41.

Energy Performance Certificate

HM Government

40, Wheatcroft Drive, Edwalton, NOTTINGHAM, NG12 4JF

Dwelling type:	Mid-terrace house	**Reference number:**	0267-3834-7746-9701-8955
Date of assessment:	04 April 2019	**Type of assessment:**	SAP, new dwelling
Date of certificate:	04 April 2019	**Total floor area:**	84 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

Estimated energy costs of dwelling for 3 years:	**£ 990**
Over 3 years you could save	**£ 87**

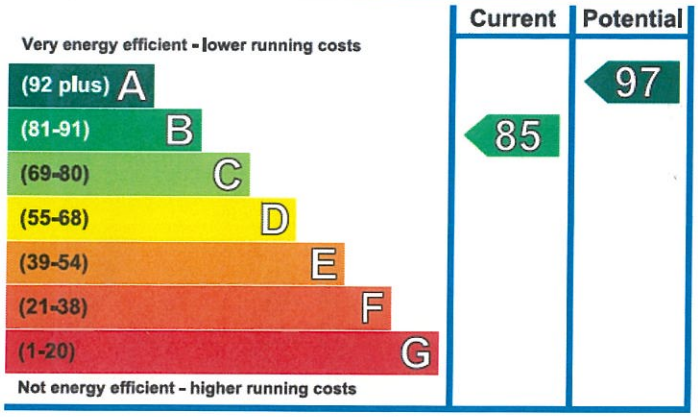
Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£ 198 over 3 years	£ 198 over 3 years	
Heating	£ 573 over 3 years	£ 573 over 3 years	
Hot Water	£ 219 over 3 years	£ 132 over 3 years	
Totals	**£ 990**	**£ 903**	

You could save £ 87 over 3 years

These figures show how much the average household would spend in this property for heating, lighting and hot water and is not based on energy used by individual households. This excludes energy use for running appliances like TVs, computers and cookers, and electricity generated by microgeneration.

Energy Efficiency Rating



The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

The EPC rating shown here is based on standard assumptions about occupancy and energy use and may not reflect how energy is consumed by individual occupants.

Actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years
1 Solar water heating	£4,000 - £6,000	£ 87
2 Solar photovoltaic panels, 2.5 kWp	£5,000 - £8,000	£ 897

Summary of this home's energy performance related features

Element	Description	Energy Efficiency
Walls	Average thermal transmittance 0.24 W/m²K	★★★★★
Roof	Average thermal transmittance 0.16 W/m²K	★★★★☆
Floor	Average thermal transmittance 0.24 W/m²K	★★★★☆
Windows	High performance glazing	★★★★★
Main heating	Boiler and radiators, mains gas	★★★★☆
Main heating controls	Time and temperature zone control	★★★★★
Secondary heating	None	—
Hot water	From main system	★★★★☆
Lighting	Low energy lighting in all fixed outlets	★★★★★
Air tightness	Air permeability 4.4 m³/h.m² (as tested)	★★★★☆

Thermal transmittance is a measure of the rate of heat loss through a building element; the lower the value the better the energy performance.
Air permeability is a measure of the air tightness of a building; the lower the value the better the air tightness.

Current primary energy use per square metre of floor area: 76 kWh/m² per year

Low and zero carbon energy sources

Low and zero carbon energy sources are sources of energy that release either very little or no carbon dioxide into the atmosphere when they are used. Installing these sources may help reduce energy bills as well as cutting carbon. There are none provided for this home.

Your home's heat demand

This table shows the energy used for space and water heating by an average household in this property.

Heat demand

Space heating (kWh per year)	1,913
Water heating (kWh per year)	1,654

If you built your own home and, as part of its construction, you installed a renewable heating system, you could receive Renewable Heat Incentive (RHI) payments. The estimated energy required for space and water heating will form the basis of the payments. For more information, search for the domestic RHI on the www.gov.uk website.

Recommendations

The measures below will improve the energy performance of your dwelling. The performance ratings after improvements listed below are cumulative; that is, they assume the improvements have been installed in the order that they appear in the table. Further information about the recommended measures and other simple actions you could take today to save money is available at www.gov.uk/energy-grants-calculator. Before installing measures, you should make sure you have secured the appropriate permissions, where necessary. Such permissions might include permission from your landlord (if you are a tenant) or approval under Building Regulations for certain types of work.

