



SAP Calculations

Client:

Project: 1, Moor Road
DUNGANNON, County Tyrone, BT71 6HF

Contact: Conor Loughran
CPL Services
cplservices@hotmail.com

Building Regulation Compliance

Property Reference: 000004
Survey Reference: 000004

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

Property: 1, Moor Road, DUNGANNON, County Tyrone, BT71 6HF

SAP Rating: 79 C **CO2 Emissions (t/year):** 1.30 **DER:** 24.60 Pass **Reduction:** 1.9% **FEE:** 70.7 **ZC8:** 0.00
Environmental: 83 B **General Requirements Compliance:** Pass **TER:** 25.07 **HLP:** 1.90 **Energy cost:** £ 392

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: Conor Loughran, Tel: 028 807 60819 **Surveyor ID:** 7181-0001
Address: Aughnagreggan Rd, Carrickmore, Tyrone, BT79 9JZ
Client:

Software Version: Elmhurst Energy Systems SAP2009 Calculator (Design System) version 4.04r04
SAP version: SAP 2009, **Regs Region:** Northern Ireland (NI Technical Booklet F1 2011), **Calculation Type:** New Dwelling As Built

SUMMARY FOR INPUT DATA FOR New Build (As Built)

1 TER and DER

Fuel for main heating:	Mains gas	
Fuel factor:	1.00 (mains gas)	
Target Carbon Dioxide Emission Rate (TER)	25.07 kg/m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.60 kg/m ²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.28 (max. 0.70)	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.50 (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 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Boiler system with radiators or underfloor - Mains gas Data from database Vokera Vision 25C Combi boiler Efficiency: 89.1% SEDBUK2009 Minimum: 88.0%	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water storage	No cylinder
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6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Northern Ireland): Based On:	Slight	OK
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Overshading:	Average
Windows facing North:	7.58 m ² , No overhang
Windows facing South:	7.77 m ² , No overhang
Windows facing West:	2.64 m ² , No overhang
Ventilation rate:	2.00
Blinds/curtains:	None

10 Key features

Floor U-value	0.18 W/m ² K
Window U-value	1.40 W/m ² K

Full SAP Calculation Printout

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Surveyor ID: 7181-0001

Address: Aughnagreggan Rd, Carrickmore, Tyrone, BT79 9JZ

Client:

Software Version: Elmhurst Energy Systems SAP2009 Calculator (Design System) version 4.04r04

SAP version: SAP 2009, Regs Region: Northern Ireland (NI Technical Booklet F1 2011), Calculation Type: New Dwelling As Built

CALCULATION DETAILS for survey reference no '000004'

SAP2009 - 9.81 input data (DesignData) -

Page: 4 of 27

SAP2009 Input Data

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FullRefNo: 000004
Sap Version: SAP 2009
Regs Region: Northern Ireland
Region: Northern Ireland
Calculation Type: New Build (As Built)
DwellingOrientation: North
Property Type: Bungalow, Detached
Storeys: 1
Date Built: 2016
Sheltered Sides: 2
Sunlight Shade: Average or unknown
Measurements
  1st Storey: 36.2, 55.38, 2.4
Living Area: 27.7 m2, fraction: 50.0%
Thermal Mass: Simple calculation
Thermal Mass Simple: Low
Thermal MassValue: 100
External Walls
  External Wall 1: 67.0005, 86.88, 9, , TimberWallOneLayer, , TimberFrame, 0, 0.28, Calculate
External Roofs
  Main Roof: 55.38, 55.38, 9, PlasterInsulatedAtCeiling, , , 0.14
Heat Loss Floors
  Ground Floor: 55.38, 20, GroundFloorSuspendedTimber, , GroundTimber, 0, 0.18
Description
  DG24mm1.4: Manufacturer, Window, Double Low-E Soft 0.1, , , 0.63, , 0.7,
  Glazed Door: Manufacturer, Half Glazed Door, Double Low-E Soft 0.05, , , 0.63, , 0.7,
Openings
  Front: Opening Type, Location, Orientation, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
  Front: Half Glazed Door, External Wall 1, North, , , , 0, 0, 0, 1.89,
  Rear: Window, External Wall 1, South, None, 0, , 0, 0, 0, 7.77,
  Left: Window, External Wall 1, West, None, 0, , 0, 0, 0, 2.64,
Conservatory: None
Draught Proofing: 100
Draught Lobby: No
Thermal Bridges
  0. Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
  1. External wall, E1 Steel lintel with perforated steel base plate, , No, 0, 0, , ,
  2. External wall, E2 Other lintels (including other steel lintels), Table K1 - Accredited, Yes, 14.92, 0.3, 0.3, 4.48,
  3. External wall, E3 Sill, Table K1 - Accredited, No, 12.32, 0.04, 0.04, 0.49,
  4. External wall, E4 Jamb, Table K1 - Accredited, Yes, 36, 0.05, 0.05, 1.80,
  5. External wall, E5 Ground floor, Table K1 - Accredited, Yes, 36.2, 0.16, 0.16, 5.79,
  6. External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, , ,
  7. External wall, E7 Intermediate floor between dwellings (in blocks of flats), , No, 0, 0, , ,
  8. External wall, E8 Balcony within a dwelling, , No, 0, 0, , ,
  9. External wall, E9 Balcony between dwellings, , No, 0, 0, , ,
  10. External wall, E10 Eaves (insulation at ceiling level), Table K1 - Accredited, No, 28, 0.06, 0.06, 1.68,
  11. External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, , ,
  12. External wall, E12 Gable (insulation at ceiling level), Table K1 - Accredited, No, 7.8, 0.24, 0.24, 1.87,
  13. External wall, E13 Gable (insulation at rafter level), , No, 0, 0, , ,
  14. External wall, E14 Flat roof, , No, 0, 0, , ,
  15. External wall, E15 Flat roof with parapet, , No, 0, 0, , ,
  16. External wall, E16 Corner (normal), Table K1 - Accredited, Yes, 9.6, 0.09, 0.09, 0.86,
  17. External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, , ,
  18. Party wall, E18 Party wall between dwellings, , No, 0, 0, , ,
  19. Party wall, P1 Party wall - Ground floor, , No, 0, 0, , ,
  20. Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, , ,
  21. Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), , No, 0, 0, , ,
  22. Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, , ,
  Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, , ,
Pressure Test: True
Designed q50: 5
AsBuilt q50: 5
Property Tested: True
Mechanical Ventilation: None
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: 2
Passive Vents: 0
Flueless Gas Fires: 0
Cooling System: None

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Light Fittings:	8
LEL Fittings:	8
Percentage of LEL Fittings:	100
External Lights Fitted:	No
External LELs Fitted:	No
Electricity Tariff:	Standard
Main Heating 1	
Description	
Percentage	100
Sedbuk ID	16976
Fuel Type	Mains gas
MHS	Mains gas BGW Post 98 Combi condens. with auto ign.
SAP Code	104
Boiler Efficiency Type	Split Efficiencies
Efficiency Winter	90
Efficiency Summer	86.6
MHS Controls	CBI Time and temperature zone control
Delayed Start Stat	Yes
Ctrl SAP Code	2110
Boiler Compensator	None
Flue Type	Balanced
Fan Assisted Flue	Yes
Pumped	Pump in heated space
Heat Emitter	Radiators
Combi boiler type	Standard Combi
Combi keep hot type	None
Main Heating 2	None
Smoke Control Area	Unknown
Community Heating	None
Secondary Heating	None
Water Heating	
Type	MainHeating1
WHS	HWP From main heating 1
SAP Code	901
Hot Water Cylinder	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	None
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

SAP 2009 WORKSHEET FOR New Build (As Built) BRE SAP Worksheet 9.90
 CALCULATION OF FABRIC ENERGY EFFICIENCY
 Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.04r04

