Building Regulation Compliance

Property Reference: 507 Linton House
Survey Reference: 507 design
Property: 507, London

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

SAP Rating:	83 B	**CO2 Emissions (t/year):**	1.60	**DER:**	16.88 Pass	**TER:**	25.68	**Percentage DER<TER:**	34.26 %
Environmental:	85 B	**General Requirements Compliance:**	Pass	**DFEE:**	55.43 Pass	**TFEE:**	59.67	**Percentage DFEE<TFEE:**	7.10 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.1 **ENE2 Credits:** 0.0 **ENE7 Credits:** 0 **CfSH Level:** 4

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

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

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

1a TER and DER

Fuel for main heating:	Electricity	
Fuel factor:	1.55 (electricity)	
Target Carbon Dioxide Emission Rate (TER)	25.68 kg/m^2	
Dwelling Carbon Dioxide Emission Rate (DER)	16.88 kg/m^2	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.67 kWh/m^2	
Dwelling Fabric Energy Efficiency (DFEE)	55.43 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	0.81 (max. 2.00)	0.89 (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

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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 North:	23.30 m^2, No overhang	
Windows facing East:	51.03 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
Thermal bridging y-value	0.033 W/m^2K
Photovoltaic array	

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Full SAP Calculation Printout

Property Reference: 507 Linton House
Survey Reference: 507 design
Property: 507, London

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

SAP Rating:	83 B	**CO2 Emissions (t/year):**	1.60	**DER:**	16.88 Pass	**TER:**	25.68	**Percentage DER<TER:**	34.26 %
Environmental:	85 B	**General Requirements Compliance:**	Pass	**DFEE:**	55.43 Pass	**TFEE:**	59.67	**Percentage DFEE<TFEE:**	7.10 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.1 **ENE2 Credits:** 0.0 **ENE7 Credits:** 0 **CfSH Level:** 4

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

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

CALCULATION DETAILS for survey reference no '507 design'
SAP2012 - 9.92 input data (DesignData) -

SAP2012 Input Data (Flat)	01/11/2016
FullRefNo:	507 design
Regs Region:	England
SAP Region:	Thames Valley
Postcode:	
DwellingOrientation:	West
Property Type:	Flat, End-Terrace
Storeys:	2
Date Built:	2016
Sheltered Sides:	2
Sunlight Shade:	Average or unknown
Measurements	Perimeter, Floor Area, Storey Height
1st Storey:	24.56, 92.21, 2.6
2nd Storey:	13.79, 26.57, 2.85
Living Area:	36.96 m2, fraction: 31.1%
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	20.55, 63.86, 0, Other, CurtainWalling, 0, 0.89, Calculate
External Wall 2	8.28, 39.3, 0, Other, CurtainWalling, 0, 0.89, Gross
Party Walls	Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall 1	91.29, 20, PartyWallSteelFrame, Solid, 0, 0
Party Wall 2	25.42, 20, PartyWallSteelFrame, Solid, 0, 0
External Roofs	Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
penthouse roof	65.64, 65.64, 0, Other, 0.1
garden room roof	26.57, 26.57, 0, Other, 0.1
Heat Loss Floors	Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
penthouse floor	92.21, 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, North, , None, 0, , 0, 0, 0, 4.16,
2	Window, External Wall 1, North, , None, 0, , 0, 0, 0, 6.48,
3	Window, External Wall 1, North, , None, 0, , 0, 0, 0, 3.51,
4	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 7.29,
1gh	Window, External Wall 2, North, , None, 0, , 0, 0, 0, 9.15,
5	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 7.29,
6	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 7.29,
7	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 7.29,
2gh	Window, External Wall 2, East, , None, 0, , 0, 0, 0, 21.87,
Conservatory:	None
Draught Proofing:	100
Draught Lobby:	No
Thermal Bridges	
Bridging:	Calculate Bridges
Y	0.033
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, 24.56, 0.16, 0.16, 3.93,
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, 13.79, 0.07, 0.07, 0.97,
10.	External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, Yes, 24.56, 0.07, 0.07, 1.72,
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, 13.79, 0.08, 0.08, 1.10,
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,