Recommended measures	Indicative cost	Typical savings per year	Rating after improvement
Solar water heating	£4,000 - £6,000	£ 29	B86
Solar photovoltaic panels, 2.5 kWp	£5,000 - £8,000	£ 299	A97

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by Stroma Certification. You can obtain contact details of the Accreditation Scheme at www.stroma.com.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.epcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. Any personal data it contains will be processed in accordance with the General Data Protection Regulation and all applicable laws and regulations relating to the processing of personal data and privacy. For further information about this and how data about the property are used, please visit www.epcregister.com. To opt out of having information about your building made publicly available, please visit www.epcregister.com/optout.

Assessor's accreditation number:	STRO016309
Assessor's name:	Chris Nicholls
Phone number:	02033971373
E-mail address:	chris@briaryenergy.co.uk
Related party disclosure:	No related party

There is more information in the guidance document *Energy Performance Certificates for the marketing, sale and let of dwellings* available on the Government website at: www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document, advises on how to identify the authenticity of a certificate and how to make a complaint.

About the impact of buildings on the environment

One of the biggest contributors to global warming is carbon dioxide. The energy we use for heating, lighting and power in homes produces over a quarter of the UK's carbon dioxide emissions.

The average household causes about 6 tonnes of carbon dioxide every year. Based on this assessment, your home currently produces approximately 1.1 tonnes of carbon dioxide every year. Adopting the recommendations in this report can reduce emissions and protect the environment. If you were to install these recommendations you could reduce this amount by 1.1 tonnes per year. You could reduce emissions even more by switching to renewable energy sources.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions based on standardised assumptions about occupancy and energy use. The higher the rating the less impact it has on the environment.

Regulations Compliance Report

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Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
Printed on 04 April 2019 at 16:46:39

Project Information:

Assessed By: Chris Nicholls (STRO016309) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING AS BUILT Total Floor Area: 83.52m²

Site Reference : MI110 - Edwalton **Plot Reference:** Plot 041 - 3B5P mid

Address : 40, Wheatcroft Drive, Edwalton, NOTTINGHAM, NG12 4JF

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	16.53 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.26 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	41.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	37.8 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.24 (max. 0.25)	0.24 (max. 0.70)	**OK**
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	**OK**
Openings	1.30 (max. 2.00)	1.40 (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	4.37 (measured in this dwelling)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Database: (rev 441, product index 017956):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Ideal
Model: LOGIC COMBI
Model qualifier: ESP1 30
(Combi)
Efficiency 89.6 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder	
	No cylinder	
Boiler interlock:	Yes	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous extract system (decentralised)		
Specific fan power:	0.19 0.18	
Maximum	0.7	**OK**

9 Summertime temperature

Overheating risk (Midlands):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	4.74m²
Windows facing: North East	3.72m²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Doors U-value	1.09 W/m²K
Party Walls U-value	0 W/m²K

SAP WorkSheet: New dwelling as built

User Details:

Assessor Name:	Chris Nicholls	**Stroma Number:**	STRO016309
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Plot 041 - 3B5P mid

Address : 40, Wheatcroft Drive, Edwalton, NOTTINGHAM, NG12 4JF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	41.76	(1a) x	2.33	(2a) =	97.3	(3a)
First floor	41.76	(1b) x	2.53	(2b) =	105.65	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	83.52	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		202.95	(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							0	x 10 =	0	(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) =	0	÷ (5) =	0 (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			4.36999988555908 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.22 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.15 (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

SAP WorkSheet: New dwelling as built

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

0.2	0.19	0.19	0.17	0.16	0.15	0.15	0.14	0.15	0.16	0.17	0.18

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (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=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(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 Type 1			2.1	x	1.09	=	2.289			(26)
Doors Type 2			1.96	x	1.09	=	2.1364			(26)
Windows Type 1			4.74	x	1/[1/(1.4)+ 0.04]	=	6.28			(27)
Windows Type 2			3.72	x	1/[1/(1.4)+ 0.04]	=	4.93			(27)
Floor			41.76	x	0.24	=	10.0224	75	3132	(28)
Walls	46.65	12.52	34.13	x	0.24	=	8.19	49.5	1689.44	(29)
Roof	41.76	0	41.76	x	0.16	=	6.68	9	375.84	(30)
Total area of elements, m²			130.17							(31)
Party wall			84.55	x	0	=	0	45	3804.75	(32)
Internal wall **			66.5					9	598.5	(32c)
Internal wall **			103.39					9	930.51	(32c)
Internal floor			41.76					18	751.68	(32d)
Internal ceiling			41.76					9	375.84	(32e)

** 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) = 40.54 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 11658.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 139.59 (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 — 5.89 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 46.42 (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=	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	(38)