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.3800 (1b)	x 2.4000 (2b)	= 132.9120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 132.9120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1505 (8)
Pressure test					Yes
Measured/design q50					5.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.4005 (18)
Number of sides on which dwelling is 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) = 0.3404 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.4000	5.1000	5.1000	4.5000	4.1000	3.9000	3.7000	3.7000	4.2000	4.5000	4.8000	5.1000 (22)
Wind factor	1.3500	1.2750	1.2750	1.1250	1.0250	0.9750	0.9250	0.9250	1.0500	1.1250	1.2000	1.2750 (22a)
(22b)m	0.4595	0.4340	0.4340	0.3830	0.3489	0.3319	0.3149	0.3149	0.3574	0.3830	0.4085	0.4340 (22b)
Effective ach	0.6056	0.5942	0.5942	0.5733	0.5609	0.5551	0.5496	0.5496	0.5639	0.5733	0.5834	0.5942 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Glazed Door			1.8900	1.5000	2.8350		(26)
DG24mm1.4 (Uw = 1.40)			17.9895	1.3258	23.8497		(27)
Ground Floor			55.3800	0.1800	9.9684		(28a)
External Wall 1	86.8800	19.8795	67.0005	0.2800	18.7601		(29a)
Main Roof	55.3800		55.3800	0.1400	7.7532		(30)
Total net area of external elements Aum(A, m ²)			197.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 63.1665		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.9768 (36)
Total fabric heat loss							(33) + (36) = 80.1433 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.5618	26.0615	26.0615	25.1467	24.6003	24.3462	24.1048	24.1048	24.7321	25.1467	25.5898	26.0615 (38)
(39)m	106.7051	106.2048	106.2048	105.2899	104.7436	104.4895	104.2480	104.2480	104.8754	105.2899	105.7331	106.2048 (39)
(40)m	1.9268	1.9177	1.9177	1.9012	1.8914	1.8868	1.8824	1.8824	Average = Sum(39)m / 12 = 1.8937	1.9012	1.9092	1.9177 (40)
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 = 30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy, N												1.8485 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												82.2121 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	90.4333	87.1448	83.8564	80.5679	77.2794	73.9909	73.9909	77.2794	80.5679	83.8564	87.1448	90.4333 (44)
(45)m	134.4309	117.5741	121.3259	105.7749	101.4935	87.5812	81.1568	93.1287	94.2409	109.8287	119.8866	130.1891 (45)
Energy content (annual)										Total = Sum(45)m =		1296.6113 (45)
(46)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:												
(57)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 (57)
Primary circuit loss (annual) from Table 3												0.0000 (58)
(59)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 (59)
(65)m	28.5666	24.9845	25.7818	22.4772	21.5674	18.6110	17.2458	19.7898	20.0262	23.3386	25.4759	27.6652 (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	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242 (66)
(67)m	14.3679	12.7615	10.3783	7.8571	5.8732	4.9584	5.3578	6.9642	9.3474	11.8686	13.8524	14.7673 (67)
(68)m	161.1644	162.8368	158.6224	149.6506	138.3252	127.6810	120.5700	118.8976	123.1120	132.0838	143.4092	154.0534 (68)
(69)m	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424 (69)
(70)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 (70)
(71)m	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394 (71)
(72)m	38.3959	37.1793	34.6529	31.2183	28.9884	25.8486	23.1799	26.5993	27.8142	31.3691	35.3832	37.1844 (72)
(73)m	264.6555	263.5048	254.3809	239.4532	223.9141	209.2153	199.8349	203.1884	211.0008	226.0488	243.3721	256.7323 (73)

6. Solar gains

[Jan]			Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North			7.5825	10.7264	0.6300	0.7000	0.7700	24.8564 (74)
South			7.7670	47.3233	0.6300	0.7000	0.7700	112.3312 (78)
West			2.6400	19.8726	0.6300	0.7000	0.7700	16.0335 (80)

(83)m	153.2212	261.4647	350.5701	449.8775	521.6974	546.9841	528.5374	468.3469	391.9401	297.8061	183.6557	131.0147 (83)
(84)m	417.8767	524.9695	604.9510	689.3307	745.6116	756.1994	728.3723	671.5352	602.9409	523.8549	427.0277	387.7470 (84)

7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	14.4167	14.4846	14.4846	14.6105	14.6867	14.7224	14.7565	14.7565	14.6682	14.6105	14.5492	14.4846
alpha	1.9611	1.9656	1.9656	1.9740	1.9791	1.9815	1.9838	1.9838	1.9779	1.9740	1.9699	1.9656
(86)m	0.9539	0.9292	0.8935	0.8409	0.7483	0.6230	0.4810	0.5089	0.7136	0.8592	0.9370	0.9576 (86)
(87)m	17.5434	17.9174	18.5380	19.1710	19.9329	20.4927	20.8020	20.7798	20.3020	19.4050	18.2448	17.5940 (87)
(88)m	19.3888	19.3949	19.3949	19.4060	19.4127	19.4158	19.4188	19.4188	19.4111	19.4060	19.4006	19.3949 (88)
(89)m	0.9452	0.9162	0.8728	0.8085	0.6906	0.5242	0.3285	0.3517	0.6245	0.8221	0.9233	0.9494 (89)
(90)m	16.3593	16.7286	17.3347	17.9490	18.6616	19.1416	19.3589	19.3508	19.0024	18.1904	17.0619	16.4145 (90)
Living area fraction									fLA = Living area / (4) =			0.5002 (91)
(92)m	16.9516	17.3232	17.9366	18.5602	19.2975	19.8174	20.0807	20.0656	19.6524	18.7979	17.6536	17.0045 (92)
Temperature adjustment												0.0000
(93)m	16.9516	17.3232	17.9366	18.5602	19.2975	19.8174	20.0807	20.0656	19.6524	18.7979	17.6536	17.0045 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.9267	0.8935	0.8485	0.7874	0.6857	0.5521	0.3977	0.4220	0.6402	0.8042	0.9027	0.9318 (94)
(95)m	387.2408	469.0488	513.2842	542.7552	511.2797	417.4757	289.6588	283.4116	385.9975	421.2957	385.4643	361.3203 (95)
(96)m	4.5000	5.0000	6.8000	8.7000	11.7000	14.6000	16.9000	16.9000	14.3000	10.8000	7.0000	4.9000 (96)
(97)m	1328.6439	1308.7837	1182.7557	1038.1796	795.7900	545.1613	331.5802	330.0069	561.3386	842.1026	1126.4328	1285.5530 (97)
(98)m	700.4039	564.3019	498.0868	356.7056	211.6757	0.0000	0.0000	0.0000	0.0000	313.0803	533.4973	687.6291 (98)
Space heating (October to May) (kWh/year)												3865.3807 (98)
Space heating requirement in kWh/m ² /year												(98) / (4) = 69.7974 (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.	0.0000	0.0000	0.0000	0.0000	0.0000	13.4000	15.4000	15.2000	0.0000	0.0000	0.0000	0.0000
(100)m	0.0000	0.0000	0.0000	0.0000	0.0000	1107.5883	896.5332	917.3828	0.0000	0.0000	0.0000	0.0000 (100)
(101)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.5984	0.6512	0.6275	0.0000	0.0000	0.0000	0.0000 (101)
(102)m	0.0000	0.0000	0.0000	0.0000	0.0000	662.7287	583.7856	575.6120	0.0000	0.0000	0.0000	0.0000 (102)
(103)m	0.0000	0.0000	0.0000	0.0000	0.0000	911.8821	860.5783	821.2199	0.0000	0.0000	0.0000	0.0000 (103)
(104)m	0.0000	0.0000	0.0000	0.0000	0.0000	179.3904	205.9337	182.7323	0.0000	0.0000	0.0000	0.0000 (104)
(98)m	0.0000	0.0000	0.0000	0.0000	0.0000	112.4723	59.1316	68.2714	0.0000	0.0000	0.0000	0.0000 (98)
(104)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	205.9337	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
(106)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000 (106)
(107)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	51.4834	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement in kWh/m ² /year												Total = Sum(107)6.8 = 51.4834 (107)
												(107) / (4) = 0.9296 (108)

8f. Fabric Energy Efficiency

Fabric Energy Efficiency (99) + (108) = 70.7271
 Fabric Energy Efficiency rounded 70.7 (109)

SAP 2009 WORKSHEET FOR New Build (As Built) BRE SAP Worksheet 9.90
 CALCULATION OF ENERGY RATINGS
 Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.04r04

