.4129	0.4129	0.4289 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.58)			44.2300	0.5668	25.0717		(27)
penthouse floor			112.3600	0.1500	16.8540		(28a)
External Wall 1	89.3700	40.6100	48.7600	0.5800	28.2808		(29a)
External Wall 2	28.4300	3.6200	24.8100	0.5800	14.3898		(29a)
penthouse roof	71.0200		71.0200	0.1000	7.1020		(30)
garden room roof	41.3400		41.3400	0.1000	4.1340		(30)
Total net area of external elements Aum(A, m ²)			342.5200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		95.8323		(33)
Party Wall 1			93.4300	0.0000	0.0000		(32)
Party Wall 2			39.8100	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4579 (36)
Total fabric heat loss						(33) + (36) =	105.2902 (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	60.8952	59.4578	59.4578	57.3017	57.3017	54.4269	55.1456	53.7082	54.4269	55.8643	55.8643	58.0204 (38)
Heat transfer coeff	166.1855	164.7481	164.7481	162.5920	162.5920	159.7171	160.4358	158.9984	159.7171	161.1545	161.1545	163.3107 (39)
Average = Sum(39)m / 12 =												162.1128 (39)
HLP	1.0812	1.0719	1.0719	1.0579	1.0579	1.0391	1.0438	1.0345	1.0391	1.0485	1.0485	1.0625 (40)
HLP (average)												1.0547 (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												2.9398 (42)
Average daily hot water use (litres/day)												104.0207 (43)
Daily hot water use	114.4228	110.2620	106.1011	101.9403	97.7795	93.6187	93.6187	97.7795	101.9403	106.1011	110.2620	114.4228 (44)
Energy conte	169.6857	148.4082	153.1440	133.5146	128.1105	110.5496	102.4404	117.5519	118.9559	138.6316	151.3272	164.3316 (45)
Energy content (annual)										Total = Sum(45)m =		1636.6511 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4529	22.2612	22.9716	20.0272	19.2166	16.5824	15.3661	17.6328	17.8434	20.7947	22.6991	24.6497 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)