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    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,
    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              118.78
    Data Source              SAP table
    Type                     Split or Multi-Split
    Class                    A
    Control                  On/Off
Light Fittings:              52
LEL Fittings:                52
Percentage of LEL Fittings:  100
External Lights Fitted:      Yes
External LELs Fitted:        Yes
Electricity Tariff:          Standard
Main Heating 1
    Description              ashp
    Percentage               100
    MHS                      Electricity PET Heat pump air-to-water
    SAP Code                 224
    Boiler Efficiency Type   SAP Table
    Efficiency               170
    Controls by PCDF         0
    MHS Controls             CHD Time and temperature zone control
    Boiler Interlock         No
    Ctrl SAP Code            2207
    MCS Installation CertificateNo
    Pumped                   Pump in heated space
    Heat Pump Age            2013 or later
    Heat Emitter             Radiators and Underfloor
    Flow Temperature         <= 35°C
    Under Floor Heating      Yes - Pipes in thin screed
Main Heating 2               None
Heating Systems Interaction  Each system heats separate parts of dwelling
Smoke Control Area           Unknown
Community Heating            None
Secondary Heating            None
Water Heating
    Type                     MainHeating1
    WHS                      HWP From main heating 1
    Low Water Usage          Yes
    SAP Code                 901
    Showers in Property      Non-electric only
    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 = 1.64, 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 119 m²
```

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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) 25.68 kg/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.88 kg/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.7 kWh/m²
Dwelling Fabric Energy Efficiency (DFEE)55.4 kWh/m²OK

---

2 Fabric U-values

Element	Average	Highest	
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings and curtain wall	0.81 (max. 2.00)	0.89 (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 North: 23.30 m², No overhang
Windows facing East: 51.03 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
Thermal bridging y-value 0.033 W/m²K
Photovoltaic array

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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	92.2100 (1b)	x	2.6000 (2b)	=	239.7460 (1b) - (3b)	
First floor	26.5700 (1c)	x	2.8500 (2c)	=	75.7245 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		315.4705	(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)			74.3300	0.7564	56.2232			(27)
penthouse floor			92.2100	0.1500	13.8315			(28a)
External Wall 1	63.8600	43.3100	20.5500	0.8900	18.2895			(29a)
External Wall 2	39.3000	31.0200	8.2800	0.8900	7.3692			(29a)
penthouse roof	65.6400		65.6400	0.1000	6.5640			(30)
garden room roof	26.5700		26.5700	0.1000	2.6570			(30)
Total net area of external elements Aum(A, m2)			287.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		104.9344			(33)
Party Wall 1			91.2900	0.0000	0.0000			(32)
Party Wall 2			25.4200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3523 (36)
Total fabric heat loss (33) + (36) =	114.2867 (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	51.8379	51.2849	50.7318	47.9665	47.4134	44.6481	44.6481	44.0951	45.7543	47.4134	48.5196	49.6257	(38)
Heat transfer coeff	166.1247	165.5716	165.0185	162.2532	161.7002	158.9349	158.9349	158.3818	160.0410	161.7002	162.8063	163.9124	(39)

Average = Sum(39)m / 12 = 162.1150 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3986	1.3939	1.3893	1.3660	1.3613	1.3381	1.3381	1.3334	1.3474	1.3613	1.3707	1.3800	(40)
HLP (average)												1.3648	(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	2.8585 (42)
Average daily hot water use (litres/day)	102.0888 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.2977	108.2141	104.1306	100.0470	95.9635	91.8799	91.8799	95.9635	100.0470	104.1306	108.2141	112.2977	(44)
Energy conte	166.5342	145.6519	150.2997	131.0349	125.7311	108.4964	100.5378	115.3686	116.7465	136.0568	148.5166	161.2795	(45)
Energy content (annual)											Total = Sum(45)m =	1606.2540	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9801	21.8478	22.5450	19.6552	18.8597	16.2745	15.0807	17.3053	17.5120	20.4085	22.2775	24.1919	(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)

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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
220.1931 194.1179 203.9586 182.9628 179.3900 160.4243 154.1967 169.0275 168.6745 189.7157 200.4446 214.9383 (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
220.1931 194.1179 203.9586 182.9628 179.3900 160.4243 154.1967 169.0275 168.6745 189.7157 200.4446 214.9383 (64)
Total per year (kWh/year) = Sum(64)m = 2238.0441 (64)
Heat gains from water heating, kWh/month
98.2997 87.2021 92.9017 85.1115 84.7327 77.6174 76.3559 81.2872 80.3606 88.1660 90.9241 96.5525 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
25.2846 22.4576 18.2637 13.8268 10.3357 8.7258 9.4286 12.2556 16.4495 20.8864 24.3775 25.9873 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
283.6163 286.5594 279.1430 263.3544 243.4241 224.6924 212.1785 209.2355 216.6518 232.4405 252.3708 271.1024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 (71)
Water heating gains (Table 5)
132.1233 129.7650 124.8679 118.2104 113.8880 107.8020 102.6290 109.2570 111.6119 118.5027 126.2835 129.7749 (72)
Total internal gains
509.9013 507.6591 491.1518 464.2687 436.5249 410.0973 393.1131 399.6252 413.5903 440.7066 471.9089 495.7418 (73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	23.3000	10.6334	0.3600	1.0000	0.7700	61.8107	(74)
East	51.0300	19.6403	0.3600	1.0000	0.7700	250.0395	(76)

Solar gains	311.8502	607.2537	1006.2484	1497.2230	1874.0930	1938.8161	1837.2709	1549.7069	1178.1934	721.0048	388.0213	257.1487	(83)
Total gains	821.7515	1114.9128	1497.4002	1961.4917	2310.6180	2348.9134	2230.3840	1949.3321	1591.7837	1161.7114	859.9302	752.8905	(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	19.8613	19.9276	19.9944	20.3352	20.4047	20.7597	20.7597	20.8322	20.6162	20.4047	20.2661	20.1293	
alpha	2.3241	2.3285	2.3330	2.3557	2.3603	2.3840	2.3840	2.3888	2.3744	2.3603	2.3511	2.3420	
util living area	0.9576	0.9191	0.8414	0.7023	0.5429	0.3976	0.2997	0.3506	0.5679	0.8185	0.9337	0.9647	(86)
MIT	18.8209	19.1783	19.7052	20.2718	20.6245	20.7995	20.8551	20.8402	20.6759	20.1185	19.3561	18.7675	(87)
Th 2	19.7644	19.7680	19.7716	19.7895	19.7931	19.8111	19.8111	19.8148	19.8039	19.7931	19.7859	19.7787	(88)
util rest of house	0.9508	0.9068	0.8187	0.6645	0.4910	0.3330	0.2235	0.2679	0.4963	0.7832	0.9214	0.9589	(89)
MIT 2	16.8765	17.3897	18.1326	18.9109	19.3591	19.5754	19.6285	19.6220	19.4490	18.7394	17.6655	16.8086	(90)
Living area fraction									fLA = Living area / (4) =			0.3112	(91)
MIT	17.4815	17.9463	18.6219	19.3344	19.7529	19.9563	20.0102	20.0010	19.8308	19.1685	18.1915	17.4182	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4815	17.9463	18.6219	19.3344	19.7529	19.9563	20.0102	20.0010	19.8308	19.1685	18.1915	17.4182	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9334	0.8834	0.7933	0.6488	0.4892	0.3412	0.2366	0.2814	0.4981	0.7615	0.9001	0.9435	(94)
Useful gains	767.0244	984.8762	1187.9501	1272.7000	1130.3448	801.4107	527.8060	548.5831	792.8374	884.6016	774.0595	710.3186	(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	2189.7745	2160.0939	2000.3461	1693.0100	1302.1518	851.3026	541.9983	570.3387	917.1604	1385.5321	1805.7700	2166.6228	(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	1058.5261	789.7463	604.4227	302.6232	127.8244	0.0000	0.0000	0.0000	0.0000	372.6923	742.8316	1083.4903	(98)
Space heating												5082.1568	(98)
Space heating per m2											(98) / (4) =	42.7863	(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	1493.9879	1176.1181	1203.7018	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8846	0.9173	0.8920	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1321.5639	1078.8898	1073.6888	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2843.3058	2702.5230	2375.7123	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	1095.6542	1207.9831	968.7055	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling 3272.3428 (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	273.9135	301.9958	242.1764	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling 818.0857 (107)
Space cooling per m2 6.8874 (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 2989.5040 (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													
	1058.5261	789.7463	604.4227	302.6232	127.8244	0.0000	0.0000	0.0000	0.0000	372.6923	742.8316	1083.4903	(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)													
	622.6624	464.5566	355.5428	178.0136	75.1908	0.0000	0.0000	0.0000	0.0000	219.2307	436.9598	637.3472	(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

220.1931	194.1179	203.9586	182.9628	179.3900	160.4243	154.1967	169.0275	168.6745	189.7157	200.4446	214.9383	(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	(217)

Fuel for water heating, kWh/month

129.5253	114.1870	119.9756	107.6252	105.5235	94.3673	90.7040	99.4280	99.2203	111.5975	117.9086	126.4343	(219)

Water heating fuel used 1316.4965 (219)
Space cooling fuel requirement

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	68.4784	75.4989	60.5441	0.0000	0.0000	0.0000	0.0000	(221)

Cooling 204.5214 (221)
Annual totals kWh/year
Space heating fuel - main system 2989.5040 (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) 293.4664 (230a)
central heating pump 30.0000 (230c)
Total electricity for the above, kWh/year 323.4664 (231)