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.3800 (1b)	x 2.4000 (2b)	= 132.9120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 132.9120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	+	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	+	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1505 (8)
Pressure test					Yes
Measured/design q50					5.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.4005 (18)
Number of sides on which dwelling is 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) =	0.3404 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.4000	5.1000	5.1000	4.5000	4.1000	3.9000	3.7000	3.7000	4.2000	4.5000	4.8000	5.1000 (22)
Wind factor	1.3500	1.2750	1.2750	1.1250	1.0250	0.9750	0.9250	0.9250	1.0500	1.1250	1.2000	1.2750 (22a)
(22b)m	0.4595	0.4340	0.4340	0.3830	0.3489	0.3319	0.3149	0.3149	0.3574	0.3830	0.4085	0.4340 (22b)
Effective ach	0.6056	0.5942	0.5942	0.5733	0.5609	0.5551	0.5496	0.5496	0.5639	0.5733	0.5834	0.5942 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Glazed Door			1.8900	1.5000	2.8350		(26)
DG24mm1.4 (Uw = 1.40)			17.9895	1.3258	23.8497		(27)
Ground Floor			55.3800	0.1800	9.9684		(28a)
External Wall 1	86.8800	19.8795	67.0005	0.2800	18.7601		(29a)
Main Roof	55.3800		55.3800	0.1400	7.7532		(30)
Total net area of external elements Aum(A, m ²)			197.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	63.1665	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.9768 (36)
Total fabric heat loss							(33) + (36) = 80.1433 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.5618	26.0615	26.0615	25.1467	24.6003	24.3462	24.1048	24.1048	24.7321	25.1467	25.5898	26.0615 (38)
(39)m	106.7051	106.2048	106.2048	105.2899	104.7436	104.4895	104.2480	104.2480	104.8754	105.2899	105.7331	106.2048 (39)
(40)m	1.9268	1.9177	1.9177	1.9012	1.8914	1.8868	1.8824	1.8824	Average = Sum(39)m / 12 =	1.8937	1.9012	1.9092
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 =	30	31	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												1.8485 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												82.2121 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	90.4333	87.1448	83.8564	80.5679	77.2794	73.9909	73.9909	77.2794	80.5679	83.8564	87.1448	90.4333 (44)
(45)m	134.4309	117.5741	121.3259	105.7749	101.4935	87.5812	81.1568	93.1287	94.2409	109.8287	119.8866	130.1891 (45)
Energy content (annual)										Total = Sum(45)m =		1296.6113 (45)
(46)m	20.1646	17.6361	18.1989	15.8662	15.2240	13.1372	12.1735	13.9693	14.1361	16.4743	17.9830	19.5284 (46)
Water storage loss:												
(57)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 (57)
(61)m	36.6697	33.0990	36.6102	35.3896	36.5403	35.3283	36.4852	36.5209	35.3617	36.5813	35.4473	36.6582 (61)
(62)m	171.1006	150.6731	157.9362	141.1644	138.0339	122.9095	117.6420	129.6496	129.6026	146.4100	155.3339	166.8473 (62)
(63)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 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Water heat.	171.1006	150.6731	157.9362	141.1644	138.0339	122.9095	117.6420	129.6496	129.6026	146.4100	155.3339	166.8473 (64)
(65)m	53.8657	47.3681	49.4934	44.0175	42.8817	37.9528	36.1059	40.0955	40.1755	45.6634	48.7241	52.4524 (65)
Total per year (kWh/year) = Sum(64)m =												1727.3032 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091 (66)
(67)m	35.9198	31.9037	25.9458	19.6426	14.6831	12.3961	13.3944	17.4106	23.3684	29.6716	34.6311	36.9181 (67)
(68)m	240.5439	243.0399	236.7499	223.3591	206.4556	190.5686	179.9552	177.4591	183.7492	197.1400	214.0435	229.9304 (68)
(69)m	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394 (69)
(70)m	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000 (70)
(71)m	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394 (71)
(72)m	72.4001	70.4883	66.5234	61.1355	57.6367	52.7123	48.5295	53.8918	55.7993	61.3755	67.6724	70.5006 (72)
(73)m	443.7729	440.3410	424.1282	399.0463	373.6844	350.5861	336.7882	343.6706	357.8260	383.0962	411.2561	432.2582 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.5825	10.7264	0.6300	0.7000	0.7700	24.8564 (74)
South	7.7670	47.3233	0.6300	0.7000	0.7700	112.3312 (78)
West	2.6400	19.8726	0.6300	0.7000	0.7700	16.0335 (80)

(83)m	153.2212	261.4647	350.5701	449.8775	521.6974	546.9841	528.5374	468.3469	391.9401	297.8061	183.6557	131.0147 (83)
(84)m	596.9941	701.8057	774.6983	848.9238	895.3818	897.5702	865.3256	812.0175	749.7662	680.9023	594.9118	563.2729 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	14.4167	14.4846	14.4846	14.6105	14.6867	14.7224	14.7565	14.7565	14.6682	14.6105	14.5492	14.4846
alpha	1.9611	1.9656	1.9656	1.9740	1.9791	1.9815	1.9838	1.9838	1.9779	1.9740	1.9699	1.9656
(86)m	0.9174	0.8887	0.8476	0.7908	0.6919	0.5636	0.4237	0.4445	0.6424	0.7994	0.8936	0.9215 (86)
(87)m	17.9217	18.2632	18.8334	19.4052	20.0908	20.5818	20.8437	20.8291	20.4338	19.6459	18.5803	17.9699 (87)
(88)m	19.3888	19.3949	19.3949	19.4060	19.4127	19.4158	19.4188	19.4188	19.4111	19.4060	19.4006	19.3949 (88)
(89)m	0.9031	0.8700	0.8207	0.7524	0.6296	0.4654	0.2830	0.2992	0.5488	0.7530	0.8727	0.9074 (89)
(90)m	15.5380	16.0162	16.8123	17.5990	18.5070	19.0982	19.3530	19.3459	18.9493	17.9509	16.4784	15.6112 (90)
Living area fraction										fLA = Living area / (4) =		0.5002 (91)
(92)m	16.7303	17.1401	17.8232	18.5024	19.2992	19.8403	20.0986	20.0878	19.6918	18.7987	17.5297	16.7910 (92)
Temperature adjustment												-0.1500
(93)m	16.5803	16.9901	17.6732	18.3524	19.1492	19.6903	19.9486	19.9378	19.5418	18.6487	17.3797	16.6410 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.8678	0.8322	0.7836	0.7214	0.6177	0.4842	0.3337	0.3509	0.5576	0.7256	0.8364	0.8730 (94)
(95)m	518.0811	584.0165	607.0377	612.4418	553.1081	434.6087	288.7830	284.9350	418.1053	494.0812	497.5843	491.7344 (95)
(96)m	4.5000	5.0000	6.8000	8.7000	11.7000	14.6000	16.9000	16.9000	14.3000	10.8000	7.0000	4.9000 (96)
(97)m	1289.0256	1273.4057	1154.7866	1016.3040	780.2557	531.8809	317.8151	316.6808	549.7394	826.3869	1097.4809	1246.9481 (97)
(98)m	573.5827	463.2696	407.5252	290.7808	168.9978	0.0000	0.0000	0.0000	0.0000	247.2355	431.9255	561.8790 (98)
Space heating (October to May) (kWh/year)												3145.1961 (98)
Space heating requirement in kWh/m ² /year												(98) / (4) = 56.7930 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 90.0000 (206)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

Space heating:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m	573.5827	463.2696	407.5252	290.7808	168.9978	0.0000	0.0000	0.0000	0.0000	247.2355	431.9255	561.8790 (98)
(211)m	637.3141	514.7440	452.8058	323.0898	187.7754	0.0000	0.0000	0.0000	0.0000	274.7061	479.9172	624.3100 (211)
(215)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 (215)
Annual totals kWh/year												
Space heating fuel used, main system 1												3494.6624 (211)
Space heating fuel used, secondary												0.0000 (215)
Water heating												
(64)m	171.1006	150.6731	157.9362	141.1644	138.0339	122.9095	117.6420	129.6496	129.6026	146.4100	155.3339	166.8473 (64)
Efficiency of water heater												86.6000 (216)
(217)m	89.1954	89.1411	89.0238	88.8598	88.4390	86.6000	86.6000	86.6000	86.6000	88.7047	89.0750	89.1982 (217)
(219)m	191.8267	169.0277	177.4090	158.8619	156.0781	141.9278	135.8453	149.7109	149.6566	165.0533	174.3856	187.0524 (219)
Water heating fuel used												1956.8352 (219)
Electricity for pumps, fans and electric keep-hot (Table 4f):												
central heating pump												130.0000 (230c)
boiler with a fan-assisted flue												45.0000 (230e)
Total electricity for the above, kWh/year												175.0000 (231)
Electricity for lighting (calculated in Appendix L)												253.7420 (232)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3494.6624	3.1000	108.3345 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	1956.8352	3.1000	60.6619 (247)
Pumps and fans for heating	175.0000	11.4600	20.0550 (249)
Energy for lighting	253.7420	11.4600	29.0788 (250)
Additional standing charges			106.0000 (251)
Total energy cost			324.1303 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4700 (256)

Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 1.5176 (257)

SAP value 78.8289

SAP rating (Section 12) 79 (258)
 SAP band C

 10a. Fuel costs - using BEDF prices (396)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3494.6624	4.2800	149.5715 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	1956.8352	4.2800	83.7525 (247)
Pumps and fans for heating	175.0000	15.4400	27.0200 (249)
Energy for lighting	253.7420	15.4400	39.1778 (250)
Additional standing charges			92.0000 (251)
Total energy cost			391.5219 (255)

 12a. CO2 emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3494.6624	0.1980	691.9431 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	1956.8352	0.1980	387.4534 (264)
Space and water heating			1079.3965 (265)
Pumps and fans	175.0000	0.5170	90.4750 (267)
Energy for lighting	253.7420	0.5170	131.1846 (268)
Total CO2, kg/year			1301.0561 (272)
CO2 emissions per m2			23.4900 (273)
EI value			82.6318
EI rating			83 (274)
EI band			B

