Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

Assessor and House Details

Assessor Name: Behdad Yazdani **Assessor Number:** STRO002254

Property Address: 469 Gander Green Lane
Cheam
SUTTON
SM3 9RA

Buiding regulation assessment

	kg/m²/year
TER	14.88
DER	29.04

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO_2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2012 DER Worksheet		29.04	*(ZC1)*
TER		14.88	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		29.04	
% improvement DER/TER	0		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	29.04	*(ZC1)*
CO2 emissions from appliances, equation (L14)	14.62	*(ZC2)*
CO2 emissions from cooking, equation (L16)	1.71	*(ZC3)*
Net CO2 emissions	45.7	*(ZC8)*

Result:

Credits awarded for ENE 1 = 0

Code Level = 0

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 92.89

Credits awarded for ENE 2 = 0

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		45.67
Standard DER		29.34
Actual Case CO2 emissions		45.67
Actual DER		29.34
Reduction in CO2 emissions	0	

Credits awarded for ENE 7 = 0

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

SAP Input

Property Details: NOTIONAL

Address:	469 Gander Green Lane, Cheam, SUTTON, SM3 9RA
Located in:	England
Region:	Thames valley
UPRN:	UPRN-005870024458
Date of assessment:	25 March 2022
Date of certificate:	25 March 2022
Assessment type:	New extension to existing dwelling
Transaction type:	Non marketed sale
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	False
PCDF Version:	492

Property description:

Dwelling type:	House
Detachment:	Mid-terrace
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	49.16 m²	2.41 m
Floor 1	36.2 m²	2.6 m
Floor 2	23.7 m²	2 m

Living area:	12.21 m² (fraction 0.112)
Front of dwelling faces:	North East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
DR	Manufacturer	Solid			PVC-U
new	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
old	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
SE	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
S	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
W	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
SW	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
SW	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
RF	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
RF	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
DR	mm	0.7	0	1	2	1
new	16mm or more	0.7	0.63	1.6	12.68	1
old	16mm or more	0.7	0.63	1.7	7.87	1
SE	16mm or more	0.7	0.63	1.7	0.64	1
E	16mm or more	0.7	0.63	1.7	0.92	1
N	16mm or more	0.7	0.63	1.7	0.92	1
S	16mm or more	0.7	0.63	1.7	0.69	1
W	16mm or more	0.7	0.63	1.7	0.69	1
SW	16mm or more	0.7	0.63	1.7	4.88	1
SW	16mm or more	0.7	0.63	1.6	1.98	1
RF	16mm or more	0.7	0.63	1.6	1.7	1
RF	16mm or more	0.7	0.63	1.6	1.7	1

SAP Input

Name:	Type-Name:	Location:	Orient:	Width:	Height:
DR		OLD WALL	North East	0	0
new		NEW WALL	South West	0	0
old		OLD WALL	North East	0	0
SE		OLD WALL	South East	0	0
E		OLD WALL	East	0	0
N		OLD WALL	North	0	0
S		OLD WALL	South	0	0
W		OLD WALL	West	0	0
SW		OLD WALL	South West	0	0
SW		DORM	South West	0	0
RF		new ROOF	South West	0.001	0
RF		new ROOF	South West	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OLD WALL	45.283	18.61	26.67	1.96	0	False	N/A
NEW WALL	18.991	12.68	6.31	0.28	0	False	N/A
STUDS	10.571	0	10.57	0.28	0.5	False	N/A
DORM	10.32	1.98	8.34	0.28	0	False	N/A
old ROOF	13.5	0	13.5	0.13	0.5		N/A
new ROOF	13	3.4	9.6	0.18	0		N/A
TOP	8.272	0	8.27	0.16	0		N/A
SLOP	16.73	0	16.73	0.16	0		N/A
old FLOOR	35.27			0.6			N/A
new floor	14.1			0.22			N/A
Internal Elements							
Party Elements							
MID	92.137						N/A

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Ventilation:

Pressure test:	No (Assumed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	4
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	15