Electricity for lighting (calculated in Appendix L) 446.5340 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 1.64 * 1080 * 1.00) = -1416.3363 -1416.3363 (233)
Total delivered energy for all uses 3864.1861 (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	2989.5040	0.5190	1551.5526	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1316.4965	0.5190	683.2617	(264)
Space and water heating			2234.8143	(265)
Space cooling	204.5214	0.5190	106.1466	(266)
Pumps and fans	323.4664	0.5190	167.8791	(267)
Energy for lighting	446.5340	0.5190	231.7511	(268)
Energy saving/generation technologies				
PV Unit	-1416.3363	0.5190	-735.0785	(269)
Total CO2, kg/year			2005.5126	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.8800	(273)

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

DER		16.8800	ZC1
Total Floor Area	TFA	118.7800	
Assumed number of occupants	N	2.8585	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.1493	ZC2
CO2 emissions from cooking, equation (L16)		1.5794	ZC3
Total CO2 emissions		32.6087	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.6087	ZC8

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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	92.2100 (1b)	x	2.6000 (2b)	=	239.7460	(1b) - (3b)
First floor	26.5700 (1c)	x	2.8500 (2c)	=	75.7245	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	315.4705	(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)

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)			74.3300	0.7564	56.2232			(27)
penthouse floor			92.2100	0.1500	13.8315			(28a)
External Wall 1	63.8600	43.3100	20.5500	0.8900	18.2895			(29a)
External Wall 2	39.3000	31.0200	8.2800	0.8900	7.3692			(29a)
penthouse roof	65.6400		65.6400	0.1000	6.5640			(30)
garden room roof	26.5700		26.5700	0.1000	2.6570			(30)
Total net area of external elements Aum(A, m2)			287.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		104.9344			(33)
Party Wall 1			91.2900	0.0000	0.0000			(32)
Party Wall 2			25.4200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3523 (36)
Total fabric heat loss (33) + (36) = 114.2867 (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	51.8379	51.2849	50.7318	47.9665	47.4134	44.6481	44.6481	44.0951	45.7543	47.4134	48.5196	49.6257	(38)
Heat transfer coeff	166.1247	165.5716	165.0185	162.2532	161.7002	158.9349	158.9349	158.3818	160.0410	161.7002	162.8063	163.9124	(39)

Average = Sum(39)m / 12 = 162.1150 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3986	1.3939	1.3893	1.3660	1.3613	1.3381	1.3381	1.3334	1.3474	1.3613	1.3707	1.3800	(40)
HLP (average)												1.3648	(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 2.8585 (42)
Average daily hot water use (litres/day) 102.0888 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.2977	108.2141	104.1306	100.0470	95.9635	91.8799	91.8799	95.9635	100.0470	104.1306	108.2141	112.2977	(44)
Energy conte	166.5342	145.6519	150.2997	131.0349	125.7311	108.4964	100.5378	115.3686	116.7465	136.0568	148.5166	161.2795	(45)
Energy content (annual)											Total = Sum(45)m =	1606.2540	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9801	21.8478	22.5450	19.6552	18.8597	16.2745	15.0807	17.3053	17.5120	20.4085	22.2775	24.1919	(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)

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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
234.3248 206.8821 218.0903 196.6387 193.5217 174.1002 168.3284 183.1592 182.3503 203.8474 214.1204 229.0701 (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
234.3248 206.8821 218.0903 196.6387 193.5217 174.1002 168.3284 183.1592 182.3503 203.8474 214.1204 229.0701 (64)
Total per year (kWh/year) = Sum(64)m = 2404.4336 (64)
Heat gains from water heating, kWh/month
109.6051 97.4134 104.2071 96.0521 96.0381 88.5581 87.6613 92.5925 91.3013 99.4714 101.8648 107.8579 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
25.2846 22.4576 18.2637 13.8268 10.3357 8.7258 9.4286 12.2556 16.4495 20.8864 24.3775 25.9873 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
283.6163 286.5594 279.1430 263.3544 243.4241 224.6924 212.1785 209.2355 216.6518 232.4405 252.3708 271.1024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 37.2924 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 (71)
Water heating gains (Table 5)
147.3187 144.9604 140.0633 133.4058 129.0834 122.9973 117.8243 124.4523 126.8073 133.6981 141.4789 144.9703 (72)
Total internal gains
525.0967 522.8545 506.3471 479.4640 451.7203 425.2927 408.3085 414.8205 428.7857 455.9020 487.1043 510.9372 (73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	23.3000	10.6334	0.3600	1.0000	0.7700	61.8107	(74)
East	51.0300	19.6403	0.3600	1.0000	0.7700	250.0395	(76)

Solar gains	311.8502	607.2537	1006.2484	1497.2230	1874.0930	1938.8161	1837.2709	1549.7069	1178.1934	721.0048	388.0213	257.1487	(83)
Total gains	836.9469	1130.1082	1512.5955	1976.6871	2325.8134	2364.1088	2245.5794	1964.5275	1606.9791	1176.9068	875.1256	768.0859	(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	19.8613	19.9276	19.9944	20.3352	20.4047	20.7597	20.7597	20.8322	20.6162	20.4047	20.2661	20.1293	
alpha	2.3241	2.3285	2.3330	2.3557	2.3603	2.3840	2.3840	2.3888	2.3744	2.3603	2.3511	2.3420	
util living area	0.9561	0.9171	0.8389	0.6996	0.5404	0.3954	0.2979	0.3483	0.5643	0.8150	0.9315	0.9632	(86)
MIT	18.2662	18.7404	19.4390	20.1878	20.6539	20.8837	20.9570	20.9372	20.7221	19.9874	18.9769	18.1945	(87)
Th 2	19.7644	19.7680	19.7716	19.7895	19.7931	19.8111	19.8111	19.8148	19.8039	19.7931	19.7859	19.7787	(88)
util rest of house	0.9490	0.9046	0.8159	0.6617	0.4886	0.3311	0.2221	0.2660	0.4928	0.7793	0.9189	0.9573	(89)
MIT 2	17.3067	17.7716	18.4439	19.1474	19.5517	19.7470	19.7947	19.7890	19.6337	18.9951	18.0237	17.2457	(90)
Living area fraction									fLA = Living area / (4) =			0.3112	(91)
MIT	17.6053	18.0731	18.7535	19.4711	19.8947	20.1007	20.1564	20.1463	19.9724	19.3039	18.3203	17.5409	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6053	18.0731	18.7535	19.4711	19.8947	20.1007	20.1564	20.1463	19.9724	19.3039	18.3203	17.5409	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9323	0.8826	0.7935	0.6508	0.4932	0.3473	0.2446	0.2897	0.5036	0.7623	0.8991	0.9423	(94)
Useful gains	780.2722	997.4436	1200.3131	1286.4327	1147.1017	820.9876	549.3094	569.2063	809.2907	897.1716	786.8221	723.7559	(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	2210.3352	2181.0907	2022.0614	1715.2008	1325.0844	874.2487	565.2373	593.3413	939.8214	1407.4191	1826.7340	2186.7409	(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	1063.9668	795.4108	611.3808	308.7130	132.4191	0.0000	0.0000	0.0000	0.0000	379.6241	748.7365	1088.4608	(98)

Space heating 5128.7119 (98)
Space heating per m2 (98) / (4) = 43.1782 (99)

8c. Space cooling requirement

Not applicable

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

DER		16.3200	ZC1
Total Floor Area	TFA	118.7800	
Assumed number of occupants	N	2.8585	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.1493	ZC2
CO2 emissions from cooking, equation (L16)		1.5794	ZC3
Total CO2 emissions		32.0487	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5

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Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	32.0487	ZC8

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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	92.2100 (1b)	x	2.6000 (2b)	=	239.7460 (1b) - (3b)	
First floor	26.5700 (1c)	x	2.8500 (2c)	=	75.7245 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		315.4705	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1268 (8)
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.3768 (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) =	0.3203 (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	0.4084	0.4003	0.3923	0.3523	0.3443	0.3043	0.3043	0.2963	0.3203	0.3443	0.3603	0.3763	(22b)
Effective ac	0.5834	0.5801	0.5770	0.5621	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5649	0.5708	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type Curtain (Uw = 1.50)			29.6900	1.4151	42.0142			(27)
penthouse floor			92.2100	0.1300	11.9873			(28a)
External Wall 1	63.8600	17.2900	46.5700	0.1800	8.3826			(29a)
External Wall 2	39.3000	12.4000	26.9000	0.1800	4.8420			(29a)
penthouse roof	65.6400		65.6400	0.1300	8.5332			(30)
garden room roof	26.5700		26.5700	0.1300	3.4541			(30)
Total net area of external elements Aum(A, m2)			287.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		79.2134			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3870	(36)
Total fabric heat loss					(33) + (36) =		87.6004	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.7324	60.3954	60.0650	58.5133	58.2229	56.8714	56.8714	56.6211	57.3920	58.2229	58.8103	59.4243	(38)
Heat transfer coeff	148.3328	147.9958	147.6654	146.1136	145.8233	144.4718	144.4718	144.2215	144.9924	145.8233	146.4106	147.0247	(39)
Average = Sum(39)m / 12 =												146.1122	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2488	1.2460	1.2432	1.2301	1.2277	1.2163	1.2163	1.2142	1.2207	1.2277	1.2326	1.2378	(40)
HLP (average)												1.2301	(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												2.8585	(42)
Average daily hot water use (litres/day)												102.0888	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.2977	108.2141	104.1306	100.0470	95.9635	91.8799	91.8799	95.9635	100.0470	104.1306	108.2141	112.2977	(44)
Energy conte	166.5342	145.6519	150.2997	131.0349	125.7311	108.4964	100.5378	115.3686	116.7465	136.0568	148.5166	161.2795	(45)
Energy content (annual)										Total = Sum(45)m =		1606.2540	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9801	21.8478	22.5450	19.6552	18.8597	16.2745	15.0807	17.3053	17.5120	20.4085	22.2775	24.1919	(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	215.7769	190.1291	199.5423	178.6891	174.9738	156.1506	149.7805	164.6113	164.4007	185.2995	196.1708	210.5221	(62)

