Building Regulation Compliance

Property Reference: 503 Linton House
Survey Reference: 503 design
Property: 503, London

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

SAP Rating:	85 B	**CO2 Emissions (t/year):**	1.39	**DER:**	15.66 Pass	**TER:**	23.37	**Percentage DER<TER:**	32.99 %
Environmental:	86 B	**General Requirements Compliance:**	Pass	**DFEE:**	46.72 Pass	**TFEE:**	51.25	**Percentage DFEE<TFEE:**	8.84 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.0 **ENE2 Credits:** 3.4 **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)	23.37 kg/m^2	
Dwelling Carbon Dioxide Emission Rate (DER)	15.66 kg/m^2	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.25 kWh/m^2	
Dwelling Fabric Energy Efficiency (DFEE)	46.72 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	1.01 (max. 2.00)	1.01 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

5 Cylinder insulation

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

6 Controls

Space heating controls:	Time and temperature zone control	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system
Specific fan power: 0.61

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

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK
Based On:		
Overshading:	Average	
Windows facing West:	47.52 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	1.01 W/m^2K
Thermal bridging y-value	0.026 W/m^2K
Photovoltaic array	

Full SAP Calculation Printout

Property Reference: 503 Linton House
Survey Reference: 503 design
Property: 503, London

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

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Environmental:	86 B	**General Requirements Compliance:**	Pass	**DFEE:**46.72 Pass	**TFEE:**51.25	**Percentage DFEE<TFEE:**	8.84 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.0 **ENE2 Credits:** 3.4 **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 '503 design'
SAP2012 - 9.92 input data (DesignData) -


```
SAP2012 Input Data (Flat)     01/11/2016

FullRefNo:                    503 design

Regs Region:                  England
SAP Region:                   Thames Valley
Postcode:
DwellingOrientation:          East
Property Type:                Flat, End-Terrace
Storeys:                      2
Date Built:                   2016
Sheltered Sides:              2
Sunlight Shade:               Average or unknown
Measurements                  Perimeter, Floor Area, Storey Height
    1st Storey:              11.61, 82.43, 2.6
    2nd Storey:              9.97, 29.87, 2.85
Living Area:                  29.33 m2, fraction: 26.1%
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               8.32, 30.19, 0, Other, CurtainWalling, 0, 1.01, Calculate
External Wall 2               2.76, 28.41, 0, Other, CurtainWalling, 0, 1.01, Gross
Party Walls                   Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall 1                  74.14, 20, PartyWallSteelFrame, Solid, 0, 0
Party Wall 2                  36.78, 20, PartyWallSteelFrame, Solid, 0, 0
External Roofs                Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
    penthouse roof           52.56, 52.56, 0, Other, 0.1
    garden room roof         29.87, 29.87, 0, Other, 0.1
Heat Loss Floors              Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
    penthouse floor          82.43, 0, Other, Ground Floor - Solid, 0, 0.15
Description                   Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
    Opening Type 1           Manufacturer, Window, Double Low-E Soft 0.05, , , 0.36, , 1,
Openings                      Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
    1                        Window, External Wall 1, West, , None, 0, , 0, 0, 0, 7.29,
    2                        Window, External Wall 1, West, , None, 0, , 0, 0, 0, 7.29,
    3                        Window, External Wall 1, West, , None, 0, , 0, 0, 0, 7.29,
    1gh                      Window, External Wall 2, West, , None, 0, , 0, 0, 0, 25.65,
Conservatory:                 None
Draught Proofing:             100
Draught Lobby:                No
Thermal Bridges
    Bridging:                Calculate Bridges
    Y                        0.026
    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, 11.61, 0.16, 0.16, 1.86,
    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, 9.97, 0.07, 0.07, 0.70,
    10.                      External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, Yes, 11.61, 0.07, 0.07, 0.81,
    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, 9.97, 0.08, 0.08, 0.80,
    20.                      External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
    21.                      External wall, E16 Corner (normal), Table K1 - Approved, Yes, 10.9, 0.09, 0.09, 0.98,
    22.                      External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
    23.                      External wall, E18 Party wall between dwellings, Table K1 - Approved, Yes, 10.9, 0.06, 0.06, 0.65,
    24.                      External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
    25.                      Party wall, P1 Party wall - Ground floor, , No, 0, 0, 0, 0.00,
    26.                      Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
    27.                      Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
    28.                      Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), , No, 0, 0, 0, 0.00,
    29.                      Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
    30.                      Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
    31.                      Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
    32.                      Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
    33.                      External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
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    34.                     External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
    35.                     External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
    36.                     External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
    37.                     External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
    38.                     External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
    39.                     External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
    40.                     External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
    41.                     External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:               True
Designed q50:                5
AsBuilt q50:                 15
Property Tested:             False
Mechanical Ventilation
    MV System Present       Yes
    Windows In Hot Weather  Windows fully open
    Cross Ventilation       Yes
    Night Ventilation       No
    Air Change Rate         8.00
    Approved Installation   Yes
    DataType                Database
    Type                    Balanced mechanical ventilation with heat recovery
    Database Ref Number     500320
    Configuration           2
    HR Duct Insulated       No
    ManufacturerSFP         0.61
    DuctType                Rigid
    HR Efficiency           78
    Wet Rooms               2
Chimneys MHS:                0
Chimneys SHS:                0
Chimneys Other:              0
Chimneys Total:              0
Open Flues MHS:              0
Open Flues SHS:              0
Open Flues Other:            0
Open Flues Total:            0
Intermittent Fans:           0
Passive Vents:               0
Flueless Gas Fires:          0
Cooling System
    Cooled Area             112.30
    Data Source             SAP table
    Type                    Split or Multi-Split
    Class                   A
    Control                 On/Off
Light Fittings:              40
LEL Fittings:                40
Percentage of LEL Fittings:  100
External Lights Fitted:      Yes
External LELs Fitted:        Yes
Electricity Tariff:          Standard
Main Heating 1
    Description             ashp
    Percentage              100
    MHS                     Electricity PET Heat pump air-to-water
    SAP Code                224
    Boiler Efficiency Type  SAP Table
    Efficiency              170
    Controls by PCDF        0
    MHS Controls            CHD Time and temperature zone control
    Boiler Interlock        No
    Ctrl SAP Code           2207
    MCS Installation CertificateNo
    Pumped                  Pump in heated space
    Heat Pump Age           2013 or later
    Heat Emitter            Radiators and Underfloor
    Flow Temperature        <= 35°C
    Under Floor Heating     Yes - Pipes in thin screed
Main Heating 2               None
Heating Systems Interaction  Each system heats separate parts of dwelling
Smoke Control Area           Unknown
Community Heating            None
Secondary Heating            None
Water Heating
    Type                    MainHeating1
    WHS                     HWP From main heating 1
    Low Water Usage         Yes
    SAP Code                901
    Showers in Property     Non-electric only
    Suplementary Immersion  No
    Hot Water Cylinder
    Cylinder Type           HotWaterCylinder
    Cylinder Insulation Type Foam
    Cylinder Volume         180.00
    Cylinder Stat           Yes
    Pipeworks Insulated     Fully insulated primary pipework
    Cylinder in Heated Space Yes
    Separate Time Control   Yes
Flue Gas Heat Recovery System None
Waste Water Heat Recovery    none
PV Unit
Type                         One Dwelling
PVUnit 1                     Cells Peak = 1.31, Orientation = South, Elevation = 30°, Overshading = None Or Little, , Connected to Dwelling = Yes
Wind Turbine                 None
Terrain Type:                Urban
Small Scale Hydro            None
Special Features             None


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

Top-floor flat, total floor area 112 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------
1a TER and DER
```

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 23.37 kg/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.66 kg/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²
Dwelling Fabric Energy Efficiency (DFEE)46.7 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	1.01 (max. 2.00)	1.01 (max. 3.30)	OK

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

---

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

---

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

Secondary heating system: None

---

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

---

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

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---

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

---

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

---

9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing West: 47.52 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 1.01 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.4300 (1b)	x	2.6000 (2b)	=	214.3180 (1b) - (3b)	
First floor	29.8700 (1c)	x	2.8500 (2c)	=	85.1295 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		299.4475	(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 = 1.01)			47.5200	0.9708	46.1315			(27)
penthouse floor			82.4300	0.1500	12.3645			(28a)
External Wall 1	30.1900	21.8700	8.3200	1.0100	8.4032			(29a)
External Wall 2	28.4100	25.6500	2.7600	1.0100	2.7876			(29a)
penthouse roof	52.5600		52.5600	0.1000	5.2560			(30)
garden room roof	29.8700		29.8700	0.1000	2.9870			(30)
Total net area of external elements Aum(A, m2)			223.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.9298			(33)
Party Wall 1			74.1400	0.0000	0.0000			(32)
Party Wall 2			36.7800	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)	5.8008	(36)
Total fabric heat loss (33) + (36) =	83.7306	(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	49.2050	48.6801	48.1551	45.5302	45.0053	42.3804	42.3804	41.8555	43.4304	45.0053	46.0552	47.1052	(38)
Heat transfer coeff	132.9356	132.4106	131.8857	129.2608	128.7359	126.1110	126.1110	125.5860	127.1610	128.7359	129.7858	130.8357	(39)

Average = Sum(39)m / 12 = 129.1296 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1838	1.1791	1.1744	1.1510	1.1464	1.1230	1.1230	1.1183	1.1323	1.1464	1.1557	1.1651	(40)
HLP (average)												1.1499	(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	2.8279 (42)
Average daily hot water use (litres/day)	101.3638 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5002	107.4456	103.3911	99.3365	95.2820	91.2274	91.2274	95.2820	99.3365	103.3911	107.4456	111.5002	(44)
Energy conte	165.3515	144.6175	149.2323	130.1044	124.8382	107.7259	99.8239	114.5494	115.9174	135.0906	147.4620	160.1341	(45)
Energy content (annual)										Total = Sum(45)m =		1594.8472	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8027	21.6926	22.3848	19.5157	18.7257	16.1589	14.9736	17.1824	17.3876	20.2636	22.1193	24.0201	(46)