Enter (49) or (54) in (55)	0.9805 (55)										
Total storage loss	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160 (56)
If cylinder contains dedicated solar storage	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	30.3965 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	23.2624 (59)
Total heat required for water heating calculated for each month	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	171.2108	170.8838	192.2905	203.2552 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	171.2108	170.8838	192.2905	203.2552 (64)
Heat gains from water heating, kWh/month	99.3476	88.1186	93.8475	85.9360	85.5238	78.3001	76.9886	82.0131	81.0952	89.0221	91.8587 (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	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892	176.3892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.3277	64.2409	52.2442	39.5522	29.5657	24.9606	26.9708	35.0577	47.0544	59.7464	69.7329	74.3379 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	484.3565	489.3826	476.7170	449.7534	415.7167	383.7270	362.3559	357.3298	369.9954	396.9590	430.9957	462.9854 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787	55.5787 (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)	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928	-117.5928 (71)
Water heating gains (Table 5)	133.5317	131.1289	126.1391	119.3555	114.9514	108.7501	103.4792	110.2327	112.6322	119.6534	127.5815	131.1389 (72)
Total internal gains	807.5911	802.1275	772.4754	726.0363	677.6089	634.8129	610.1811	619.9953	647.0571	693.7339	745.6852	785.8374 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East	44.2300	22.3313	0.3600	1.0000	0.7700	246.4149 (76)						
Solar gains	246.4149	433.6027	704.0942	1055.2354	1257.3575	1376.4078	1296.6318	1140.7285	886.6462	549.0564	314.7648	200.6734 (83)
Total gains	1054.0060	1235.7302	1476.5696	1781.2716	1934.9665	2011.2207	1906.8129	1760.7238	1533.7034	1242.7903	1060.4500	986.5109 (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, n _{li} ,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.6908	25.9150	25.9150	26.2586	26.2586	26.7313	26.6115	26.8521	26.7313	26.4929	26.4929	26.1431
alpha	2.7127	2.7277	2.7277	2.7506	2.7506	2.7821	2.7741	2.7901	2.7821	2.7662	2.7662	2.7429
util living area	0.9486	0.9226	0.8614	0.7382	0.5768	0.3782	0.2562	0.2825	0.5349	0.8024	0.9186	0.9552 (86)
MIT	19.4342	19.6498	20.0336	20.4612	20.7361	20.8690	20.8951	20.8934	20.8074	20.4352	19.8902	19.4148 (87)
Th 2	20.0162	20.0239	20.0239	20.0354	20.0354	20.0508	20.0470	20.0547	20.0508	20.0431	20.0431	20.0316 (88)
util rest of house	0.9410	0.9116	0.8420	0.7042	0.5250	0.3123	0.1794	0.2017	0.4647	0.7668	0.9050	0.9485 (89)
MIT 2	17.9263	18.2395	18.7819	19.3734	19.7236	19.8843	19.9019	19.9092	19.8271	19.3614	18.6026	17.9094 (90)
Living area fraction	18.3712	18.6556	19.1512	19.6944	20.0224	20.1748	20.1950	20.1996	fLA = Living area / (4) =	20.1163	19.6782	18.9825 (91)
MIT	18.3712	18.6556	19.1512	19.6944	20.0224	20.1748	20.1950	20.1996	20.1163	19.6782	18.9825	18.3536 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT	18.3712	18.6556	19.1512	19.6944	20.0224	20.1748	20.1950	20.1996	20.1163	19.6782	18.9825	18.3536 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	974.6311	1102.9593	1213.3059	1230.9932	1014.4928	645.8069	365.0907	377.3287	720.5785	933.6920	939.8682	920.8285 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2205.4791	2150.8920	1935.9929	1592.4877	1141.7817	666.7898	368.1984	381.5329	785.2210	1301.8443	1769.8797	2164.4512 (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	915.7509	704.2108	537.6791	260.2761	94.7029	0.0000	0.0000	0.0000	0.0000	273.9954	597.6082	925.2553 (98)
Space heating	4309.3886 (98)											
Space heating per m2	(98) / (4) = 28.0377 (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.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1277.7371	978.6587	985.7903	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8977	0.9335	0.9203	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1147.0266	913.5878	907.2258	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2240.6012	2122.7248	1950.3144	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	787.3737	899.5979	776.0579	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling	2463.0295 (104)											

Cooled fraction	fc = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kwh	0.0000	0.0000	0.0000	0.0000	0.0000	196.8434	224.8995	194.0145	0.0000	0.0000	0.0000 (107)
Space cooling											615.7574 (107)
Space cooling per m2											4.0062 (108)

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 %)													170.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2534.9345 (211)
Cooling System Energy Efficiency Ratio (see Table 10c)													4.0000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	915.7509	704.2108	537.6791	260.2761	94.7029	0.0000	0.0000	0.0000	0.0000	273.9054	597.6082	925.2553	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	538.6770	414.2416	316.2818	153.1036	55.7076	0.0000	0.0000	0.0000	0.0000	161.1208	351.5343	544.2678	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	223.3446	196.8743	206.8029	185.4426	181.7693	162.4775	156.0993	171.2108	170.8838	192.2905	203.2552	217.9904	(64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
Fuel for water heating, kwh/month	131.3792	115.8084	121.6487	109.0839	106.9231	95.5750	91.8231	100.7122	100.5199	113.1120	119.5619	128.2297	(219)
Water heating fuel used												1334.3772	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	49.2109	56.2249	48.5036	0.0000	0.0000	0.0000	0.0000	(221)
Cooling												153.9393	(221)
Annual totals kwh/year													
Space heating fuel - main system												2534.9345	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7625)													
mechanical ventilation fans (SFP = 0.7625)													381.3606 (230a)
central heating pump													30.0000 (230c)
Total electricity for the above, kwh/year													411.3606 (231)
Electricity for lighting (calculated in Appendix L)													510.9321 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.31 * 1140 * 1.00) =											-1194.8246	-1194.8246 (233)	
Total delivered energy for all uses												3750.7192 (238)	

10a. Fuel costs - using BEDF prices (401)

