Building Regulation Compliance

Property Reference: 505 Linton House
Survey Reference: 505 design
Property: 505, London

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

SAP Rating:	85 B	**CO2 Emissions (t/year):**	1.13	**DER:**	17.65 Pass	**TER:**	27.09	**Percentage DER<TER:**	34.84 %
Environmental:	86 B	**General Requirements Compliance:**	Pass	**DFEE:**	54.00 Pass	**TFEE:**	55.26	**Percentage DFEE<TFEE:**	2.27 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.2 **ENE2 Credits:** 0.0 **ENE7 Credits:** 1 **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)	27.09 kg/m^2	
Dwelling Carbon Dioxide Emission Rate (DER)	17.65 kg/m^2	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.26 kWh/m^2	
Dwelling Fabric Energy Efficiency (DFEE)	54.00 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	0.78 (max. 2.00)	0.78 (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):	Medium	OK
Based On:		
Overshading:	Average	
Windows facing East:	10.69 m^2, No overhang	
Windows facing West:	32.94 m^2, No overhang	
Air change rate:	8.00 ach	
Blinds/curtains:	None	

10 Key features

Party wall U-value	0.00 W/m^2K
Party wall U-value	0.00 W/m^2K
Roof U-value	0.10 W/m^2K
Roof U-value	0.10 W/m^2K
Window U-value	0.78 W/m^2K
Photovoltaic array	

Full SAP Calculation Printout

Property Reference: 505 Linton House
Survey Reference: 505 design
Property: 505, London

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

SAP Rating:	85 B	**CO2 Emissions (t/year):**	1.13	**DER:** 17.65 Pass	**TER:** 27.09	**Percentage DER<TER:**	34.84 %
Environmental:	86 B	**General Requirements Compliance:**	Pass	**DFEE:** 54.00 Pass	**TFEE:** 55.26	**Percentage DFEE<TFEE:**	2.27 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.2 **ENE2 Credits:** 0.0 **ENE7 Credits:** 1 **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 '505 design'
SAP2012 - 9.92 input data (DesignData) -

SAP2012 Input Data (Flat)	01/11/2016
FullRefNo:	505 design
Regs Region:	England
SAP Region:	Thames Valley
Postcode:	
DwellingOrientation:	East
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:	9.58, 54.55, 2.6
2nd Storey:	16.52, 25.48, 2.85
Living Area:	29.23 m2, fraction: 36.5%
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	6.91, 24.89, 0, Other, CurtainWalling, 0, 0.78, Calculate
External Wall 2	21.45, 47.1, 0, Other, CurtainWalling, 0, 0.78, Gross
Party Walls	Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall 1	62.49, 20, PartyWallSteelFrame, Solid, 0, 0
Party Wall 2	19.6, 20, PartyWallSteelFrame, Solid, 0, 0
External Roofs	Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
penthouse roof	29.07, 29.07, 0, Other, 0.1
garden room roof	25.48, 25.48, 0, Other, 0.1
Heat Loss Floors	Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
penthouse floor	54.55, 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, West, , None, 0, , 0, 0, 0, 7.29,
2	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 7.29,
3	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 3.40,
1gh	Window, External Wall 2, West, , None, 0, , 0, 0, 0, 25.65,
Conservatory:	None
Draught Proofing:	100
Draught Lobby:	No
Thermal Bridges	
Bridging:	Calculate Bridges
Y	0.041
List of Bridges	Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
0.	External wall, E1 Steel lintel with perforated steel base plate, , No, 0, 0, 0, 0.00,
1.	External wall, E2 Other lintels (including other steel lintels), , No, 0, 0, 0, 0.00,
2.	External wall, E3 Sill, , No, 0, 0, 0, 0.00,
3.	External wall, E4 Jamb, , No, 0, 0, 0, 0.00,
4.	External wall, E5 Ground floor (normal), Table K1 - Approved, No, 16.52, 0.16, 0.16, 2.64,
5.	External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
6.	External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
7.	External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
8.	External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
9.	External wall, E6 Intermediate floor within a dwelling, Table K1 - Approved, Yes, 16.52, 0.07, 0.07, 1.16,
10.	External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, Yes, 9.58, 0.07, 0.07, 0.67,
11.	External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
12.	External wall, E9 Balcony between dwellings, wall insulation continuous, , No, 0, 0, 0, 0.00,
13.	External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 0, 0, 0.00,
14.	External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
15.	External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
16.	External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
17.	External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
18.	External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
19.	External wall, E14 Flat roof, Table K1 - Default, Yes, 16.52, 0.08, 0.08, 1.32,
20.	External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
21.	External wall, E16 Corner (normal), Table K1 - Approved, Yes, 10.9, 0.09, 0.09, 0.98,
22.	External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
23.	External wall, E18 Party wall between dwellings, Table K1 - Approved, Yes, 10.9, 0.06, 0.06, 0.65,
24.	External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
25.	Party wall, P1 Party wall - Ground floor, , No, 0, 0, 0, 0.00,
26.	Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
27.	Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
28.	Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), , No, 0, 0, 0, 0.00,
29.	Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
30.	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,

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    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
    ManufacturerSFP         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             80.36
    Data Source             SAP table
    Type                    Split or Multi-Split
    Class                   A
    Control                 On/Off
Light Fittings:              38
LEL Fittings:                38
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
    Suplementary 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


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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Top-floor flat, total floor area 80 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) 27.09 kg/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.65 kg/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²
Dwelling Fabric Energy Efficiency (DFEE)54.0 kWh/m²OK

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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	0.78 (max. 2.00)	0.78 (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): Medium OK
Based on:
Overshading: Average
Windows facing East: 10.69 m², No overhang
Windows facing West: 32.94 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

---

10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Window U-value 0.78 W/m²K
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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.5500 (1b)	x	2.6000 (2b)	=	141.8300 (1b) - (3b)	
First floor	25.4800 (1c)	x	2.8500 (2c)	=	72.6180 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.4480	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 = 0.78)			43.6300	0.7564	33.0017			(27)
penthouse floor			54.5500	0.1500	8.1825			(28a)
External Wall 1	24.8900	17.9800	6.9100	0.7800	5.3898			(29a)
External Wall 2	47.1000	25.6500	21.4500	0.7800	16.7310			(29a)
penthouse roof	29.0700		29.0700	0.1000	2.9070			(30)
garden room roof	25.4800		25.4800	0.1000	2.5480			(30)
Total net area of external elements Aum(A, m2)			181.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7600			(33)
Party Wall 1			62.4900	0.0000	0.0000			(32)
Party Wall 2			19.6000	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)	7.4268	(36)
Total fabric heat loss (33) + (36) =	76.1868	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.2380	34.8620	34.4861	32.6063	32.2303	30.3506	30.3506	29.9746	31.1025	32.2303	32.9822	33.7341	(38)
Heat transfer coeff	111.4248	111.0489	110.6729	108.7931	108.4172	106.5374	106.5374	106.1614	107.2893	108.4172	109.1691	109.9210	(39)

Average = Sum(39)m / 12 = 108.6991 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3923	1.3876	1.3829	1.3594	1.3547	1.3312	1.3312	1.3265	1.3406	1.3547	1.3641	1.3735	(40)
HLP (average)												1.3582	(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	2.4634 (42)
Average daily hot water use (litres/day)	92.7065 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9771	98.2689	94.5606	90.8523	87.1441	83.4358	83.4358	87.1441	90.8523	94.5606	98.2689	101.9771	(44)
Energy conte	151.2291	132.2659	136.4866	118.9923	114.1760	98.5252	91.2981	104.7659	106.0171	123.5527	134.8674	146.4573	(45)
Energy content (annual)											Total = Sum(45)m =	1458.6337	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6844	19.8399	20.4730	17.8488	17.1264	14.7788	13.6947	15.7149	15.9026	18.5329	20.2301	21.9686	(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
204.8880 180.7320 190.1455 170.9203 167.8349 150.4531 144.9570 158.4247 157.9451 177.2116 186.7954 200.1162 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
204.8880 180.7320 190.1455 170.9203 167.8349 150.4531 144.9570 158.4247 157.9451 177.2116 186.7954 200.1162 (64)
Total per year (kWh/year) = Sum(64)m = 2090.4237 (64)
Heat gains from water heating, kWh/month
93.2108 82.7513 88.3089 81.1073 80.8906 74.3020 73.2837 77.7618 76.7930 84.0084 86.3858 91.6242 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
19.5689 17.3809 14.1351 10.7012 7.9993 6.7533 7.2972 9.4852 12.7310 16.1649 18.8668 20.1128 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
219.5032 221.7810 216.0411 203.8216 188.3967 173.8994 164.2143 161.9366 167.6765 179.8960 195.3209 209.8182 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 (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)
-98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 (71)
Water heating gains (Table 5)
125.2833 123.1418 118.6948 112.6490 108.7239 103.1972 98.4996 104.5185 106.6570 112.9145 119.9803 123.1508 (72)
Total internal gains
427.3069 425.2551 411.8224 390.1233 368.0713 346.8014 332.9626 338.8917 350.0159 371.9268 397.1194 416.0331 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6900	19.6403	0.3600	1.0000	0.7700	52.3794	(76)
West	32.9400	19.6403	0.3600	1.0000	0.7700	161.4012	(80)