Water storage loss:		
Store volume	180.0000	(47)
b) If manufacturer declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115	(51)
Volume factor from Table 2a	0.8736	(52)
Temperature factor from Table 2b	0.5400	(53)

Enter (49) or (54) in (55) 0.9805 (55)
Total storage loss
30.3965 27.4549 30.3965 29.4160 30.3965 29.4160 30.3965 30.3965 29.4160 30.3965 29.4160 30.3965 (56)
If cylinder contains dedicated solar storage
30.3965 27.4549 30.3965 29.4160 30.3965 29.4160 30.3965 30.3965 29.4160 30.3965 29.4160 30.3965 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
219.0104 193.0836 202.8912 182.0323 178.4971 159.6538 153.4828 168.2082 167.8454 188.7495 199.3899 213.7930 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
219.0104 193.0836 202.8912 182.0323 178.4971 159.6538 153.4828 168.2082 167.8454 188.7495 199.3899 213.7930 (64)
Total per year (kWh/year) = Sum(64)m = 2226.6373 (64)
Heat gains from water heating, kWh/month
97.9065 86.8582 92.5469 84.8021 84.4358 77.3612 76.1185 81.0148 80.0849 87.8447 90.5735 96.1717 (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	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
24.5004 21.7610 17.6973 13.3980 10.0151 8.4552 9.1361 11.8755 15.9393 20.2386 23.6214 25.1813 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
274.8199 277.6717 270.4853 255.1864 235.8742 217.7235 205.5978 202.7460 209.9324 225.2313 244.5434 262.6941 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.1397 37.1397 37.1397 37.1397 37.1397 37.1397 37.1397 37.1397 37.1397 37.1397 37.1397 37.1397 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 (71)
Water heating gains (Table 5)
131.5947 129.2533 124.3909 117.7806 113.4890 107.4461 102.3099 108.8908 111.2290 118.0709 125.7965 129.2630 (72)
Total internal gains
499.3343 497.1052 480.9928 454.7842 427.7976 402.0441 385.4630 391.9315 405.5199 431.9600 462.3806 485.5578 (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	
West	47.5200	19.6403	0.3600	1.0000	0.7700	232.8410	(80)

Solar gains	232.8410	455.4864	750.1213	1094.0071	1340.7468	1372.4929	1306.6692	1122.4096	872.4221	540.4730	290.3254	191.4771	(83)
Total gains	732.1753	952.5916	1231.1140	1548.7914	1768.5444	1774.5370	1692.1322	1514.3411	1277.9420	972.4330	752.7059	677.0349	(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	23.4658	23.5589	23.6526	24.1329	24.2314	24.7357	24.7357	24.8391	24.5315	24.2314	24.0353	23.8424	
alpha	2.5644	2.5706	2.5768	2.6089	2.6154	2.6490	2.6490	2.6559	2.6354	2.6154	2.6024	2.5895	
util living area	0.9603	0.9261	0.8556	0.7264	0.5727	0.4222	0.3162	0.3627	0.5794	0.8270	0.9374	0.9667	(86)
MIT	19.1064	19.4196	19.8796	20.3737	20.6772	20.8291	20.8749	20.8646	20.7338	20.2587	19.5889	19.0643	(87)
Th 2	19.9330	19.9368	19.9405	19.9594	19.9632	19.9821	19.9821	19.9859	19.9745	19.9632	19.9556	19.9481	(88)
util rest of house	0.9543	0.9155	0.8361	0.6934	0.5261	0.3634	0.2471	0.2889	0.5158	0.7959	0.9267	0.9617	(89)
MIT 2	17.3970	17.8482	18.5001	19.1875	19.5796	19.7740	19.8191	19.8154	19.6710	19.0581	18.1112	17.3463	(90)
Living area fraction									fLA = Living area / (4) =			0.2612	(91)
MIT	17.8435	18.2586	18.8604	19.4973	19.8662	20.0496	20.0948	20.0894	19.9485	19.3717	18.4972	17.7950	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8435	18.2586	18.8604	19.4973	19.8662	20.0496	20.0948	20.0894	19.9485	19.3717	18.4972	17.7950	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9385	0.8944	0.8126	0.6772	0.5215	0.3674	0.2550	0.2967	0.5141	0.7751	0.9072	0.9476	(94)
Useful gains	687.1142	851.9923	1000.4258	1048.8561	922.2135	652.0231	431.4339	449.3113	656.9354	753.6902	682.8553	641.5497	(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	1800.4122	1768.8209	1630.1616	1369.8154	1051.2860	687.2518	440.7372	463.3403	743.7053	1129.2261	1479.1887	1778.7138	(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	828.2937	616.1088	468.5235	231.0907	96.0300	0.0000	0.0000	0.0000	0.0000	279.3987	573.3600	846.0501	(98)
Space heating												3938.8555	(98)
Space heating per m2											(98) / (4) =	35.0744	(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	1185.4436	933.2215	954.4540	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8972	0.9296	0.9098	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1063.5221	867.5640	868.3177	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2169.1118	2070.6429	1864.4474	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	796.0246	895.0907	741.1205	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2432.2358	(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	199.0061	223.7727	185.2801	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling 608.0590 (107)
Space cooling per m2 5.4146 (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 2316.9738 (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													
	828.2937	616.1088	468.5235	231.0907	96.0300	0.0000	0.0000	0.0000	0.0000	279.3987	573.3600	846.0501	(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)													
	487.2316	362.4169	275.6020	135.9357	56.4882	0.0000	0.0000	0.0000	0.0000	164.3522	337.2706	497.6765	(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

219.0104	193.0836	202.8912	182.0323	178.4971	159.6538	153.4828	168.2082	167.8454	188.7495	199.3899	213.7930	(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

128.8297	113.5786	119.3478	107.0778	104.9983	93.9140	90.2840	98.9460	98.7326	111.0291	117.2882	125.7606	(219)

Water heating fuel used 1309.7866 (219)
Space cooling fuel requirement

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	49.7515	55.9432	46.3200	0.0000	0.0000	0.0000	0.0000 (221)

Cooling 152.0147 (221)
Annual totals kWh/year
Space heating fuel - main system 2316.9738 (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) 278.5610 (230a)
central heating pump 30.0000 (230c)
Total electricity for the above, kWh/year 308.5610 (231)
Electricity for lighting (calculated in Appendix L) 432.6847 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 1.31 * 1080 * 1.00) = -1131.3418 -1131.3418 (233)
Total delivered energy for all uses 3388.6791 (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	2316.9738	0.5190	1202.5094	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1309.7866	0.5190	679.7793	(264)
Space and water heating			1882.2887	(265)
Space cooling	152.0147	0.5190	78.8956	(266)
Pumps and fans	308.5610	0.5190	160.1432	(267)
Energy for lighting	432.6847	0.5190	224.5633	(268)
Energy saving/generation technologies				
PV Unit	-1131.3418	0.5190	-587.1664	(269)
Total CO2, kg/year			1758.7244	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.6600	(273)

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

DER		15.6600	ZC1
Total Floor Area	TFA	112.3000	
Assumed number of occupants	N	2.8279	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.5016	ZC2
CO2 emissions from cooking, equation (L16)		1.6640	ZC3
Total CO2 emissions		31.8256	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.8256	ZC8

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.4300 (1b)	x	2.6000 (2b)	=	214.3180	(1b) - (3b)
First floor	29.8700 (1c)	x	2.8500 (2c)	=	85.1295	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	299.4475	(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 = 1.01)			47.5200	0.9708	46.1315			(27)
penthouse floor			82.4300	0.1500	12.3645			(28a)
External Wall 1	30.1900	21.8700	8.3200	1.0100	8.4032			(29a)
External Wall 2	28.4100	25.6500	2.7600	1.0100	2.7876			(29a)
penthouse roof	52.5600		52.5600	0.1000	5.2560			(30)
garden room roof	29.8700		29.8700	0.1000	2.9870			(30)
Total net area of external elements Aum(A, m2)			223.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.9298			(33)
Party Wall 1			74.1400	0.0000	0.0000			(32)
Party Wall 2			36.7800	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)	5.8008	(36)
Total fabric heat loss (33) + (36) =	83.7306	(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	49.2050	48.6801	48.1551	45.5302	45.0053	42.3804	42.3804	41.8555	43.4304	45.0053	46.0552	47.1052	(38)
Heat transfer coeff	132.9356	132.4106	131.8857	129.2608	128.7359	126.1110	126.1110	125.5860	127.1610	128.7359	129.7858	130.8357	(39)
Average = Sum(39)m / 12 =												129.1296	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1838	1.1791	1.1744	1.1510	1.1464	1.1230	1.1230	1.1183	1.1323	1.1464	1.1557	1.1651	(40)
HLP (average)												1.1499	(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	2.8279	(42)
Average daily hot water use (litres/day)	101.3638	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5002	107.4456	103.3911	99.3365	95.2820	91.2274	91.2274	95.2820	99.3365	103.3911	107.4456	111.5002	(44)
Energy conte	165.3515	144.6175	149.2323	130.1044	124.8382	107.7259	99.8239	114.5494	115.9174	135.0906	147.4620	160.1341	(45)
Energy content (annual)										Total = Sum(45)m =		1594.8472	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8027	21.6926	22.3848	19.5157	18.7257	16.1589	14.9736	17.1824	17.3876	20.2636	22.1193	24.0201	(46)

Water storage loss:		
Store volume	150.0000	(47)
b) If manufacturer declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0191	(51)
Volume factor from Table 2a	0.9283	(52)
Temperature factor from Table 2b	0.5400	(53)

Enter (49) or (54) in (55) 1.4364 (55)

Total storage loss

	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282 (56)

If cylinder contains dedicated solar storage

	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	233.1421	205.8477	217.0229	195.7081	192.6288	173.3297	167.6145	182.3399	181.5212	202.8812	213.0658	227.9247 (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

	233.1421	205.8477	217.0229	195.7081	192.6288	173.3297	167.6145	182.3399	181.5212	202.8812	213.0658	227.9247 (64)

Total per year (kWh/year) = Sum(64)m = 2393.0267 (64)

Heat gains from water heating, kWh/month

	109.2119	97.0695	103.8522	95.7427	95.7412	88.3019	87.4239	92.3201	91.0256	99.1501	101.5141	107.4771 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	(66)