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Manufacturer Declaration
Manufacturer's data
Efficiency: 89.0% (SEDBUK2009)
Condensing combi with automatic ignition
Fuel Burning Type: Modulation
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Unknown

SAP Input

	Room-sealed Boiler interlock: Yes
Main heating Control:	
Main heating Control:	Programmer, room thermostat and TRVs Control code: 2106
Secondary heating system:	
Secondary heating system:	None
Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Solar panel: False
Others:	
Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

DER WorkSheet: New extension to existing dwelling

User Details:

Assessor Name:	Behdad Yazdani	**Stroma Number:**	STRO002254
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: NOTIONAL

Address : 469 Gander Green Lane, Cheam, SUTTON, SM3 9RA

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	49.16	(1a)	x	2.41	(2a)	=	118.48	(3a)
First floor	36.2	(1b)	x	2.6	(2b)	=	94.12	(3b)
Second floor	23.7	(1c)	x	2	(2c)	=	47.4	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	109.06	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	260	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.9	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.77	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New extension to existing dwelling

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.98	0.96	0.94	0.85	0.83	0.73	0.73	0.71	0.77	0.83	0.86	0.9

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.98	0.96	0.94	0.86	0.84	0.77	0.77	0.75	0.8	0.84	0.87	0.91	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.98	0.96	0.94	0.86	0.84	0.77	0.77	0.75	0.8	0.84	0.87	0.91	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2	x	1	=	2			(26)
Windows Type 1			12.68	x1/[1/(1.6)+ 0.04]		=	19.07			(27)
Windows Type 2			7.87	x1/[1/(1.7)+ 0.04]		=	12.53			(27)
Windows Type 3			0.64	x1/[1/(1.7)+ 0.04]		=	1.02			(27)
Windows Type 4			0.92	x1/[1/(1.7)+ 0.04]		=	1.46			(27)
Windows Type 5			0.92	x1/[1/(1.7)+ 0.04]		=	1.46			(27)
Windows Type 6			0.69	x1/[1/(1.7)+ 0.04]		=	1.1			(27)
Windows Type 7			0.69	x1/[1/(1.7)+ 0.04]		=	1.1			(27)
Windows Type 8			4.88	x1/[1/(1.7)+ 0.04]		=	7.77			(27)
Windows Type 9			1.98	x1/[1/(1.6)+ 0.04]		=	2.98			(27)
Rooflights Type 1			1.7	x1/[1/(1.6) + 0.04]		=	2.72			(27b)
Rooflights Type 2			1.7	x1/[1/(1.6) + 0.04]		=	2.72			(27b)
Floor Type 1			35.27	x	0.6	=	21.162			(28)
Floor Type 2			14.1	x	0.22	=	3.102			(28)
Walls Type1	45.28	18.61	26.67	x	1.96	=	52.28			(29)
Walls Type2	18.99	12.68	6.31	x	0.28	=	1.77			(29)
Walls Type3	10.57	0	10.57	x	0.25	=	2.6			(29)

DER WorkSheet: New extension to existing dwelling

Walls Type4	10.32	1.98	8.34	x	0.28	=	2.34			(29)
Roof Type1	13.5	0	13.5	x	0.12	=	1.65			(30)
Roof Type2	13	3.4	9.6	x	0.18	=	1.73			(30)
Roof Type3	8.27	0	8.27	x	0.16	=	1.32			(30)
Roof Type4	16.73	0	16.73	x	0.16	=	2.68			(30)
Total area of elements, m²			186.04							(31)
Party wall			92.14	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	146.21	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	23300.3	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		27.91	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	174.12	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	84.06	82.46	80.9	73.54	72.16	65.75	65.75	64.56	68.22	72.16	74.95	77.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	258.18	256.58	255.02	247.66	246.28	239.87	239.87	238.69	242.34	246.28	249.07	251.98

Average = $Sum(39)_{1…12}$ /12= 247.65 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	2.37	2.35	2.34	2.27	2.26	2.2	2.2	2.19	2.22	2.26	2.28	2.31