 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	3494.6624	1.0200	3564.5556 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	1956.8352	1.0200	1995.9719 (264)
Space and water heating			5560.5275 (265)
Pumps and fans	175.0000	2.9200	511.0000 (267)
Energy for lighting	253.7420	2.9200	740.9266 (268)
Primary energy kWh/year			6812.4541 (272)
Primary energy kWh/m2/year			123.0129 (273)

SAP 2009 WORKSHEET FOR New Build (As Built) BRE SAP Worksheet 9.90
 CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE
 Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.04r04

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.3800 (1b)	x 2.4000 (2b)	= 132.9120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 132.9120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1505 (8)
Pressure test					Yes
Measured/design q50					5.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.4005 (18)
Number of sides on which dwelling is 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) = 0.3404 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.4000	5.1000	5.1000	4.5000	4.1000	3.9000	3.7000	3.7000	4.2000	4.5000	4.8000	5.1000 (22)
Wind factor	1.3500	1.2750	1.2750	1.1250	1.0250	0.9750	0.9250	0.9250	1.0500	1.1250	1.2000	1.2750 (22a)
(22b)m	0.4595	0.4340	0.4340	0.3830	0.3489	0.3319	0.3149	0.3149	0.3574	0.3830	0.4085	0.4340 (22b)
Effective ach	0.6056	0.5942	0.5942	0.5733	0.5609	0.5551	0.5496	0.5496	0.5639	0.5733	0.5834	0.5942 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Glazed Door			1.8900	1.5000	2.8350		(26)
DG24mm1.4 (Uw = 1.40)			17.9895	1.3258	23.8497		(27)
Ground Floor			55.3800	0.1800	9.9684		(28a)
External Wall 1	86.8800	19.8795	67.0005	0.2800	18.7601		(29a)
Main Roof	55.3800		55.3800	0.1400	7.7532		(30)
Total net area of external elements Aum(A, m ²)			197.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 63.1665		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							
Total fabric heat loss						(33) + (36) =	80.1433 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.5618	26.0615	26.0615	25.1467	24.6003	24.3462	24.1048	24.1048	24.7321	25.1467	25.5898	26.0615 (38)
(39)m	106.7051	106.2048	106.2048	105.2899	104.7436	104.4895	104.2480	104.2480	104.8754	105.2899	105.7331	106.2048 (39)
(40)m	1.9268	1.9177	1.9177	1.9012	1.8914	1.8868	1.8824	1.8824	Average = Sum(39)m / 12 = 1.8937	1.9012	1.9092	1.9177 (40)
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 = 30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												1.8485 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												82.2121 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	90.4333	87.1448	83.8564	80.5679	77.2794	73.9909	73.9909	77.2794	80.5679	83.8564	87.1448	90.4333 (44)
(45)m	134.4309	117.5741	121.3259	105.7749	101.4935	87.5812	81.1568	93.1287	94.2409	109.8287	119.8866	130.1891 (45)
Energy content (annual)										Total = Sum(45)m =		1296.6113 (45)
(46)m	20.1646	17.6361	18.1989	15.8662	15.2240	13.1372	12.1735	13.9693	14.1361	16.4743	17.9830	19.5284 (46)
Water storage loss:												
(57)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 (57)
(61)m	36.6697	33.0990	36.6102	35.3896	36.5403	35.3283	36.4852	36.5209	35.3617	36.5813	35.4473	36.6582 (61)
(62)m	171.1006	150.6731	157.9362	141.1644	138.0339	122.9095	117.6420	129.6496	129.6026	146.4100	155.3339	166.8473 (62)
(63)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 (63)
Water heat.	171.1006	150.6731	157.9362	141.1644	138.0339	122.9095	117.6420	129.6496	129.6026	146.4100	155.3339	166.8473 (64)
(65)m	53.8657	47.3681	49.4934	44.0175	42.8817	37.9528	36.1059	40.0955	40.1755	45.6634	48.7241	52.4524 (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	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242 (66)
(67)m	14.3679	12.7615	10.3783	7.8571	5.8732	4.9584	5.3578	6.9642	9.3474	11.8686	13.8524	14.7673 (67)
(68)m	161.1644	162.8368	158.6224	149.6506	138.3252	127.6810	120.5700	118.8976	123.1120	132.0838	143.4092	154.0534 (68)
(69)m	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424 (69)
(70)m	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000 (70)
(71)m	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394 (71)
(72)m	72.4001	70.4883	66.5234	61.1355	57.6367	52.7123	48.5295	53.8918	55.7993	61.3755	67.6724	70.5006 (72)
(73)m	308.6597	306.8138	296.2514	279.3704	262.5624	246.0790	235.1845	240.4809	248.9859	266.0552	285.6613	300.0485 (73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North		7.5825	10.7264	0.6300	0.7000	0.7700	24.8564 (74)
South		7.7670	47.3233	0.6300	0.7000	0.7700	112.3312 (78)
West		2.6400	19.8726	0.6300	0.7000	0.7700	16.0335 (80)

(83)m	153.2212	261.4647	350.5701	449.8775	521.6974	546.9841	528.5374	468.3469	391.9401	297.8061	183.6557	131.0147 (83)
(84)m	461.8809	568.2785	646.8216	729.2479	784.2598	793.0630	763.7219	708.8278	640.9261	563.8613	469.3169	431.0632 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	14.4167	14.4846	14.4846	14.6105	14.6867	14.7224	14.7565	14.7565	14.6682	14.6105	14.5492	14.4846
alpha	1.9611	1.9656	1.9656	1.9740	1.9791	1.9815	1.9838	1.9838	1.9779	1.9740	1.9699	1.9656
(86)m	0.9455	0.9196	0.8823	0.8283	0.7333	0.6066	0.4650	0.4903	0.6942	0.8439	0.9265	0.9493 (86)
(87)m	17.6400	18.0059	18.6147	19.2332	19.9769	20.5183	20.8141	20.7947	20.3397	19.4708	18.3334	17.6904 (87)
(88)m	19.3888	19.3949	19.3949	19.4060	19.4127	19.4158	19.4188	19.4188	19.4111	19.4060	19.4006	19.3949 (88)
(89)m	0.9354	0.9051	0.8600	0.7942	0.6741	0.5077	0.3155	0.3361	0.6034	0.8041	0.9109	0.9396 (89)
(90)m	15.1451	15.6622	16.5197	17.3787	18.3768	19.0420	19.3383	19.3283	18.8576	17.7314	16.1404	15.2209 (90)
Living area fraction										fLA = Living area / (4) =		0.5002 (91)
(92)m	16.3930	16.8345	17.5676	18.3063	19.1771	19.7804	20.0765	20.0618	19.5989	18.6014	17.2373	16.4561 (92)
Temperature adjustment												-0.1500
(93)m	16.2430	16.6845	17.4176	18.1563	19.0271	19.6304	19.9265	19.9118	19.4489	18.4514	17.0873	16.3061 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.9059	0.8705	0.8229	0.7604	0.6571	0.5228	0.3679	0.3892	0.6060	0.7731	0.8782	0.9113 (94)
(95)m	418.4263	494.6606	532.2951	554.5057	515.3495	414.5959	280.9794	275.8423	388.3885	435.9250	412.1697	392.8480 (95)
(96)m	4.5000	5.0000	6.8000	8.7000	11.7000	14.6000	16.9000	16.9000	14.3000	10.8000	7.0000	4.9000 (96)
(97)m	1253.0407	1240.9491	1127.6376	995.6512	767.4692	525.6267	315.5074	313.9722	539.9944	805.6204	1066.5574	1211.3814 (97)
(98)m	620.9531	501.5058	442.9348	317.6247	187.5770	0.0000	0.0000	0.0000	0.0000	275.0534	471.1591	608.9888 (98)
Space heating (October to May) (kWh/year)												3425.7968 (98)
Space heating requirement in kWh/m ² /year												(98) / (4) = 61.8598 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m	620.9531	501.5058	442.9348	317.6247	187.5770	0.0000	0.0000	0.0000	0.0000	275.0534	471.1591	608.9888 (98)
(211)m	689.9479	557.2287	492.1497	352.9164	208.4189	0.0000	0.0000	0.0000	0.0000	305.6149	523.5101	676.6542 (211)
(215)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 (215)
Annual totals kWh/year												
Space heating fuel used, main system 1												3806.4409 (211)
Space heating fuel used, secondary												0.0000 (215)
Water heating												
(64)m	171.1006	150.6731	157.9362	141.1644	138.0339	122.9095	117.6420	129.6496	129.6026	146.4100	155.3339	166.8473 (64)
Efficiency of water heater												86.6000 (216)
(217)m	89.2431	89.1910	89.0807	88.9258	88.5266	86.6000	86.6000	86.6000	86.6000	88.7890	89.1323	89.2465 (217)
(219)m	191.7242	168.9331	177.2956	158.7442	155.9236	141.9278	135.8453	149.7109	149.6566	164.8965	174.2734	186.9512 (219)
Water heating fuel used												1955.8822 (219)
Electricity for pumps, fans and electric keep-hot (Table 4f):												
central heating pump												130.0000 (230c)
boiler with a fan-assisted flue												45.0000 (230e)
Total electricity for the above, kWh/year												175.0000 (231)
Electricity for lighting (calculated in Appendix L)												253.7420 (232)