Solar gains	213.7806	418.2002	688.7161	1004.4514	1230.9929	1260.1403	1199.7049	1030.5288	801.0054	496.2297	266.5593	175.8028	(83)
Total gains	641.0875	843.4553	1100.5386	1394.5747	1599.0642	1606.9417	1532.6675	1369.4205	1151.0212	868.1565	663.6787	591.8359	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9512	20.0187	20.0867	20.4338	20.5046	20.8664	20.8664	20.9403	20.7202	20.5046	20.3634	20.2241	
alpha	2.3301	2.3346	2.3391	2.3623	2.3670	2.3911	2.3911	2.3960	2.3813	2.3670	2.3576	2.3483	
util living area	0.9436	0.9004	0.8184	0.6821	0.5313	0.3910	0.2931	0.3366	0.5397	0.7883	0.9146	0.9520	(86)
MIT	18.9455	19.2946	19.7950	20.3167	20.6390	20.8039	20.8574	20.8451	20.7006	20.1942	19.4675	18.8920	(87)
Th 2	19.7693	19.7729	19.7765	19.7946	19.7982	19.8165	19.8165	19.8201	19.8092	19.7982	19.7910	19.7837	(88)
util rest of house	0.9349	0.8860	0.7938	0.6437	0.4800	0.3275	0.2187	0.2570	0.4693	0.7500	0.8996	0.9445	(89)
MIT 2	17.0577	17.5561	18.2572	18.9711	19.3798	19.5845	19.6354	19.6307	19.4781	18.8402	17.8250	16.9904	(90)
Living area fraction									fLA = Living area / (4) =			0.3652	(91)
MIT	17.7472	18.1911	18.8188	19.4626	19.8397	20.0299	20.0817	20.0742	19.9246	19.3347	18.4249	17.6849	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7472	18.1911	18.8188	19.4626	19.8397	20.0299	20.0817	20.0742	19.9246	19.3347	18.4249	17.6849	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9159	0.8627	0.7713	0.6321	0.4819	0.3393	0.2358	0.2746	0.4766	0.7329	0.8780	0.9271	(94)
Useful gains	587.1582	727.6472	848.8783	881.5382	770.5138	545.2684	361.3996	376.1013	548.5324	636.2721	582.7368	548.6730	(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	1498.3482	1475.9582	1363.3601	1149.1360	882.4844	578.4831	370.9324	390.0613	624.9182	946.9917	1236.3295	1482.2787	(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	677.9253	502.8650	382.7744	192.6704	83.3062	0.0000	0.0000	0.0000	0.0000	231.1753	470.5868	694.6026	(98)
Space heating												3235.9060	(98)
Space heating per m2											(98) / (4) =	40.4337	(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	1001.4516	788.3768	806.8270	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8900	0.9222	0.9018	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	891.3026	727.0286	727.6155	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1954.0357	1865.6037	1675.9546	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	765.1678	847.0999	705.5643	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling 2317.8320 (104)
Cooled fraction fC = cooled area / (4) = 1.0041 (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	192.0807	212.6482	177.1184	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling 581.8474 (107)
Space cooling per m2 7.2704 (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 1903.4741 (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													
	677.9253	502.8650	382.7744	192.6704	83.3062	0.0000	0.0000	0.0000	0.0000	231.1753	470.5868	694.6026	(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)													
	398.7796	295.8029	225.1614	113.3355	49.0036	0.0000	0.0000	0.0000	0.0000	135.9855	276.8158	408.5898	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

204.8880	180.7320	190.1455	170.9203	167.8349	150.4531	144.9570	158.4247	157.9451	177.2116	186.7954	200.1162	(64)

Efficiency of water heater 170.0000 (216)

(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	(217)

Fuel for water heating, kWh/month

120.5223	106.3130	111.8503	100.5413	98.7264	88.5018	85.2688	93.1910	92.9089	104.2421	109.8796	117.7154	(219)

Water heating fuel used 1229.6610 (219)
Space cooling fuel requirement

(221)m 0.0000	0.0000	0.0000	0.0000	0.0000	48.0202	53.1621	44.2796	0.0000	0.0000	0.0000	0.0000	(221)

Cooling 145.4618 (221)
Annual totals kWh/year
Space heating fuel - main system 1903.4741 (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) 199.4903 (230a)
central heating pump 30.0000 (230c)
Total electricity for the above, kWh/year 229.4903 (231)
Electricity for lighting (calculated in Appendix L) 345.5924 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 1.31 * 1080 * 1.00) = -1131.3418 -1131.3418 (233)
Total delivered energy for all uses 2722.3379 (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	1903.4741	0.5190	987.9031	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1229.6610	0.5190	638.1941	(264)
Space and water heating			1626.0972	(265)
Space cooling	145.4618	0.5190	75.4947	(266)
Pumps and fans	229.4903	0.5190	119.1054	(267)
Energy for lighting	345.5924	0.5190	179.3625	(268)
Energy saving/generation technologies				
PV Unit	-1131.3418	0.5190	-587.1664	(269)
Total CO2, kg/year			1412.8934	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.6500	(273)

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

DER		17.6500	ZC1
Total Floor Area	TFA	80.0300	
Assumed number of occupants	N	2.4634	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2530	ZC2
CO2 emissions from cooking, equation (L16)		2.2257	ZC3
Total CO2 emissions		36.1287	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.1287	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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.5500 (1b)	x	2.6000 (2b)	=	141.8300 (1b) - (3b)	
First floor	25.4800 (1c)	x	2.8500 (2c)	=	72.6180 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.4480	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 = 0.78)			43.6300	0.7564	33.0017			(27)
penthouse floor			54.5500	0.1500	8.1825			(28a)
External Wall 1	24.8900	17.9800	6.9100	0.7800	5.3898			(29a)
External Wall 2	47.1000	25.6500	21.4500	0.7800	16.7310			(29a)
penthouse roof	29.0700		29.0700	0.1000	2.9070			(30)
garden room roof	25.4800		25.4800	0.1000	2.5480			(30)
Total net area of external elements Aum(A, m2)			181.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7600			(33)
Party Wall 1			62.4900	0.0000	0.0000			(32)
Party Wall 2			19.6000	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)	7.4268	(36)
Total fabric heat loss (33) + (36) =	76.1868	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.2380	34.8620	34.4861	32.6063	32.2303	30.3506	30.3506	29.9746	31.1025	32.2303	32.9822	33.7341	(38)
Heat transfer coeff	111.4248	111.0489	110.6729	108.7931	108.4172	106.5374	106.5374	106.1614	107.2893	108.4172	109.1691	109.9210	(39)

Average = Sum(39)m / 12 = 108.6991 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3923	1.3876	1.3829	1.3594	1.3547	1.3312	1.3312	1.3265	1.3406	1.3547	1.3641	1.3735	(40)
HLP (average)												1.3582	(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	2.4634 (42)
Average daily hot water use (litres/day)	92.7065 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9771	98.2689	94.5606	90.8523	87.1441	83.4358	83.4358	87.1441	90.8523	94.5606	98.2689	101.9771	(44)
Energy conte	151.2291	132.2659	136.4866	118.9923	114.1760	98.5252	91.2981	104.7659	106.0171	123.5527	134.8674	146.4573	(45)
Energy content (annual)											Total = Sum(45)m =	1458.6337	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6844	19.8399	20.4730	17.8488	17.1264	14.7788	13.6947	15.7149	15.9026	18.5329	20.2301	21.9686	(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
219.0197 193.4962 204.2772 184.5961 181.9666 164.1290 159.0887 172.5565 171.6209 191.3433 200.4712 214.2479 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
219.0197 193.4962 204.2772 184.5961 181.9666 164.1290 159.0887 172.5565 171.6209 191.3433 200.4712 214.2479 (64)
Total per year (kWh/year) = Sum(64)m = 2256.8132 (64)
Heat gains from water heating, kWh/month
104.5162 92.9626 99.6143 92.0480 92.1960 85.2427 84.5891 89.0671 87.7337 95.3137 97.3265 102.9295 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
19.5689 17.3809 14.1351 10.7012 7.9993 6.7533 7.2972 9.4852 12.7310 16.1649 18.8668 20.1128 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
219.5032 221.7810 216.0411 203.8216 188.3967 173.8994 164.2143 161.9366 167.6765 179.8960 195.3209 209.8182 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 35.3172 (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)
-98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 (71)
Water heating gains (Table 5)
140.4787 138.3372 133.8901 127.8444 123.9193 118.3926 113.6950 119.7139 121.8524 128.1099 135.1756 138.3461 (72)
Total internal gains
442.5023 440.4505 427.0178 405.3187 383.2667 361.9967 348.1580 354.0871 365.2113 387.1222 412.3148 431.2285 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6900	19.6403	0.3600	1.0000	0.7700	52.3794	(76)
West	32.9400	19.6403	0.3600	1.0000	0.7700	161.4012	(80)