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

	24.5004	21.7610	17.6973	13.3980	10.0151	8.4552	9.1361	11.8755	15.9393	20.2386	23.6214	25.1813 (67)

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

	274.8199	277.6717	270.4853	255.1864	235.8742	217.7235	205.5978	202.7460	209.9324	225.2313	244.5434	262.6941 (68)

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

	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

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

	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180 (71)

Water heating gains (Table 5)

	146.7901	144.4486	139.5863	132.9760	128.6844	122.6415	117.5053	124.0862	126.4244	133.2663	140.9919	144.4584 (72)

Total internal gains

	514.5297	512.3006	496.1881	469.9796	442.9930	417.2395	400.6584	407.1269	420.7153	447.1554	477.5759	500.7531 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	47.5200	19.6403	0.3600	1.0000	0.7700	232.8410	(80)

Solar gains	232.8410	455.4864	750.1213	1094.0071	1340.7468	1372.4929	1306.6692	1122.4096	872.4221	540.4730	290.3254	191.4771	(83)
Total gains	747.3707	967.7870	1246.3094	1563.9867	1783.7398	1789.7324	1707.3276	1529.5365	1293.1374	987.6284	767.9013	692.2303	(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	23.4658	23.5589	23.6526	24.1329	24.2314	24.7357	24.7357	24.8391	24.5315	24.2314	24.0353	23.8424	
alpha	2.5644	2.5706	2.5768	2.6089	2.6154	2.6490	2.6490	2.6559	2.6354	2.6154	2.6024	2.5895	
util living area	0.9585	0.9237	0.8526	0.7229	0.5693	0.4192	0.3136	0.3595	0.5747	0.8226	0.9348	0.9651	(86)
MIT	18.6354	19.0504	19.6594	20.3107	20.7105	20.9087	20.9689	20.9552	20.7851	20.1614	19.2754	18.5786	(87)
Th 2	19.9330	19.9368	19.9405	19.9594	19.9632	19.9821	19.9821	19.9859	19.9745	19.9632	19.9556	19.9481	(88)
util rest of house	0.9523	0.9129	0.8328	0.6897	0.5227	0.3607	0.2450	0.2863	0.5112	0.7910	0.9237	0.9598	(89)
MIT 2	17.7842	18.1924	18.7815	19.4014	19.7539	19.9287	19.9690	19.9658	19.8369	19.2876	18.4327	17.7387	(90)

Living area fraction fLA = Living area / (4) = 0.2612 (91)

MIT	18.0065	18.4165	19.0108	19.6389	20.0037	20.1846	20.2301	20.2242	20.0845	19.5158	18.6528	17.9580	(92)

Temperature adjustment 0.0000

adjusted MIT	18.0065	18.4165	19.0108	19.6389	20.0037	20.1846	20.2301	20.2242	20.0845	19.5158	18.6528	17.9580	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9374	0.8936	0.8126	0.6785	0.5246	0.3726	0.2621	0.3039	0.5184	0.7753	0.9061	0.9465	(94)
Useful gains	700.5679	864.8128	1012.7101	1061.2381	935.8075	666.9347	447.4627	464.8499	670.3786	765.7246	695.7606	655.1619	(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	1822.0847	1789.7277	1649.9936	1388.1154	1068.9879	704.2849	457.7992	480.2670	760.9981	1147.7828	1499.3856	1800.0432	(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	834.4085	621.5428	474.1390	235.3517	99.0862	0.0000	0.0000	0.0000	0.0000	284.2513	578.6100	851.7917	(98)

Space heating 3979.1811 (98)

Space heating per m2 (98) / (4) = 35.4335 (99)

8c. Space cooling requirement

Not applicable

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

DER			15.3000 ZC1
Total Floor Area		TFA	112.3000
Assumed number of occupants		N	2.8279
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.5016 ZC2
CO2 emissions from cooking, equation (L16)			1.6640 ZC3
Total CO2 emissions			31.4656 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6

Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	31.4656	ZC8

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.4300 (1b)	x	2.6000 (2b)	=	214.3180 (1b) - (3b)	
First floor	29.8700 (1c)	x	2.8500 (2c)	=	85.1295 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		299.4475	(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) =	0.1336 (8)
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.3836 (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) =	0.3260 (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	0.4157	0.4076	0.3994	0.3586	0.3505	0.3097	0.3097	0.3016	0.3260	0.3505	0.3668	0.3831	(22b)
Effective ac	0.5864	0.5830	0.5798	0.5643	0.5614	0.5480	0.5480	0.5455	0.5532	0.5614	0.5673	0.5734	(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)			28.0800	1.4151	39.7358			(27)
penthouse floor			82.4300	0.1300	10.7159			(28a)
External Wall 1	30.1900	12.9300	17.2600	0.1800	3.1068			(29a)
External Wall 2	28.4100	15.1500	13.2600	0.1800	2.3868			(29a)
penthouse roof	52.5600		52.5600	0.1300	6.8328			(30)
garden room roof	29.8700		29.8700	0.1300	3.8831			(30)
Total net area of external elements Aum(A, m2)			223.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6612			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1029	(36)
Total fabric heat loss					(33) + (36) =		71.7641	(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	57.9472	57.6156	57.2906	55.7642	55.4786	54.1491	54.1491	53.9029	54.6612	55.4786	56.0563	56.6604	(38)
Heat transfer coeff	129.7113	129.3798	129.0548	127.5283	127.2427	125.9132	125.9132	125.6670	126.4253	127.2427	127.8205	128.4245	(39)
Average = Sum(39)m / 12 =												127.5270	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1550	1.1521	1.1492	1.1356	1.1331	1.1212	1.1212	1.1190	1.1258	1.1331	1.1382	1.1436	(40)
HLP (average)												1.1356	(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												2.8279	(42)
Average daily hot water use (litres/day)												101.3638	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5002	107.4456	103.3911	99.3365	95.2820	91.2274	91.2274	95.2820	99.3365	103.3911	107.4456	111.5002	(44)
Energy conte	165.3515	144.6175	149.2323	130.1044	124.8382	107.7259	99.8239	114.5494	115.9174	135.0906	147.4620	160.1341	(45)
Energy content (annual)										Total = Sum(45)m =		1594.8472	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8027	21.6926	22.3848	19.5157	18.7257	16.1589	14.9736	17.1824	17.3876	20.2636	22.1193	24.0201	(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	214.5942	189.0948	198.4750	177.7585	174.0809	155.3801	149.0665	163.7920	163.5716	184.3333	195.1162	209.3768	(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													
	214.5942	189.0948	198.4750	177.7585	174.0809	155.3801	149.0665	163.7920	163.5716	184.3333	195.1162	209.3768	(64)
									Total per year (kWh/year) = Sum(64)m =				2174.6399 (64)
Heat gains from water heating, kWh/month													
	94.3735	83.6671	89.0139	81.3831	80.9028	73.9422	72.5856	77.4818	76.6659	84.3118	87.1545	92.6387	(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	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.5004	21.7610	17.6973	13.3980	10.0151	8.4552	9.1361	11.8755	15.9393	20.2386	23.6214	25.1813	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	274.8199	277.6717	270.4853	255.1864	235.8742	217.7235	205.5978	202.7460	209.9324	225.2313	244.5434	262.6941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	(71)
Water heating gains (Table 5)													
	126.8461	124.5046	119.6423	113.0320	108.7404	102.6975	97.5613	104.1422	106.4804	113.3223	121.0479	124.5144	(72)
Total internal gains													
	494.5857	492.3566	476.2441	450.0356	423.0490	397.2955	380.7144	387.1829	400.7713	427.2114	457.6319	480.8091	(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	
West	28.0800	19.6403	0.6300	0.7000	0.7700	168.5451	(80)