12a. CO2 emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	3806.4409	0.1980	753.6753 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	1955.8822	0.1980	387.2647 (264)
Space and water heating			1140.9400 (265)
Pumps and fans	175.0000	0.5170	90.4750 (267)
Energy for lighting	253.7420	0.5170	131.1846 (268)
Total CO ₂ , kg/year			1362.5996 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			24.6000 (273)

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

DER			24.6000 ZC1
Total Floor Area		TFA	55.3800
Assumed number of occupants		N	1.8485
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5290
CO2 emissions from appliances, equation (L14)			17.5772 ZC2
CO2 emissions from cooking, equation (L16)			2.9499 ZC3

Total CO2 emissions	45.1271	ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	45.1271	ZC8

SAP 2009 WORKSHEET FOR New Build (As Built) BRE SAP Worksheet 9.90
 CALCULATION OF TARGET EMISSIONS
 Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.04r04

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.3800 (1b)	x 2.4000 (2b)	= 132.9120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 132.9120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1505 (8)
Pressure test					Yes
Measured/design q50					10.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.6505 (18)
Number of sides on which dwelling is 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) = 0.5529 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.4000	5.1000	5.1000	4.5000	4.1000	3.9000	3.7000	3.7000	4.2000	4.5000	4.8000	5.1000 (22)
Wind factor	1.3500	1.2750	1.2750	1.1250	1.0250	0.9750	0.9250	0.9250	1.0500	1.1250	1.2000	1.2750 (22a)
(22b)m	0.7464	0.7050	0.7050	0.6220	0.5667	0.5391	0.5114	0.5114	0.5805	0.6220	0.6635	0.7050 (22b)
Effective ach	0.7786	0.7485	0.7485	0.6935	0.6606	0.6453	0.6308	0.6308	0.6685	0.6935	0.7201	0.7485 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Doors			1.8500	2.0000	3.7000		(26)	
Windows (Uw = 2.00)			11.9950	1.8519	22.2130		(27)	
Ground Floor			55.3800	0.2500	13.8450		(28a)	
External Wall 1	86.8800	13.8450	73.0350	0.3500	25.5623		(29a)	
Main Roof	55.3800		55.3800	0.1600	8.8608		(30)	
Total net area of external elements Aum(A, m ²)					197.6400		(31)	
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 74.1810		(33)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K								250.0000 (35)
Thermal bridges (User defined value 0.110 * total exposed area)								21.7404 (36)
Total fabric heat loss								(33) + (36) = 95.9214 (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	34.1489	32.8290	32.8290	30.4155	28.9741	28.3037	27.6668	27.6668	29.3219	30.4155	31.5845	32.8290 (38)
(39)m	130.0703	128.7504	128.7504	126.3369	124.8955	124.2251	123.5882	123.5882	125.2433	126.3369	127.5060	128.7504 (39)
(40)m	2.3487	2.3249	2.3249	2.2813	2.2552	2.2431	2.2316	2.2316	Average = Sum(39)m / 12 = 2.2615		2.2813	2.3024
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 = 30		31	30

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N													1.8485 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36													82.2121 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)													
(44)m	90.4333	87.1448	83.8564	80.5679	77.2794	73.9909	73.9909	77.2794	80.5679	83.8564	87.1448	90.4333 (44)	
(45)m	134.4309	117.5741	121.3259	105.7749	101.4935	87.5812	81.1568	93.1287	94.2409	109.8287	119.8866	130.1891 (45)	
Energy content (annual)													Total = Sum(45)m = 1296.6113 (45)
(46)m	20.1646	17.6361	18.1989	15.8662	15.2240	13.1372	12.1735	13.9693	14.1361	16.4743	17.9830	19.5284 (46)	
Water storage loss:													
b) If manufacturer declared cylinder loss factor is not known :													
Cylinder volume (litres) including any solar storage within same cylinder													150.0000 (50)
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)
(57)m	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 circuit loss (annual) from Table 3													610.0000 (58)
(59)m	51.8082	46.7945	51.8082	50.1370	51.8082	50.1370	51.8082	51.8082	50.1370	51.8082	50.1370	51.8082 (59)	
(62)m	230.7673	204.5876	217.6623	199.0037	197.8299	180.8100	177.4933	189.4651	187.4697	206.1651	213.1154	226.5255 (62)	
(63)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 (63)	
Water heat.	230.7673	204.5876	217.6623	199.0037	197.8299	180.8100	177.4933	Solar input (sum of months) = Sum(63)m =				0.0000 (63)	
(65)m	121.7674	108.7042	117.4100	109.7532	110.8157	103.7038	104.0538	189.4651	187.4697	206.1651	213.1154	226.5255 (64)	
								Total per year (kWh/year) = Sum(64)m =				2430.8949 (64)	
								108.0344				120.3570 (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	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242	92.4242 (66)

(67)m	24.4486	21.7150	17.6599	13.3696	9.9940	8.4373	9.1168	11.8504	15.9056	20.1958	23.5715	25.1281 (67)
(68)m	161.1644	162.8368	158.6224	149.6506	138.3252	127.6810	120.5700	118.8976	123.1120	132.0838	143.4092	154.0534 (68)
(69)m	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424	32.2424 (69)
(70)m	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000 (70)
(71)m	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394 (71)
(72)m	163.6658	161.7622	157.8091	152.4350	148.9459	144.0330	139.8572	145.2075	147.1085	152.6709	158.9518	161.7702 (72)
(73)m	410.0061	407.0413	394.8187	376.1825	357.9923	340.8786	330.2713	336.6828	346.8533	365.6778	386.6597	401.6789 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
East	11.9950	19.8726	0.7200		0.7000		0.7700	83.2565 (76)				
(83)m	83.2565	161.3747	257.9287	382.9629	465.9568	486.2022	471.9143	410.7174	308.3643	196.5240	103.5094	68.6784 (83)
(84)m	493.2626	568.4160	652.7474	759.1454	823.9492	827.0808	802.1856	747.4002	655.2176	562.2018	490.1691	470.3573 (84)

7. Mean internal temperature (heating season)

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

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

tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	2.9712	2.9914	2.9914	3.0294	3.0528	3.0639	3.0745	3.0745	3.0471	3.0294	3.0108	2.9914
(86)m	0.9902	0.9845	0.9700	0.9382	0.8644	0.7388	0.5647	0.5948	0.8370	0.9526	0.9851	0.9908 (86)
(87)m	18.6925	18.9041	19.3305	19.8164	20.3657	20.7398	20.9239	20.9119	20.5900	19.9411	19.1748	18.7554 (87)
(88)m	19.1202	19.1346	19.1346	19.1611	19.1771	19.1846	19.1917	19.1917	19.1732	19.1611	19.1482	19.1346 (88)
(89)m	0.9865	0.9786	0.9576	0.9111	0.7982	0.6010	0.3436	0.3668	0.7256	0.9249	0.9784	0.9872 (89)
(90)m	17.1505	17.3695	17.7893	18.2753	18.7872	19.0821	19.1810	19.1788	18.9829	18.4069	17.6493	17.2231 (90)
Living area fraction	fLA = Living area / (4) =											
(92)m	17.9218	18.1370	18.5602	19.0461	19.5768	19.9113	20.0527	20.0457	19.7867	19.1743	18.4123	17.9895 (92)
Temperature adjustment	0.0000											
(93)m	17.9218	18.1370	18.5602	19.0461	19.5768	19.9113	20.0527	20.0457	19.7867	19.1743	18.4123	17.9895 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.9831	0.9742	0.9524	0.9090	0.8155	0.6634	0.4571	0.4842	0.7705	0.9251	0.9746	0.9841 (94)
(95)m	484.9286	553.7682	621.6975	690.0505	671.9353	548.6486	366.6698	361.8902	504.8704	520.1033	477.7314	462.8578 (95)
(96)m	4.5000	5.0000	6.8000	8.7000	11.7000	14.6000	16.9000	16.9000	14.3000	10.8000	7.0000	4.9000 (96)
(97)m	1745.7794	1691.4007	1514.1293	1307.0993	983.7731	659.7924	389.6411	388.7707	687.1774	1057.9811	1455.1359	1685.2790 (97)
(98)m	938.0730	764.4891	663.9693	444.2751	232.0074	0.0000	0.0000	0.0000	0.0000	400.1810	703.7312	909.4813 (98)
Space heating (October to May) (kWh/year)												
Space heating requirement in kWh/m ² /year	(98) / (4) = 91.3002 (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)	0.1000 (201)
Fraction of space heat from main system(s)	0.9000 (202)
Efficiency of main space heating system 1 (in %)	78.9000 (206)
Efficiency of secondary/supplementary heating system, %	100.0000 (208)