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

(39)m=	79.91	79.91	79.91	79.91	79.91	79.91	79.91	79.91	79.91	79.91	79.91	79.91	

Average = Sum(39)$_{1..12}$ /12= 79.91 (39)

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

(40)m=	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	

Average = Sum(40)$_{1..12}$ /12= 0.96 (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 — 2.53 (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 — 94.2 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	103.62	99.85	96.08	92.31	88.55	84.78	84.78	88.55	92.31	96.08	99.85	103.62	

Total = Sum(44)$_{1..12}$ = 1130.39 (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=	153.66	134.4	138.68	120.91	116.01	100.11	92.77	106.45	107.72	125.54	137.04	148.81	

Total = Sum(45)$_{1..12}$ = 1482.11 (45)

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

(46)m=	23.05	20.16	20.8	18.14	17.4	15.02	13.92	15.97	16.16	18.83	20.56	22.32	(46)

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)

SAP WorkSheet: New dwelling as built

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=	14.68	13.24	14.62	14.09	14.53	14.01	14.45	14.5	14.06	14.58	14.17	14.66	(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=	168.34	147.64	153.3	135	130.54	114.12	107.22	120.95	121.78	140.12	151.21	163.48	(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=	168.34	147.64	153.3	135	130.54	114.12	107.22	120.95	121.78	140.12	151.21	163.48	

Output from water heater (annual)$_{1\ldots12}$ — 1653.7 — (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=	54.76	48	49.77	43.73	42.21	36.79	34.46	39.02	39.33	45.39	49.11	53.15	(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=	151.58	151.58	151.58	151.58	151.58	151.58	151.58	151.58	151.58	151.58	151.58	151.58	(66)

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

(67)m=	55.26	49.08	39.92	30.22	22.59	19.07	20.61	26.78	35.95	45.65	53.28	56.8	(67)

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

(68)m=	338.27	341.78	332.93	314.1	290.33	267.99	253.06	249.55	258.4	277.23	301	323.34	(68)

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

(69)m=	52.68	52.68	52.68	52.68	52.68	52.68	52.68	52.68	52.68	52.68	52.68	52.68	(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=	-101.05	-101.05	-101.05	-101.05	-101.05	-101.05	-101.05	-101.05	-101.05	-101.05	-101.05	-101.05	(71)

Water heating gains (Table 5)

(72)m=	73.61	71.42	66.89	60.73	56.73	51.1	46.32	52.45	54.63	61	68.2	71.43	(72)

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

(73)m=	573.34	566.49	545.95	511.26	475.86	444.37	426.2	435	455.19	490.09	528.69	557.78	(73)

6. Solar gains:

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

SAP WorkSheet: New dwelling as built

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.72	x	11.28	x	0.5	x	1.11	=	16.16	(75)
Northeast 0.9x	0.77	x	3.72	x	22.97	x	0.5	x	1.11	=	32.89	(75)
Northeast 0.9x	0.77	x	3.72	x	41.38	x	0.5	x	1.11	=	59.26	(75)
Northeast 0.9x	0.77	x	3.72	x	67.96	x	0.5	x	1.11	=	97.33	(75)
Northeast 0.9x	0.77	x	3.72	x	91.35	x	0.5	x	1.11	=	130.83	(75)
Northeast 0.9x	0.77	x	3.72	x	97.38	x	0.5	x	1.11	=	139.47	(75)
Northeast 0.9x	0.77	x	3.72	x	91.1	x	0.5	x	1.11	=	130.48	(75)
Northeast 0.9x	0.77	x	3.72	x	72.63	x	0.5	x	1.11	=	104.02	(75)
Northeast 0.9x	0.77	x	3.72	x	50.42	x	0.5	x	1.11	=	72.21	(75)
Northeast 0.9x	0.77	x	3.72	x	28.07	x	0.5	x	1.11	=	40.2	(75)
Northeast 0.9x	0.77	x	3.72	x	14.2	x	0.5	x	1.11	=	20.33	(75)
Northeast 0.9x	0.77	x	3.72	x	9.21	x	0.5	x	1.11	=	13.2	(75)
Southwest 0.9x	0.77	x	4.74	x	36.79		0.5	x	1.11	=	67.15	(79)
Southwest 0.9x	0.77	x	4.74	x	62.67		0.5	x	1.11	=	114.37	(79)
Southwest 0.9x	0.77	x	4.74	x	85.75		0.5	x	1.11	=	156.49	(79)
Southwest 0.9x	0.77	x	4.74	x	106.25		0.5	x	1.11	=	193.9	(79)
Southwest 0.9x	0.77	x	4.74	x	119.01		0.5	x	1.11	=	217.18	(79)
Southwest 0.9x	0.77	x	4.74	x	118.15		0.5	x	1.11	=	215.61	(79)
Southwest 0.9x	0.77	x	4.74	x	113.91		0.5	x	1.11	=	207.87	(79)
Southwest 0.9x	0.77	x	4.74	x	104.39		0.5	x	1.11	=	190.5	(79)
Southwest 0.9x	0.77	x	4.74	x	92.85		0.5	x	1.11	=	169.45	(79)
Southwest 0.9x	0.77	x	4.74	x	69.27		0.5	x	1.11	=	126.41	(79)
Southwest 0.9x	0.77	x	4.74	x	44.07		0.5	x	1.11	=	80.42	(79)
Southwest 0.9x	0.77	x	4.74	x	31.49		0.5	x	1.11	=	57.46	(79)