Solar gains	213.7806	418.2002	688.7161	1004.4514	1230.9929	1260.1403	1199.7049	1030.5288	801.0054	496.2297	266.5593	175.8028	(83)
Total gains	656.2828	858.6507	1115.7339	1409.7701	1614.2596	1622.1370	1547.8629	1384.6159	1166.2166	883.3519	678.8741	607.0313	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9512	20.0187	20.0867	20.4338	20.5046	20.8664	20.8664	20.9403	20.7202	20.5046	20.3634	20.2241	
alpha	2.3301	2.3346	2.3391	2.3623	2.3670	2.3911	2.3911	2.3960	2.3813	2.3670	2.3576	2.3483	
util living area	0.9411	0.8973	0.8147	0.6782	0.5278	0.3879	0.2905	0.3333	0.5347	0.7831	0.9111	0.9495	(86)
MIT	18.4397	18.9015	19.5628	20.2500	20.6742	20.8897	20.9598	20.9436	20.7556	20.0916	19.1318	18.3681	(87)
Th 2	19.7693	19.7729	19.7765	19.7946	19.7982	19.8165	19.8165	19.8201	19.8092	19.7982	19.7910	19.7837	(88)
util rest of house	0.9320	0.8825	0.7898	0.6396	0.4765	0.3247	0.2167	0.2543	0.4645	0.7443	0.8956	0.9417	(89)
MIT 2	17.4791	17.9292	18.5615	19.2045	19.5716	19.7556	19.8011	19.7971	19.6609	19.0900	18.1752	17.4189	(90)
Living area fraction									fLA = Living area / (4) =			0.3652	(91)
MIT	17.8299	18.2843	18.9272	19.5863	19.9743	20.1698	20.2243	20.2158	20.0607	19.4558	18.5246	17.7656	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8299	18.2843	18.9272	19.5863	19.9743	20.1698	20.2243	20.2158	20.0607	19.4558	18.5246	17.7656	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9132	0.8603	0.7698	0.6324	0.4844	0.3441	0.2426	0.2815	0.4802	0.7317	0.8752	0.9244	(94)
Useful gains	599.3432	738.6786	858.8908	891.5701	781.9360	558.2482	375.5546	389.7815	560.0297	646.3456	594.1403	561.1518	(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	1507.5713	1486.3110	1375.3541	1162.5978	897.0769	593.3921	386.1278	405.0940	639.5246	960.1257	1247.2137	1491.1451	(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	675.7217	502.4089	384.2487	195.1399	85.6648	0.0000	0.0000	0.0000	0.0000	233.4524	470.2128	691.9150	(98)
Space heating												3238.7643	(98)
Space heating per m2											(98) / (4) =	40.4694	(99)

8c. Space cooling requirement

Not applicable

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

DER		17.2100	ZC1
Total Floor Area	TFA	80.0300	
Assumed number of occupants	N	2.4634	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2530	ZC2
CO2 emissions from cooking, equation (L16)		2.2257	ZC3
Total CO2 emissions		35.6887	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5

Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	35.6887	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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.5500 (1b)	x	2.6000 (2b)	=	141.8300 (1b) - (3b)	
First floor	25.4800 (1c)	x	2.8500 (2c)	=	72.6180 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.4480	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1399	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3899	(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) =	0.3314	(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	0.4225	0.4143	0.4060	0.3646	0.3563	0.3148	0.3148	0.3066	0.3314	0.3563	0.3728	0.3894	(22b)
Effective ac	0.5893	0.5858	0.5824	0.5664	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758	(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)			20.0000	1.4151	28.3019			(27)
penthouse floor			54.5500	0.1300	7.0915			(28a)
External Wall 1	24.8900	8.2400	16.6500	0.1800	2.9970			(29a)
External Wall 2	47.1000	11.7600	35.3400	0.1800	6.3612			(29a)
penthouse roof	29.0700		29.0700	0.1300	3.7791			(30)
garden room roof	25.4800		25.4800	0.1300	3.3124			(30)
Total net area of external elements Aum(A, m2)			181.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.8431			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.2704 (36)
Total fabric heat loss	(33) + (36) =	58.1135 (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	41.7016	41.4563	41.2158	40.0864	39.8750	38.8913	38.8913	38.7091	39.2702	39.8750	40.3025	40.7495	(38)
Heat transfer coeff	99.8151	99.5698	99.3293	98.1998	97.9885	97.0048	97.0048	96.8226	97.3837	97.9885	98.4160	98.8629	(39)
Average = Sum(39)m / 12 =												98.1988	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2472	1.2442	1.2412	1.2270	1.2244	1.2121	1.2121	1.2098	1.2168	1.2244	1.2297	1.2353	(40)
HLP (average)												1.2270	(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	2.4634 (42)
Average daily hot water use (litres/day)	92.7065 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9771	98.2689	94.5606	90.8523	87.1441	83.4358	83.4358	87.1441	90.8523	94.5606	98.2689	101.9771	(44)
Energy conte	151.2291	132.2659	136.4866	118.9923	114.1760	98.5252	91.2981	104.7659	106.0171	123.5527	134.8674	146.4573	(45)
Energy content (annual)										Total = Sum(45)m =		1458.6337	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6844	19.8399	20.4730	17.8488	17.1264	14.7788	13.6947	15.7149	15.9026	18.5329	20.2301	21.9686	(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	200.4718	176.7432	185.7293	166.6465	163.4186	146.1794	140.5407	154.0085	153.6713	172.7954	182.5216	195.7000	(62)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	200.4718	176.7432	185.7293	166.6465	163.4186	146.1794	140.5407	154.0085	153.6713	172.7954	182.5216	195.7000	(64)
								Total per year (kWh/year) = Sum(64)m =				2038.4264	(64)
Heat gains from water heating, kWh/month													
	89.6778	79.5602	84.7759	77.6883	77.3576	70.8830	69.7507	74.2288	73.3740	80.4754	82.9668	88.0912	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.5689	17.3809	14.1351	10.7012	7.9993	6.7533	7.2972	9.4852	12.7310	16.1649	18.8668	20.1128	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.5032	221.7810	216.0411	203.8216	188.3967	173.8994	164.2143	161.9366	167.6765	179.8960	195.3209	209.8182	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	(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)													
	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	(71)
Water heating gains (Table 5)													
	120.5347	118.3932	113.9461	107.9004	103.9753	98.4486	93.7510	99.7699	101.9084	108.1659	115.2316	118.4021	(72)
Total internal gains													
	422.5583	420.5065	407.0738	385.3747	363.3227	342.0527	328.2140	334.1431	345.2673	367.1782	392.3708	411.2845	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.9000	19.6403	0.6300	0.7000	0.7700	29.4114	(76)
West	15.1000	19.6403	0.6300	0.7000	0.7700	90.6350	(80)

Solar gains	120.0464	234.8362	386.7418	564.0399	691.2520	707.6195	673.6826	578.6834	449.7967	278.6530	149.6837	98.7203	(83)
Total gains	542.6047	655.3428	793.8156	949.4145	1054.5747	1049.6722	1001.8966	912.8264	795.0640	645.8311	542.0546	510.0048	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.6793	55.8165	55.9517	56.5952	56.7172	57.2924	57.2924	57.4002	57.0695	56.7172	56.4709	56.2156	
alpha	4.7120	4.7211	4.7301	4.7730	4.7811	4.8195	4.8195	4.8267	4.8046	4.7811	4.7647	4.7477	
util living area													
	0.9966	0.9913	0.9723	0.9052	0.7617	0.5713	0.4220	0.4800	0.7516	0.9554	0.9926	0.9974	(86)
MIT	19.7014	19.9000	20.2284	20.6194	20.8749	20.9754	20.9953	20.9916	20.9138	20.5345	20.0400	19.6686	(87)
Th 2	19.8824	19.8848	19.8872	19.8984	19.9005	19.9103	19.9103	19.9121	19.9066	19.9005	19.8963	19.8918	(88)
util rest of house													
	0.9954	0.9884	0.9630	0.8755	0.6996	0.4825	0.3196	0.3705	0.6649	0.9350	0.9897	0.9966	(89)
MIT 2	18.1678	18.4581	18.9314	19.4766	19.7889	19.8957	19.9088	19.9090	19.8440	19.3791	18.6715	18.1265	(90)
Living area fraction									fLA = Living area / (4) =			0.3652	(91)
MIT	18.7279	18.9847	19.4051	19.8940	20.1856	20.2900	20.3056	20.3044	20.2347	19.8011	19.1714	18.6897	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7279	18.9847	19.4051	19.8940	20.1856	20.2900	20.3056	20.3044	20.2347	19.8011	19.1714	18.6897	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9937	0.9851	0.9578	0.8753	0.7168	0.5143	0.3571	0.4107	0.6930	0.9327	0.9869	0.9952	(94)
Useful gains	539.1904	645.5998	760.3406	831.0436	755.8985	539.8566	357.8105	374.8750	550.9581	602.3413	534.9678	507.5605	(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													
	1440.1269	1402.4140	1281.8544	1079.6093	831.4883	551.9605	359.4636	378.0371	597.4193	901.5999	1188.0158	1432.4943	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	670.2968	508.5792	388.0063	178.9673	56.2388	0.0000	0.0000	0.0000	0.0000	222.6484	470.1946	688.1507	(98)
Space heating												3183.0821	(98)
Space heating per m2											(98) / (4) =	39.7736	(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												3404.3658	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	670.2968	508.5792	388.0063	178.9673	56.2388	0.0000	0.0000	0.0000	0.0000	222.6484	470.1946	688.1507	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													