Solar gains	168.5451	329.7101	542.9855	791.9120	970.5179	993.4977	945.8503	812.4715	631.5146	391.2288	210.1560	138.6033	(83)
Total gains	663.1308	822.0667	1019.2296	1241.9476	1393.5669	1390.7932	1326.5647	1199.6544	1032.2859	818.4401	667.7879	619.4125	(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	60.1228	60.2769	60.4287	61.1520	61.2893	61.9364	61.9364	62.0577	61.6855	61.2893	61.0122	60.7253	
alpha	5.0082	5.0185	5.0286	5.0768	5.0860	5.1291	5.1291	5.1372	5.1124	5.0860	5.0675	5.0484	
util living area													
	0.9982	0.9943	0.9780	0.9115	0.7607	0.5640	0.4149	0.4759	0.7589	0.9650	0.9956	0.9987	(86)
MIT	19.7431	19.9419	20.2685	20.6554	20.8966	20.9820	20.9969	20.9940	20.9253	20.5524	20.0682	19.7115	(87)
Th 2	19.9561	19.9585	19.9609	19.9719	19.9739	19.9835	19.9835	19.9853	19.9798	19.9739	19.9698	19.9654	(88)
util rest of house													
	0.9975	0.9923	0.9705	0.8841	0.7013	0.4811	0.3205	0.3740	0.6767	0.9486	0.9938	0.9982	(89)
MIT 2	18.2805	18.5719	19.0445	19.5862	19.8811	19.9727	19.9825	19.9831	19.9246	19.4623	18.7651	18.2408	(90)
Living area fraction									fLA = Living area / (4) =			0.2612	(91)
MIT	18.6625	18.9297	19.3642	19.8655	20.1463	20.2363	20.2474	20.2471	20.1860	19.7470	19.1054	18.6249	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6625	18.9297	19.3642	19.8655	20.1463	20.2363	20.2474	20.2471	20.1860	19.7470	19.1054	18.6249	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9896	0.9649	0.8808	0.7119	0.5022	0.3452	0.4007	0.6947	0.9439	0.9916	0.9974	(94)
Useful gains	660.7060	813.5494	983.5004	1093.8621	992.1386	698.4797	457.9554	480.7340	717.1401	772.5333	662.1869	617.7761	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1862.9755	1815.1607	1660.1859	1398.4058	1074.7317	709.6844	459.2596	483.4524	769.4232	1163.8915	1534.5411	1852.5106	(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													
	894.4885	673.0828	503.4540	219.2714	61.4493	0.0000	0.0000	0.0000	0.0000	291.1705	628.0951	918.6425	(98)
Space heating												4189.6541	(98)
Space heating per m2											(98) / (4) =	37.3077	(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												4480.9134	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	894.4885	673.0828	503.4540	219.2714	61.4493	0.0000	0.0000	0.0000	0.0000	291.1705	628.0951	918.6425	(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)													
	956.6722	719.8746	538.4535	234.5149	65.7212	0.0000	0.0000	0.0000	0.0000	311.4123	671.7594	982.5053	(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
214.5942 189.0948 198.4750 177.7585 174.0809 155.3801 149.0665 163.7920 163.5716 184.3333 195.1162 209.3768 (64)
Efficiency of water heater 79.8000 (216)
(217)m 88.2115 87.9146 87.1942 85.3747 82.3399 79.8000 79.8000 79.8000 79.8000 86.0283 87.7124 88.3023 (217)
Fuel for water heating, kWh/month
243.2725 215.0891 227.6242 208.2098 211.4174 194.7119 186.8002 205.2532 204.9770 214.2705 222.4498 237.1136 (219)
Water heating fuel used 2571.1892 (219)
Annual totals kWh/year
Space heating fuel - main system 4480.9134 (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) 432.6847 (232)
Total delivered energy for all uses 7559.7872 (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	4480.9134	0.2160	967.8773 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2571.1892	0.2160	555.3769 (264)
Space and water heating			1523.2542 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	432.6847	0.5190	224.5633 (268)
Total CO2, kg/m2/year			1786.7425 (272)
Emissions per m2 for space and water heating			13.5642 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.9997 (272b)
Emissions per m2 for pumps and fans			0.3466 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5642 * 1.55) + 1.9997 + 0.3466, rounded to 2 d.p.			23.3700 (273)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.4300 (1b)	x	2.6000 (2b)	=	214.3180 (1b) - (3b)	
First floor	29.8700 (1c)	x	2.8500 (2c)	=	85.1295 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	299.4475	(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) =	0.1336	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3836	(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) =	0.3260	(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	0.4157	0.4076	0.3994	0.3586	0.3505	0.3097	0.3097	0.3016	0.3260	0.3505	0.3668	0.3831	(22b)
Effective ac	0.5864	0.5830	0.5798	0.5643	0.5614	0.5480	0.5480	0.5455	0.5532	0.5614	0.5673	0.5734	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.01)			47.5200	0.9708	46.1315			(27)
penthouse floor			82.4300	0.1500	12.3645			(28a)
External Wall 1	30.1900	21.8700	8.3200	1.0100	8.4032			(29a)
External Wall 2	28.4100	25.6500	2.7600	1.0100	2.7876			(29a)
penthouse roof	52.5600		52.5600	0.1000	5.2560			(30)
garden room roof	29.8700		29.8700	0.1000	2.9870			(30)
Total net area of external elements Aum(A, m2)			223.4600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.9298			(33)
Party Wall 1			74.1400	0.0000	0.0000			(32)
Party Wall 2			36.7800	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)		5.8008 (36)
Total fabric heat loss	(33) + (36) =	83.7306 (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	57.9472	57.6156	57.2906	55.7642	55.4786	54.1491	54.1491	53.9029	54.6612	55.4786	56.0563	56.6604	(38)
Heat transfer coeff	141.6778	141.3462	141.0212	139.4948	139.2092	137.8797	137.8797	137.6335	138.3918	139.2092	139.7869	140.3909	(39)
Average = Sum(39)m / 12 =												139.4934	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2616	1.2586	1.2558	1.2422	1.2396	1.2278	1.2278	1.2256	1.2323	1.2396	1.2448	1.2501	(40)
HLP (average)												1.2421	(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	2.8279 (42)
Average daily hot water use (litres/day)	101.3638 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5002	107.4456	103.3911	99.3365	95.2820	91.2274	91.2274	95.2820	99.3365	103.3911	107.4456	111.5002	(44)
Energy conte	165.3515	144.6175	149.2323	130.1044	124.8382	107.7259	99.8239	114.5494	115.9174	135.0906	147.4620	160.1341	(45)
Energy content (annual)										Total = Sum(45)m =		1594.8472	(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	35.1372	30.7312	31.7119	27.6472	26.5281	22.8918	21.2126	24.3417	24.6325	28.7068	31.3357	34.0285	(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	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	(66)

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

	24.5004	21.7610	17.6973	13.3980	10.0151	8.4552	9.1361	11.8755	15.9393	20.2386	23.6214	25.1813	(67)

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

	274.8199	277.6717	270.4853	255.1864	235.8742	217.7235	205.5978	202.7460	209.9324	225.2313	244.5434	262.6941	(68)

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

	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	(71)

Water heating gains (Table 5)

	47.2274	45.7310	42.6235	38.3989	35.6561	31.7941	28.5115	32.7174	34.2117	38.5843	43.5218	45.7372	(72)

Total internal gains

	411.9670	410.5830	396.2253	372.4025	346.9647	323.3921	308.6647	312.7581	325.5026	349.4734	377.1058	399.0320	(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	
West	47.5200	19.6403	0.3600	1.0000	0.7700	232.8410	(80)

Solar gains	232.8410	455.4864	750.1213	1094.0071	1340.7468	1372.4929	1306.6692	1122.4096	872.4221	540.4730	290.3254	191.4771	(83)
Total gains	644.8080	866.0694	1146.3466	1466.4096	1687.7115	1695.8850	1615.3339	1435.1677	1197.9247	889.9465	667.4312	590.5091	(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	22.0179	22.0695	22.1204	22.3624	22.4083	22.6244	22.6244	22.6649	22.5407	22.4083	22.3157	22.2197	
alpha	2.4679	2.4713	2.4747	2.4908	2.4939	2.5083	2.5083	2.5110	2.5027	2.4939	2.4877	2.4813	
util living area	0.9703	0.9410	0.8789	0.7618	0.6144	0.4664	0.3548	0.4077	0.6298	0.8599	0.9529	0.9757	(86)
MIT	18.3343	18.7605	19.4081	20.1200	20.6024	20.8583	20.9480	20.9255	20.6900	19.9469	18.9867	18.2594	(87)
Th 2	19.8710	19.8734	19.8757	19.8864	19.8884	19.8978	19.8978	19.8996	19.8942	19.8884	19.8844	19.8801	(88)
util rest of house	0.9655	0.9320	0.8610	0.7291	0.5650	0.3995	0.2730	0.3209	0.5620	0.8315	0.9441	0.9718	(89)
MIT 2	17.4456	17.8661	18.4956	19.1720	19.6009	19.8157	19.8765	19.8669	19.6953	19.0352	18.1023	17.3777	(90)
Living area fraction										fLA = Living area / (4) =		0.2612	(91)
MIT	17.6777	18.0997	18.7339	19.4196	19.8625	20.0880	20.1564	20.1434	19.9551	19.2733	18.3333	17.6080	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6777	18.0997	18.7339	19.4196	19.8625	20.0880	20.1564	20.1434	19.9551	19.2733	18.3333	17.6080	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9528	0.9136	0.8391	0.7138	0.5638	0.4115	0.2928	0.3409	0.5661	0.8126	0.9279	0.9606	(94)
Useful gains	614.3499	791.2102	961.9154	1046.6986	951.4756	697.8587	472.9185	489.2879	678.1294	723.1579	619.3211	567.2713	(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	1895.3280	1865.7250	1725.2407	1467.4297	1136.2897	756.6811	490.3522	515.2145	810.2959	1207.4014	1570.2671	1882.3632	(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	953.0477	722.0739	567.9141	302.9264	137.5017	0.0000	0.0000	0.0000	0.0000	360.2772	684.6811	978.4284	(98)
Space heating												4706.8505	(98)
Space heating per m2											(98) / (4) =	41.9132	(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	1296.0688	1020.3095	1046.0143	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8594	0.8997	0.8726	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1113.8990	918.0049	912.8018	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2093.4598	1996.8445	1788.2740	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	705.2838	802.6567	651.3513	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2159.2918	(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	176.3209	200.6642	162.8378	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												539.8230	(107)
Space cooling per m2												4.8070	(108)
Energy for space heating												41.9132	(99)
Energy for space cooling												4.8070	(108)
Total												46.7202	(109)
Dwelling Fabric Energy Efficiency (DFEE)												46.7	(109)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.4300 (1b)	x	2.6000 (2b)	=	214.3180 (1b) - (3b)	
First floor	29.8700 (1c)	x	2.8500 (2c)	=	85.1295 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		299.4475	(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) =	0.1336 (8)
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.3836 (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) =	0.3260 (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	0.4157	0.4076	0.3994	0.3586	0.3505	0.3097	0.3097	0.3016	0.3260	0.3505	0.3668	0.3831	(22b)
Effective ac	0.5864	0.5830	0.5798	0.5643	0.5614	0.5480	0.5480	0.5455	0.5532	0.5614	0.5673	0.5734	(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)			28.0800	1.4151	39.7358			(27)
penthouse floor			82.4300	0.1300	10.7159			(28a)
External Wall 1	30.1900	12.9300	17.2600	0.1800	3.1068			(29a)
External Wall 2	28.4100	15.1500	13.2600	0.1800	2.3868			(29a)
penthouse roof	52.5600		52.5600	0.1300	6.8328			(30)
garden room roof	29.8700		29.8700	0.1300	3.8831			(30)
Total net area of external elements Aum(A, m2)			223.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6612			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1029	(36)
Total fabric heat loss					(33) + (36) =		71.7641	(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	57.9472	57.6156	57.2906	55.7642	55.4786	54.1491	54.1491	53.9029	54.6612	55.4786	56.0563	56.6604	(38)
Heat transfer coeff	129.7113	129.3798	129.0548	127.5283	127.2427	125.9132	125.9132	125.6670	126.4253	127.2427	127.8205	128.4245	(39)
Average = Sum(39)m / 12 =												127.5270	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1550	1.1521	1.1492	1.1356	1.1331	1.1212	1.1212	1.1190	1.1258	1.1331	1.1382	1.1436	(40)
HLP (average)												1.1356	(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		2.8279 (42)
Average daily hot water use (litres/day)		101.3638 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5002	107.4456	103.3911	99.3365	95.2820	91.2274	91.2274	95.2820	99.3365	103.3911	107.4456	111.5002	(44)
Energy conte	165.3515	144.6175	149.2323	130.1044	124.8382	107.7259	99.8239	114.5494	115.9174	135.0906	147.4620	160.1341	(45)
Energy content (annual)										Total = Sum(45)m =		1594.8472	(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	35.1372	30.7312	31.7119	27.6472	26.5281	22.8918	21.2126	24.3417	24.6325	28.7068	31.3357	34.0285	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	141.3975	(66)