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Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	215.7769	190.1291	199.5423	178.6891	174.9738	156.1506	149.7805	164.6113	164.4007	185.2995	196.1708	210.5221	(64)
								Total per year (kWh/year) = Sum(64)m =				2186.0468	(64)
Heat gains from water heating, kWh/month													
	94.7668	84.0110	89.3688	81.6925	81.1997	74.1984	72.8230	77.7542	76.9416	84.6330	87.5051	93.0196	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.2846	22.4576	18.2637	13.8268	10.3357	8.7258	9.4286	12.2556	16.4495	20.8864	24.3775	25.9873	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	283.6163	286.5594	279.1430	263.3544	243.4241	224.6924	212.1785	209.2355	216.6518	232.4405	252.3708	271.1024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	(71)
Water heating gains (Table 5)													
	127.3747	125.0164	120.1193	113.4618	109.1394	103.0533	97.8803	104.5083	106.8633	113.7541	121.5349	125.0263	(72)
Total internal gains													
	505.1527	502.9105	486.4031	459.5200	431.7763	405.3487	388.3645	394.8765	408.8417	435.9580	467.1603	490.9932	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.3100	10.6334	0.6300	0.7000	0.7700	30.2547	(74)
East	20.3800	19.6403	0.6300	0.7000	0.7700	122.3273	(76)

Solar gains	152.5820	297.1165	492.3374	732.5673	916.9712	948.6432	898.9566	758.2494	576.4682	352.7726	189.8508	125.8178	(83)
Total gains	657.7347	800.0269	978.7405	1192.0874	1348.7476	1353.9919	1287.3212	1153.1260	985.3099	788.7306	657.0111	616.8110	(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	55.6088	55.7355	55.8602	56.4534	56.5658	57.0950	57.0950	57.1941	56.8900	56.5658	56.3389	56.1036	
alpha	4.7073	4.7157	4.7240	4.7636	4.7711	4.8063	4.8063	4.8129	4.7927	4.7711	4.7559	4.7402	
util living area													
	0.9986	0.9961	0.9864	0.9444	0.8290	0.6440	0.4852	0.5575	0.8336	0.9783	0.9969	0.9990	(86)
MIT	19.5861	19.7677	20.0859	20.4996	20.8144	20.9589	20.9914	20.9840	20.8602	20.4192	19.9249	19.5573	(87)
Th 2	19.8812	19.8834	19.8856	19.8960	19.8979	19.9070	19.9070	19.9087	19.9035	19.8979	19.8940	19.8899	(88)
util rest of house													
	0.9981	0.9948	0.9814	0.9242	0.7734	0.5497	0.3691	0.4341	0.7563	0.9670	0.9955	0.9986	(89)
MIT 2	17.9988	18.2653	18.7286	19.3196	19.7240	19.8813	19.9040	19.9024	19.7935	19.2206	18.5031	17.9626	(90)
Living area fraction									fLA = Living area / (4) =			0.3112	(91)
MIT	18.4927	18.7328	19.1510	19.6868	20.0633	20.2166	20.2424	20.2390	20.1254	19.5936	18.9455	18.4588	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4927	18.7328	19.1510	19.6868	20.0633	20.2166	20.2424	20.2390	20.1254	19.5936	18.9455	18.4588	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9927	0.9770	0.9195	0.7827	0.5777	0.4055	0.4727	0.7741	0.9628	0.9938	0.9979	(94)
Useful gains	655.8398	794.1975	956.1968	1096.0856	1055.6044	782.1894	521.9759	545.1171	762.7764	759.3821	652.9604	615.4909	(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													
	2105.2420	2047.1987	1868.1088	1576.0930	1219.5595	811.4415	526.2221	553.6623	873.6358	1311.4720	1734.3144	2096.3959	(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													
	1078.3552	842.0168	678.4625	345.6054	121.9827	0.0000	0.0000	0.0000	0.0000	410.7549	778.5748	1101.7933	(98)
Space heating												5357.5457	(98)
Space heating per m2											(98) / (4) =	45.1048	(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												5729.9954	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1078.3552	842.0168	678.4625	345.6054	121.9827	0.0000	0.0000	0.0000	0.0000	410.7549	778.5748	1101.7933	(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)													

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	1153.3211	900.5528	725.6283	369.6314	130.4627	0.0000	0.0000	0.0000	0.0000	439.3101	832.7003	1178.3886 (211)
Water heating requirement												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	215.7769	190.1291	199.5423	178.6891	174.9738	156.1506	149.7805	164.6113	164.4007	185.2995	196.1708	210.5221 (64)
Efficiency of water heater												79.8000 (216)
(217)m	88.5210	88.3186	87.8237	86.5450	83.8735	79.8000	79.8000	79.8000	79.8000	86.8786	88.1220	88.5943 (217)
Fuel for water heating, kWh/month												
	243.7579	215.2765	227.2078	206.4696	208.6163	195.6774	187.6949	206.2798	206.0159	213.2856	222.6127	237.6248 (219)
Water heating fuel used												2570.5194 (219)
Annual totals kWh/year												
Space heating fuel - main system												5729.9954 (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)												446.5340 (232)
Total delivered energy for all uses												8822.0487 (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	5729.9954	0.2160	1237.6790	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2570.5194	0.2160	555.2322	(264)
Space and water heating			1792.9112	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	446.5340	0.5190	231.7511	(268)
Total CO2, kg/m2/year			2063.5873	(272)
Emissions per m2 for space and water heating			15.0944	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.9511	(272b)
Emissions per m2 for pumps and fans			0.3277	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0944 * 1.55) + 1.9511 + 0.3277, rounded to 2 d.p.			25.6800	(273)

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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	92.2100 (1b)	x	2.6000 (2b)	=	239.7460 (1b) - (3b)	
First floor	26.5700 (1c)	x	2.8500 (2c)	=	75.7245 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	315.4705	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1268	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3768	(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) =	0.3203	(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	0.4084	0.4003	0.3923	0.3523	0.3443	0.3043	0.3043	0.2963	0.3203	0.3443	0.3603	0.3763	(22b)
Effective ac	0.5834	0.5801	0.5770	0.5621	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5649	0.5708	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 0.78)			74.3300	0.7564	56.2232			(27)
penthouse floor			92.2100	0.1500	13.8315			(28a)
External Wall 1	63.8600	43.3100	20.5500	0.8900	18.2895			(29a)
External Wall 2	39.3000	31.0200	8.2800	0.8900	7.3692			(29a)
penthouse roof	65.6400		65.6400	0.1000	6.5640			(30)
garden room roof	26.5700		26.5700	0.1000	2.6570			(30)
Total net area of external elements Aum(A, m2)			287.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9344			(33)
Party Wall 1			91.2900	0.0000	0.0000			(32)
Party Wall 2			25.4200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.3523 (36)
Total fabric heat loss	(33) + (36) =	114.2867 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.7324	60.3954	60.0650	58.5133	58.2229	56.8714	56.8714	56.6211	57.3920	58.2229	58.8103	59.4243	(38)
Heat transfer coeff	175.0192	174.6821	174.3518	172.8000	172.5097	171.1582	171.1582	170.9079	171.6787	172.5097	173.0970	173.7110	(39)
Average = Sum(39)m / 12 =												172.7986	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4735	1.4706	1.4679	1.4548	1.4523	1.4410	1.4410	1.4389	1.4454	1.4523	1.4573	1.4625	(40)
HLP (average)												1.4548	(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	2.8585 (42)
Average daily hot water use (litres/day)	102.0888 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.2977	108.2141	104.1306	100.0470	95.9635	91.8799	91.8799	95.9635	100.0470	104.1306	108.2141	112.2977	(44)
Energy conte	166.5342	145.6519	150.2997	131.0349	125.7311	108.4964	100.5378	115.3686	116.7465	136.0568	148.5166	161.2795	(45)
Energy content (annual)										Total = Sum(45)m =		1606.2540	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.3885	30.9510	31.9387	27.8449	26.7179	23.0555	21.3643	24.5158	24.8086	28.9121	31.5598	34.2719	(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	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	(66)

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

	25.2846	22.4576	18.2637	13.8268	10.3357	8.7258	9.4286	12.2556	16.4495	20.8864	24.3775	25.9873	(67)

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

	283.6163	286.5594	279.1430	263.3544	243.4241	224.6924	212.1785	209.2355	216.6518	232.4405	252.3708	271.1024	(68)

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

	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	(71)

Water heating gains (Table 5)

	47.5652	46.0581	42.9283	38.6735	35.9111	32.0215	28.7154	32.9514	34.4564	38.8603	43.8330	46.0644	(72)

Total internal gains

	422.3433	420.9521	406.2122	381.7318	355.5480	331.3169	316.1996	320.3196	333.4349	358.0643	386.4584	409.0312	(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	
North	23.3000	10.6334	0.3600	1.0000	0.7700	61.8107	(74)
East	51.0300	19.6403	0.3600	1.0000	0.7700	250.0395	(76)

Solar gains	311.8502	607.2537	1006.2484	1497.2230	1874.0930	1938.8161	1837.2709	1549.7069	1178.1934	721.0048	388.0213	257.1487	(83)
Total gains	734.1934	1028.2058	1412.4606	1878.9548	2229.6410	2270.1329	2153.4705	1870.0265	1511.6282	1079.0690	774.4797	666.1800	(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	18.8519	18.8883	18.9241	19.0940	19.1261	19.2772	19.2772	19.3054	19.2187	19.1261	19.0612	18.9939	
alpha	2.2568	2.2592	2.2616	2.2729	2.2751	2.2851	2.2851	2.2870	2.2812	2.2751	2.2707	2.2663	
util living area													
	0.9665	0.9321	0.8609	0.7307	0.5749	0.4306	0.3284	0.3848	0.6071	0.8454	0.9470	0.9726	(86)
MIT	18.0066	18.4903	19.2222	20.0232	20.5608	20.8388	20.9374	20.9089	20.6359	19.7994	18.7263	17.9187	(87)
Th 2	19.7075	19.7096	19.7117	19.7216	19.7234	19.7321	19.7321	19.7337	19.7287	19.7234	19.7197	19.7158	(88)
util rest of house													
	0.9608	0.9212	0.8395	0.6928	0.5201	0.3586	0.2411	0.2904	0.5313	0.8123	0.9366	0.9680	(89)
MIT 2	17.0144	17.4897	18.1972	18.9485	19.4177	19.6441	19.7089	19.6972	19.5060	18.7739	17.7363	16.9330	(90)
Living area fraction									fLA = Living area / (4) =			0.3112	(91)