	716.8950	543.9350	414.9800	191.4089	60.1485	0.0000	0.0000	0.0000	0.0000	238.1266	502.8819	735.9901 (211)
Water heating requirement												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement												
	200.4718	176.7432	185.7293	166.6465	163.4186	146.1794	140.5407	154.0085	153.6713	172.7954	182.5216	195.7000 (64)
Efficiency of water heater												79.8000 (216)
(217)m	87.7900	87.4751	86.7352	85.0043	82.2910	79.8000	79.8000	79.8000	79.8000	85.4910	87.2294	87.8906 (217)
Fuel for water heating, kWh/month												
	228.3539	202.0498	214.1337	196.0449	198.5862	183.1822	176.1162	192.9932	192.5706	202.1211	209.2434	222.6631 (219)
Water heating fuel used												2418.0582 (219)
Annual totals kWh/year												
Space heating fuel - main system												3404.3658 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	75.0000 (231)
Electricity for lighting (calculated in Appendix L)	345.5924 (232)
Total delivered energy for all uses	6243.0165 (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	3404.3658	0.2160	735.3430 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2418.0582	0.2160	522.3006 (264)
Space and water heating			1257.6436 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	345.5924	0.5190	179.3625 (268)
Total CO2, kg/m2/year			1475.9311 (272)
Emissions per m2 for space and water heating			15.7147 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2412 (272b)
Emissions per m2 for pumps and fans			0.4864 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7147 * 1.55) + 2.2412 + 0.4864, rounded to 2 d.p.			27.0900 (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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.5500 (1b)	x	2.6000 (2b)	=	141.8300 (1b) - (3b)	
First floor	25.4800 (1c)	x	2.8500 (2c)	=	72.6180 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.4480	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1399	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3899	(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) =	0.3314	(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	0.4225	0.4143	0.4060	0.3646	0.3563	0.3148	0.3148	0.3066	0.3314	0.3563	0.3728	0.3894	(22b)
Effective ac	0.5893	0.5858	0.5824	0.5664	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758	(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 = 0.78)			43.6300	0.7564	33.0017			(27)
penthouse floor			54.5500	0.1500	8.1825			(28a)
External Wall 1	24.8900	17.9800	6.9100	0.7800	5.3898			(29a)
External Wall 2	47.1000	25.6500	21.4500	0.7800	16.7310			(29a)
penthouse roof	29.0700		29.0700	0.1000	2.9070			(30)
garden room roof	25.4800		25.4800	0.1000	2.5480			(30)
Total net area of external elements Aum(A, m2)			181.0900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.7600			(33)
Party Wall 1			62.4900	0.0000	0.0000			(32)
Party Wall 2			19.6000	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)		7.4268 (36)
Total fabric heat loss	(33) + (36) =	76.1868 (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	41.7016	41.4563	41.2158	40.0864	39.8750	38.8913	38.8913	38.7091	39.2702	39.8750	40.3025	40.7495	(38)
Heat transfer coeff	117.8884	117.6431	117.4027	116.2732	116.0619	115.0782	115.0782	114.8960	115.4571	116.0619	116.4894	116.9363	(39)
Average = Sum(39)m / 12 =												116.2722	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4731	1.4700	1.4670	1.4529	1.4502	1.4379	1.4379	1.4357	1.4427	1.4502	1.4556	1.4612	(40)
HLP (average)												1.4529	(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	2.4634 (42)
Average daily hot water use (litres/day)	92.7065 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9771	98.2689	94.5606	90.8523	87.1441	83.4358	83.4358	87.1441	90.8523	94.5606	98.2689	101.9771	(44)
Energy conte	151.2291	132.2659	136.4866	118.9923	114.1760	98.5252	91.2981	104.7659	106.0171	123.5527	134.8674	146.4573	(45)
Energy content (annual)										Total = Sum(45)m =		1458.6337	(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	32.1362	28.1065	29.0034	25.2859	24.2624	20.9366	19.4008	22.2627	22.5286	26.2550	28.6593	31.1222	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.5689	17.3809	14.1351	10.7012	7.9993	6.7533	7.2972	9.4852	12.7310	16.1649	18.8668	20.1128	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.5032	221.7810	216.0411	203.8216	188.3967	173.8994	164.2143	161.9366	167.6765	179.8960	195.3209	209.8182	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	(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)													
	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	(71)
Water heating gains (Table 5)													
	43.1938	41.8252	38.9831	35.1193	32.6107	29.0786	26.0764	29.9230	31.2898	35.2889	39.8046	41.8309	(72)
Total internal gains													
	342.2174	340.9385	329.1107	309.5935	288.9581	269.6828	257.5394	261.2962	271.6486	291.3012	313.9438	331.7133	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6900	19.6403	0.3600	1.0000	0.7700	52.3794	(76)
West	32.9400	19.6403	0.3600	1.0000	0.7700	161.4012	(80)

Solar gains	213.7806	418.2002	688.7161	1004.4514	1230.9929	1260.1403	1199.7049	1030.5288	801.0054	496.2297	266.5593	175.8028	(83)
Total gains	555.9979	759.1387	1017.8269	1314.0449	1519.9510	1529.8231	1457.2443	1291.8250	1072.6540	787.5310	580.5030	507.5160	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.8573	18.8966	18.9353	19.1192	19.1541	19.3178	19.3178	19.3484	19.2544	19.1541	19.0838	19.0108	
alpha	2.2572	2.2598	2.2624	2.2746	2.2769	2.2879	2.2879	2.2899	2.2836	2.2769	2.2723	2.2674	
util living area													
	0.9580	0.9200	0.8456	0.7180	0.5701	0.4299	0.3266	0.3762	0.5873	0.8255	0.9354	0.9651	(86)
MIT	18.1168	18.5973	19.3069	20.0636	20.5696	20.8399	20.9384	20.9135	20.6622	19.8738	18.8275	18.0283	(87)
Th 2	19.7078	19.7101	19.7124	19.7230	19.7250	19.7344	19.7344	19.7361	19.7308	19.7250	19.7210	19.7168	(88)
util rest of house													
	0.9510	0.9075	0.8226	0.6795	0.5154	0.3581	0.2398	0.2836	0.5118	0.7898	0.9231	0.9593	(89)
MIT 2	17.1226	17.5932	18.2763	18.9844	19.4258	19.6470	19.7116	19.7016	19.5257	18.8412	17.8348	17.0414	(90)
Living area fraction									fLA = Living area / (4) =			0.3652	(91)
MIT	17.4857	17.9600	18.6527	19.3786	19.8436	20.0827	20.1596	20.1442	19.9408	19.2183	18.1974	17.4019	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4857	17.9600	18.6527	19.3786	19.8436	20.0827	20.1596	20.1442	19.9408	19.2183	18.1974	17.4019	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9346	0.8857	0.8001	0.6680	0.5208	0.3786	0.2698	0.3146	0.5253	0.7729	0.9036	0.9447	(94)
Useful gains	519.6458	672.3540	814.3402	877.7504	791.6213	579.2651	393.2338	406.4208	563.4362	608.6539	524.5684	479.4297	(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													
	1554.4463	1536.4141	1426.7635	1218.3807	945.1589	630.9426	409.6358	430.1940	674.3630	1000.2613	1292.7281	1543.7765	(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													
	769.8916	580.6484	455.6429	245.2538	114.2320	0.0000	0.0000	0.0000	0.0000	291.3559	553.0750	791.8740	(98)
Space heating												3801.9736	(98)
Space heating per m2											(98) / (4) =	47.5069	(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	1081.7347	851.5784	873.2095	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8568	0.8954	0.8687	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	926.8622	762.4860	758.5932	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1879.9171	1793.1805	1601.3591	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	686.1995	766.8367	627.0179	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2080.0541	(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	171.5499	191.7092	156.7545	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												520.0135	(107)
Space cooling per m2												6.4977	(108)
Energy for space heating												47.5069	(99)
Energy for space cooling												6.4977	(108)
Total												54.0046	(109)
Dwelling Fabric Energy Efficiency (DFEE)												54.0	(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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.5500 (1b)	x	2.6000 (2b)	=	141.8300 (1b) - (3b)	
First floor	25.4800 (1c)	x	2.8500 (2c)	=	72.6180 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.4480	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1399	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3899	(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) =	0.3314	(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	0.4225	0.4143	0.4060	0.3646	0.3563	0.3148	0.3148	0.3066	0.3314	0.3563	0.3728	0.3894	(22b)
Effective ac	0.5893	0.5858	0.5824	0.5664	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758	(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)			20.0000	1.4151	28.3019			(27)
penthouse floor			54.5500	0.1300	7.0915			(28a)
External Wall 1	24.8900	8.2400	16.6500	0.1800	2.9970			(29a)
External Wall 2	47.1000	11.7600	35.3400	0.1800	6.3612			(29a)
penthouse roof	29.0700		29.0700	0.1300	3.7791			(30)
garden room roof	25.4800		25.4800	0.1300	3.3124			(30)
Total net area of external elements Aum(A, m2)			181.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.8431			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2704	(36)
Total fabric heat loss					(33) + (36) =		58.1135	(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	41.7016	41.4563	41.2158	40.0864	39.8750	38.8913	38.8913	38.7091	39.2702	39.8750	40.3025	40.7495	(38)
Heat transfer coeff	99.8151	99.5698	99.3293	98.1998	97.9885	97.0048	97.0048	96.8226	97.3837	97.9885	98.4160	98.8629	(39)
Average = Sum(39)m / 12 =												98.1988	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2472	1.2442	1.2412	1.2270	1.2244	1.2121	1.2121	1.2098	1.2168	1.2244	1.2297	1.2353	(40)
HLP (average)												1.2270	(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		2.4634 (42)
Average daily hot water use (litres/day)		92.7065 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9771	98.2689	94.5606	90.8523	87.1441	83.4358	83.4358	87.1441	90.8523	94.5606	98.2689	101.9771	(44)
Energy conte	151.2291	132.2659	136.4866	118.9923	114.1760	98.5252	91.2981	104.7659	106.0171	123.5527	134.8674	146.4573	(45)
Energy content (annual)										Total = Sum(45)m =		1458.6337	(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	32.1362	28.1065	29.0034	25.2859	24.2624	20.9366	19.4008	22.2627	22.5286	26.2550	28.6593	31.1222	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	123.1715	(66)