Average = $Sum(40)_{1…12}$ /12= 2.27 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.81 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.23 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	116.85	112.6	108.35	104.1	99.85	95.6	95.6	99.85	104.1	108.35	112.6	116.85

Total = $Sum(44)_{1…12}$ = 1274.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.28	151.56	156.39	136.35	130.83	112.89	104.61	120.04	121.48	141.57	154.54	167.82

Total = $Sum(45)_{1…12}$ = 1671.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.99	22.73	23.46	20.45	19.62	16.93	15.69	18.01	18.22	21.24	23.18	25.17	(46)

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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.96	49.32	50.88	47.15	48.72	50.88	49.32	50.96	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	224.24	197.58	207.35	185.66	181.71	160.04	153.33	170.93	170.79	192.53	203.85	218.78	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	224.24	197.58	207.35	185.66	181.71	160.04	153.33	170.93	170.79	192.53	203.85	218.78

Output from water heater (annual)1…12 — 2266.8 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	70.36	61.9	64.74	57.66	56.22	49.32	46.96	52.64	52.72	59.81	63.71	68.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	140.45	140.45	140.45	140.45	140.45	140.45	140.45	140.45	140.45	140.45	140.45	140.45	(66)

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

(67)m=	24.09	21.4	17.4	13.17	9.85	8.31	8.98	11.68	15.67	19.9	23.22	24.76	(67)

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

(68)m=	270.2	273	265.94	250.9	231.91	214.06	202.14	199.34	206.4	221.44	240.43	258.28	(68)

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

(69)m=	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-112.36	-112.36	-112.36	-112.36	-112.36	-112.36	-112.36	-112.36	-112.36	-112.36	-112.36	-112.36	(71)

Water heating gains (Table 5)

(72)m=	94.57	92.11	87.02	80.09	75.57	68.51	63.12	70.75	73.22	80.39	88.49	92.12	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	456.99	454.65	438.49	412.29	385.46	359.02	342.38	349.9	363.43	389.87	420.28	443.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.92	x	10.63	x	0.63	x	0.7	=	2.99	(74)
North	0.9x	0.77	x	0.92	x	20.32	x	0.63	x	0.7	=	5.71	(74)
North	0.9x	0.77	x	0.92	x	34.53	x	0.63	x	0.7	=	9.71	(74)
North	0.9x	0.77	x	0.92	x	55.46	x	0.63	x	0.7	=	15.59	(74)
North	0.9x	0.77	x	0.92	x	74.72	x	0.63	x	0.7	=	21.01	(74)
North	0.9x	0.77	x	0.92	x	79.99	x	0.63	x	0.7	=	22.49	(74)
North	0.9x	0.77	x	0.92	x	74.68	x	0.63	x	0.7	=	21	(74)
North	0.9x	0.77	x	0.92	x	59.25	x	0.63	x	0.7	=	16.66	(74)
North	0.9x	0.77	x	0.92	x	41.52	x	0.63	x	0.7	=	11.67	(74)
North	0.9x	0.77	x	0.92	x	24.19	x	0.63	x	0.7	=	6.8	(74)
North	0.9x	0.77	x	0.92	x	13.12	x	0.63	x	0.7	=	3.69	(74)
North	0.9x	0.77	x	0.92	x	8.86	x	0.63	x	0.7	=	2.49	(74)
Northeast	0.9x	0.77	x	7.87	x	11.28	x	0.63	x	0.7	=	27.14	(75)
Northeast	0.9x	0.77	x	7.87	x	22.97	x	0.63	x	0.7	=	55.24	(75)
Northeast	0.9x	0.77	x	7.87	x	41.38	x	0.63	x	0.7	=	99.52	(75)
Northeast	0.9x	0.77	x	7.87	x	67.96	x	0.63	x	0.7	=	163.45	(75)
Northeast	0.9x	0.77	x	7.87	x	91.35	x	0.63	x	0.7	=	219.7	(75)
Northeast	0.9x	0.77	x	7.87	x	97.38	x	0.63	x	0.7	=	234.23	(75)
Northeast	0.9x	0.77	x	7.87	x	91.1	x	0.63	x	0.7	=	219.11	(75)
Northeast	0.9x	0.77	x	7.87	x	72.63	x	0.63	x	0.7	=	174.68	(75)
Northeast	0.9x	0.77	x	7.87	x	50.42	x	0.63	x	0.7	=	121.27	(75)
Northeast	0.9x	0.77	x	7.87	x	28.07	x	0.63	x	0.7	=	67.51	(75)
Northeast	0.9x	0.77	x	7.87	x	14.2	x	0.63	x	0.7	=	34.15	(75)
Northeast	0.9x	0.77	x	7.87	x	9.21	x	0.63	x	0.7	=	22.16	(75)
East	0.9x	0.77	x	0.92	x	19.64	x	0.63	x	0.7	=	5.52	(76)
East	0.9x	0.77	x	0.92	x	38.42	x	0.63	x	0.7	=	10.8	(76)