	Fuel	Fuel price	Fuel cost
	kwh/year	p/kwh	£/year
Space heating - main system 1	2534.9345	15.4400	391.3939 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1334.3772	15.4400	206.0278 (247)
Space cooling	153.9393	15.4400	23.7682 (248)
Mechanical ventilation fans	381.3606	15.4400	58.8821 (249)
Pumps and fans for heating	30.0000	15.4400	4.6320 (249)
Energy for lighting	510.9321	15.4400	78.8879 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1194.8246	15.4400	-184.4809 (252)
Total energy cost			579.1110 (255)

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

	Energy	Emission factor	Emissions
	kwh/year	kg CO2/kwh	kg CO2/year
Space heating - main system 1	2534.9345	0.5190	1315.6310 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1334.3772	0.5190	692.5418 (264)
Space and water heating			2008.1728 (265)
Space cooling	153.9393	0.5190	79.8945 (266)
Pumps and fans	411.3606	0.5190	213.4962 (267)
Energy for lighting	510.9321	0.5190	265.1738 (268)
Energy saving/generation technologies			
PV Unit	-1194.8246	0.5190	-620.1139 (269)
Total kg/year			1946.6233 (272)

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

	Energy	Primary energy factor	Primary energy
	kwh/year	kg CO2/kwh	kwh/year
Space heating - main system 1	2534.9345	3.0700	7782.2489 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1334.3772	3.0700	4096.5379 (264)
Space and water heating			11878.7868 (265)
Space cooling	153.9393	3.0700	472.5938 (266)
Pumps and fans	411.3606	3.0700	1262.8772 (267)
Energy for lighting	510.9321	3.0700	1568.5617 (268)
Energy saving/generation technologies			

PV Unit	-1194.8246	3.0700	-3668.1114 (269)
Primary energy kWh/year			11514.7080 (272)
Primary energy kWh/m2/year			74.9168 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 83
Current environmental impact rating:	B 85

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating:	B 83
Potential environmental impact rating:	B 85

Fuel prices for cost data on this page from database revision number 401 TEST (27 Oct 2016)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£764	£764	£0
Space heating	£455	£455	£0
Space cooling	£24	£24	£0
Water heating	£206	£206	£0
Lighting	£79	£79	£0
Generated (PV)	-£184	-£184	£0
Total cost of fuels	£580	£580	£0
Total cost of uses	£580	£580	£0
Delivered energy	24 kWh/m²	24 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.9 tonnes	1.9 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	75 kWh/m²	75 kWh/m²	0 kWh/m²

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

No improvements selected / applicable

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	1082.28 (P1)
Transmission heat loss coefficient	105.29 (37)
Summer heat loss coefficient	1187.57 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
East	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs
East	1.000	0.90	1.000
			0.900 (P8)
[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b
			Specific data FF or Table 6c
East	44.2300	117.5071	0.3600
			1.0000
total:			0.9000
			1515.5437

Solar gains	Jun	Jul	Aug	
	1609	1516	1333	(P3)
Internal gains	632	607	617	
Total summer gains	2241	2123	1950	(P5)
Summer gain/loss ratio	1.89	1.79	1.64	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.19	20.99	20.74	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

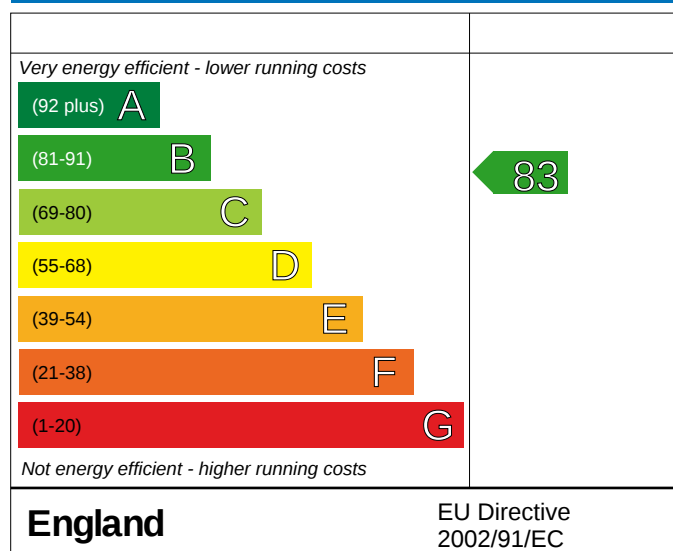
504,
London

Dwelling type: Flat, End-Terrace
Date of assessment: 01.Nov.2016
Produced by: Gecko
Total floor area: 153.7 m²