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

	24.5004	21.7610	17.6973	13.3980	10.0151	8.4552	9.1361	11.8755	15.9393	20.2386	23.6214	25.1813	(67)

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

	274.8199	277.6717	270.4853	255.1864	235.8742	217.7235	205.5978	202.7460	209.9324	225.2313	244.5434	262.6941	(68)

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

	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	37.1397	(69)

Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	(71)

Water heating gains (Table 5)

	47.2274	45.7310	42.6235	38.3989	35.6561	31.7941	28.5115	32.7174	34.2117	38.5843	43.5218	45.7372	(72)

Total internal gains

	411.9670	410.5830	396.2253	372.4025	346.9647	323.3921	308.6647	312.7581	325.5026	349.4734	377.1058	399.0320	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	28.0800	19.6403	0.6300	0.7000	0.7700	168.5451	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	168.5451	329.7101	542.9855	791.9120	970.5179	993.4977	945.8503	812.4715	631.5146	391.2288	210.1560	138.6033	(83)
Total gains	580.5121	740.2930	939.2108	1164.3144	1317.4825	1316.8898	1254.5150	1125.2296	957.0172	740.7022	587.2618	537.6353	(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	60.1228	60.2769	60.4287	61.1520	61.2893	61.9364	61.9364	62.0577	61.6855	61.2893	61.0122	60.7253	
alpha	5.0082	5.0185	5.0286	5.0768	5.0860	5.1291	5.1291	5.1372	5.1124	5.0860	5.0675	5.0484	
util living area	0.9990	0.9964	0.9842	0.9283	0.7878	0.5918	0.4379	0.5054	0.7954	0.9763	0.9975	0.9993	(86)
MIT	19.6746	19.8753	20.2080	20.6124	20.8780	20.9777	20.9960	20.9921	20.9066	20.4965	20.0019	19.6434	(87)
Th 2	19.9561	19.9585	19.9609	19.9719	19.9739	19.9835	19.9835	19.9853	19.9798	19.9739	19.9698	19.9654	(88)
util rest of house	0.9987	0.9952	0.9786	0.9045	0.7302	0.5063	0.3387	0.3982	0.7162	0.9644	0.9965	0.9991	(89)
MIT 2	18.7437	18.9457	19.2766	19.6710	19.8978	19.9742	19.9826	19.9833	19.9311	19.5726	19.0815	18.7199	(90)

Living area fraction fLA = Living area / (4) = 0.2612 (91)

MIT	18.9869	19.1885	19.5199	19.9169	20.1538	20.2363	20.2473	20.2468	20.1859	19.8139	19.3219	18.9611	(92)

Temperature adjustment 0.0000

adjusted MIT	18.9869	19.1885	19.5199	19.9169	20.1538	20.2363	20.2473	20.2468	20.1859	19.8139	19.3219	18.9611	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9939	0.9756	0.9031	0.7411	0.5282	0.3647	0.4264	0.7338	0.9621	0.9956	0.9988	(94)
Useful gains	579.4611	735.7806	916.2938	1051.4447	976.3819	695.6341	457.5578	479.7960	702.2902	712.5937	584.6795	536.9700	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1905.0534	1848.6396	1680.2765	1404.9637	1075.6810	709.6851	459.2424	483.4097	769.4115	1172.4028	1562.2117	1895.6899	(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	986.2407	747.8413	568.4031	254.5337	73.8786	0.0000	0.0000	0.0000	0.0000	342.0980	703.8231	1010.8876	(98)

Space heating 4687.7060 (98)

Space heating per m2 (98) / (4) = 41.7427 (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	1183.5843	931.7579	955.0694	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9409	0.9712	0.9539	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1113.6428	904.9219	911.0806	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1650.4783	1575.1082	1426.0087	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	386.5216	498.6186	383.1065	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling 1268.2467 (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	96.6304	124.6547	95.7766	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling 317.0617 (107)

Space cooling per m2 2.8233 (108)

Energy for space heating 41.7427 (99)

Energy for space cooling 2.8233 (108)

Total 44.5661 (109)

Target Fabric Energy Efficiency (TFEE) 51.3 (109)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.4300 (1b)	x	2.6000 (2b)	=	214.3180 (1b) - (3b)	
First floor	29.8700 (1c)	x	2.8500 (2c)	=	85.1295 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		299.4475	(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 = 1.01)			47.5200	0.9708	46.1315			(27)
penthouse floor			82.4300	0.1500	12.3645			(28a)
External Wall 1	30.1900	21.8700	8.3200	1.0100	8.4032			(29a)
External Wall 2	28.4100	25.6500	2.7600	1.0100	2.7876			(29a)
penthouse roof	52.5600		52.5600	0.1000	5.2560			(30)
garden room roof	29.8700		29.8700	0.1000	2.9870			(30)
Total net area of external elements Aum(A, m2)			223.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.9298			(33)
Party Wall 1			74.1400	0.0000	0.0000			(32)
Party Wall 2			36.7800	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)	5.8008	(36)
Total fabric heat loss (33) + (36) =	83.7306	(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	44.4803	43.4304	43.4304	41.8555	41.8555	39.7556	40.2806	39.2306	39.7556	40.8055	40.8055	42.3804	(38)
Heat transfer coeff	128.2109	127.1610	127.1610	125.5860	125.5860	123.4862	124.0111	122.9612	123.4862	124.5361	124.5361	126.1110	(39)

Average = Sum(39)m / 12 = 125.2361 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1417	1.1323	1.1323	1.1183	1.1183	1.0996	1.1043	1.0949	1.0996	1.1090	1.1090	1.1230	(40)
HLP (average)												1.1152	(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	2.8279	(42)
Average daily hot water use (litres/day)	101.3638	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5002	107.4456	103.3911	99.3365	95.2820	91.2274	91.2274	95.2820	99.3365	103.3911	107.4456	111.5002	(44)
Energy conte	165.3515	144.6175	149.2323	130.1044	124.8382	107.7259	99.8239	114.5494	115.9174	135.0906	147.4620	160.1341	(45)
Energy content (annual)											Total = Sum(45)m =	1594.8472	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8027	21.6926	22.3848	19.5157	18.7257	16.1589	14.9736	17.1824	17.3876	20.2636	22.1193	24.0201	(46)

Water storage loss:		
Store volume	180.0000	(47)
b) If manufacturer declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115	(51)
Volume factor from Table 2a	0.8736	(52)
Temperature factor from Table 2b	0.5400	(53)

Enter (49) or (54) in (55) 0.9805 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	219.0104	193.0836	202.8912	182.0323	178.4971	159.6538	153.4828	168.2082	167.8454	188.7495	199.3899	213.7930	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from w/h	219.0104	193.0836	202.8912	182.0323	178.4971	159.6538	153.4828	168.2082	167.8454	188.7495	199.3899	213.7930	(64)

Total per year (kWh/year) = Sum(64)m = 2226.6373 (64)

RHI water heating demand 2227 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat gains from water heating, kWh/month	97.9065	86.8582	92.5469	84.8021	84.4358	77.3612	76.1185	81.0148	80.0849	87.8447	90.5735	96.1717	(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	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.2510	54.4026	44.2432	33.4949	25.0378	21.1380	22.8404	29.6888	39.8482	50.5964	59.0535	62.9533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.1790	414.4354	403.7094	380.8752	352.0511	324.9605	306.8623	302.6059	313.3319	336.1661	364.9902	392.0808	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7956	54.7956	54.7956	54.7956	54.7956	54.7956	54.7956	54.7956	54.7956	54.7956	54.7956	54.7956	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	-113.1180	(71)
Water heating gains (Table 5)	131.5947	129.2533	124.3909	117.7806	113.4890	107.4461	102.3099	108.8908	111.2290	118.0709	125.7965	129.2630	(72)
Total internal gains	717.3794	712.4458	686.6982	646.5054	604.9326	567.8993	546.3672	555.5401	578.7637	619.1880	664.1948	698.6518	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	47.5200	22.3313	0.3600	1.0000	0.7700	264.7442	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	264.7442	465.8558	756.4675	1133.7279	1350.8847	1478.7904	1393.0803	1225.5804	952.5984	589.8974	338.1783	215.6003	(83)
Total gains	982.1236	1178.3016	1443.1657	1780.2333	1955.8173	2046.6897	1939.4475	1781.1205	1531.3622	1209.0854	1002.3731	914.2521	(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	24.3306	24.5315	24.5315	24.8391	24.8391	25.2615	25.1545	25.3693	25.2615	25.0485	25.0485	24.7357	
alpha	2.6220	2.6354	2.6354	2.6559	2.6559	2.6841	2.6770	2.6913	2.6841	2.6699	2.6699	2.6490	
util living area	0.9178	0.8760	0.7868	0.6329	0.4670	0.2931	0.1961	0.2179	0.4332	0.7157	0.8721	0.9280	(86)
MIT	19.5370	19.7865	20.1853	20.5766	20.7889	20.8788	20.8948	20.8939	20.8359	20.5299	19.9980	19.5055	(87)
Th 2	19.9669	19.9745	19.9745	19.9859	19.9859	20.0012	19.9973	20.0050	20.0012	19.9935	19.9935	19.9821	(88)
util rest of house	0.9063	0.8599	0.7610	0.5947	0.4175	0.2373	0.1336	0.1514	0.3680	0.6727	0.8525	0.9177	(89)
MIT 2	18.0365	18.3930	18.9449	19.4707	19.7306	19.8400	19.8487	19.8563	19.8025	19.4351	18.7133	18.0031	(90)