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

	19.5689	17.3809	14.1351	10.7012	7.9993	6.7533	7.2972	9.4852	12.7310	16.1649	18.8668	20.1128	(67)

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

	219.5032	221.7810	216.0411	203.8216	188.3967	173.8994	164.2143	161.9366	167.6765	179.8960	195.3209	209.8182	(68)

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

	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	35.3172	(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)

	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	-98.5372	(71)

Water heating gains (Table 5)

	43.1938	41.8252	38.9831	35.1193	32.6107	29.0786	26.0764	29.9230	31.2898	35.2889	39.8046	41.8309	(72)

Total internal gains

	342.2174	340.9385	329.1107	309.5935	288.9581	269.6828	257.5394	261.2962	271.6486	291.3012	313.9438	331.7133	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.9000	19.6403	0.6300	0.7000	0.7700	29.4114	(76)
West	15.1000	19.6403	0.6300	0.7000	0.7700	90.6350	(80)

Solar gains	120.0464	234.8362	386.7418	564.0399	691.2520	707.6195	673.6826	578.6834	449.7967	278.6530	149.6837	98.7203	(83)
Total gains	462.2638	575.7747	715.8525	873.6334	980.2102	977.3022	931.2220	839.9796	721.4454	569.9542	463.6275	430.4336	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.6793	55.8165	55.9517	56.5952	56.7172	57.2924	57.2924	57.4002	57.0695	56.7172	56.4709	56.2156	
alpha	4.7120	4.7211	4.7301	4.7730	4.7811	4.8195	4.8195	4.8267	4.8046	4.7811	4.7647	4.7477	
util living area	0.9983	0.9949	0.9812	0.9266	0.7956	0.6072	0.4525	0.5183	0.7970	0.9716	0.9962	0.9988	(86)
MIT	19.6100	19.8114	20.1483	20.5617	20.8478	20.9682	20.9937	20.9883	20.8876	20.4613	19.9519	19.5775	(87)
Th 2	19.8824	19.8848	19.8872	19.8984	19.9005	19.9103	19.9103	19.9121	19.9066	19.9005	19.8963	19.8918	(88)
util rest of house	0.9977	0.9931	0.9746	0.9016	0.7361	0.5154	0.3435	0.4018	0.7143	0.9575	0.9946	0.9984	(89)
MIT 2	18.6207	18.8232	19.1576	19.5601	19.8056	19.8971	19.9089	19.9091	19.8485	19.4772	18.9729	18.5958	(90)
Living area fraction									fLA = Living area / (4) =			0.3652	(91)
MIT	18.9821	19.1841	19.5194	19.9259	20.1862	20.2883	20.3051	20.3033	20.2280	19.8366	19.3305	18.9543	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9821	19.1841	19.5194	19.9259	20.1862	20.2883	20.3051	20.3033	20.2280	19.8366	19.3305	18.9543	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9916	0.9718	0.9024	0.7528	0.5484	0.3835	0.4446	0.7411	0.9564	0.9934	0.9979	(94)
Useful gains	460.8841	570.9524	695.6874	788.3392	737.9335	535.9418	357.1585	373.4842	534.6798	545.1154	460.5903	429.5090	(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	1465.4909	1422.2637	1293.2097	1082.7447	831.5542	551.7941	359.4119	377.9286	596.7673	905.0821	1203.6757	1458.6574	(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	747.4275	572.0811	444.5566	211.9719	69.6538	0.0000	0.0000	0.0000	0.0000	267.8152	535.0215	765.6864	(98)
Space heating												3614.2141	(98)
Space heating per m2											(98) / (4) =	45.1607	(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	911.8451	717.8355	735.8520	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9267	0.9620	0.9428	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	844.9764	690.5721	693.7628	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1234.1135	1178.3492	1073.2281	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	280.1787	362.9062	282.3222	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												925.4071	(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	70.0447	90.7265	70.5805	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												231.3518	(107)
Space cooling per m2												2.8908	(108)
Energy for space heating												45.1607	(99)
Energy for space cooling												2.8908	(108)
Total												48.0516	(109)
Target Fabric Energy Efficiency (TFEE)												55.3	(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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.5500 (1b)	x	2.6000 (2b)	=	141.8300 (1b) - (3b)	
First floor	25.4800 (1c)	x	2.8500 (2c)	=	72.6180 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.4480	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 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 = 0.78)			43.6300	0.7564	33.0017			(27)
penthouse floor			54.5500	0.1500	8.1825			(28a)
External Wall 1	24.8900	17.9800	6.9100	0.7800	5.3898			(29a)
External Wall 2	47.1000	25.6500	21.4500	0.7800	16.7310			(29a)
penthouse roof	29.0700		29.0700	0.1000	2.9070			(30)
garden room roof	25.4800		25.4800	0.1000	2.5480			(30)
Total net area of external elements Aum(A, m2)			181.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7600			(33)
Party Wall 1			62.4900	0.0000	0.0000			(32)
Party Wall 2			19.6000	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)	7.4268	(36)
Total fabric heat loss (33) + (36) =	76.1868	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.8544	31.1025	31.1025	29.9746	29.9746	28.4708	28.8467	28.0948	28.4708	29.2227	29.2227	30.3506	(38)
Heat transfer coeff	108.0412	107.2893	107.2893	106.1614	106.1614	104.6576	105.0336	104.2817	104.6576	105.4095	105.4095	106.5374	(39)

Average = Sum(39)m / 12 = 105.9108 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3500	1.3406	1.3406	1.3265	1.3265	1.3077	1.3124	1.3030	1.3077	1.3171	1.3171	1.3312	(40)
HLP (average)												1.3234	(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	2.4634 (42)
Average daily hot water use (litres/day)	92.7065 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9771	98.2689	94.5606	90.8523	87.1441	83.4358	83.4358	87.1441	90.8523	94.5606	98.2689	101.9771	(44)
Energy conte	151.2291	132.2659	136.4866	118.9923	114.1760	98.5252	91.2981	104.7659	106.0171	123.5527	134.8674	146.4573	(45)
Energy content (annual)											Total = Sum(45)m =	1458.6337	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6844	19.8399	20.4730	17.8488	17.1264	14.7788	13.6947	15.7149	15.9026	18.5329	20.2301	21.9686	(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
204.8880 180.7320 190.1455 170.9203 167.8349 150.4531 144.9570 158.4247 157.9451 177.2116 186.7954 200.1162 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
204.8880 180.7320 190.1455 170.9203 167.8349 150.4531 144.9570 158.4247 157.9451 177.2116 186.7954 200.1162 (64)
Total per year (kWh/year) = Sum(64)m = 2090.4237 (64)
RHI water heating demand 2090 (64)
Heat gains from water heating, kWh/month
93.2108 82.7513 88.3089 81.1073 80.8906 74.3020 73.2837 77.7618 76.7930 84.0084 86.3858 91.6242 (65)

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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	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
48.9222 43.4522 35.3377 26.7529 19.9981 16.8833 18.2430 23.7129 31.8274 40.4122 47.1670 50.2819 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
327.6168 331.0164 322.4494 304.2114 281.1891 259.5513 245.0960 241.6964 250.2634 268.5014 291.5237 313.1614 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 (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)
-98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 (71)
Water heating gains (Table 5)
125.2833 123.1418 118.6948 112.6490 108.7239 103.1972 98.4996 104.5185 106.6570 112.9145 119.9803 123.1508 (72)
Total internal gains
606.3349 602.1231 580.9945 548.1260 514.4238 484.1444 466.3512 474.4404 493.2604 526.3408 563.1836 591.1067 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6900	22.3313	0.3600	1.0000	0.7700	59.5563	(76)
West	32.9400	22.3313	0.3600	1.0000	0.7700	183.5159	(80)