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

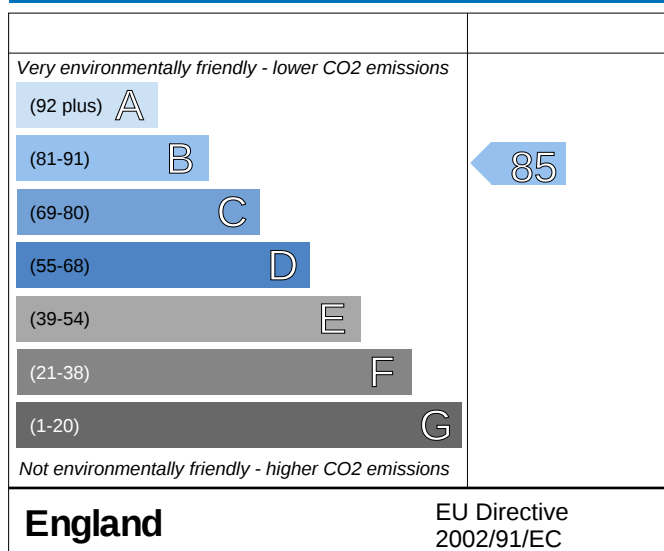
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO₂) Rating



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

SURVEY NOTES

Property Reference: 504 Linton House

Issued on Date: 01.Nov.2016

Survey Reference: 504 design

Prop Type Ref:

Property: 504, London

SAP Rating: 83 B	CO2 Emissions (t/year): 1.95	DER: 16.00 Pass	TER: 22.94	Percentage DER<TER: 30.24 %
Environmental: 85 B	General Requirements Compliance: Pass	DFEE: 47.39 Pass	TFEE: 56.34	Percentage DFEE<TFEE: 15.89 %

CfSH Results Version: November 2010 - June 2014 Addendum **ENE1 Credits:** 3.8 **ENE2 Credits:** 3.2 **ENE7 Credits:** 0 **CfSH Level:** 4

Surveyor: Mike Ovenden, Tel: 01908 850109

Surveyor ID: H824-0001

Address: Dudley Hill, Shenley Church End, Milton Keynes, Buckinghamshire, MK5 6LL

Client: Synergy, 3

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.06r08

SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

SURVEY NOTES - Last time updated on: 01.11.2016

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Summary Information

Property Reference: 504 Linton House
Survey Reference: 504 design

Issued on Date: 01.Nov.2016
Prop Type Ref:

Property: 504, London

SAP Rating: 83 B **CO2 Emissions (t/year):** 1.95 **DER:** 16.00 Pass **TER:** 22.94 **Percentage DER<TER:** 30.24 %
Environmental: 85 B **General Requirements Compliance:** Pass **DFEE:** 47.39 Pass **TFEE:** 56.34 **Percentage DFEE<TFEE:** 15.89 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 3.8 **ENE2 Credits:** 3.2 **ENE7 Credits:** 0 **CfSH Level:** 4

Surveyor: Mike Ovenden, Tel: 01908 850109 **Surveyor ID:** H824-0001
Address: Dudley Hill, Shenley Church End, Milton Keynes, Buckinghamshire, MK5 6LL
Client: Synergy, 3

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.06r08
SAP version: SAP 2012, **Regs Region:** England (Part L1A 2013), **Calculation Type:** New Build (As Designed)

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Page 34 of 38

Orientation West
1.0 Property Type Flat, End-Terrace
2.0 Number of Storeys 2
3.0 Date Built 2016
3.0 Property Age Band
4.0 Sheltered Sides 2
5.0 Sunlight/Shade Average or unknown
6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	23.45	112.36	2.60
1st Storey:	19.94	41.34	2.85