Living area fraction fLA = Living area / (4) = 0.2612 (91)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
MIT	18.4284	18.7569	19.2689	19.7595	20.0070	20.1113	20.1219	20.1273	20.0724	19.7211	19.0488	18.3955	(92)

Temperature adjustment 0.0000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
adjusted MIT	18.4284	18.7569	19.2689	19.7595	20.0070	20.1113	20.1219	20.1273	20.0724	19.7211	19.0488	18.3955	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8850	0.8371	0.7410	0.5857	0.4186	0.2436	0.1414	0.1597	0.3728	0.6598	0.8304	0.8976	(94)
Useful gains	869.1762	986.3054	1069.3211	1042.6215	818.6385	498.5811	274.2681	284.4159	570.9324	797.7833	832.4175	820.6281	(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	1708.8436	1673.0478	1509.2581	1238.2168	879.9784	507.6851	275.5424	286.1697	601.6774	1011.3640	1375.9776	1676.7060	(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	624.7125	461.4909	327.3131	140.8286	45.6369	0.0000	0.0000	0.0000	0.0000	158.9040	391.3632	636.9220	(98)

Space heating 2787.1713 (98)

RHI space heating demand 2787 (98)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.4300 (1b)	x	2.6000 (2b)	=	214.3180 (1b) - (3b)	
First floor	29.8700 (1c)	x	2.8500 (2c)	=	85.1295 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		299.4475	(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 = 1.01)			47.5200	0.9708	46.1315			(27)
penthouse floor			82.4300	0.1500	12.3645			(28a)
External Wall 1	30.1900	21.8700	8.3200	1.0100	8.4032			(29a)
External Wall 2	28.4100	25.6500	2.7600	1.0100	2.7876			(29a)
penthouse roof	52.5600		52.5600	0.1000	5.2560			(30)
garden room roof	29.8700		29.8700	0.1000	2.9870			(30)
Total net area of external elements Aum(A, m2)			223.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.9298			(33)
Party Wall 1			74.1400	0.0000	0.0000			(32)
Party Wall 2			36.7800	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) 5.8008 (36)
Total fabric heat loss (33) + (36) = 83.7306 (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	49.2050	48.6801	48.1551	45.5302	45.0053	42.3804	42.3804	41.8555	43.4304	45.0053	46.0552	47.1052	(38)
Heat transfer coeff	132.9356	132.4106	131.8857	129.2608	128.7359	126.1110	126.1110	125.5860	127.1610	128.7359	129.7858	130.8357	(39)

Average = Sum(39)m / 12 = 129.1296 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1838	1.1791	1.1744	1.1510	1.1464	1.1230	1.1230	1.1183	1.1323	1.1464	1.1557	1.1651	(40)
HLP (average)												1.1499	(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 2.8279 (42)
Average daily hot water use (litres/day) 101.3638 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5002	107.4456	103.3911	99.3365	95.2820	91.2274	91.2274	95.2820	99.3365	103.3911	107.4456	111.5002	(44)
Energy conte	165.3515	144.6175	149.2323	130.1044	124.8382	107.7259	99.8239	114.5494	115.9174	135.0906	147.4620	160.1341	(45)
Energy content (annual)										Total = Sum(45)m =		1594.8472	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8027	21.6926	22.3848	19.5157	18.7257	16.1589	14.9736	17.1824	17.3876	20.2636	22.1193	24.0201	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0115 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)

Enter (49) or (54) in (55) 0.9805 (55)
Total storage loss
30.3965 27.4549 30.3965 29.4160 30.3965 29.4160 30.3965 30.3965 29.4160 30.3965 29.4160 30.3965 (56)
If cylinder contains dedicated solar storage
30.3965 27.4549 30.3965 29.4160 30.3965 29.4160 30.3965 30.3965 29.4160 30.3965 29.4160 30.3965 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
219.0104 193.0836 202.8912 182.0323 178.4971 159.6538 153.4828 168.2082 167.8454 188.7495 199.3899 213.7930 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
219.0104 193.0836 202.8912 182.0323 178.4971 159.6538 153.4828 168.2082 167.8454 188.7495 199.3899 213.7930 (64)
Total per year (kWh/year) = Sum(64)m = 2226.6373 (64)
Heat gains from water heating, kWh/month
97.9065 86.8582 92.5469 84.8021 84.4358 77.3612 76.1185 81.0148 80.0849 87.8447 90.5735 96.1717 (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	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
61.2510 54.4026 44.2432 33.4949 25.0378 21.1380 22.8404 29.6888 39.8482 50.5964 59.0535 62.9533 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
410.1790 414.4354 403.7094 380.8752 352.0511 324.9605 306.8623 302.6059 313.3319 336.1661 364.9902 392.0808 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 (71)
Water heating gains (Table 5)
131.5947 129.2533 124.3909 117.7806 113.4890 107.4461 102.3099 108.8908 111.2290 118.0709 125.7965 129.2630 (72)
Total internal gains
717.3794 712.4458 686.6982 646.5054 604.9326 567.8993 546.3672 555.5401 578.7637 619.1880 664.1948 698.6518 (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	
West	47.5200	19.6403	0.3600	1.0000	0.7700	232.8410	(80)

Solar gains	232.8410	455.4864	750.1213	1094.0071	1340.7468	1372.4929	1306.6692	1122.4096	872.4221	540.4730	290.3254	191.4771	(83)
Total gains	950.2204	1167.9323	1436.8194	1740.5125	1945.6794	1940.3922	1853.0364	1677.9497	1451.1858	1159.6610	954.5202	890.1290	(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	23.4658	23.5589	23.6526	24.1329	24.2314	24.7357	24.7357	24.8391	24.5315	24.2314	24.0353	23.8424	
alpha	2.5644	2.5706	2.5768	2.6089	2.6154	2.6490	2.6490	2.6559	2.6354	2.6154	2.6024	2.5895	
util living area	0.9318	0.8910	0.8141	0.6833	0.5350	0.3912	0.2907	0.3307	0.5290	0.7732	0.9001	0.9404	(86)
MIT	19.3214	19.6068	20.0173	20.4501	20.7107	20.8408	20.8793	20.8715	20.7665	20.3691	19.7718	19.2810	(87)
Th 2	19.9330	19.9368	19.9405	19.9594	19.9632	19.9821	19.9821	19.9859	19.9745	19.9632	19.9556	19.9481	(88)
util rest of house	0.9223	0.8767	0.7913	0.6486	0.4892	0.3354	0.2265	0.2624	0.4671	0.7372	0.8845	0.9320	(89)
MIT 2	17.7039	18.1109	18.6865	19.2838	19.6170	19.7846	19.8219	19.8201	19.7038	19.1998	18.3672	17.6567	(90)
Living area fraction									fLA = Living area / (4) =			0.2612	(91)
MIT	18.1264	18.5016	19.0341	19.5884	19.9026	20.0604	20.0981	20.0947	19.9814	19.5052	18.7340	18.0809	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1264	18.5016	19.0341	19.5884	19.9026	20.0604	20.0981	20.0947	19.9814	19.5052	18.7340	18.0809	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9017	0.8533	0.7689	0.6353	0.4864	0.3398	0.2340	0.2699	0.4675	0.7192	0.8620	0.9128	(94)
Useful gains	856.7915	996.5892	1104.7209	1105.7589	946.2902	659.3902	433.6009	452.8576	678.4723	834.0754	822.8382	812.5178	(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	1838.0184	1800.9916	1653.0673	1381.5907	1055.9713	688.6186	441.1458	464.0062	747.8806	1146.4195	1509.9330	1816.1217	(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	730.0328	540.5584	407.9698	198.5989	81.6028	0.0000	0.0000	0.0000	0.0000	232.3840	494.7082	746.6813	(98)
Space heating												3432.5362	(98)
Space heating per m2											(98) / (4) =	30.5658	(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	1185.4436	933.2215	954.4540	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8972	0.9296	0.9098	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1063.5221	867.5640	868.3177	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2169.1118	2070.6429	1864.4474	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	796.0246	895.0907	741.1205	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2432.2358	(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	199.0061	223.7727	185.2801	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling 608.0590 (107)
Space cooling per m2 5.4146 (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 2019.1389 (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													
	730.0328	540.5584	407.9698	198.5989	81.6028	0.0000	0.0000	0.0000	0.0000	232.3840	494.7082	746.6813	(98)
Space heating efficiency (main heating system 1)													
	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)													
	429.4311	317.9755	239.9822	116.8229	48.0016	0.0000	0.0000	0.0000	0.0000	136.6965	291.0048	439.2243	(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

219.0104	193.0836	202.8912	182.0323	178.4971	159.6538	153.4828	168.2082	167.8454	188.7495	199.3899	213.7930	(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

128.8297	113.5786	119.3478	107.0778	104.9983	93.9140	90.2840	98.9460	98.7326	111.0291	117.2882	125.7606	(219)

Water heating fuel used 1309.7866 (219)
Space cooling fuel requirement

(221)m 0.0000	0.0000	0.0000	0.0000	0.0000	49.7515	55.9432	46.3200	0.0000	0.0000	0.0000	0.0000	(221)

Cooling 152.0147 (221)
Annual totals kWh/year
Space heating fuel - main system 2019.1389 (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) 278.5610 (230a)
central heating pump 30.0000 (230c)
Total electricity for the above, kWh/year 308.5610 (231)
Electricity for lighting (calculated in Appendix L) 432.6847 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 1.31 * 1080 * 1.00) = -1131.3418 -1131.3418 (233)
Total delivered energy for all uses 3090.8442 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2019.1389	13.1900	266.3244	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1309.7866	13.1900	172.7609	(247)
Space cooling	152.0147	13.1900	20.0507	(248)
Mechanical ventilation fans	278.5610	13.1900	36.7422	(249)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	432.6847	13.1900	57.0711	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1131.3418	13.1900	-149.2240	(252)
Total energy cost			407.6823	(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] = 1.0885 (257)
SAP value 84.8149
SAP rating (Section 12) 85 (258)
SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2019.1389	0.5190	1047.9331	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1309.7866	0.5190	679.7793	(264)
Space and water heating			1727.7124	(265)
Space cooling	152.0147	0.5190	78.8956	(266)
Pumps and fans	308.5610	0.5190	160.1432	(267)
Energy for lighting	432.6847	0.5190	224.5633	(268)
Energy saving/generation technologies				
PV Unit	-1131.3418	0.5190	-587.1664	(269)
Total kg/year			1604.1481	(272)
CO2 emissions per m2			14.2800	(273)
EI value			86.3347	
EI rating			86	(274)
EI band			B	