DER WorkSheet: New extension to existing dwelling

East	0.9x	0.77	x	0.92	x	63.27	x	0.63	x	0.7	=	17.79	(76)
East	0.9x	0.77	x	0.92	x	92.28	x	0.63	x	0.7	=	25.95	(76)
East	0.9x	0.77	x	0.92	x	113.09	x	0.63	x	0.7	=	31.8	(76)
East	0.9x	0.77	x	0.92	x	115.77	x	0.63	x	0.7	=	32.55	(76)
East	0.9x	0.77	x	0.92	x	110.22	x	0.63	x	0.7	=	30.99	(76)
East	0.9x	0.77	x	0.92	x	94.68	x	0.63	x	0.7	=	26.62	(76)
East	0.9x	0.77	x	0.92	x	73.59	x	0.63	x	0.7	=	20.69	(76)
East	0.9x	0.77	x	0.92	x	45.59	x	0.63	x	0.7	=	12.82	(76)
East	0.9x	0.77	x	0.92	x	24.49	x	0.63	x	0.7	=	6.89	(76)
East	0.9x	0.77	x	0.92	x	16.15	x	0.63	x	0.7	=	4.54	(76)
Southeast	0.9x	0.77	x	0.64	x	36.79	x	0.63	x	0.7	=	7.2	(77)
Southeast	0.9x	0.77	x	0.64	x	62.67	x	0.63	x	0.7	=	12.26	(77)
Southeast	0.9x	0.77	x	0.64	x	85.75	x	0.63	x	0.7	=	16.77	(77)
Southeast	0.9x	0.77	x	0.64	x	106.25	x	0.63	x	0.7	=	20.78	(77)
Southeast	0.9x	0.77	x	0.64	x	119.01	x	0.63	x	0.7	=	23.28	(77)
Southeast	0.9x	0.77	x	0.64	x	118.15	x	0.63	x	0.7	=	23.11	(77)
Southeast	0.9x	0.77	x	0.64	x	113.91	x	0.63	x	0.7	=	22.28	(77)
Southeast	0.9x	0.77	x	0.64	x	104.39	x	0.63	x	0.7	=	20.42	(77)
Southeast	0.9x	0.77	x	0.64	x	92.85	x	0.63	x	0.7	=	18.16	(77)
Southeast	0.9x	0.77	x	0.64	x	69.27	x	0.63	x	0.7	=	13.55	(77)
Southeast	0.9x	0.77	x	0.64	x	44.07	x	0.63	x	0.7	=	8.62	(77)
Southeast	0.9x	0.77	x	0.64	x	31.49	x	0.63	x	0.7	=	6.16	(77)
South	0.9x	0.77	x	0.69	x	46.75	x	0.63	x	0.7	=	9.86	(78)
South	0.9x	0.77	x	0.69	x	76.57	x	0.63	x	0.7	=	16.15	(78)
South	0.9x	0.77	x	0.69	x	97.53	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	0.69	x	110.23	x	0.63	x	0.7	=	23.25	(78)
South	0.9x	0.77	x	0.69	x	114.87	x	0.63	x	0.7	=	24.22	(78)
South	0.9x	0.77	x	0.69	x	110.55	x	0.63	x	0.7	=	23.31	(78)
South	0.9x	0.77	x	0.69	x	108.01	x	0.63	x	0.7	=	22.78	(78)
South	0.9x	0.77	x	0.69	x	104.89	x	0.63	x	0.7	=	22.12	(78)
South	0.9x	0.77	x	0.69	x	101.89	x	0.63	x	0.7	=	21.48	(78)
South	0.9x	0.77	x	0.69	x	82.59	x	0.63	x	0.7	=	17.42	(78)
South	0.9x	0.77	x	0.69	x	55.42	x	0.63	x	0.7	=	11.69	(78)
South	0.9x	0.77	x	0.69	x	40.4	x	0.63	x	0.7	=	8.52	(78)
Southwest	0.9x	0.77	x	12.68	x	36.79		0.63	x	0.7	=	142.58	(79)
Southwest	0.9x	0.77	x	4.88	x	36.79		0.63	x	0.7	=	54.87	(79)
Southwest	0.9x	0.77	x	1.98	x	36.79		0.63	x	0.7	=	22.26	(79)
Southwest	0.9x	0.77	x	12.68	x	62.67		0.63	x	0.7	=	242.87	(79)
Southwest	0.9x	0.77	x	4.88	x	62.67		0.63	x	0.7	=	93.47	(79)
Southwest	0.9x	0.77	x	1.98	x	62.67		0.63	x	0.7	=	37.92	(79)
Southwest	0.9x	0.77	x	12.68	x	85.75		0.63	x	0.7	=	332.31	(79)