MIT	17.3231	17.8011	18.5162	19.2829	19.7734	20.0159	20.0911	20.0742	19.8576	19.0930	18.0443	17.2397	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3231	17.8011	18.5162	19.2829	19.7734	20.0159	20.0911	20.0742	19.8576	19.0930	18.0443	17.2397	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9461	0.8999	0.8154	0.6783	0.5224	0.3754	0.2666	0.3169	0.5397	0.7923	0.9181	0.9551	(94)
Useful gains	694.5987	925.2668	1151.7100	1274.4582	1164.7009	852.1909	574.1287	592.5889	815.8164	854.9810	711.0118	636.2671	(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													
	2279.2918	2253.5864	2095.0383	1794.1699	1392.7461	926.9710	597.5384	627.9517	988.4576	1465.1262	1894.4333	2265.1419	(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													
	1179.0117	892.6308	701.8362	374.1924	169.6656	0.0000	0.0000	0.0000	0.0000	453.9480	852.0634	1211.8829	(98)
Space heating												5835.2308	(98)
Space heating per m2											(98) / (4) =	49.1264	(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	1608.8866	1266.5703	1298.8998	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8543	0.8925	0.8609	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1374.3979	1130.4754	1118.1736	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2767.5254	2628.6095	2299.4067	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	1003.0518	1114.6118	878.8374	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2996.5010	(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	250.7629	278.6530	219.7094	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												749.1252	(107)
Space cooling per m2												6.3068	(108)
Energy for space heating												49.1264	(99)
Energy for space cooling												6.3068	(108)
Total												55.4332	(109)
Dwelling Fabric Energy Efficiency (DFEE)												55.4	(109)

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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	92.2100 (1b)	x	2.6000 (2b)	=	239.7460 (1b) - (3b)	
First floor	26.5700 (1c)	x	2.8500 (2c)	=	75.7245 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		315.4705	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1268 (8)
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.3768 (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) =	0.3203 (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	0.4084	0.4003	0.3923	0.3523	0.3443	0.3043	0.3043	0.2963	0.3203	0.3443	0.3603	0.3763	(22b)
Effective ac	0.5834	0.5801	0.5770	0.5621	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5649	0.5708	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type Curtain (Uw = 1.50)			29.6900	1.4151	42.0142			(27)
penthouse floor			92.2100	0.1300	11.9873			(28a)
External Wall 1	63.8600	17.2900	46.5700	0.1800	8.3826			(29a)
External Wall 2	39.3000	12.4000	26.9000	0.1800	4.8420			(29a)
penthouse roof	65.6400		65.6400	0.1300	8.5332			(30)
garden room roof	26.5700		26.5700	0.1300	3.4541			(30)
Total net area of external elements Aum(A, m2)			287.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		79.2134			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3870	(36)
Total fabric heat loss					(33) + (36) =		87.6004	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.7324	60.3954	60.0650	58.5133	58.2229	56.8714	56.8714	56.6211	57.3920	58.2229	58.8103	59.4243	(38)
Heat transfer coeff	148.3328	147.9958	147.6654	146.1136	145.8233	144.4718	144.4718	144.2215	144.9924	145.8233	146.4106	147.0247	(39)
Average = Sum(39)m / 12 =												146.1122	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2488	1.2460	1.2432	1.2301	1.2277	1.2163	1.2163	1.2142	1.2207	1.2277	1.2326	1.2378	(40)
HLP (average)												1.2301	(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		2.8585 (42)
Average daily hot water use (litres/day)		102.0888 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.2977	108.2141	104.1306	100.0470	95.9635	91.8799	91.8799	95.9635	100.0470	104.1306	108.2141	112.2977	(44)
Energy conte	166.5342	145.6519	150.2997	131.0349	125.7311	108.4964	100.5378	115.3686	116.7465	136.0568	148.5166	161.2795	(45)
Energy content (annual)										Total = Sum(45)m =		1606.2540	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.3885	30.9510	31.9387	27.8449	26.7179	23.0555	21.3643	24.5158	24.8086	28.9121	31.5598	34.2719	(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	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	142.9237	(66)

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

	25.2846	22.4576	18.2637	13.8268	10.3357	8.7258	9.4286	12.2556	16.4495	20.8864	24.3775	25.9873	(67)

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

	283.6163	286.5594	279.1430	263.3544	243.4241	224.6924	212.1785	209.2355	216.6518	232.4405	252.3708	271.1024	(68)

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

	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	37.2924	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	(71)

Water heating gains (Table 5)

	47.5652	46.0581	42.9283	38.6735	35.9111	32.0215	28.7154	32.9514	34.4564	38.8603	43.8330	46.0644	(72)

Total internal gains

	422.3433	420.9521	406.2122	381.7318	355.5480	331.3169	316.1996	320.3196	333.4349	358.0643	386.4584	409.0312	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.3100	10.6334	0.6300	0.7000	0.7700	30.2547	(74)
East	20.3800	19.6403	0.6300	0.7000	0.7700	122.3273	(76)

Solar gains	152.5820	297.1165	492.3374	732.5673	916.9712	948.6432	898.9566	758.2494	576.4682	352.7726	189.8508	125.8178	(83)
Total gains	574.9253	718.0686	898.5496	1114.2991	1272.5192	1279.9601	1215.1563	1078.5690	909.9031	710.8368	576.3092	534.8491	(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	55.6088	55.7355	55.8602	56.4534	56.5658	57.0950	57.0950	57.1941	56.8900	56.5658	56.3389	56.1036	
alpha	4.7073	4.7157	4.7240	4.7636	4.7711	4.8063	4.8063	4.8129	4.7927	4.7711	4.7559	4.7402	
util living area	0.9992	0.9976	0.9903	0.9559	0.8519	0.6729	0.5118	0.5908	0.8641	0.9855	0.9982	0.9994	(86)
MIT	19.5222	19.7050	20.0272	20.4523	20.7879	20.9505	20.9892	20.9795	20.8328	20.3638	19.8629	19.4938	(87)
Th 2	19.8812	19.8834	19.8856	19.8960	19.8979	19.9070	19.9070	19.9087	19.9035	19.8979	19.8940	19.8899	(88)
util rest of house	0.9989	0.9967	0.9867	0.9390	0.7999	0.5775	0.3905	0.4626	0.7935	0.9776	0.9975	0.9992	(89)
MIT 2	18.5321	18.7164	19.0382	19.4593	19.7595	19.8854	19.9044	19.9031	19.8102	19.3826	18.8827	18.5106	(90)
Living area fraction									fLA = Living area / (4) =			0.3112	(91)
MIT	18.8402	19.0240	19.3459	19.7683	20.0795	20.2168	20.2420	20.2380	20.1284	19.6879	19.1877	18.8165	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8402	19.0240	19.3459	19.7683	20.0795	20.2168	20.2420	20.2380	20.1284	19.6879	19.1877	18.8165	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9957	0.9844	0.9366	0.8095	0.6060	0.4286	0.5029	0.8103	0.9756	0.9967	0.9990	(94)
Useful gains	574.0891	715.0061	884.4922	1043.6402	1030.1500	775.7104	520.7810	542.4316	737.3304	693.4850	574.4349	534.2983	(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	2156.7881	2090.2937	1896.8946	1588.0034	1221.9280	811.4746	526.1627	553.5291	874.0768	1325.2331	1769.7622	2148.9889	(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	1177.5281	924.1933	753.2274	391.9416	142.6829	0.0000	0.0000	0.0000	0.0000	470.0206	860.6357	1201.3298	(98)
Space heating												5921.5593	(98)
Space heating per m2											(98) / (4) =	49.8532	(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	1358.0346	1069.0911	1096.0833	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8900	0.9388	0.9068	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1208.6748	1003.6557	993.9672	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1610.1805	1531.8786	1374.3265	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	289.0841	392.9978	282.9873	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												965.0692	(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	72.2710	98.2494	70.7468	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												241.2673	(107)
Space cooling per m2												2.0312	(108)
Energy for space heating												49.8532	(99)
Energy for space cooling												2.0312	(108)
Total												51.8844	(109)
Target Fabric Energy Efficiency (TFEE)												59.7	(109)

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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	92.2100 (1b)	x	2.6000 (2b)	=	239.7460 (1b) - (3b)	
First floor	26.5700 (1c)	x	2.8500 (2c)	=	75.7245 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	315.4705	(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)			74.3300	0.7564	56.2232			(27)
penthouse floor			92.2100	0.1500	13.8315			(28a)
External Wall 1	63.8600	43.3100	20.5500	0.8900	18.2895			(29a)
External Wall 2	39.3000	31.0200	8.2800	0.8900	7.3692			(29a)
penthouse roof	65.6400		65.6400	0.1000	6.5640			(30)
garden room roof	26.5700		26.5700	0.1000	2.6570			(30)
Total net area of external elements Aum(A, m2)			287.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		104.9344			(33)
Party Wall 1			91.2900	0.0000	0.0000			(32)
Party Wall 2			25.4200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3523	(36)
Total fabric heat loss (33) + (36) =	114.2867	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8604	45.7543	45.7543	44.0951	44.0951	41.8828	42.4359	41.3298	41.8828	42.9890	42.9890	44.6481	(38)
Heat transfer coeff	161.1471	160.0410	160.0410	158.3818	158.3818	156.1696	156.7226	155.6165	156.1696	157.2757	157.2757	158.9349	(39)

Average = Sum(39)m / 12 = 158.0131 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3567	1.3474	1.3474	1.3334	1.3334	1.3148	1.3194	1.3101	1.3148	1.3241	1.3241	1.3381	(40)
HLP (average)												1.3303	(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	2.8585 (42)
Average daily hot water use (litres/day)	102.0888 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.2977	108.2141	104.1306	100.0470	95.9635	91.8799	91.8799	95.9635	100.0470	104.1306	108.2141	112.2977	(44)