7.0 Living Area 45.35

8.0 Thermal Mass Parameter Simple calculation - Low

9.0 External Walls	Description	Construction	U-Value	Kappa	Gross Area	Nett Area
External Wall 1	Other		0.58		89.37	48.76
External Wall 2	Other		0.58		28.43	24.81

9.1 Party walls	Description	Construction	Kappa	Area
Party Wall 1	Steel frame			93.43
Party Wall 2	Steel frame			39.81

10.0 External Roofs	Description	Construction	U-Value	Kappa	Gross Area	Nett Area
penthouse roof	Other		0.10		71.02	71.02
garden room roof	Other		0.10		41.34	41.34

11.0 HeatLoss Floors	Description	Construction	U-Value	Kappa	Area
penthouse floor	Other		0.15		112.36

12.0 Opening Types	Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	Solar Trans	Frame Type	Frame Factor	U value
Opening Type 1	Manufacturer	Window	Double Low-E Soft	0.05			0.36		1.00	0.58

13.0 Openings	Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width	Height	Count	Area	Curtain Closed
1	Window		[1] External Wall 1	East	None	0.00					4.16	
2	Window		[1] External Wall 1	East	None	0.00					7.29	
3	Window		[1] External Wall 1	East	None	0.00					7.29	

4	Window	[1] External Wall 1	East	None	0.00	7.29
5	Window	[1] External Wall 1	East	None	0.00	7.29
6	Window	[1] External Wall 1	East	None	0.00	7.29
1gh	Window	[2] External Wall 2	East	None	0.00	3.62
14.0	Conservatory	None				
15.0	Draught Proofing	100				
16.0	Draught Lobby	No				
17.0	Thermal Bridging	Calculate Bridges				
17.1	List of Bridges					
	Source Type	Bridge Type			Length	Psi Imported
	Table K1 - Approved	E5 Ground floor (normal)			19.94	0.160 No
	Table K1 - Approved	E6 Intermediate floor within a dwelling			19.94	0.070 Yes
	Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)			23.45	0.070 Yes
	Table K1 - Default	E14 Flat roof			19.94	0.080 Yes
	Table K1 - Approved	E16 Corner (normal)			10.90	0.090 Yes
	Table K1 - Approved	E18 Party wall between dwellings			10.90	0.060 Yes
18.0	Pressure Testing	Yes				
	Designed q50	5.00				
	Property Tested ?					
	As Built q50					
	Same As Designed ?					
19.0	Mechanical Ventilation					
	Mechanical Ventilation System	Yes				
	Present					
	Approved Installation	Yes				
	Windows open in hot weather	Windows fully open				
	Cross ventilation possible	Yes				
	Night Ventilation	No				
	Air change rate	8.00				
	Mechanical Ventilation data Type	Database				
	Type	Balanced mechanical ventilation with heat recovery				
	MV Reference Number	500320				
	Configuration	2				
	MVHR Duct Insulated	No				
	Manufacturer SFP	0.61				
	Duct Type	Rigid				
	MVHR Efficiency	78.00				
	Wet Rooms	2				
	Brand, Model					
20.0	Fans, Open Fireplaces, Flues					
		MHS	SHS	Other	Total	
	Number of Chimneys	0		0	0	
	Number of open flues	0		0	0	
	Number of intermittent fans				0	
	Number of passive vents				0	
	Number of flueless gas fires				0	
21.0	Cooling System	Yes				
	Cooled Area	153.70				
	Data Source	SAP table				
	Cooling Type	Split or Multi-Split				
	Energy Class	A				
	Energy Efficiency Ratio					
	System Control	On/Off				
22.0	Lighting					
	Internal					
	Total number of light fittings	52				
	Total number of L.E.L. fittings	52				
	Percentage of L.E.L. fittings	100.00				
	External					
	External lights fitted	Yes				
	Light and motion sensors	Yes				
23.0	Electricity Tariff	Standard				
24.0	Heating Systems					
	Main Heating 1	SAP table				
	Description	ashp				
	Percentage of Heat	100 %				
	Main Heating 2	None				
	Description					
	Percentage of Heat	%				