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

(83)m=	83.3	147.27	215.75	291.22	348.01	355.09	338.35	294.52	241.66	166.6	100.76	70.66	(83)

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

(84)m=	656.65	715.76	761.7	802.48	823.87	799.45	764.54	729.51	696.85	656.7	629.45	628.44	(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=	0.96	0.95	0.92	0.85	0.74	0.59	0.45	0.48	0.69	0.87	0.94	0.97	(86)

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

(87)m=	19.72	19.89	20.16	20.49	20.76	20.93	20.98	20.97	20.87	20.52	20.06	19.66	(87)

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

(88)m=	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	(88)

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

(89)m=	0.96	0.94	0.9	0.83	0.7	0.52	0.36	0.4	0.62	0.84	0.93	0.96	(89)

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

(90)m=	18.42	18.66	19.05	19.5	19.87	20.06	20.11	20.1	20	19.56	18.91	18.33	(90)

fLA = Living area ÷ (4) = 0.25 (91)

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

(92)m=	18.74	18.97	19.33	19.75	20.09	20.28	20.33	20.32	20.22	19.8	19.2	18.67	(92)

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

(93)m=	18.74	18.97	19.33	19.75	20.09	20.28	20.33	20.32	20.22	19.8	19.2	18.67	(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=	0.94	0.92	0.89	0.82	0.7	0.53	0.38	0.42	0.63	0.83	0.92	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	618.9	660.23	675.03	655.3	576.69	427.71	292.24	305.39	440.37	544.73	577.69	596.59	(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=	1154.2	1124.27	1024.88	866.89	670.6	453.59	297.86	313.37	488.76	735.53	966.56	1156.03	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	398.26	311.84	260.29	152.34	69.87	0	0	0	0	141.95	279.99	416.23	

Total per year (kWh/year) = Sum(98)$_{1\_5,9\_12}$ = 2030.77 (98)

Space heating requirement in kWh/m²/year 24.31 (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 93.5 (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)													
	398.26	311.84	260.29	152.34	69.87	0	0	0	0	141.95	279.99	416.23	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	425.95	333.52	278.39	162.93	74.72	0	0	0	0	151.82	299.45	445.16	

Total (kWh/year) =Sum(211)$_{1\ldots5,10\ldots12}$= 2171.95 (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)$_{1\ldots5,10\ldots12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.34	147.64	153.3	135	130.54	114.12	107.22	120.95	121.78	140.12	151.21	163.48

Efficiency of water heater 87.3 (216)

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(217)m=	89.53	89.45	89.29	88.97	88.39	87.3	87.3	87.3	87.3	88.88	89.35	89.57	(217)

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

(219)m=	188.04	165.06	171.69	151.74	147.69	130.73	122.82	138.55	139.5	157.65	169.23	182.51	

Total = Sum(219a)$_{1..12}$ = 1865.19 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2171.95	
Water heating fuel used		1865.19	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	59.38		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	134.38	(231)
Electricity for lighting		390.36	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	75.58	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	64.91	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	17.73	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	13.19	x 0.01 =	51.49	(250)
Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =			329.71	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.08 (257)
SAP rating (Section 12)		84.97 (258)

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	=	469.14	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	402.66	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			872.02	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	69.74	(267)
Electricity for lighting	(232) x	0.519	=	202.6	(268)
Total CO2, kg/year	sum of (265)...(271) =			1144.36	(272)
CO2 emissions per m²	(272) ÷ (4) =			13.7	(273)
EI rating (section 14)				88	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	2649.78	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2275.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4925.31	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	412.55	(267)
Electricity for lighting	(232) x	0	=	1198.41	(268)
'Total Primary Energy	sum of (265)...(271) =			6536.27	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			78.26	(273)