Calculation of stars for heating and DHW

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

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.4300 (1b)	x	2.6000 (2b)	=	214.3180	(1b) - (3b)
First floor	29.8700 (1c)	x	2.8500 (2c)	=	85.1295	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		299.4475	(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)

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 = 1.01)			47.5200	0.9708	46.1315			(27)
penthouse floor			82.4300	0.1500	12.3645			(28a)
External Wall 1	30.1900	21.8700	8.3200	1.0100	8.4032			(29a)
External Wall 2	28.4100	25.6500	2.7600	1.0100	2.7876			(29a)
penthouse roof	52.5600		52.5600	0.1000	5.2560			(30)
garden room roof	29.8700		29.8700	0.1000	2.9870			(30)
Total net area of external elements Aum(A, m2)			223.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.9298			(33)
Party Wall 1			74.1400	0.0000	0.0000			(32)
Party Wall 2			36.7800	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) 5.8008 (36)
Total fabric heat loss (33) + (36) = 83.7306 (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	44.4803	43.4304	43.4304	41.8555	41.8555	39.7556	40.2806	39.2306	39.7556	40.8055	40.8055	42.3804	(38)
Heat transfer coeff	128.2109	127.1610	127.1610	125.5860	125.5860	123.4862	124.0111	122.9612	123.4862	124.5361	124.5361	126.1110	(39)

Average = Sum(39)m / 12 = 125.2361 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1417	1.1323	1.1323	1.1183	1.1183	1.0996	1.1043	1.0949	1.0996	1.1090	1.1090	1.1230	(40)
HLP (average)												1.1152	(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 2.8279 (42)
Average daily hot water use (litres/day) 101.3638 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5002	107.4456	103.3911	99.3365	95.2820	91.2274	91.2274	95.2820	99.3365	103.3911	107.4456	111.5002	(44)
Energy conte	165.3515	144.6175	149.2323	130.1044	124.8382	107.7259	99.8239	114.5494	115.9174	135.0906	147.4620	160.1341	(45)
Energy content (annual)										Total = Sum(45)m =		1594.8472	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8027	21.6926	22.3848	19.5157	18.7257	16.1589	14.9736	17.1824	17.3876	20.2636	22.1193	24.0201	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0115 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)

Enter (49) or (54) in (55) 0.9805 (55)
Total storage loss
30.3965 27.4549 30.3965 29.4160 30.3965 29.4160 30.3965 30.3965 29.4160 30.3965 29.4160 30.3965 (56)
If cylinder contains dedicated solar storage
30.3965 27.4549 30.3965 29.4160 30.3965 29.4160 30.3965 30.3965 29.4160 30.3965 29.4160 30.3965 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
219.0104 193.0836 202.8912 182.0323 178.4971 159.6538 153.4828 168.2082 167.8454 188.7495 199.3899 213.7930 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
219.0104 193.0836 202.8912 182.0323 178.4971 159.6538 153.4828 168.2082 167.8454 188.7495 199.3899 213.7930 (64)
Total per year (kWh/year) = Sum(64)m = 2226.6373 (64)
Heat gains from water heating, kWh/month
97.9065 86.8582 92.5469 84.8021 84.4358 77.3612 76.1185 81.0148 80.0849 87.8447 90.5735 96.1717 (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	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	169.6770	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
61.2510 54.4026 44.2432 33.4949 25.0378 21.1380 22.8404 29.6888 39.8482 50.5964 59.0535 62.9533 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
410.1790 414.4354 403.7094 380.8752 352.0511 324.9605 306.8623 302.6059 313.3319 336.1661 364.9902 392.0808 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 54.7956 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 -113.1180 (71)
Water heating gains (Table 5)
131.5947 129.2533 124.3909 117.7806 113.4890 107.4461 102.3099 108.8908 111.2290 118.0709 125.7965 129.2630 (72)
Total internal gains
717.3794 712.4458 686.6982 646.5054 604.9326 567.8993 546.3672 555.5401 578.7637 619.1880 664.1948 698.6518 (73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	47.5200	22.3313	0.3600	1.0000	0.7700	264.7442 (80)	
Solar gains	264.7442	465.8558	756.4675	1133.7279	1350.8847	1478.7904	1393.0803	1225.5804	952.5984	589.8974	338.1783	215.6003 (83)
Total gains	982.1236	1178.3016	1443.1657	1780.2333	1955.8173	2046.6897	1939.4475	1781.1205	1531.3622	1209.0854	1002.3731	914.2521 (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	24.3306	24.5315	24.5315	24.8391	24.8391	25.2615	25.1545	25.3693	25.2615	25.0485	25.0485	24.7357	
alpha	2.6220	2.6354	2.6354	2.6559	2.6559	2.6841	2.6770	2.6913	2.6841	2.6699	2.6699	2.6490	
util living area	0.9178	0.8760	0.7868	0.6329	0.4670	0.2931	0.1961	0.2179	0.4332	0.7157	0.8721	0.9280	(86)
MIT	19.5370	19.7865	20.1853	20.5766	20.7889	20.8788	20.8948	20.8939	20.8359	20.5299	19.9980	19.5055	(87)
Th 2	19.9669	19.9745	19.9745	19.9859	19.9859	20.0012	19.9973	20.0050	20.0012	19.9935	19.9935	19.9821	(88)
util rest of house	0.9063	0.8599	0.7610	0.5947	0.4175	0.2373	0.1336	0.1514	0.3680	0.6727	0.8525	0.9177	(89)
MIT 2	18.0365	18.3930	18.9449	19.4707	19.7306	19.8400	19.8487	19.8563	19.8025	19.4351	18.7133	18.0031	(90)
Living area fraction									fLA = Living area / (4) =			0.2612	(91)
MIT	18.4284	18.7569	19.2689	19.7595	20.0070	20.1113	20.1219	20.1273	20.0724	19.7211	19.0488	18.3955	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4284	18.7569	19.2689	19.7595	20.0070	20.1113	20.1219	20.1273	20.0724	19.7211	19.0488	18.3955	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8850	0.8371	0.7410	0.5857	0.4186	0.2436	0.1414	0.1597	0.3728	0.6598	0.8304	0.8976	(94)
Useful gains	869.1762	986.3054	1069.3211	1042.6215	818.6385	498.5811	274.2681	284.4159	570.9324	797.7833	832.4175	820.6281	(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	1708.8436	1673.0478	1509.2581	1238.2168	879.9784	507.6851	275.5424	286.1697	601.6774	1011.3640	1375.9776	1676.7060	(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	624.7125	461.4909	327.3131	140.8286	45.6369	0.0000	0.0000	0.0000	0.0000	158.9040	391.3632	636.9220	(98)
Space heating												2787.1713	(98)
Space heating per m2											(98) / (4) =	24.8190	(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	987.8894	756.4680	762.3595	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9378	0.9605	0.9517	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	926.4820	726.5557	725.5411	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2293.3556	2171.6429	1985.0367	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	984.1490	1075.1449	937.0647	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2996.3586	(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	246.0372	268.7862	234.2662	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling 749.0896 (107)
Space cooling per m2 6.6704 (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 1639.5125 (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													
	624.7125	461.4909	327.3131	140.8286	45.6369	0.0000	0.0000	0.0000	0.0000	158.9040	391.3632	636.9220	(98)
Space heating efficiency (main heating system 1)													
	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)													
	367.4780	271.4652	192.5371	82.8404	26.8452	0.0000	0.0000	0.0000	0.0000	93.4730	230.2137	374.6600	(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													
	219.0104	193.0836	202.8912	182.0323	178.4971	159.6538	153.4828	168.2082	167.8454	188.7495	199.3899	213.7930	(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													
	128.8297	113.5786	119.3478	107.0778	104.9983	93.9140	90.2840	98.9460	98.7326	111.0291	117.2882	125.7606	(219)
Water heating fuel used													1309.7866 (219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	61.5093	67.1966	58.5665	0.0000	0.0000	0.0000	0.0000	(221)
Cooling													187.2724 (221)
Annual totals kWh/year													
Space heating fuel - main system													1639.5125 (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) 278.5610 (230a)
central heating pump 30.0000 (230c)
Total electricity for the above, kWh/year 308.5610 (231)
Electricity for lighting (calculated in Appendix L) 432.6847 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 1.31 * 1140 * 1.00) = -1194.8246 -1194.8246 (233)
Total delivered energy for all uses 2682.9927 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1639.5125	15.4400	253.1407	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1309.7866	15.4400	202.2311	(247)
Space cooling	187.2724	15.4400	28.9149	(248)
Mechanical ventilation fans	278.5610	15.4400	43.0098	(249)
Pumps and fans for heating	30.0000	15.4400	4.6320	(249)
Energy for lighting	432.6847	15.4400	66.8065	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1194.8246	15.4400	-184.4809	(252)
Total energy cost			414.2541	(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	1639.5125	0.5190	850.9070	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1309.7866	0.5190	679.7793	(264)
Space and water heating			1530.6863	(265)
Space cooling	187.2724	0.5190	97.1944	(266)
Pumps and fans	308.5610	0.5190	160.1432	(267)
Energy for lighting	432.6847	0.5190	224.5633	(268)
Energy saving/generation technologies				
PV Unit	-1194.8246	0.5190	-620.1139	(269)
Total kg/year			1392.4732	(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	1639.5125	3.0700	5033.3035	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1309.7866	3.0700	4021.0450	(264)
Space and water heating			9054.3485	(265)
Space cooling	187.2724	3.0700	574.9263	(266)
Pumps and fans	308.5610	3.0700	947.2824	(267)
Energy for lighting	432.6847	3.0700	1328.3419	(268)
Energy saving/generation technologies				