DER WorkSheet: New extension to existing dwelling

Southwest	0.9x	0.77	x	4.88	x	85.75		0.63	x	0.7	=	127.89	(79)
Southwest	0.9x	0.77	x	1.98	x	85.75		0.63	x	0.7	=	51.89	(79)
Southwest	0.9x	0.77	x	12.68	x	106.25		0.63	x	0.7	=	411.74	(79)
Southwest	0.9x	0.77	x	4.88	x	106.25		0.63	x	0.7	=	158.46	(79)
Southwest	0.9x	0.77	x	1.98	x	106.25		0.63	x	0.7	=	64.29	(79)
Southwest	0.9x	0.77	x	12.68	x	119.01		0.63	x	0.7	=	461.19	(79)
Southwest	0.9x	0.77	x	4.88	x	119.01		0.63	x	0.7	=	177.49	(79)
Southwest	0.9x	0.77	x	1.98	x	119.01		0.63	x	0.7	=	72.01	(79)
Southwest	0.9x	0.77	x	12.68	x	118.15		0.63	x	0.7	=	457.85	(79)
Southwest	0.9x	0.77	x	4.88	x	118.15		0.63	x	0.7	=	176.21	(79)
Southwest	0.9x	0.77	x	1.98	x	118.15		0.63	x	0.7	=	71.49	(79)
Southwest	0.9x	0.77	x	12.68	x	113.91		0.63	x	0.7	=	441.42	(79)
Southwest	0.9x	0.77	x	4.88	x	113.91		0.63	x	0.7	=	169.88	(79)
Southwest	0.9x	0.77	x	1.98	x	113.91		0.63	x	0.7	=	68.93	(79)
Southwest	0.9x	0.77	x	12.68	x	104.39		0.63	x	0.7	=	404.53	(79)
Southwest	0.9x	0.77	x	4.88	x	104.39		0.63	x	0.7	=	155.69	(79)
Southwest	0.9x	0.77	x	1.98	x	104.39		0.63	x	0.7	=	63.17	(79)
Southwest	0.9x	0.77	x	12.68	x	92.85		0.63	x	0.7	=	359.82	(79)
Southwest	0.9x	0.77	x	4.88	x	92.85		0.63	x	0.7	=	138.48	(79)
Southwest	0.9x	0.77	x	1.98	x	92.85		0.63	x	0.7	=	56.19	(79)
Southwest	0.9x	0.77	x	12.68	x	69.27		0.63	x	0.7	=	268.42	(79)
Southwest	0.9x	0.77	x	4.88	x	69.27		0.63	x	0.7	=	103.31	(79)
Southwest	0.9x	0.77	x	1.98	x	69.27		0.63	x	0.7	=	41.91	(79)
Southwest	0.9x	0.77	x	12.68	x	44.07		0.63	x	0.7	=	170.78	(79)
Southwest	0.9x	0.77	x	4.88	x	44.07		0.63	x	0.7	=	65.73	(79)
Southwest	0.9x	0.77	x	1.98	x	44.07		0.63	x	0.7	=	26.67	(79)
Southwest	0.9x	0.77	x	12.68	x	31.49		0.63	x	0.7	=	122.02	(79)
Southwest	0.9x	0.77	x	4.88	x	31.49		0.63	x	0.7	=	46.96	(79)
Southwest	0.9x	0.77	x	1.98	x	31.49		0.63	x	0.7	=	19.05	(79)
West	0.9x	0.77	x	0.69	x	19.64	x	0.63	x	0.7	=	4.14	(80)
West	0.9x	0.77	x	0.69	x	38.42	x	0.63	x	0.7	=	8.1	(80)
West	0.9x	0.77	x	0.69	x	63.27	x	0.63	x	0.7	=	13.34	(80)
West	0.9x	0.77	x	0.69	x	92.28	x	0.63	x	0.7	=	19.46	(80)
West	0.9x	0.77	x	0.69	x	113.09	x	0.63	x	0.7	=	23.85	(80)
West	0.9x	0.77	x	0.69	x	115.77	x	0.63	x	0.7	=	24.41	(80)
West	0.9x	0.77	x	0.69	x	110.22	x	0.63	x	0.7	=	23.24	(80)
West	0.9x	0.77	x	0.69	x	94.68	x	0.63	x	0.7	=	19.96	(80)
West	0.9x	0.77	x	0.69	x	73.59	x	0.63	x	0.7	=	15.52	(80)
West	0.9x	0.77	x	0.69	x	45.59	x	0.63	x	0.7	=	9.61	(80)
West	0.9x	0.77	x	0.69	x	24.49	x	0.63	x	0.7	=	5.16	(80)
West	0.9x	0.77	x	0.69	x	16.15	x	0.63	x	0.7	=	3.41	(80)