Energy conte	166.5342	145.6519	150.2997	131.0349	125.7311	108.4964	100.5378	115.3686	116.7465	136.0568	148.5166	161.2795	(45)
Energy content (annual)											Total = Sum(45)m =	1606.2540	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9801	21.8478	22.5450	19.6552	18.8597	16.2745	15.0807	17.3053	17.5120	20.4085	22.2775	24.1919	(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)

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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
220.1931 194.1179 203.9586 182.9628 179.3900 160.4243 154.1967 169.0275 168.6745 189.7157 200.4446 214.9383 (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
220.1931 194.1179 203.9586 182.9628 179.3900 160.4243 154.1967 169.0275 168.6745 189.7157 200.4446 214.9383 (64)
Total per year (kWh/year) = Sum(64)m = 2238.0441 (64)
RHI water heating demand 2238 (64)
Heat gains from water heating, kWh/month
98.2997 87.2021 92.9017 85.1115 84.7327 77.6174 76.3559 81.2872 80.3606 88.1660 90.9241 96.5525 (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	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	(66)

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

	63.2115	56.1439	45.6593	34.5670	25.8392	21.8146	23.5714	30.6390	41.1236	52.2159	60.9437	64.9683	(67)

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

	423.3079	427.7006	416.6313	393.0662	363.3195	335.3618	316.6843	312.2917	323.3610	346.9261	376.6728	404.6305	(68)

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

	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	(71)

Water heating gains (Table 5)

	132.1233	129.7650	124.8679	118.2104	113.8880	107.8020	102.6290	109.2570	111.6119	118.5027	126.2835	129.7749	(72)

Total internal gains

	733.8216	728.7883	702.3374	661.0224	618.2256	580.1572	558.0635	567.3665	591.2753	632.8235	679.0788	714.5526	(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	
North	23.3000	11.9814	0.3600	1.0000	0.7700	69.6467	(74)
East	51.0300	22.3313	0.3600	1.0000	0.7700	284.2992	(76)

Solar gains	353.9459	621.0979	1017.2519	1558.1289	1897.1081	2098.5769	1967.8983	1699.8150	1290.7208	787.7080	451.4042	288.8834	(83)
Total gains	1087.7675	1349.8863	1719.5892	2219.1513	2515.3337	2678.7341	2525.9618	2267.1816	1881.9961	1420.5315	1130.4830	1003.4359	(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	20.4747	20.6162	20.6162	20.8322	20.8322	21.1273	21.0528	21.2024	21.1273	20.9787	20.9787	20.7597	
alpha	2.3650	2.3744	2.3744	2.3888	2.3888	2.4085	2.4035	2.4135	2.4085	2.3986	2.3986	2.3840	
util living area													
	0.9196	0.8754	0.7813	0.6193	0.4499	0.2807	0.1894	0.2152	0.4345	0.7197	0.8754	0.9303	(86)
MIT	19.2427	19.5327	20.0077	20.4811	20.7443	20.8581	20.8807	20.8784	20.7950	20.4033	19.7661	19.2000	(87)
Th 2	19.7967	19.8039	19.8039	19.8148	19.8148	19.8293	19.8256	19.8329	19.8293	19.8220	19.8220	19.8111	(88)
util rest of house													
	0.9074	0.8576	0.7523	0.5764	0.3947	0.2185	0.1188	0.1385	0.3596	0.6719	0.8543	0.9194	(89)
MIT 2	17.5013	17.9138	18.5696	19.1984	19.5162	19.6468	19.6601	19.6668	19.5943	19.1310	18.2663	17.4511	(90)
Living area fraction									fLA = Living area / (4) =			0.3112	(91)
MIT	18.0432	18.4175	19.0171	19.5975	19.8984	20.0237	20.0399	20.0438	19.9679	19.5269	18.7330	17.9953	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0432	18.4175	19.0171	19.5975	19.8984	20.0237	20.0399	20.0438	19.9679	19.5269	18.7330	17.9953	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8845	0.8326	0.7306	0.5680	0.3987	0.2291	0.1319	0.1526	0.3689	0.6585	0.8303	0.8979	(94)
Useful gains	962.0878	1123.9430	1256.3228	1260.4336	1002.9519	613.6404	333.0959	345.9362	694.2351	935.3650	938.6328	900.9727	(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													
	2085.7568	2051.3332	1859.2089	1535.9134	1092.5754	628.3839	335.3681	349.1744	744.6027	1246.7046	1688.0363	2049.5100	(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													
	836.0097	623.2062	448.5473	198.3455	66.6799	0.0000	0.0000	0.0000	0.0000	231.6367	539.5705	854.5117	(98)
Space heating												3798.5075	(98)
RHI space heating demand												3799	(98)

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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	92.2100 (1b)	x	2.6000 (2b)	=	239.7460	(1b) - (3b)
First floor	26.5700 (1c)	x	2.8500 (2c)	=	75.7245	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		315.4705	(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)
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)			74.3300	0.7564	56.2232			(27)
penthouse floor			92.2100	0.1500	13.8315			(28a)
External Wall 1	63.8600	43.3100	20.5500	0.8900	18.2895			(29a)
External Wall 2	39.3000	31.0200	8.2800	0.8900	7.3692			(29a)
penthouse roof	65.6400		65.6400	0.1000	6.5640			(30)
garden room roof	26.5700		26.5700	0.1000	2.6570			(30)
Total net area of external elements Aum(A, m2)			287.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		104.9344			(33)
Party Wall 1			91.2900	0.0000	0.0000			(32)
Party Wall 2			25.4200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.3523	(36)
Total fabric heat loss	(33) + (36) =	114.2867	(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	51.8379	51.2849	50.7318	47.9665	47.4134	44.6481	44.6481	44.0951	45.7543	47.4134	48.5196	49.6257	(38)
Heat transfer coeff	166.1247	165.5716	165.0185	162.2532	161.7002	158.9349	158.9349	158.3818	160.0410	161.7002	162.8063	163.9124	(39)
Average = Sum(39)m / 12 =												162.1150	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3986	1.3939	1.3893	1.3660	1.3613	1.3381	1.3381	1.3334	1.3474	1.3613	1.3707	1.3800	(40)
HLP (average)												1.3648	(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		2.8585	(42)
Average daily hot water use (litres/day)		102.0888	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.2977	108.2141	104.1306	100.0470	95.9635	91.8799	91.8799	95.9635	100.0470	104.1306	108.2141	112.2977	(44)
Energy conte	166.5342	145.6519	150.2997	131.0349	125.7311	108.4964	100.5378	115.3686	116.7465	136.0568	148.5166	161.2795	(45)
Energy content (annual)											Total = Sum(45)m =	1606.2540	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9801	21.8478	22.5450	19.6552	18.8597	16.2745	15.0807	17.3053	17.5120	20.4085	22.2775	24.1919	(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)

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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

	220.1931	194.1179	203.9586	182.9628	179.3900	160.4243	154.1967	169.0275	168.6745	189.7157	200.4446	214.9383 (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

	220.1931	194.1179	203.9586	182.9628	179.3900	160.4243	154.1967	169.0275	168.6745	189.7157	200.4446	214.9383 (64)

Total per year (kWh/year) = Sum(64)m = 2238.0441 (64)

Heat gains from water heating, kWh/month

	98.2997	87.2021	92.9017	85.1115	84.7327	77.6174	76.3559	81.2872	80.3606	88.1660	90.9241	96.5525 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	(66)

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

	63.2115	56.1439	45.6593	34.5670	25.8392	21.8146	23.5714	30.6390	41.1236	52.2159	60.9437	64.9683 (67)

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

	423.3079	427.7006	416.6313	393.0662	363.3195	335.3618	316.6843	312.2917	323.3610	346.9261	376.6728	404.6305 (68)

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

	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093	55.0093 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390	-114.3390 (71)

Water heating gains (Table 5)

	132.1233	129.7650	124.8679	118.2104	113.8880	107.8020	102.6290	109.2570	111.6119	118.5027	126.2835	129.7749 (72)

Total internal gains

	733.8216	728.7883	702.3374	661.0224	618.2256	580.1572	558.0635	567.3665	591.2753	632.8235	679.0788	714.5526 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	23.3000	10.6334	0.3600	1.0000	0.7700	61.8107	(74)
East	51.0300	19.6403	0.3600	1.0000	0.7700	250.0395	(76)

Solar gains	311.8502	607.2537	1006.2484	1497.2230	1874.0930	1938.8161	1837.2709	1549.7069	1178.1934	721.0048	388.0213	257.1487 (83)
Total gains	1045.6717	1336.0420	1708.5858	2158.2454	2492.3187	2518.9732	2395.3344	2117.0735	1769.4687	1353.8282	1067.1001	971.7013 (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	19.8613	19.9276	19.9944	20.3352	20.4047	20.7597	20.7597	20.8322	20.6162	20.4047	20.2661	20.1293	
alpha	2.3241	2.3285	2.3330	2.3557	2.3603	2.3840	2.3840	2.3888	2.3744	2.3603	2.3511	2.3420	
util living area													
	0.9329	0.8890	0.8068	0.6681	0.5145	0.3747	0.2808	0.3260	0.5279	0.7742	0.9018	0.9418	(86)
MIT	19.0167	19.3479	19.8288	20.3393	20.6538	20.8102	20.8595	20.8473	20.7076	20.2207	19.5232	18.9648	(87)
Th 2	19.7644	19.7680	19.7716	19.7895	19.7931	19.8111	19.8111	19.8148	19.8039	19.7931	19.7859	19.7787	(88)
util rest of house													
	0.9227	0.8732	0.7811	0.6292	0.4635	0.3129	0.2088	0.2481	0.4578	0.7345	0.8851	0.9329	(89)
MIT 2	17.1557	17.6269	18.2985	18.9946	19.3909	19.5845	19.6311	19.6265	19.4799	18.8695	17.8989	17.0910	(90)
Living area fraction									fLA = Living area / (4) =			0.3112	(91)
MIT	17.7347	18.1624	18.7747	19.4130	19.7838	19.9659	20.0133	20.0063	19.8619	19.2899	18.4044	17.6741	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7347	18.1624	18.7747	19.4130	19.7838	19.9659	20.0133	20.0063	19.8619	19.2899	18.4044	17.6741	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9008	0.8477	0.7570	0.6160	0.4631	0.3212	0.2214	0.2611	0.4614	0.7154	0.8610	0.9125	(94)
Useful gains	941.9061	1132.6259	1293.3314	1329.4424	1154.1570	809.0513	530.2451	552.7190	816.4669	968.4832	918.7300	886.6799	(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													
	2231.8420	2195.8731	2025.5521	1705.7734	1307.1584	852.8324	542.4950	571.1786	922.1457	1405.1658	1840.4209	2208.5655	(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													
	959.7123	714.5021	544.7722	270.9583	113.8331	0.0000	0.0000	0.0000	0.0000	324.8918	663.6175	983.4829	(98)
Space heating												4575.7702	(98)