PV Unit	-1194.8246	3.0700	-3668.1114 (269)
Primary energy kWh/year			8236.7876 (272)
Primary energy kWh/m2/year			73.3463 (273)

SAP 2012 EPC IMPROVEMENTS

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

_____

(For testing purposes):

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

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

_____

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

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

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

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

	Current	Potential	Saving
Electricity	£599	£599	£0
Space heating	£301	£301	£0
Space cooling	£29	£29	£0
Water heating	£202	£202	£0
Lighting	£67	£67	£0
Generated (PV)	-£184	-£184	£0
Total cost of fuels	£415	£415	£0
Total cost of uses	£415	£415	£0
Delivered energy	24 kWh/m²	24 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.4 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	73 kWh/m²	73 kWh/m²	0 kWh/m²

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

No improvements selected / applicable

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

No improvements selected / applicable

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

Overheating Calculation Input Data

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

Overheating Calculation

Summer ventilation heat loss coefficient	790.54 (P1)
Transmission heat loss coefficient	83.73 (37)
Summer heat loss coefficient	874.27 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
West	0.000	1.000	None

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
West	47.5200	117.5071	0.3600	1.0000	0.9000	1628.2757
total:						1628.2757

	Jun	Jul	Aug	
Solar gains	1728	1628	1432	(P3)
Internal gains	565	543	553	
Total summer gains	2293	2172	1985	(P5)
Summer gain/loss ratio	2.62	2.48	2.27	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.92	21.68	21.37	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

Predicted Energy Assessment

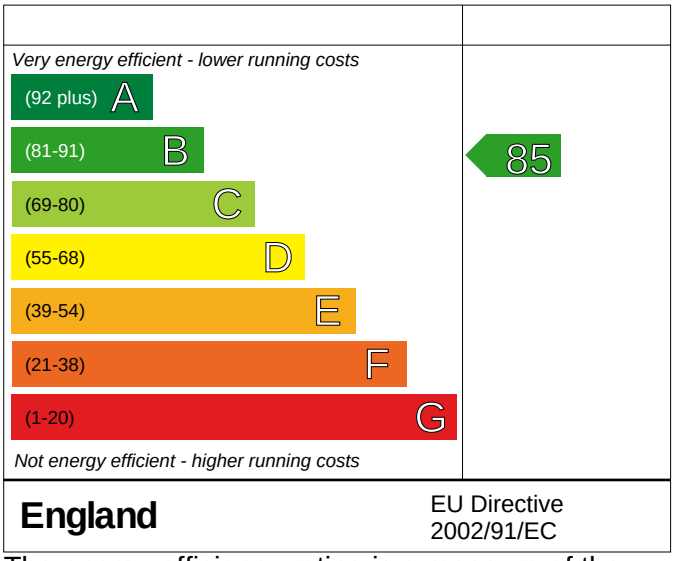
503,
London

Dwelling type:	Flat, End-Terrace
Date of assessment:	01.Nov.2016
Produced by:	Gecko
Total floor area:	112.3 m^2

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

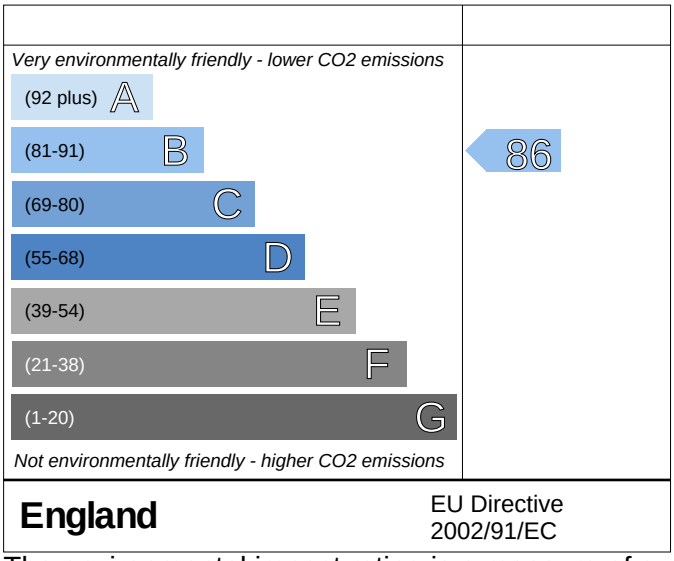
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO2) Rating



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

SURVEY NOTES

Property Reference: 503 Linton House
Survey Reference: 503 design
Property: 503, London

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

SAP Rating:	85 B	**CO2 Emissions (t/year):**	1.39	**DER:**	15.66 Pass	**TER:**	23.37	**Percentage DER<TER:**	32.99 %
Environmental:	86 B	**General Requirements Compliance:**	Pass	**DFEE:**	46.72 Pass	**TFEE:**	51.25	**Percentage DFEE<TFEE:**	8.84 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.0 **ENE2 Credits:** 3.4 **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: 503 Linton House
Survey Reference: 503 design
Property: 503, London

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

SAP Rating: 85 B **CO2 Emissions (t/year):** 1.39 **DER:** 15.66 Pass **TER:** 23.37 **Percentage DER<TER:** 32.99 %
Environmental: 86 B **General Requirements Compliance:** Pass **DFEE:** 46.72 Pass **TFEE:** 51.25 **Percentage DFEE<TFEE:** 8.84 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.0 **ENE2 Credits:** 3.4 **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	East
1.0 Property Type	Flat, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2016
3.0 Property Age Band	
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	11.61	82.43	2.60
1st Storey:	9.97	29.87	2.85

7.0 Living Area	29.33
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	1.01		30.19	8.32
External Wall 2	Other	1.01		28.41	2.76

9.1 Party walls

Description	Construction	Kappa	Area
Party Wall 1	Steel frame		74.14
Party Wall 2	Steel frame		36.78

10.0 External Roofs

Description	Construction	U-Value	Kappa	Gross Area	Nett Area
penthouse roof	Other	0.10		52.56	52.56
garden room roof	Other	0.10		29.87	29.87

11.0 HeatLoss Floors

Description	Construction	U-Value	Kappa	Area
penthouse floor	Other	0.15		82.43

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	1.01

13.0 Openings

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

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

14.0 Conservatory None
15.0 Draught Proofing 100
16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges
17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E5 Ground floor (normal)	11.61	0.160	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	9.97	0.070	Yes
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	11.61	0.070	Yes
Table K1 - Default	E14 Flat roof	9.97	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 112.30
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 40
Total number of L.E.L. fittings 40
Percentage of L.E.L. fittings 100.00
External
External lights fitted Yes
Light and motion sensors Yes
23.0 Electricity Tariff Standard

24.0 Heating Systems
Main Heating 1 SAP table
Description ashp
Percentage of Heat 100 %
Main Heating 2 None
Description
Percentage of Heat %
Community Heating
Secondary Heating None
Water Heating Main Heating 1

Flue Gas Heat Recovery System	No
Waste Water Heat Recovery	No
Instantaneous System 1	
Waste Water Heat Recovery	No
Instantaneous System 2	
Waste Water Heat Recovery Storage	No
System	
Solar Panel	No
25.0 Main Heating 1	
Database Ref. No.	
Fuel Type	
Main Heating	PET
TestMethod	
SAP Code	224
Efficiency (SAP Table) %	170.0
Efficiency (SAP Table) %	
In Winter	
In Summer	
Model Name	
Manufacturer	
Controls	CHD Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	
Sap Code	2207
Burner Control	
Boiler Compensator	
HETAS approved System	
Oil Pump Inside	
FI Case	
FI Water	
Flue Type	
Smoke Control Area	
Fan Assisted Flue	
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators and Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	<= 35°C
Electric CPSU Temperature	
Combi boiler type	
Combi keep hot type	
Combi store type	
27.0 Community Heating	
Space Community Heating	
PCDF Index	
Distribution Loss	
Distribution Loss Value	
Controls	
SAP Code	
Water Community Heating	
PCDF Index	
Distribution Loss	
Distribution Loss Value	
Charging Linked To Heat Use	
28.0 Secondary Heating	
Description	
SHS efficiency %	
SAP Code	
HETAS Approved System	
Smoke Control Area	
Test Method	
Manufacturer	
Model Name	
29.0 Water Heating	HWP From main heating 1
Water use <= 125 litres/person/day	Yes
SAP Code	901
Immersion Heater	
Summer Immersion	
Suplementary Immersion	No
Immersion Only Heating Hot Water	
29.1 Flue Gas Heat Recovery System	
Database ID	
Brand Model	
Details	
29.2 Waste Water Heat Recovery	
System	
Total rooms with shower and/or bath	

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

31.0 Solar Panel	
Solar Panel Area	
Area Type	
Panel Type	
n0, a1, a2, A/G ratio	
Orientation	
Elevation	
Overshading	
Solar Storage Volume	
Pump electrically powered	
Combined Cylinder	

32.0 Thermal Store	None
Thermal Store Pipework	
33.0 Photovoltaic Unit	One Dwelling
Apportioned KWh/Year	

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

34.0 Wind Turbines	
Terrain Type	Urban
Wind Turbines	
Count	
Apportioned Kwh/year	
Rotor Diameter	
Hub Height	
35.0 Small-scale Hydro	
Electricity Generated	
Description	
Apportioned kWh/Year	

Recommendations
None

Further measures to achieve even higher standards
None

Thermal Bridging

Property Reference: 503 Linton House
Survey Reference: 503 design
Property: 503, London

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

SAP Rating:	85 B	**CO2 Emissions (t/year):**	1.39	**DER:**	15.66 Pass	**TER:**	23.37	**Percentage DER<TER:**	32.99 %
Environmental:	86 B	**General Requirements Compliance:**	Pass	**DFEE:**	46.72 Pass	**TFEE:**	51.25	**Percentage DFEE<TFEE:**	8.84 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.0 **ENE2 Credits:** 3.4 **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	11.61	1.86	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	9.97	0.70	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	11.61	0.81	
External wall	E14 Flat roof	Table K1 - Default	0.080	9.97	0.80	
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: 5.80
Y-Value W/m2K: 0.026