Space heating:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m	938.0730	764.4891	663.9693	444.2751	232.0074	0.0000	0.0000	0.0000	0.0000	400.1810	703.7312	909.4813 (98)
(211)m	1070.0452	872.0407	757.3794	506.7777	264.6472	0.0000	0.0000	0.0000	0.0000	456.4803	802.7353	1037.4312 (211)
(215)m	93.8073	76.4489	66.3969	44.4275	23.2007	0.0000	0.0000	0.0000	0.0000	40.0181	70.3731	90.9481 (215)

Annual totals kWh/year												
Space heating fuel used, main system 1												5767.5370 (211)
Space heating fuel used, secondary												505.6207 (215)

Water heating	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(64)m	230.7673	204.5876	217.6623	199.0037	197.8299	180.8100	177.4933	189.4651	187.4697	206.1651	213.1154	226.5255 (64)
Efficiency of water heater												
(217)m	76.4896	76.3317	75.9241	75.2300	73.6406	68.8000	68.8000	68.8000	68.8000	74.8974	76.0878	68.8000 (217)
(219)m	301.6975	268.0245	286.6840	264.5270	268.6425	262.8052	257.9844	275.3853	272.4850	275.2635	280.0915	296.2404 (219)

Water heating fuel used												3309.8309 (219)
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Electricity for pumps, fans and electric keep-hot (Table 4f):												
central heating pump												130.0000 (230c)
boiler with a fan-assisted flue												45.0000 (230e)
Total electricity for the above, kWh/year												175.0000 (231)
Electricity for lighting (calculated in Appendix L)												431.7701 (232)

12a. CO2 emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5767.5370	0.1940	1118.9022 (261)
Space heating - secondary	505.6207	0.4220	213.3720 (263)
Water heating cost (other fuel)	3309.8309	0.1940	642.1072 (264)
Space and water heating			1974.3813 (265)
Pumps and fans	175.0000	0.4220	73.8500 (267)
Energy for lighting	431.7701	0.4220	182.2070 (268)
Total CO2, kg/year			2230.4383 (272)
Emissions per m ² for space and water heating			36.9850 (272a)
Emissions per m ² for lighting			3.2901 (272b)
Target Carbon Dioxide Emission Rate (TER)			25.0700 (273)
= [(36.9850 * 1.00 * 1.0206) + (3.2901 * 1.2251)] * 0.60			

SAP 2009 WORKSHEET FOR New Build (As Built) BRE SAP Worksheet 9.90
 CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING
 Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.04r04

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.3800 (1b)	x 2.4000 (2b)	= 132.9120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 132.9120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	+	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	+	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1505 (8)
Pressure test					Yes
Measured/design q50					5.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.4005 (18)
Number of sides on which dwelling is 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) = 0.3404 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.4000	5.1000	5.1000	4.5000	4.1000	3.9000	3.7000	3.7000	4.2000	4.5000	4.8000	5.1000 (22)
Wind factor	1.3500	1.2750	1.2750	1.1250	1.0250	0.9750	0.9250	0.9250	1.0500	1.1250	1.2000	1.2750 (22a)
(22b)m	0.4595	0.4340	0.4340	0.3830	0.3489	0.3319	0.3149	0.3149	0.3574	0.3830	0.4085	0.4340 (22b)
Effective ach	0.6056	0.5942	0.5942	0.5733	0.5609	0.5551	0.5496	0.5496	0.5639	0.5733	0.5834	0.5942 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Glazed Door			1.8900	1.5000	2.8350		(26)
DG24mm1.4 (Uw = 1.40)			17.9895	1.3258	23.8497		(27)
Ground Floor			55.3800	0.1800	9.9684		(28a)
External Wall 1	86.8800	19.8795	67.0005	0.2800	18.7601		(29a)
Main Roof	55.3800		55.3800	0.1400	7.7532		(30)
Total net area of external elements Aum(A, m ²)			197.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 63.1665		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							
Total fabric heat loss						(33) + (36) =	80.1433 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.5618	26.0615	26.0615	25.1467	24.6003	24.3462	24.1048	24.1048	24.7321	25.1467	25.5898	26.0615 (38)
(39)m	106.7051	106.2048	106.2048	105.2899	104.7436	104.4895	104.2480	104.2480	104.8754	105.2899	105.7331	106.2048 (39)
(40)m	1.9268	1.9177	1.9177	1.9012	1.8914	1.8868	1.8824	1.8824	Average = Sum(39)m / 12 = 1.8937		1.9012	1.9092
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 = 30		31	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												1.8485 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												82.2121 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	90.4333	87.1448	83.8564	80.5679	77.2794	73.9909	73.9909	77.2794	80.5679	83.8564	87.1448	90.4333 (44)
(45)m	134.4309	117.5741	121.3259	105.7749	101.4935	87.5812	81.1568	93.1287	94.2409	109.8287	119.8866	130.1891 (45)
Energy content (annual)	Total = Sum(45)m =											1296.6113 (45)
(46)m	20.1646	17.6361	18.1989	15.8662	15.2240	13.1372	12.1735	13.9693	14.1361	16.4743	17.9830	19.5284 (46)
Water storage loss:												
(57)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 (57)
(61)m	36.6697	33.0990	36.6102	35.3896	36.5403	35.3283	36.4852	36.5209	35.3617	36.5813	35.4473	36.6582 (61)
(62)m	171.1006	150.6731	157.9362	141.1644	138.0339	122.9095	117.6420	129.6496	129.6026	146.4100	155.3339	166.8473 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector performance ratio												2.5714 (H4)
Annual solar radiation per m ²												1073.0000 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1802.6400 (H7)
Solar-to-load ratio												1.3903 (H8)
Utilisation factor												0.5129 (H9)
Collector performance factor												0.8796 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												82.2121 (H14)
Volume ratio Veff/V												0.9123 (H15)
Solar storage volume factor												0.9816 (H16)
Solar input												-798.3170 (H17)
(63)m	-23.7308	-38.5817	-62.3781	-85.2996	-107.1276	-110.2334	-109.8397	-94.2452	-70.8643	-50.1737	-28.2145	-19.6627 (63)
Water heat.	147.3698	112.0914	95.5581	55.8648	30.9063	12.6761	7.8024	35.4045	58.7383	96.2364	127.1195	147.1847 (64)
Solar input (sum of months) = Sum(63)m =											-800.3511 (63)	
Total per year (kWh/year) = Sum(64)m =											926.9522 (64)	

(65)m 53.8657 47.3681 49.4934 44.0175 42.8817 37.9528 36.1059 40.0955 40.1755 45.6634 48.7241 52.4524 (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	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091	110.9091 (66)
(67)m	35.9198	31.9037	25.9458	19.6426	14.6831	12.3961	13.3944	17.4106	23.3684	29.6716	34.6311	36.9181 (67)
(68)m	240.5439	243.0399	236.7499	223.3591	206.4556	190.5686	179.9552	177.4591	183.7492	197.1400	214.0435	229.9304 (68)
(69)m	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394	47.9394 (69)
(70)m	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000 (70)
(71)m	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394	-73.9394 (71)
(72)m	72.4001	70.4883	66.5234	61.1355	57.6367	52.7123	48.5295	53.8918	55.7993	61.3755	67.6724	70.5006 (72)
(73)m	443.7729	440.3410	424.1282	399.0463	373.6844	350.5861	336.7882	343.6706	357.8260	383.0962	411.2561	432.2582 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.5825	10.7264	0.6300	0.7000	0.7700	24.8564 (74)
South	7.7670	47.3233	0.6300	0.7000	0.7700	112.3312 (78)
West	2.6400	19.8726	0.6300	0.7000	0.7700	16.0335 (80)