Space heating per m2											(98) / (4) =	38.5231	(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	1493.9879	1176.1181	1203.7018	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8846	0.9173	0.8920	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1321.5639	1078.8898	1073.6888	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2843.3058	2702.5230	2375.7123	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	1095.6542	1207.9831	968.7055	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling													3272.3428 (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	273.9135	301.9958	242.1764	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													818.0857 (107)
Space cooling per m2													6.8874 (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													2691.6295 (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													
	959.7123	714.5021	544.7722	270.9583	113.8331	0.0000	0.0000	0.0000	0.0000	324.8918	663.6175	983.4829	(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)													
	564.5367	420.2954	320.4542	159.3872	66.9606	0.0000	0.0000	0.0000	0.0000	191.1128	390.3632	578.5193	(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													
	220.1931	194.1179	203.9586	182.9628	179.3900	160.4243	154.1967	169.0275	168.6745	189.7157	200.4446	214.9383	(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													
	129.5253	114.1870	119.9756	107.6252	105.5235	94.3673	90.7040	99.4280	99.2203	111.5975	117.9086	126.4343	(219)
Water heating fuel used													1316.4965 (219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	68.4784	75.4989	60.5441	0.0000	0.0000	0.0000	0.0000	(221)
Cooling													204.5214 (221)
Annual totals kWh/year													
Space heating fuel - main system													2691.6295 (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)													293.4664 (230a)
central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													323.4664 (231)
Electricity for lighting (calculated in Appendix L)													446.5340 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.64 * 1080 * 1.00) =											-1416.3363		-1416.3363 (233)
Total delivered energy for all uses													3566.3116 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2691.6295	13.1900	355.0259	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1316.4965	13.1900	173.6459	(247)
Space cooling	204.5214	13.1900	26.9764	(248)
Mechanical ventilation fans	293.4664	13.1900	38.7082	(249)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	446.5340	13.1900	58.8978	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1416.3363	13.1900	-186.8148	(252)
Total energy cost			470.3965	(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] =	1.2063	(257)
SAP value		83.1722	
SAP rating (Section 12)		83	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2691.6295	0.5190	1396.9557	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1316.4965	0.5190	683.2617	(264)
Space and water heating			2080.2174	(265)
Space cooling	204.5214	0.5190	106.1466	(266)
Pumps and fans	323.4664	0.5190	167.8791	(267)
Energy for lighting	446.5340	0.5190	231.7511	(268)
Energy saving/generation technologies				
PV Unit	-1416.3363	0.5190	-735.0785	(269)
Total kg/year			1850.9157	(272)
CO2 emissions per m2			15.5800	(273)
EI value			84.8563	
EI rating			85	(274)
EI band			B	

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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

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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	92.2100 (1b)	x	2.6000 (2b)	=	239.7460 (1b) - (3b)	
First floor	26.5700 (1c)	x	2.8500 (2c)	=	75.7245 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	118.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		315.4705	(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)			74.3300	0.7564	56.2232			(27)
penthouse floor			92.2100	0.1500	13.8315			(28a)
External Wall 1	63.8600	43.3100	20.5500	0.8900	18.2895			(29a)
External Wall 2	39.3000	31.0200	8.2800	0.8900	7.3692			(29a)
penthouse roof	65.6400		65.6400	0.1000	6.5640			(30)
garden room roof	26.5700		26.5700	0.1000	2.6570			(30)
Total net area of external elements Aum(A, m2)			287.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		104.9344			(33)
Party Wall 1			91.2900	0.0000	0.0000			(32)
Party Wall 2			25.4200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3523	(36)
Total fabric heat loss (33) + (36) =	114.2867	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8604	45.7543	45.7543	44.0951	44.0951	41.8828	42.4359	41.3298	41.8828	42.9890	42.9890	44.6481	(38)
Heat transfer coeff	161.1471	160.0410	160.0410	158.3818	158.3818	156.1696	156.7226	155.6165	156.1696	157.2757	157.2757	158.9349	(39)

Average = Sum(39)m / 12 = 158.0131 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3567	1.3474	1.3474	1.3334	1.3334	1.3148	1.3194	1.3101	1.3148	1.3241	1.3241	1.3381	(40)
HLP (average)												1.3303	(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	2.8585 (42)
Average daily hot water use (litres/day)	102.0888 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.2977	108.2141	104.1306	100.0470	95.9635	91.8799	91.8799	95.9635	100.0470	104.1306	108.2141	112.2977	(44)
Energy conte	166.5342	145.6519	150.2997	131.0349	125.7311	108.4964	100.5378	115.3686	116.7465	136.0568	148.5166	161.2795	(45)
Energy content (annual)											Total = Sum(45)m =	1606.2540	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9801	21.8478	22.5450	19.6552	18.8597	16.2745	15.0807	17.3053	17.5120	20.4085	22.2775	24.1919	(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)

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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
220.1931 194.1179 203.9586 182.9628 179.3900 160.4243 154.1967 169.0275 168.6745 189.7157 200.4446 214.9383 (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
220.1931 194.1179 203.9586 182.9628 179.3900 160.4243 154.1967 169.0275 168.6745 189.7157 200.4446 214.9383 (64)
Total per year (kWh/year) = Sum(64)m = 2238.0441 (64)
Heat gains from water heating, kWh/month
98.2997 87.2021 92.9017 85.1115 84.7327 77.6174 76.3559 81.2872 80.3606 88.1660 90.9241 96.5525 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	171.5085	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
63.2115 56.1439 45.6593 34.5670 25.8392 21.8146 23.5714 30.6390 41.1236 52.2159 60.9437 64.9683 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
423.3079 427.7006 416.6313 393.0662 363.3195 335.3618 316.6843 312.2917 323.3610 346.9261 376.6728 404.6305 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
55.0093 55.0093 55.0093 55.0093 55.0093 55.0093 55.0093 55.0093 55.0093 55.0093 55.0093 55.0093 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 -114.3390 (71)
Water heating gains (Table 5)
132.1233 129.7650 124.8679 118.2104 113.8880 107.8020 102.6290 109.2570 111.6119 118.5027 126.2835 129.7749 (72)
Total internal gains
733.8216 728.7883 702.3374 661.0224 618.2256 580.1572 558.0635 567.3665 591.2753 632.8235 679.0788 714.5526 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	23.3000	11.9814	0.3600	1.0000	0.7700	69.6467	(74)
East	51.0300	22.3313	0.3600	1.0000	0.7700	284.2992	(76)

Solar gains	353.9459	621.0979	1017.2519	1558.1289	1897.1081	2098.5769	1967.8983	1699.8150	1290.7208	787.7080	451.4042	288.8834	(83)
Total gains	1087.7675	1349.8863	1719.5892	2219.1513	2515.3337	2678.7341	2525.9618	2267.1816	1881.9961	1420.5315	1130.4830	1003.4359	(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	20.4747	20.6162	20.6162	20.8322	20.8322	21.1273	21.0528	21.2024	21.1273	20.9787	20.9787	20.7597	
alpha	2.3650	2.3744	2.3744	2.3888	2.3888	2.4085	2.4035	2.4135	2.4085	2.3986	2.3986	2.3840	
util living area	0.9196	0.8754	0.7813	0.6193	0.4499	0.2807	0.1894	0.2152	0.4345	0.7197	0.8754	0.9303	(86)
MIT	19.2427	19.5327	20.0077	20.4811	20.7443	20.8581	20.8807	20.8784	20.7950	20.4033	19.7661	19.2000	(87)
Th 2	19.7967	19.8039	19.8039	19.8148	19.8148	19.8293	19.8256	19.8329	19.8293	19.8220	19.8220	19.8111	(88)
util rest of house	0.9074	0.8576	0.7523	0.5764	0.3947	0.2185	0.1188	0.1385	0.3596	0.6719	0.8543	0.9194	(89)
MIT 2	17.5013	17.9138	18.5696	19.1984	19.5162	19.6468	19.6601	19.6668	19.5943	19.1310	18.2663	17.4511	(90)
Living area fraction									fLA = Living area / (4) =			0.3112	(91)
MIT	18.0432	18.4175	19.0171	19.5975	19.8984	20.0237	20.0399	20.0438	19.9679	19.5269	18.7330	17.9953	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0432	18.4175	19.0171	19.5975	19.8984	20.0237	20.0399	20.0438	19.9679	19.5269	18.7330	17.9953	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8845	0.8326	0.7306	0.5680	0.3987	0.2291	0.1319	0.1526	0.3689	0.6585	0.8303	0.8979	(94)
Useful gains	962.0878	1123.9430	1256.3228	1260.4336	1002.9519	613.6404	333.0959	345.9362	694.2351	935.3650	938.6328	900.9727	(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	2085.7568	2051.3332	1859.2089	1535.9134	1092.5754	628.3839	335.3681	349.1744	744.6027	1246.7046	1688.0363	2049.5100	(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	836.0097	623.2062	448.5473	198.3455	66.6799	0.0000	0.0000	0.0000	0.0000	231.6367	539.5705	854.5117	(98)
Space heating												3798.5075	(98)
Space heating per m2											(98) / (4) =	31.9794	(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	1249.3567	956.0081	964.8225	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9269	0.9509	0.9383	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1157.9737	909.0281	905.2679	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3030.0393	2855.2044	2551.1633	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	1347.8872	1447.9552	1224.5462	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling 4020.3886 (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	336.9718	361.9888	306.1366	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling 1005.0971 (107)