Solar gains	243.0722	427.7207	694.5429	1040.9206	1240.3009	1357.7362	1279.0424	1125.2540	874.6185	541.6082	310.4949	197.9512	(83)
Total gains	849.4071	1029.8438	1275.5374	1589.0466	1754.7247	1841.8806	1745.3936	1599.6944	1367.8789	1067.9490	873.6785	789.0579	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.5760	20.7202	20.7202	20.9403	20.9403	21.2412	21.1652	21.3178	21.2412	21.0897	21.0897	20.8664	
alpha	2.3717	2.3813	2.3813	2.3960	2.3960	2.4161	2.4110	2.4212	2.4161	2.4060	2.4060	2.3911	
util living area	0.8951	0.8468	0.7500	0.5948	0.4360	0.2742	0.1839	0.2049	0.4068	0.6795	0.8435	0.9071	(86)
MIT	19.3879	19.6624	20.0985	20.5203	20.7555	20.8604	20.8817	20.8800	20.8090	20.4691	19.8864	19.3471	(87)
Th 2	19.8019	19.8092	19.8092	19.8201	19.8201	19.8348	19.8311	19.8385	19.8348	19.8274	19.8274	19.8165	(88)
util rest of house	0.8800	0.8264	0.7192	0.5519	0.3820	0.2136	0.1156	0.1320	0.3354	0.6300	0.8188	0.8934	(89)
MIT 2	17.7083	18.0956	18.6923	19.2496	19.5326	19.6541	19.6662	19.6733	19.6113	19.2137	18.4329	17.6616	(90)
Living area fraction									fLA = Living area / (4) =			0.3652	(91)
MIT	18.3217	18.6678	19.2059	19.7137	19.9792	20.0947	20.1101	20.1140	20.0487	19.6722	18.9638	18.2772	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3217	18.6678	19.2059	19.7137	19.9792	20.0947	20.1101	20.1140	20.0487	19.6722	18.9638	18.2772	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8571	0.8034	0.7018	0.5478	0.3896	0.2274	0.1321	0.1495	0.3490	0.6228	0.7974	0.8713	(94)
Useful gains	728.0169	827.3799	895.1616	870.5055	683.6145	418.7676	230.5845	239.2061	477.3612	665.0790	696.6391	687.5236	(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	1428.4924	1402.0401	1266.6424	1041.8357	740.9271	428.5385	232.1398	241.3115	507.4576	850.8922	1155.6879	1403.8636	(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	521.1538	386.1717	276.3818	123.3577	42.6405	0.0000	0.0000	0.0000	0.0000	138.2450	330.5152	532.9569	(98)

Space heating 2351.4226 (98)
RHI space heating demand 2351 (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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.5500 (1b)	x	2.6000 (2b)	=	141.8300 (1b) - (3b)	
First floor	25.4800 (1c)	x	2.8500 (2c)	=	72.6180 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.4480	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 = 0.78)			43.6300	0.7564	33.0017			(27)
penthouse floor			54.5500	0.1500	8.1825			(28a)
External Wall 1	24.8900	17.9800	6.9100	0.7800	5.3898			(29a)
External Wall 2	47.1000	25.6500	21.4500	0.7800	16.7310			(29a)
penthouse roof	29.0700		29.0700	0.1000	2.9070			(30)
garden room roof	25.4800		25.4800	0.1000	2.5480			(30)
Total net area of external elements Aum(A, m2)			181.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7600			(33)
Party Wall 1			62.4900	0.0000	0.0000			(32)
Party Wall 2			19.6000	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)	7.4268	(36)
Total fabric heat loss (33) + (36) =	76.1868	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.2380	34.8620	34.4861	32.6063	32.2303	30.3506	30.3506	29.9746	31.1025	32.2303	32.9822	33.7341	(38)
Heat transfer coeff	111.4248	111.0489	110.6729	108.7931	108.4172	106.5374	106.5374	106.1614	107.2893	108.4172	109.1691	109.9210	(39)

Average = Sum(39)m / 12 = 108.6991 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3923	1.3876	1.3829	1.3594	1.3547	1.3312	1.3312	1.3265	1.3406	1.3547	1.3641	1.3735	(40)
HLP (average)												1.3582	(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	2.4634 (42)
Average daily hot water use (litres/day)	92.7065 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9771	98.2689	94.5606	90.8523	87.1441	83.4358	83.4358	87.1441	90.8523	94.5606	98.2689	101.9771	(44)
Energy conte	151.2291	132.2659	136.4866	118.9923	114.1760	98.5252	91.2981	104.7659	106.0171	123.5527	134.8674	146.4573	(45)
Energy content (annual)											Total = Sum(45)m =	1458.6337	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6844	19.8399	20.4730	17.8488	17.1264	14.7788	13.6947	15.7149	15.9026	18.5329	20.2301	21.9686	(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
204.8880 180.7320 190.1455 170.9203 167.8349 150.4531 144.9570 158.4247 157.9451 177.2116 186.7954 200.1162 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
204.8880 180.7320 190.1455 170.9203 167.8349 150.4531 144.9570 158.4247 157.9451 177.2116 186.7954 200.1162 (64)
Total per year (kWh/year) = Sum(64)m = 2090.4237 (64)
Heat gains from water heating, kWh/month
93.2108 82.7513 88.3089 81.1073 80.8906 74.3020 73.2837 77.7618 76.7930 84.0084 86.3858 91.6242 (65)

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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	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
48.9222 43.4522 35.3377 26.7529 19.9981 16.8833 18.2430 23.7129 31.8274 40.4122 47.1670 50.2819 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
327.6168 331.0164 322.4494 304.2114 281.1891 259.5513 245.0960 241.6964 250.2634 268.5014 291.5237 313.1614 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 (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)
-98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 (71)
Water heating gains (Table 5)
125.2833 123.1418 118.6948 112.6490 108.7239 103.1972 98.4996 104.5185 106.6570 112.9145 119.9803 123.1508 (72)
Total internal gains
606.3349 602.1231 580.9945 548.1260 514.4238 484.1444 466.3512 474.4404 493.2604 526.3408 563.1836 591.1067 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6900	19.6403	0.3600	1.0000	0.7700	52.3794	(76)
West	32.9400	19.6403	0.3600	1.0000	0.7700	161.4012	(80)

Solar gains	213.7806	418.2002	688.7161	1004.4514	1230.9929	1260.1403	1199.7049	1030.5288	801.0054	496.2297	266.5593	175.8028	(83)
Total gains	820.1155	1020.3232	1269.7107	1552.5774	1745.4167	1744.2847	1666.0562	1504.9692	1294.2657	1022.5705	829.7429	766.9095	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9512	20.0187	20.0867	20.4338	20.5046	20.8664	20.8664	20.9403	20.7202	20.5046	20.3634	20.2241	
alpha	2.3301	2.3346	2.3391	2.3623	2.3670	2.3911	2.3911	2.3960	2.3813	2.3670	2.3576	2.3483	
util living area	0.9113	0.8630	0.7775	0.6428	0.4987	0.3646	0.2715	0.3094	0.4957	0.7365	0.8742	0.9216	(86)
MIT	19.1655	19.4819	19.9289	20.3897	20.6714	20.8159	20.8622	20.8525	20.7326	20.3017	19.6520	19.1148	(87)
Th 2	19.7693	19.7729	19.7765	19.7946	19.7982	19.8165	19.8165	19.8201	19.8092	19.7982	19.7910	19.7837	(88)
util rest of house	0.8986	0.8447	0.7498	0.6034	0.4485	0.3042	0.2019	0.2351	0.4277	0.6941	0.8541	0.9102	(89)
MIT 2	17.3689	17.8157	18.4352	19.0608	19.4147	19.5947	19.6382	19.6353	19.5088	18.9745	18.0799	17.3070	(90)
Living area fraction									fLA = Living area / (4) =			0.3652	(91)
MIT	18.0251	18.4242	18.9807	19.5461	19.8737	20.0407	20.0852	20.0798	19.9558	19.4592	18.6541	17.9673	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0251	18.4242	18.9807	19.5461	19.8737	20.0407	20.0852	20.0798	19.9558	19.4592	18.6541	17.9673	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8758	0.8205	0.7294	0.5947	0.4518	0.3160	0.2181	0.2519	0.4365	0.6807	0.8311	0.8886	(94)
Useful gains	718.2940	837.1940	926.1582	923.2728	788.5143	551.1828	363.2912	379.1148	564.9398	696.0513	689.6336	681.4649	(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	1529.3164	1501.8517	1381.2792	1158.2251	886.1673	579.6389	371.3085	390.6580	628.2663	960.4948	1261.3501	1513.3135	(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	603.4006	446.6500	338.6100	169.1657	72.6539	0.0000	0.0000	0.0000	0.0000	196.7460	411.6359	618.8953	(98)
Space heating												2857.7573	(98)
Space heating per m2											(98) / (4) =	35.7086	(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	1001.4516	788.3768	806.8270	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8900	0.9222	0.9018	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	891.3026	727.0286	727.6155	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1954.0357	1865.6037	1675.9546	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	765.1678	847.0999	705.5643	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling 2317.8320 (104)
Cooled fraction fC = cooled area / (4) = 1.0041 (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	192.0807	212.6482	177.1184	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling 581.8474 (107)
Space cooling per m2 7.2704 (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 1681.0337 (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													
	603.4006	446.6500	338.6100	169.1657	72.6539	0.0000	0.0000	0.0000	0.0000	196.7460	411.6359	618.8953	(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)													
	354.9416	262.7353	199.1824	99.5092	42.7376	0.0000	0.0000	0.0000	0.0000	115.7329	242.1387	364.0561	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

204.8880	180.7320	190.1455	170.9203	167.8349	150.4531	144.9570	158.4247	157.9451	177.2116	186.7954	200.1162	(64)