Community Heating	
Secondary Heating	None
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery	No
Instantaneous System 1	
Waste Water Heat Recovery	No
Instantaneous System 2	
Waste Water Heat Recovery Storage	No
System	
Solar Panel	No
25.0 Main Heating 1	
Database Ref. No.	
Fuel Type	
Main Heating	PET
TestMethod	
SAP Code	224
Efficiency (SAP Table) %	170.0
Efficiency (SAP Table) %	
In Winter	
In Summer	
Model Name	
Manufacturer	
Controls	CHD Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	
Sap Code	2207
Burner Control	
Boiler Compensator	
HETAS approved System	
Oil Pump Inside	
FI Case	
FI Water	
Flue Type	
Smoke Control Area	
Fan Assisted Flue	
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators and Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	<= 35°C
Electric CPSU Temperature	
Combi boiler type	
Combi keep hot type	
Combi store type	
27.0 Community Heating	
Space Community Heating	
PCDF Index	
Distribution Loss	
Distribution Loss Value	
Controls	
SAP Code	
Water Community Heating	
PCDF Index	
Distribution Loss	
Distribution Loss Value	
Charging Linked To Heat Use	
28.0 Secondary Heating	
Description	
SHS efficiency %	
SAP Code	
HETAS Approved System	
Smoke Control Area	
Test Method	
Manufacturer	
Model Name	
29.0 Water Heating	HWP From main heating 1
Water use <= 125 litres/person/day	Yes
SAP Code	901
Immersion Heater	
Summer Immersion	
Supplementary Immersion	No
Immersion Only Heating Hot Water	
29.1 Flue Gas Heat Recovery System	
Database ID	
Brand Model	
Details	

29.2 Waste Water Heat Recovery

System

Total rooms with shower and/or bath

30.0 Hot Water Cylinder	Hot Water Cylinder
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Foam
Insulation Thickness	
Cylinder Volume	180.00
Loss (kwh/day)	
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	

31.0 Solar Panel

Solar Panel Area

Area Type

Panel Type

n0, a1, a2, A/G ratio

Orientation

Elevation

Overshading

Solar Storage Volume

Pump electrically powered

Combined Cylinder

32.0 Thermal Store	None
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Thermal Store Pipework

33.0 Photovoltaic Unit	One Dwelling
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Apportioned KWh/Year

PV Cells kW Peak	Orientation	Elevation	Overshading
1.31	South	30°	None Or Little

34.0 Wind Turbines

Terrain Type

Urban

Wind Turbines

Count

Apportioned Kwh/year

Rotor Diameter

Hub Height

35.0 Small-scale Hydro

Electricity Generated

Description

Apportioned kWh/Year

Recommendations

None

Further measures to achieve even higher standards

None

Thermal Bridging

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Property Reference: 504 Linton House

Issued on Date: 01.Nov.2016

Survey Reference: 504 design

Prop Type Ref:
Property: 504, London

SAP Rating: 83 B **CO2 Emissions (t/year):** 1.95 **DER:** 16.00 Pass **TER:** 22.94 **Percentage DER<TER:** 30.24 %
Environmental: 85 B **General Requirements Compliance:** Pass **DFEE:** 47.39 Pass **TFEE:** 56.34 **Percentage DFEE<TFEE:** 15.89 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 3.8 **ENE2 Credits:** 3.2 **ENE7 Credits:** 0 **CfSH Level:** 4

Surveyor: Mike Ovenden, Tel: 01908 850109

Surveyor ID: H824-0001

Address: Dudley Hill, Shenley Church End, Milton Keynes, Buckinghamshire, MK5 6LL

Client: Synergy, 3

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.06r08

SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	19.94	3.19	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	19.94	1.40	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	23.45	1.64	
External wall	E14 Flat roof	Table K1 - Default	0.080	19.94	1.60	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	10.90	0.98	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	10.90	0.65	

Total W/mK: 9.46

Y-Value W/m2K: 0.028