Rooflights 0.9x	1	x	1.7	x	26	x	0.63	x	0.7	=	17.54	(82)
Rooflights 0.9x	1	x	1.7	x	38.23	x	0.63	x	0.7	=	25.8	(82)
Rooflights 0.9x	1	x	1.7	x	54	x	0.63	x	0.7	=	36.44	(82)
Rooflights 0.9x	1	x	1.7	x	71.75	x	0.63	x	0.7	=	48.41	(82)
Rooflights 0.9x	1	x	1.7	x	96	x	0.63	x	0.7	=	64.77	(82)
Rooflights 0.9x	1	x	1.7	x	112.53	x	0.63	x	0.7	=	75.93	(82)
Rooflights 0.9x	1	x	1.7	x	150	x	0.63	x	0.7	=	101.21	(82)
Rooflights 0.9x	1	x	1.7	x	158.21	x	0.63	x	0.7	=	106.75	(82)
Rooflights 0.9x	1	x	1.7	x	192	x	0.63	x	0.7	=	129.55	(82)
Rooflights 0.9x	1	x	1.7	x	190.52	x	0.63	x	0.7	=	128.55	(82)
Rooflights 0.9x	1	x	1.7	x	200	x	0.63	x	0.7	=	134.95	(82)
Rooflights 0.9x	1	x	1.7	x	193.98	x	0.63	x	0.7	=	130.88	(82)
Rooflights 0.9x	1	x	1.7	x	189	x	0.63	x	0.7	=	127.52	(82)
Rooflights 0.9x	1	x	1.7	x	185.08	x	0.63	x	0.7	=	124.88	(82)
Rooflights 0.9x	1	x	1.7	x	157	x	0.63	x	0.7	=	105.93	(82)
Rooflights 0.9x	1	x	1.7	x	160.91	x	0.63	x	0.7	=	108.57	(82)
Rooflights 0.9x	1	x	1.7	x	115	x	0.63	x	0.7	=	77.59	(82)
Rooflights 0.9x	1	x	1.7	x	128.69	x	0.63	x	0.7	=	86.83	(82)
Rooflights 0.9x	1	x	1.7	x	66	x	0.63	x	0.7	=	44.53	(82)
Rooflights 0.9x	1	x	1.7	x	83.48	x	0.63	x	0.7	=	56.33	(82)
Rooflights 0.9x	1	x	1.7	x	33	x	0.63	x	0.7	=	22.27	(82)
Rooflights 0.9x	1	x	1.7	x	47.08	x	0.63	x	0.7	=	31.77	(82)
Rooflights 0.9x	1	x	1.7	x	21	x	0.63	x	0.7	=	14.17	(82)
Rooflights 0.9x	1	x	1.7	x	31.85	x	0.63	x	0.7	=	21.49	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	319.91	567.37	830.49	1110.93	1312.65	1331.48	1272.03	1118.35	927.71	642.21	387.4	270.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	776.9	1022.02	1268.98	1523.22	1698.1	1690.5	1614.41	1468.24	1291.14	1032.08	807.68	714.26	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.93	0.85	0.72	0.58	0.64	0.84	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.51	18.8	19.26	19.87	20.4	20.77	20.91	20.88	20.58	19.88	19.1	18.5	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.1	19.11	19.12	19.16	19.17	19.2	19.2	19.21	19.19	19.17	19.15	19.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.9	0.78	0.58	0.37	0.43	0.74	0.94	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

DER WorkSheet: New extension to existing dwelling

(90)m=	16.95	17.24	17.7	18.33	18.8	19.11	19.19	19.19	18.99	18.35	17.58	16.96	(90)

