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Northwest	0.9x	0.77	x	1.3	x	97.38	x	0.63	x	0.7	=	38.69	(81)
Northwest	0.9x	0.77	x	2.7	x	91.1	x	0.63	x	0.7	=	75.17	(81)
Northwest	0.9x	0.77	x	1.3	x	91.1	x	0.63	x	0.7	=	36.19	(81)
Northwest	0.9x	0.77	x	2.7	x	72.63	x	0.63	x	0.7	=	59.93	(81)
Northwest	0.9x	0.77	x	1.3	x	72.63	x	0.63	x	0.7	=	28.85	(81)
Northwest	0.9x	0.77	x	2.7	x	50.42	x	0.63	x	0.7	=	41.6	(81)
Northwest	0.9x	0.77	x	1.3	x	50.42	x	0.63	x	0.7	=	20.03	(81)
Northwest	0.9x	0.77	x	2.7	x	28.07	x	0.63	x	0.7	=	23.16	(81)
Northwest	0.9x	0.77	x	1.3	x	28.07	x	0.63	x	0.7	=	11.15	(81)
Northwest	0.9x	0.77	x	2.7	x	14.2	x	0.63	x	0.7	=	11.71	(81)
Northwest	0.9x	0.77	x	1.3	x	14.2	x	0.63	x	0.7	=	5.64	(81)
Northwest	0.9x	0.77	x	2.7	x	9.21	x	0.63	x	0.7	=	7.6	(81)
Northwest	0.9x	0.77	x	1.3	x	9.21	x	0.63	x	0.7	=	3.66	(81)
Rooflights	0.9x	1	x	2	x	26	x	0.63	x	0.7	=	41.28	(82)
Rooflights	0.9x	1	x	3	x	26	x	0.63	x	0.7	=	30.96	(82)
Rooflights	0.9x	1	x	7.5	x	26	x	0.63	x	0.7	=	77.4	(82)
Rooflights	0.9x	1	x	2	x	54	x	0.63	x	0.7	=	85.73	(82)
Rooflights	0.9x	1	x	3	x	54	x	0.63	x	0.7	=	64.3	(82)
Rooflights	0.9x	1	x	7.5	x	54	x	0.63	x	0.7	=	160.74	(82)
Rooflights	0.9x	1	x	2	x	96	x	0.63	x	0.7	=	152.41	(82)
Rooflights	0.9x	1	x	3	x	96	x	0.63	x	0.7	=	114.31	(82)
Rooflights	0.9x	1	x	7.5	x	96	x	0.63	x	0.7	=	285.77	(82)
Rooflights	0.9x	1	x	2	x	150	x	0.63	x	0.7	=	238.14	(82)
Rooflights	0.9x	1	x	3	x	150	x	0.63	x	0.7	=	178.6	(82)
Rooflights	0.9x	1	x	7.5	x	150	x	0.63	x	0.7	=	446.51	(82)
Rooflights	0.9x	1	x	2	x	192	x	0.63	x	0.7	=	304.82	(82)
Rooflights	0.9x	1	x	3	x	192	x	0.63	x	0.7	=	228.61	(82)
Rooflights	0.9x	1	x	7.5	x	192	x	0.63	x	0.7	=	571.54	(82)
Rooflights	0.9x	1	x	2	x	200	x	0.63	x	0.7	=	317.52	(82)
Rooflights	0.9x	1	x	3	x	200	x	0.63	x	0.7	=	238.14	(82)
Rooflights	0.9x	1	x	7.5	x	200	x	0.63	x	0.7	=	595.35	(82)
Rooflights	0.9x	1	x	2	x	189	x	0.63	x	0.7	=	300.06	(82)
Rooflights	0.9x	1	x	3	x	189	x	0.63	x	0.7	=	225.04	(82)
Rooflights	0.9x	1	x	7.5	x	189	x	0.63	x	0.7	=	562.61	(82)
Rooflights	0.9x	1	x	2	x	157	x	0.63	x	0.7	=	249.25	(82)
Rooflights	0.9x	1	x	3	x	157	x	0.63	x	0.7	=	186.94	(82)
Rooflights	0.9x	1	x	7.5	x	157	x	0.63	x	0.7	=	467.35	(82)
Rooflights	0.9x	1	x	2	x	115	x	0.63	x	0.7	=	182.57	(82)
Rooflights	0.9x	1	x	3	x	115	x	0.63	x	0.7	=	136.93	(82)
Rooflights	0.9x	1	x	7.5	x	115	x	0.63	x	0.7	=	342.33	(82)
Rooflights	0.9x	1	x	2	x	66	x	0.63	x	0.7	=	104.78	(82)