(83)m	153.2212	261.4647	350.5701	449.8775	521.6974	546.9841	528.5374	468.3469	391.9401	297.8061	183.6557	131.0147 (83)
(84)m	596.9941	701.8057	774.6983	848.9238	895.3818	897.5702	865.3256	812.0175	749.7662	680.9023	594.9118	563.2729 (84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	14.4167	14.4846	14.4846	14.6105	14.6867	14.7224	14.7565	14.7565	14.6682	14.6105	14.5492	14.4846
alpha	1.9611	1.9656	1.9656	1.9740	1.9791	1.9815	1.9838	1.9838	1.9779	1.9740	1.9699	1.9656
(86)m	0.9174	0.8887	0.8476	0.7908	0.6919	0.5636	0.4237	0.4445	0.6424	0.7994	0.8936	0.9215 (86)
(87)m	17.9217	18.2632	18.8334	19.4052	20.0908	20.5818	20.8437	20.8291	20.4338	19.6459	18.5803	17.9699 (87)
(88)m	19.3888	19.3949	19.3949	19.4060	19.4127	19.4158	19.4188	19.4188	19.4111	19.4060	19.4006	19.3949 (88)
(89)m	0.9031	0.8700	0.8207	0.7524	0.6296	0.4654	0.2830	0.2992	0.5488	0.7530	0.8727	0.9074 (89)
(90)m	15.5380	16.0162	16.8123	17.5990	18.5070	19.0982	19.3530	19.3459	18.9493	17.9509	16.4784	15.6112 (90)
Living area fraction									fLA = Living area / (4) =			0.5002 (91)
(92)m	16.7303	17.1401	17.8232	18.5024	19.2992	19.8403	20.0986	20.0878	19.6918	18.7987	17.5297	16.7910 (92)
Temperature adjustment												-0.1500
(93)m	16.5803	16.9901	17.6732	18.3524	19.1492	19.6903	19.9486	19.9378	19.5418	18.6487	17.3797	16.6410 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.8678	0.8322	0.7836	0.7214	0.6177	0.4842	0.3337	0.3509	0.5576	0.7256	0.8364	0.8730 (94)
(95)m	518.0811	584.0165	607.0377	612.4418	553.1081	434.6087	288.7830	284.9350	418.1053	494.0812	497.5843	491.7344 (95)
(96)m	4.5000	5.0000	6.8000	8.7000	11.7000	14.6000	16.9000	16.9000	14.3000	10.8000	7.0000	4.9000 (96)
(97)m	1289.0256	1273.4057	1154.7866	1016.3040	780.2557	531.8809	317.8151	316.6808	549.7394	826.3869	1097.4809	1246.9481 (97)
(98)m	573.5827	463.2696	407.5252	290.7808	168.9978	0.0000	0.0000	0.0000	0.0000	247.2355	431.9255	561.8790 (98)
Space heating (October to May) (kWh/year)												3145.1961 (98)
Space heating requirement in kWh/m2/year												(98) / (4) = 56.7930 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m	573.5827	463.2696	407.5252	290.7808	168.9978	0.0000	0.0000	0.0000	0.0000	247.2355	431.9255	561.8790 (98)
(211)m	637.3141	514.7440	452.8058	323.0898	187.7754	0.0000	0.0000	0.0000	0.0000	274.7061	479.9172	624.3100 (211)
(215)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 (215)

Annual totals kWh/year												
Space heating fuel used, main system 1												3494.6624 (211)
Space heating fuel used, secondary												0.0000 (215)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(64)m	147.3698	112.0914	95.5581	55.8648	30.9063	12.6761	7.8024	35.4045	58.7383	96.2364	127.1195	147.1847 (64)
Efficiency of water heater												86.6000 (216)
(217)m	89.2835	89.3168	89.3338	89.4341	89.4570	86.6000	86.6000	86.6000	86.6000	89.0207	89.2036	89.2725 (217)
(219)m	165.0583	125.4987	106.9675	62.4648	34.5487	14.6376	9.0096	40.8827	67.8271	108.1055	142.5048	164.8713 (219)

Water heating fuel used												1042.3767 (219)
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Electricity for pumps, fans and electric keep-hot (Table 4f):												
central heating pump												130.0000 (230c)
boiler with a fan-assisted flue												45.0000 (230e)
pump for solar water heating												75.0000 (230g)
Total electricity for the above, kWh/year												250.0000 (231)
Electricity for lighting (calculated in Appendix L)												253.7420 (232)

Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1073 * 0.80)												-1716.8000 (233)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3494.6624	3.1000	108.3345 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	1042.3767	3.1000	32.3137 (247)
Pumps and fans for heating	175.0000	11.4600	20.0550 (249)
Pump for solar water heating	75.0000	11.4600	8.5950 (249)
Energy for lighting	253.7420	11.4600	29.0788 (250)
Additional standing charges			106.0000 (251)
Energy saving/generation technologies			
PV Unit	-1716.8000	11.4600	-196.7453 (252)
Total energy cost			107.6318 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4700 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.5040 (257)
SAP value		92.9698
SAP rating (Section 12)		93 (258)
SAP band		A

10a. Fuel costs - using BEDF prices (396)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3494.6624	4.2800	149.5715 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	1042.3767	4.2800	44.6137 (247)
Pumps and fans for heating	175.0000	15.4400	27.0200 (249)
Pump for solar water heating	75.0000	15.4400	11.5800 (249)
Energy for lighting	253.7420	15.4400	39.1778 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit	-1716.8000	15.4400	-265.0739 (252)
Total energy cost			98.8891 (255)

12a. CO2 emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3494.6624	0.1980	691.9431 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	1042.3767	0.1980	206.3906 (264)
Space and water heating			898.3337 (265)
Pumps and fans	250.0000	0.5170	129.2500 (267)
Energy for lighting	253.7420	0.5170	131.1846 (268)
Energy saving/generation technologies			
PV Unit	-1716.8000	0.5290	-908.1872 (269)
Total CO2, kg/year			250.5811 (272)
CO2 emissions per m2			4.5200 (273)
EI value			96.6549
EI rating			97 (274)
EI band			A

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	3494.6624	1.0200	3564.5556 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	1042.3767	1.0200	1063.2242 (264)
Space and water heating			4627.7798 (265)
Pumps and fans	250.0000	2.9200	730.0000 (267)
Energy for lighting	253.7420	2.9200	740.9266 (268)
Energy saving/generation technologies			
PV Unit	-1716.8000	2.9200	-5013.0560 (269)
Primary energy kWh/year			1085.6505 (272)
Primary energy kWh/m2/year			19.6037 (273)

REGULATIONS COMPLIANCE REPORT - Technical Booklet F1, 2012 Edition
 Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.04r04

New Build (As Built)

1 TER and DER

Fuel for main heating:Mains gas
 Fuel factor:1.00 (mains gas)
 Target Carbon Dioxide Emission Rate (TER) 25.07 kg/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 24.60 kg/m²OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.28 (max. 0.70)	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.50 (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 (measured in this dwelling)
 Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
 Data from database
 Vokera Vision 25C
 Combi boiler
 Efficiency: 89.1% SEDBUK2009
 Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Northern Ireland): Slight OK

Based on:

Overshading: Average
 Windows facing North: 7.58 m², No overhang
 Windows facing South: 7.77 m², No overhang
 Windows facing West: 2.64 m², No overhang
 Ventilation rate: 2.00
 Blinds/curtains: None

10 Key features

Floor U-value 0.18 W/m²K
 Window U-value 1.40 W/m²K

SAP 2009 OVERHEATING ASSESSMENT FOR New Build (As Built) BRE SAP Worksheet 9.90
 Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.04r04

Overheating Calculation Input Data

Dwelling type Detached Bungalow
 Number of storeys 1
 Cross ventilation possible No
 Region Northern Ireland
 Front of dwelling faces North
 Overshading Average or unknown
 Thermal mass parameter 100.0
 Night ventilation No
 Ventilation rate during hot weather (ach) 2.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient 87.72 (P1)
 Transmission heat loss coefficient 80.14 (37)
 Summer heat loss coefficient 167.87 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Shading	Gains W
North	7.5825	70.2048	0.6300	0.7000	0.9000	190.1528
South	7.7670	98.3100	0.6300	0.7000	0.9000	272.7561
West	2.6400	102.0438	0.6300	0.7000	0.9000	96.2308
total:						559.1397

	Jun	Jul	Aug	
Solar gains	598	559	515	(P3)
Internal gains	341	327	334	
Total summer gains	939	886	849	(P5)
Summer gain/loss ratio	5.59	5.28	5.05	(P6)
Summer external temperature	13.40	15.40	15.20	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.29	21.98	21.55	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

SAP 2009 IMPROVEMENTS
 Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.04r04

000004

Current energy efficiency rating: C 79
 Current environmental impact rating: B 83

(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
L	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
Q	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic (PV) panels	Recommended
V Wind turbine	SAP increase too small

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 28	-142 kg (10.9%)
U Solar photovoltaic (PV) panels	+ 12.9	-£ 265	-908 kg (78.4%)

Measures omitted - SAP change or cost saving too small:			
V Wind turbine	+ 0.5	-£ 10	-33 kg (13.0%)

	Typical annual savings	Energy efficiency	Environmental impact
Lower cost measures (none)			
Sub Total	£0	0.00 kg/m ²	
Higher cost measures (none)			
Sub Total	£0	0.00 kg/m ²	

Potential energy efficiency rating: C 79
 Potential environmental impact rating: B 83

Further improvements to achieve even higher standards

Solar water heating	£28	2.57 kg/m ²	C 80	B 85
Solar photovoltaic	£265	16.40 kg/m ²	A 93	A 97
Total Savings	£293	18.97 kg/m ²		

Enhanced energy efficiency rating: A 93
 Enhanced environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 396 TEST (25 Jul 2016)
 Recommendation texts revision number 4.6 (10 Dec 2012)