fLA = Living area ÷ (4) = 0.11 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.12	17.42	17.88	18.5	18.98	19.3	19.38	19.38	19.17	18.52	17.75	17.14	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.12	17.42	17.88	18.5	18.98	19.3	19.38	19.38	19.17	18.52	17.75	17.14	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.89	0.77	0.59	0.4	0.46	0.74	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	768.68	998.47	1205.89	1353.63	1312.86	995.6	641.45	670.24	949.89	956.62	792.18	708.41	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	3310.99	3211.65	2901.29	2377.26	1792.79	1127.29	667.34	710.48	1227.49	1950.62	2651.96	3259.53	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1891.48	1487.26	1261.37	737.01	357.07	0	0	0	0	739.53	1339.04	1898.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 9710.79 (98)

Space heating requirement in kWh/m²/year 89.04 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1891.48	1487.26	1261.37	737.01	357.07	0	0	0	0	739.53	1339.04	1898.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	2125.26	1671.07	1417.27	828.1	401.2	0	0	0	0	830.93	1504.54	2132.62	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 10911 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

224.24	197.58	207.35	185.66	181.71	160.04	153.33	170.93	170.79	192.53	203.85	218.78

Efficiency of water heater 89 (216)

DER WorkSheet: New extension to existing dwelling

(217)m=	89	89	89	89	89	89	89	89	89	89	89	89	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	251.96	222	232.98	208.61	204.17	179.82	172.28	192.05	191.9	216.33	229.05	245.81

Total = Sum(219a)$_{1...12}$ = 2546.97 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			10911	
Water heating fuel used			2546.97	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			425.41	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			13958.37	(338)

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)	(211) x	0.216	=	2356.78	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	550.14	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2906.92	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	220.79	(268)
Total CO2, kg/year		sum of (265)…(271) =		3166.63	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		29.04	(273)
EI rating (section 14)				72	(274)