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Rooflights 0.9x	1	x	3	x	66	x	0.63	x	0.7	=	78.59	(82)
Rooflights 0.9x	1	x	7.5	x	66	x	0.63	x	0.7	=	196.47	(82)
Rooflights 0.9x	1	x	2	x	33	x	0.63	x	0.7	=	52.39	(82)
Rooflights 0.9x	1	x	3	x	33	x	0.63	x	0.7	=	39.29	(82)
Rooflights 0.9x	1	x	7.5	x	33	x	0.63	x	0.7	=	98.23	(82)
Rooflights 0.9x	1	x	2	x	21	x	0.63	x	0.7	=	33.34	(82)
Rooflights 0.9x	1	x	3	x	21	x	0.63	x	0.7	=	25	(82)
Rooflights 0.9x	1	x	7.5	x	21	x	0.63	x	0.7	=	62.51	(82)

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

(83)m=	676.39	1228.98	1864.43	2582.04	3115.23	3184.16	3032.3	2624.96	2113.77	1409.65	824.67	569.19	(83)

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

(84)m=	1651.69	2201.56	2806.32	3472.88	3950.95	3969.54	3786.77	3386.97	2903.6	2250.79	1724.83	1516.77	(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=	1	1	1	0.97	0.86	0.64	0.47	0.54	0.86	0.99	1	1	(86)

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

(87)m=	19.9	20.06	20.32	20.66	20.9	20.99	21	21	20.93	20.58	20.18	19.88	(87)

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

(88)m=	20.2	20.2	20.2	20.22	20.22	20.24	20.24	20.24	20.23	20.22	20.22	20.21	(88)

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

(89)m=	1	1	1	0.96	0.82	0.57	0.39	0.46	0.8	0.99	1	1	(89)

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

(90)m=	18.68	18.93	19.31	19.81	20.13	20.23	20.24	20.24	20.18	19.7	19.11	18.67	(90)

fLA = Living area ÷ (4) = 0.09 (91)

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

(92)m=	18.79	19.03	19.4	19.89	20.2	20.3	20.31	20.31	20.24	19.78	19.21	18.78	(92)

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

(93)m=	18.79	19.03	19.4	19.89	20.2	20.3	20.31	20.31	20.24	19.78	19.21	18.78	(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=	1	1	0.99	0.95	0.81	0.58	0.4	0.47	0.8	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1651.43	2199.35	2787.76	3316.07	3216.87	2288.32	1503.94	1575.43	2321.73	2221.07	1723.8	1516.63	(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=	6240.89	6058.53	5507.61	4587.44	3531.99	2315.18	1505.87	1580.55	2518.44	3816.07	5076.95	6169.67	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	3414.56	2593.37	2023.56	915.38	234.45	0	0	0	0	1186.68	2414.26	3461.86	
									Total per year (kWh/year) = Sum(98)$_{1..5,9..12}$ =				16244.13 (98)

Space heating requirement in kWh/m²/year 32.64 (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 93 (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)	3414.56	2593.37	2023.56	915.38	234.45	0	0	0	0	1186.68	2414.26	3461.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	3671.57	2788.57	2175.87	984.28	252.1	0	0	0	0	1276	2595.98	3722.43	(211)
										Total (kWh/year) =Sum(211)$_{1..5,10..12}$=			17466.81 (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)

	300.44	240.61	218.86	156.7	122.28	100.12	98.2	136.48	165.6	227.78	269.32	299.81	

Efficiency of water heater 86.9 (216)

(217)m=	89.74	89.73	89.69	89.53	88.91	86.9	86.9	86.9	86.9	89.49	89.68	89.74	(217)

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

(219)m=	334.79	268.15	244.02	175.02	137.53	115.22	113	157.06	190.57	254.54	300.32	334.07	
										Total = Sum(219a)$_{1..12}$ =			2624.28 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		17466.81
Water heating fuel used		2624.28
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	1885	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
pump for solar water heating	50	(230g)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		2010 (231)
Electricity for lighting		998.4 (232)

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Electricity generated by PVs				-1630.23	(233)

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	=	3772.83	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	566.84	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4339.67	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	1043.19	(267)
Electricity for lighting	(232)	x	0.519	=	518.17	(268)
Energy saving/generation technologies Item 1			0.519	=	-846.09	(269)
Total CO2, kg/year			sum of (265)...(271) =		5054.95	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		10.16	(273)
EI rating (section 14)					88	(274)