Space cooling per m2 8.4618 (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 2234.4162 (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													
	836.0097	623.2062	448.5473	198.3455	66.6799	0.0000	0.0000	0.0000	0.0000	231.6367	539.5705	854.5117	(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)													
	491.7704	366.5919	263.8514	116.6738	39.2235	0.0000	0.0000	0.0000	0.0000	136.2569	317.3944	502.6540	(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													
	220.1931	194.1179	203.9586	182.9628	179.3900	160.4243	154.1967	169.0275	168.6745	189.7157	200.4446	214.9383	(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													
	129.5253	114.1870	119.9756	107.6252	105.5235	94.3673	90.7040	99.4280	99.2203	111.5975	117.9086	126.4343	(219)
Water heating fuel used												1316.4965	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	84.2429	90.4972	76.5341	0.0000	0.0000	0.0000	0.0000	(221)
Cooling												251.2743	(221)
Annual totals kWh/year													
Space heating fuel - main system												2234.4162	(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)												293.4664	(230a)
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												323.4664	(231)
Electricity for lighting (calculated in Appendix L)												446.5340	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.64 * 1140 * 1.00) =										-1495.8109		-1495.8109	(233)
Total delivered energy for all uses												3076.3765	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2234.4162	15.4400	344.9939	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1316.4965	15.4400	203.2671	(247)
Space cooling	251.2743	15.4400	38.7967	(248)
Mechanical ventilation fans	293.4664	15.4400	45.3112	(249)
Pumps and fans for heating	30.0000	15.4400	4.6320	(249)
Energy for lighting	446.5340	15.4400	68.9448	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1495.8109	15.4400	-230.9532	(252)
Total energy cost			474.9925	(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	2234.4162	0.5190	1159.6620	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1316.4965	0.5190	683.2617	(264)
Space and water heating			1842.9237	(265)
Space cooling	251.2743	0.5190	130.4114	(266)
Pumps and fans	323.4664	0.5190	167.8791	(267)
Energy for lighting	446.5340	0.5190	231.7511	(268)
Energy saving/generation technologies				
PV Unit	-1495.8109	0.5190	-776.3259	(269)
Total kg/year			1596.6394	(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	2234.4162	3.0700	6859.6577	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1316.4965	3.0700	4041.6443	(264)
Space and water heating			10901.3020	(265)
Space cooling	251.2743	3.0700	771.4121	(266)
Pumps and fans	323.4664	3.0700	993.0419	(267)
Energy for lighting	446.5340	3.0700	1370.8593	(268)

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Energy saving/generation technologies

PV Unit	-1495.8109	3.0700	-4592.1395 (269)
Primary energy kWh/year			9444.4758 (272)
Primary energy kWh/m2/year			79.5123 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

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

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

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

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

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

	Current	Potential	Saving
Electricity	£706	£706	£0
Space heating	£395	£395	£0
Space cooling	£39	£39	£0
Water heating	£203	£203	£0
Lighting	£69	£69	£0
Generated (PV)	-£231	-£231	£0
Total cost of fuels	£475	£475	£0
Total cost of uses	£475	£475	£0
Delivered energy	26 kWh/m²	26 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.6 tonnes	1.6 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	80 kWh/m²	80 kWh/m²	0 kWh/m²

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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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

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

Overheating Calculation

Summer ventilation heat loss coefficient	832.84 (P1)
Transmission heat loss coefficient	114.29 (37)
Summer heat loss coefficient	947.13 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	23.3000	81.1852	0.3600	1.0000	0.9000	551.5948
East	51.0300	117.5071	0.3600	1.0000	0.9000	1748.5461
total:						2300.1409

	Jun	Jul	Aug	
Solar gains	2453	2300	1987	(P3)
Internal gains	577	555	564	
Total summer gains	3030	2855	2551	(P5)
Summer gain/loss ratio	3.20	3.01	2.69	(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	20.50	22.21	21.79	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium

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Predicted Energy Assessment

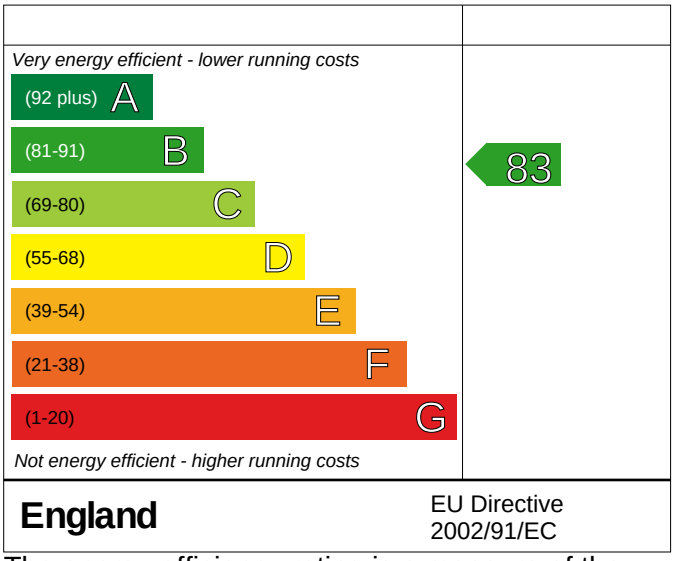
507,
London

Dwelling type:	Flat, End-Terrace
Date of assessment:	01.Nov.2016
Produced by:	Gecko
Total floor area:	118.78 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.

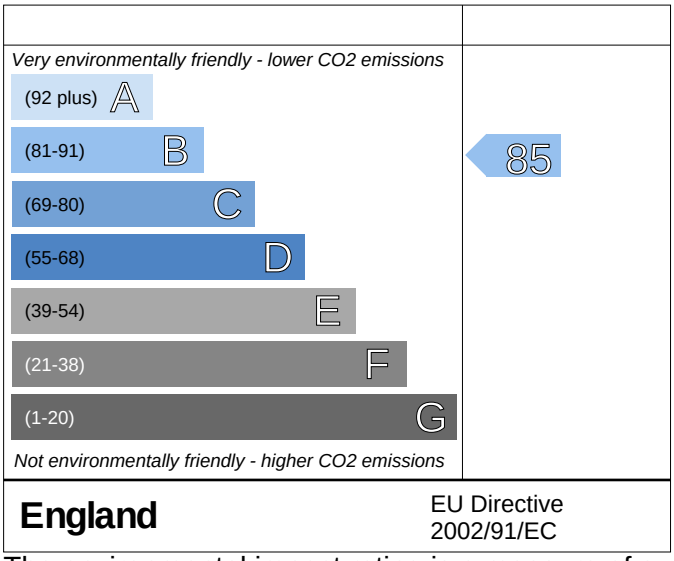
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

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.

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SURVEY NOTES

Property Reference: 507 Linton House
Survey Reference: 507 design
Property: 507, London

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

SAP Rating:	83 B	**CO2 Emissions (t/year):**	1.60	**DER:**	16.88 Pass	**TER:**	25.68	**Percentage DER<TER:**	34.26 %
Environmental:	85 B	**General Requirements Compliance:**	Pass	**DFEE:**	55.43 Pass	**TFEE:**	59.67	**Percentage DFEE<TFEE:**	7.10 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.1 **ENE2 Credits:** 0.0 **ENE7 Credits:** 0 **CfSH Level:** 4

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

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

Summary Information

Property Reference: 507 Linton House
Survey Reference: 507 design
Property: 507, London

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

SAP Rating: 83 B **CO2 Emissions (t/year):** 1.60 **DER:** 16.88 Pass **TER:** 25.68 **Percentage DER<TER:** 34.26 %
Environmental: 85 B **General Requirements Compliance:** Pass **DFEE:** 55.43 Pass **TFEE:** 59.67 **Percentage DFEE<TFEE:** 7.10 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.1 **ENE2 Credits:** 0.0 **ENE7 Credits:** 0 **CfSH Level:** 4

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

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

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

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

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	24.56	92.21	2.60
1st Storey:	13.79	26.57	2.85

7.0 Living Area	36.96
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	0.89		63.86	20.55
External Wall 2	Other	0.89		39.30	8.28

9.1 Party walls

Description	Construction	Kappa	Area
Party Wall 1	Steel frame		91.29
Party Wall 2	Steel frame		25.42

10.0 External Roofs

Description	Construction	U-Value	Kappa	Gross Area	Nett Area
penthouse roof	Other	0.10		65.64	65.64
garden room roof	Other	0.10		26.57	26.57

11.0 HeatLoss Floors

Description	Construction	U-Value	Kappa	Area
penthouse floor	Other	0.15		92.21

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	North	None	0.00					4.16	
2	Window	[1] External Wall 1	North	None	0.00					6.48	
3	Window	[1] External Wall 1	North	None	0.00					3.51	

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4	Window	[1] External Wall 1	East	None	0.00	7.29
1gh	Window	[2] External Wall 2	North	None	0.00	9.15
5	Window	[1] External Wall 1	East	None	0.00	7.29
6	Window	[1] External Wall 1	East	None	0.00	7.29
7	Window	[1] External Wall 1	East	None	0.00	7.29
2gh	Window	[2] External Wall 2	East	None	0.00	21.87

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)	24.56	0.160	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	13.79	0.070	Yes
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	24.56	0.070	Yes
Table K1 - Default	E14 Flat roof	13.79	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 118.78
Data Source SAP table
Cooling Type Split or Multi-Split
Energy Class A
Energy Efficiency Ratio
System Control On/Off

22.0 Lighting
Internal
Total number of light fittings 52
Total number of L.E.L. fittings 52
Percentage of L.E.L. fittings 100.00
External
External lights fitted Yes
Light and motion sensors Yes
23.0 Electricity Tariff Standard

24.0 Heating Systems
Main Heating 1 SAP table
Description ashp
Percentage of Heat 100 %

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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 Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
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

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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
1.64	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

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Thermal Bridging

Property Reference: 507 Linton House
Survey Reference: 507 design
Property: 507, London

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

SAP Rating:	83 B	**CO2 Emissions (t/year):**	1.60	**DER:**	16.88 Pass	**TER:**	25.68	**Percentage DER<TER:**	34.26 %
Environmental:	85 B	**General Requirements Compliance:**	Pass	**DFEE:**	55.43 Pass	**TFEE:**	59.67	**Percentage DFEE<TFEE:**	7.10 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.1 **ENE2 Credits:** 0.0 **ENE7 Credits:** 0 **CfSH Level:** 4

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

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

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	24.56	3.93	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	13.79	0.97	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	24.56	1.72	
External wall	E14 Flat roof	Table K1 - Default	0.080	13.79	1.10	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	10.90	0.98	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	10.90	0.65	

Total W/mK: 9.35
Y-Value W/m2K: 0.033