Efficiency of water heater 170.0000 (216)

(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 (217)

Fuel for water heating, kWh/month

120.5223	106.3130	111.8503	100.5413	98.7264	88.5018	85.2688	93.1910	92.9089	104.2421	109.8796	117.7154 (219)

Water heating fuel used 1229.6610 (219)
Space cooling fuel requirement

(221)m 0.0000	0.0000	0.0000	0.0000	0.0000	48.0202	53.1621	44.2796	0.0000	0.0000	0.0000	0.0000 (221)

Cooling 145.4618 (221)
Annual totals kWh/year
Space heating fuel - main system 1681.0337 (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) 199.4903 (230a)
central heating pump 30.0000 (230c)
Total electricity for the above, kWh/year 229.4903 (231)
Electricity for lighting (calculated in Appendix L) 345.5924 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 1.31 * 1080 * 1.00) = -1131.3418 -1131.3418 (233)
Total delivered energy for all uses 2499.8974 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1681.0337	13.1900	221.7283	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1229.6610	13.1900	162.1923	(247)
Space cooling	145.4618	13.1900	19.1864	(248)
Mechanical ventilation fans	199.4903	13.1900	26.3128	(249)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	345.5924	13.1900	45.5836	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1131.3418	13.1900	-149.2240	(252)
Total energy cost			329.7365	(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] = 1.1076 (257)
SAP value 84.5483
SAP rating (Section 12) 85 (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	1681.0337	0.5190	872.4565	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1229.6610	0.5190	638.1941	(264)
Space and water heating			1510.6506	(265)
Space cooling	145.4618	0.5190	75.4947	(266)
Pumps and fans	229.4903	0.5190	119.1054	(267)
Energy for lighting	345.5924	0.5190	179.3625	(268)
Energy saving/generation technologies				
PV Unit	-1131.3418	0.5190	-587.1664	(269)
Total kg/year			1297.4468	(272)
CO2 emissions per m2			16.2100	(273)
EI value			86.0947	
EI rating			86	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.25) / 1.7000 = 8.321, stars = 2
Main heating environmental impact	0.519 × (1 + 0.29 × 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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.5500 (1b)	x	2.6000 (2b)	=	141.8300 (1b) - (3b)	
First floor	25.4800 (1c)	x	2.8500 (2c)	=	72.6180 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.4480	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 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 = 0.78)			43.6300	0.7564	33.0017			(27)
penthouse floor			54.5500	0.1500	8.1825			(28a)
External Wall 1	24.8900	17.9800	6.9100	0.7800	5.3898			(29a)
External Wall 2	47.1000	25.6500	21.4500	0.7800	16.7310			(29a)
penthouse roof	29.0700		29.0700	0.1000	2.9070			(30)
garden room roof	25.4800		25.4800	0.1000	2.5480			(30)
Total net area of external elements Aum(A, m2)			181.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7600			(33)
Party Wall 1			62.4900	0.0000	0.0000			(32)
Party Wall 2			19.6000	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)	7.4268	(36)
Total fabric heat loss (33) + (36) =	76.1868	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.8544	31.1025	31.1025	29.9746	29.9746	28.4708	28.8467	28.0948	28.4708	29.2227	29.2227	30.3506	(38)
Heat transfer coeff	108.0412	107.2893	107.2893	106.1614	106.1614	104.6576	105.0336	104.2817	104.6576	105.4095	105.4095	106.5374	(39)

Average = Sum(39)m / 12 = 105.9108 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3500	1.3406	1.3406	1.3265	1.3265	1.3077	1.3124	1.3030	1.3077	1.3171	1.3171	1.3312	(40)
HLP (average)												1.3234	(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	2.4634 (42)
Average daily hot water use (litres/day)	92.7065 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9771	98.2689	94.5606	90.8523	87.1441	83.4358	83.4358	87.1441	90.8523	94.5606	98.2689	101.9771	(44)
Energy conte	151.2291	132.2659	136.4866	118.9923	114.1760	98.5252	91.2981	104.7659	106.0171	123.5527	134.8674	146.4573	(45)
Energy content (annual)											Total = Sum(45)m =	1458.6337	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6844	19.8399	20.4730	17.8488	17.1264	14.7788	13.6947	15.7149	15.9026	18.5329	20.2301	21.9686	(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
204.8880 180.7320 190.1455 170.9203 167.8349 150.4531 144.9570 158.4247 157.9451 177.2116 186.7954 200.1162 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
204.8880 180.7320 190.1455 170.9203 167.8349 150.4531 144.9570 158.4247 157.9451 177.2116 186.7954 200.1162 (64)
Total per year (kWh/year) = Sum(64)m = 2090.4237 (64)
Heat gains from water heating, kWh/month
93.2108 82.7513 88.3089 81.1073 80.8906 74.3020 73.2837 77.7618 76.7930 84.0084 86.3858 91.6242 (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	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	147.8058	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
48.9222 43.4522 35.3377 26.7529 19.9981 16.8833 18.2430 23.7129 31.8274 40.4122 47.1670 50.2819 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
327.6168 331.0164 322.4494 304.2114 281.1891 259.5513 245.0960 241.6964 250.2634 268.5014 291.5237 313.1614 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 52.2440 (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)
-98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 -98.5372 (71)
Water heating gains (Table 5)
125.2833 123.1418 118.6948 112.6490 108.7239 103.1972 98.4996 104.5185 106.6570 112.9145 119.9803 123.1508 (72)
Total internal gains
606.3349 602.1231 580.9945 548.1260 514.4238 484.1444 466.3512 474.4404 493.2604 526.3408 563.1836 591.1067 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6900	22.3313	0.3600	1.0000	0.7700	59.5563	(76)
West	32.9400	22.3313	0.3600	1.0000	0.7700	183.5159	(80)

Solar gains	243.0722	427.7207	694.5429	1040.9206	1240.3009	1357.7362	1279.0424	1125.2540	874.6185	541.6082	310.4949	197.9512	(83)
Total gains	849.4071	1029.8438	1275.5374	1589.0466	1754.7247	1841.8806	1745.3936	1599.6944	1367.8789	1067.9490	873.6785	789.0579	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.5760	20.7202	20.7202	20.9403	20.9403	21.2412	21.1652	21.3178	21.2412	21.0897	21.0897	20.8664	
alpha	2.3717	2.3813	2.3813	2.3960	2.3960	2.4161	2.4110	2.4212	2.4161	2.4060	2.4060	2.3911	
util living area	0.8951	0.8468	0.7500	0.5948	0.4360	0.2742	0.1839	0.2049	0.4068	0.6795	0.8435	0.9071	(86)
MIT	19.3879	19.6624	20.0985	20.5203	20.7555	20.8604	20.8817	20.8800	20.8090	20.4691	19.8864	19.3471	(87)
Th 2	19.8019	19.8092	19.8092	19.8201	19.8201	19.8348	19.8311	19.8385	19.8348	19.8274	19.8274	19.8165	(88)
util rest of house	0.8800	0.8264	0.7192	0.5519	0.3820	0.2136	0.1156	0.1320	0.3354	0.6300	0.8188	0.8934	(89)
MIT 2	17.7083	18.0956	18.6923	19.2496	19.5326	19.6541	19.6662	19.6733	19.6113	19.2137	18.4329	17.6616	(90)
Living area fraction									fLA = Living area / (4) =			0.3652	(91)
MIT	18.3217	18.6678	19.2059	19.7137	19.9792	20.0947	20.1101	20.1140	20.0487	19.6722	18.9638	18.2772	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3217	18.6678	19.2059	19.7137	19.9792	20.0947	20.1101	20.1140	20.0487	19.6722	18.9638	18.2772	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8571	0.8034	0.7018	0.5478	0.3896	0.2274	0.1321	0.1495	0.3490	0.6228	0.7974	0.8713	(94)
Useful gains	728.0169	827.3799	895.1616	870.5055	683.6145	418.7676	230.5845	239.2061	477.3612	665.0790	696.6391	687.5236	(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	1428.4924	1402.0401	1266.6424	1041.8357	740.9271	428.5385	232.1398	241.3115	507.4576	850.8922	1155.6879	1403.8636	(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	521.1538	386.1717	276.3818	123.3577	42.6405	0.0000	0.0000	0.0000	0.0000	138.2450	330.5152	532.9569	(98)
Space heating												2351.4226	(98)
Space heating per m2											(98) / (4) =	29.3818	(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	837.2611	640.7049	646.5464	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9298	0.9535	0.9438	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	778.5240	610.8931	610.2126	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2068.1088	1958.3358	1786.6724	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	928.5011	1002.4974	875.2861	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling													2806.2845 (104)
Cooled fraction											fC = cooled area / (4) =		1.0041 (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	233.0824	251.6578	219.7238	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling													704.4640 (107)
Space cooling per m2													8.8025 (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													1383.1898 (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													
	521.1538	386.1717	276.3818	123.3577	42.6405	0.0000	0.0000	0.0000	0.0000	138.2450	330.5152	532.9569 (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)													
	306.5611	227.1598	162.5775	72.5633	25.0827	0.0000	0.0000	0.0000	0.0000	81.3206	194.4207	313.5041 (211)	
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement													
	204.8880	180.7320	190.1455	170.9203	167.8349	150.4531	144.9570	158.4247	157.9451	177.2116	186.7954	200.1162 (64)	
Efficiency of water heater													170.0000 (216)
(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 (217)	
Fuel for water heating, kWh/month													
	120.5223	106.3130	111.8503	100.5413	98.7264	88.5018	85.2688	93.1910	92.9089	104.2421	109.8796	117.7154 (219)	
Water heating fuel used													1229.6610 (219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	58.2706	62.9144	54.9310	0.0000	0.0000	0.0000	0.0000 (221)	
Cooling													176.1160 (221)
Annual totals kWh/year													
Space heating fuel - main system													1383.1898 (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)													199.4903 (230a)
central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													229.4903 (231)
Electricity for lighting (calculated in Appendix L)													345.5924 (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													2169.2249 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1383.1898	15.4400	213.5645 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1229.6610	15.4400	189.8597 (247)
Space cooling	176.1160	15.4400	27.1923 (248)
Mechanical ventilation fans	199.4903	15.4400	30.8013 (249)
Pumps and fans for heating	30.0000	15.4400	4.6320 (249)
Energy for lighting	345.5924	15.4400	53.3595 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1194.8246	15.4400	-184.4809 (252)
Total energy cost			334.9283 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1383.1898	0.5190	717.8755 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1229.6610	0.5190	638.1941 (264)
Space and water heating			1356.0696 (265)
Space cooling	176.1160	0.5190	91.4042 (266)
Pumps and fans	229.4903	0.5190	119.1054 (267)
Energy for lighting	345.5924	0.5190	179.3625 (268)
Energy saving/generation technologies			
PV Unit	-1194.8246	0.5190	-620.1139 (269)
Total kg/year			1125.8277 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1383.1898	3.0700	4246.3925 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1229.6610	3.0700	3775.0593 (264)
Space and water heating			8021.4519 (265)
Space cooling	176.1160	3.0700	540.6761 (266)
Pumps and fans	229.4903	3.0700	704.5351 (267)
Energy for lighting	345.5924	3.0700	1060.9687 (268)