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

	Current	Potential	Enhanced
Electricity	£66	£66	£78
Mains gas	£325	£325	£286
Space heating	£269	£269	£269
Water heating	£84	£84	£56
Lighting	£39	£39	£39
Generated (PV)	-£0	-£0	-£265
Total cost	£391	£391	£99
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.3 tonnes
Primary energy	123 kWh/m ²	123 kWh/m ²	20 kWh/m ²

Summary Information

Property Reference: 000004
Survey Reference: 000004

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

Property: 1, Moor Road, DUNGANNON, County Tyrone, BT71 6HF

SAP Rating: 79 C **CO2 Emissions (t/year):** 1.30 **DER:** 24.60 Pass **Reduction:** 1.9% **FEE:** 70.7 **ZC8:** 0.00
Environmental: 83 B **General Requirements Compliance:** Pass **TER:** 25.07 **HLP:** 1.90 **Energy cost:** £ 392

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: Conor Loughran, Tel: 028 807 60819 **Surveyor ID:** 7181-0001

Address: Aughnagreggan Rd, Carrickmore, Tyrone, BT79 9JZ

Client:

Software Version: Elmhurst Energy Systems SAP2009 Calculator (Design System) version 4.04r04

SAP version: SAP 2009, **Regs Region:** Northern Ireland (NI Technical Booklet F1 2011), **Calculation Type:** New Dwelling As Built

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Page 23 of 27

Orientation North
1.0 Property Type Bungalow, Detached
2.0 Number of Storeys 1
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

	Internal Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	36.2	55.38	2.4

7.0 Living Area 27.7

8.0 Thermal Mass Parameter Simple calculation - Low

9.0 External Walls

Description	Construction	U-Value	Element	Kappa	Gross Area	Nett Area
External Wall 1	Timber framed wall (one layer of plasterboard)	0.28		9.00	86.88	67.00

10.0 External Roofs

Description	Construction	U-Value	Element	Kappa	Gross Area	Nett Area
Main Roof	Plasterboard, insulated at ceiling level	0.14		9	55.38	55.38

11.0 HeatLoss Floors

Description	Construction	U-Value	Element	Kappa	Area
Ground Floor	Suspended timber, insulation between joists	0.18		20	55.38

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	Solar Trans	Frame Type	Frame Factor	U value
DG24mm1.4	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.40
Glazed Door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width	Height	Count	Area	Curtain Closed
Front	Half Glazed Door - Glazed Door	External Wall 1	North	None	0	No	0	0	0	1.89	0
Front	Window - DG24mm1.4	External Wall 1	North	None	0	No	0	0	0	7.58	0
Rear	Window - DG24mm1.4	External Wall 1	South	None	0	No	0	0	0	7.77	0
Left	Window - DG24mm1.4	External Wall 1	West	None	0	No	0	0	0	2.64	0

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
	E1 Steel lintel with perforated steel base plate	0.00		No
Table K1 - Accredited	E2 Other lintels (including other steel lintels)	14.92	0.3	Yes
Table K1 - Accredited	E3 Sill	12.32	0.04	No
Table K1 - Accredited	E4 Jamb	36.00	0.05	Yes
Table K1 - Accredited	E5 Ground floor	36.20	0.16	Yes
	E6 Intermediate floor within a dwelling	0.00		No
	E7 Intermediate floor between dwellings (in blocks of flats)	0.00		No
	E8 Balcony within a dwelling	0.00		No
	E9 Balcony between dwellings	0.00		No
Table K1 - Accredited	E10 Eaves (insulation at ceiling level)	28.00	0.06	No
	E11 Eaves (insulation at rafter level)	0.00		No
Table K1 - Accredited	E12 Gable (insulation at ceiling level)	7.80	0.24	No
	E13 Gable (insulation at rafter level)	0.00		No
	E14 Flat roof	0.00		No
	E15 Flat roof with parapet	0.00		No
Table K1 - Accredited	E16 Corner (normal)	9.60	0.09	Yes
	E17 Corner (inverted - internal area greater than external area)	0.00		No
	E18 Party wall between dwellings	0.00		No
	P1 Party wall - Ground floor	0.00		No
	P2 Party wall - Intermediate floor within a dwelling	0.00		No
	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	0.00		No
	P4 Party wall - Roof (insulation at ceiling level)	0.00		No
	P5 Party wall - Roof (insulation at rafter level)	0.00		No
18.0 Pressure Testing	Yes			
Designed q50	5.00			
Property Tested ?	Yes			
As Built q50	5.00			
Same As Designed ?				
19.0 Mechanical Ventilation				
Mechanical Ventilation System	No			
Present				
Approved Installation				
Windows open in hot weather	Windows half open			
Cross ventilation possible	No			
Night Ventilation	No			
Air change rate	2.00			
Mechanical Ventilation data Type				
Type				
MV Reference Number				
Configuration				
MVHR Duct Insulated				
Manufacturer SFP				
Duct Type				
MVHR Efficiency				
Wet Rooms				
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				2
Number of passive vents				0
Number of flueless gas fires				0
21.0 Cooling System	No			
22.0 Lighting				
Internal				
Total number of light fittings	8			
Total number of L.E.L. fittings	8			
Percentage of L.E.L. fittings	100.00			
External				
External lights fitted	No			
Light and motion sensors				
23.0 Electricity Tariff	Standard			

24.0 Heating Systems		
Main Heating 1	Database	
Description		
Percentage of Heat	100.00	
Main Heating 2	None	
Description		
Percentage of Heat		
Community Heating		
Secondary Heating		
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery System	No	
1		
Waste Water Heat Recovery System	No	
2		
Solar Panel	No	
25.0 Main Heating 1		
Database Ref. No.	16976	
Fuel Type	Mains gas	
Main Heating	Mains gas BGW Post 98 Combi condens. with auto ign.	
TestMethod		
SAP Code	104	
Efficiency (Split Efficiencies) %		
Efficiency (Split Efficiencies) %		
In Winter	90	
In Summer	86.6	
Model Name		
Manufacturer		
Controls	CBI Time and temperature zone control	
Delayed Start Stat	Yes	
Sap Code	2110	
Burner Control		
Boiler Compensator	None	
HETAS approved System		
Oil Pump Inside		
FI Case		
FI Water		
Flue Type	Balanced	
Smoke Control Area		
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Underfloor Heating		
Electric CPSU Temperature		
Combi boiler type	Standard Combi	
Combi keep hot type	None	
Combi store type		
27.0 Community Heating		
Space Community Heating		
Distribution Loss		
Distribution Loss Value		
Controls		
SAP Code		
Water Community Heating		
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		
Water use <= 125 litres/person/day	No	HWP From main heating 1
SAP Code	901	
Immersion Heater		
Summer Immersion		
Supplementary Immersion		
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	None		
Cylinder Stat			
Cylinder In Heated Space			
Independent Time Control			
Insulation Type			
Insulation Thickness			
Cylinder Volume			
Loss (kwh/day)			
Pipes insulation			
In Airing Cupboard			
<hr/>			
31.0 Solar Panel			
Solar Panel Area			
Area Type			
Panel Type			
n0, a1, A/G ratio			
Orientation			
Elevation			
Overshading			
Solar Storage Volume			
Pump electrically powered			
Combined Cylinder			
<hr/>			
32.0 Thermal Store	None		
Thermal Store Pipework within a single casing			
33.0 Photovoltaic Unit			
Apportioned KWh/Year			
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			
<hr/>			
Recommendations			
None			
Further measures to achieve even higher standards			
Solar water heating	£28	C 80	B 85
Solar photovoltaic panels, 2.5 kWp	£265	A 93	A 97

Thermal Bridging

Property Reference: 000004

Issued on Date: 01.Sep.2016

Survey Reference: 000004

Prop Type Ref:
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SAP Rating: 79 C	CO2 Emissions (t/year): 1.30	DER: 24.60 Pass	Reduction: 1.9%	FEE: 70.7	ZC8: 0.00
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Client:
Software Version: Elmhurst Energy Systems SAP2009 Calculator (Design System) version 4.04r04

SAP version: SAP 2009, Regs Region: Northern Ireland (NI Technical Booklet F1 2011), Calculation Type: New Dwelling As Built

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Accredited	0.300	14.92	4.48	
External wall	E3 Sill	Table K1 - Accredited	0.040	12.32	0.49	
External wall	E4 Jamb	Table K1 - Accredited	0.050	36.00	1.80	
External wall	E5 Ground floor	Table K1 - Accredited	0.160	36.20	5.79	
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Accredited	0.060	28.00	1.68	
External wall	E12 Gable (insulation at ceiling level)	Table K1 - Accredited	0.240	7.80	1.87	
External wall	E16 Corner (normal)	Table K1 - Accredited	0.090	9.60	0.86	

Total W/mK: 16.98
 Y-Value W/m2K: 0.086