Energy saving/generation technologies

PV Unit	-1194.8246	3.0700	-3668.1114 (269)
Primary energy kWh/year			6659.5204 (272)
Primary energy kWh/m2/year			83.2128 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 86

(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 85
Potential environmental impact rating: B 86

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	£519	£519	£0
Space heating	£249	£249	£0
Space cooling	£27	£27	£0
Water heating	£190	£190	£0
Lighting	£53	£53	£0
Generated (PV)	-£184	-£184	£0
Total cost of fuels	£335	£335	£0
Total cost of uses	£335	£335	£0
Delivered energy	27 kWh/m²	27 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	83 kWh/m²	83 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	East
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	566.14 (P1)
Transmission heat loss coefficient	76.19 (37)
Summer heat loss coefficient	642.33 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	10.6900	117.5071	0.3600	1.0000	0.9000	366.2935
West	32.9400	117.5071	0.3600	1.0000	0.9000	1128.6911
total:						1494.9846

	Jun	Jul	Aug	
Solar gains	1587	1495	1315	(P3)
Internal gains	481	463	471	
Total summer gains	2068	1958	1787	(P5)
Summer gain/loss ratio	3.22	3.05	2.78	(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	20.52	22.25	21.88	(P7)
Likelihood of high internal temperature	Slight	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			

Predicted Energy Assessment

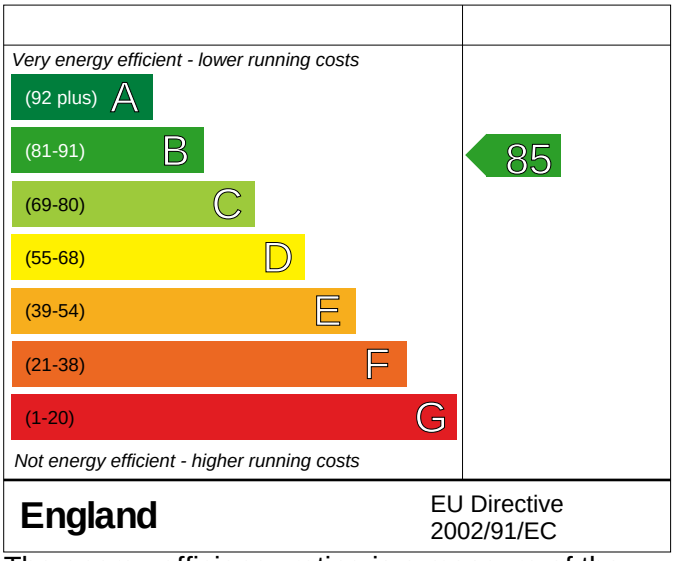
505,
London

Dwelling type:	Flat, End-Terrace
Date of assessment:	01.Nov.2016
Produced by:	Gecko
Total floor area:	80.03 m^2

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.

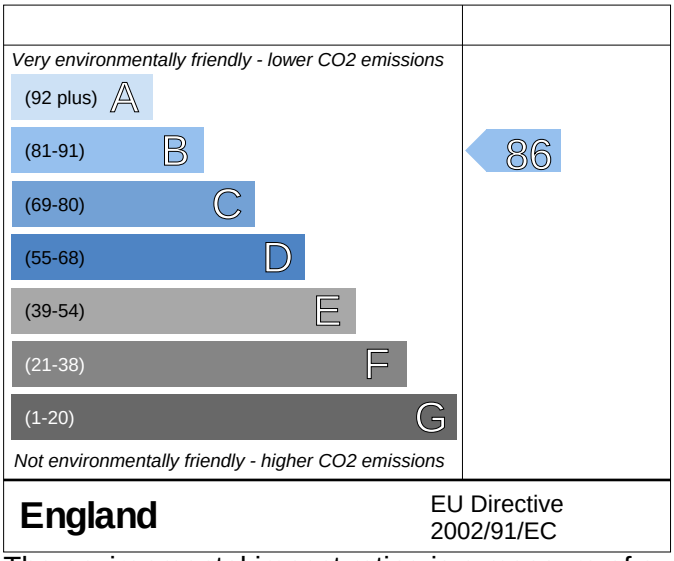
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

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: 505 Linton House
Survey Reference: 505 design
Property: 505, London

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

SAP Rating:	85 B	**CO2 Emissions (t/year):**	1.13	**DER:**	17.65 Pass	**TER:**	27.09	**Percentage DER<TER:**	34.84 %
Environmental:	86 B	**General Requirements Compliance:**	Pass	**DFEE:**	54.00 Pass	**TFEE:**	55.26	**Percentage DFEE<TFEE:**	2.27 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.2 **ENE2 Credits:** 0.0 **ENE7 Credits:** 1 **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 Information

Property Reference: 505 Linton House
Survey Reference: 505 design
Property: 505, London

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

SAP Rating: 85 B **CO2 Emissions (t/year):** 1.13 **DER:** 17.65 Pass **TER:** 27.09 **Percentage DER<TER:** 34.84 %
Environmental: 86 B **General Requirements Compliance:** Pass **DFEE:** 54.00 Pass **TFEE:** 55.26 **Percentage DFEE<TFEE:** 2.27 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.2 **ENE2 Credits:** 0.0 **ENE7 Credits:** 1 **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)

Orientation	East
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:	9.58	54.55	2.60
1st Storey:	16.52	25.48	2.85

7.0 Living Area	29.23
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	0.78		24.89	6.91
External Wall 2	Other	0.78		47.10	21.45

9.1 Party walls

Description	Construction	Kappa	Area
Party Wall 1	Steel frame		62.49
Party Wall 2	Steel frame		19.60

10.0 External Roofs

Description	Construction	U-Value	Kappa	Gross Area	Nett Area
penthouse roof	Other	0.10		29.07	29.07
garden room roof	Other	0.10		25.48	25.48

11.0 HeatLoss Floors

Description	Construction	U-Value	Kappa	Area
penthouse floor	Other	0.15		54.55

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	0.78

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	West	None	0.00					7.29	
2	Window	[1] External Wall 1	East	None	0.00					7.29	
3	Window	[1] External Wall 1	East	None	0.00					3.40	

1gh	Window	[2] External Wall 2	West	None	0.00	25.65

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)	16.52	0.160	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	16.52	0.070	Yes
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	9.58	0.070	Yes
Table K1 - Default	E14 Flat roof	16.52	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 Present Yes
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 80.36
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 38
Total number of L.E.L. fittings 38
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	
Suplementary 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
Thermal Store Pipework	
33.0 Photovoltaic Unit	One Dwelling
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

Property Reference: 505 Linton House
Survey Reference: 505 design
Property: 505, London

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

SAP Rating: 85 B **CO2 Emissions (t/year):** 1.13 **DER:** 17.65 Pass **TER:** 27.09 **Percentage DER<TER:** 34.84 %
Environmental: 86 B **General Requirements Compliance:** Pass **DFEE:** 54.00 Pass **TFEE:** 55.26 **Percentage DFEE<TFEE:** 2.27 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.2 **ENE2 Credits:** 0.0 **ENE7 Credits:** 1 **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	16.52	2.64	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	16.52	1.16	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	9.58	0.67	
External wall	E14 Flat roof	Table K1 - Default	0.080	16.52	1.32	
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: 7.43
Y-Value W/m2K: 0.041