

ENERGY STATEMENT

Proposed development at: 12 Harpsfield Broadway, Hatfield, AL10 9TF



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1. Executive Summary

This Energy Statement has been prepared by Energytest in support of a full planning application for a mixed use development at 12 Harpsfield Broadway, Hatfield, AL10 9TF

The design has been developed to address the energy performance policy requirements of Welwyn Hatfield Borough Council.

A base case has been developed, against which potential savings can be assessed. This base case is the notional building developed for the Building Regulations (2013) assessment and is quantified in terms of CO₂ emissions as the Target Emission Rate (TER) for the building(s).

This proposed development features improved insulation and air tightness standards, when compared against the compliance requirements of Approved Document L1A 2013 of the Building Regulations. In addition, this proposed development will incorporate a mechanical and electrical specification that surpasses the requirements of the Domestic Building Services Compliance Guide.

Having minimised energy consumption in the first instance, the potential for remaining energy demands to be met via a decentralised energy source has been considered. It is evident this proposed development is neither within the coverage of an existing district heating network, nor is there an expectation that a district heating network will be developed at this site in the near future.

Due to its size, this development is not suitable for combined heat and power.

An assessment has been carried out to determine the potential for renewable energy systems to reduce CO₂ emissions further. With carbon emissions within the building(s) already reduced through an enhanced fabric and energy efficient systems, it is proposed that further reduction will be achieved through installation of a heat pump hot water cylinders to serve all of the Domestic Hot Water requirements.

The total reduction in emissions resulting from energy efficiency measures and the installation of renewable technology is 10.8% compared to the regulated emissions from a building designed to just meet Building Regulations (2013) Part L1A.

2. Introduction

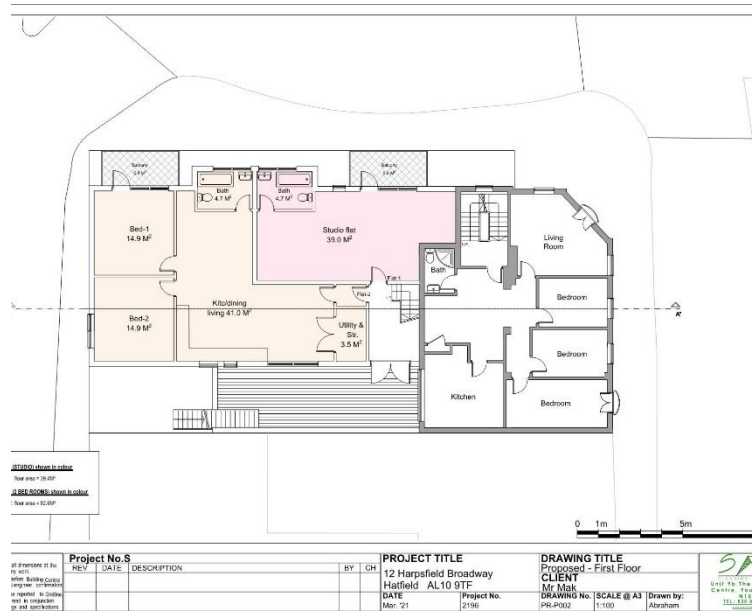
Energy use in buildings is a significant contributor to global CO₂ emissions and global warming. Designing energy efficient buildings and incorporating low and zero carbon energy generation is a vital part of ensuring this development incorporates sustainability as a core part of its design.

The purpose of the report is to assist evaluating parties to understand the energy consumption and performance of the proposed development and consider its performance against the “lean, clean, green” performance standard.

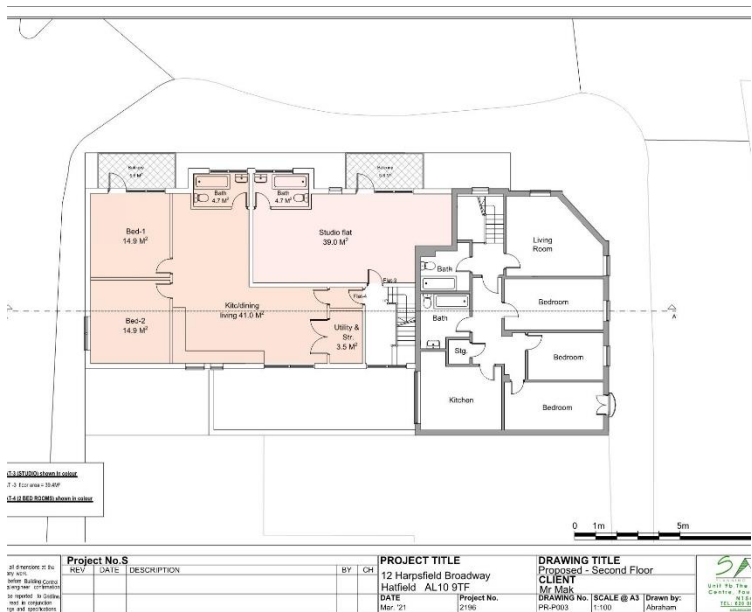
2.1. Overview of the proposed development

The proposed development consists of six newly-constructed dwellings distributed over three floors. By virtue of there being less than 10 dwellings, the proposed development is not deemed to be a major development.

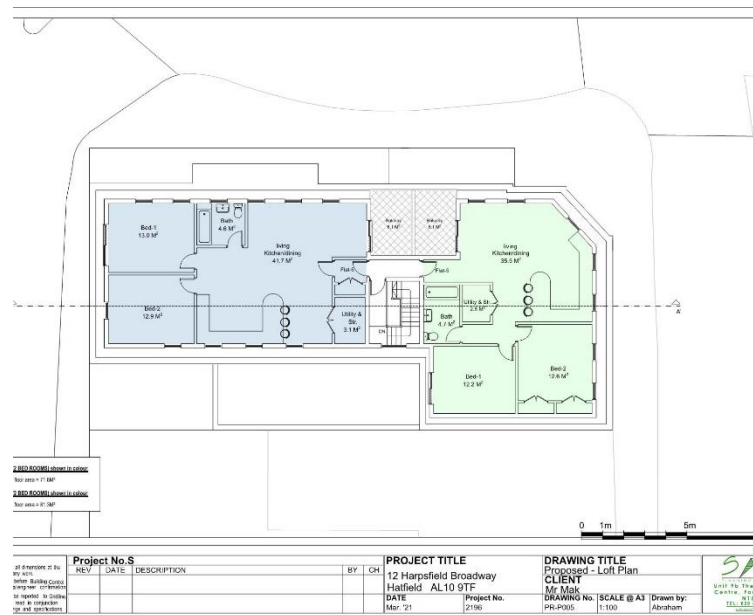
Proposed first floor plan:



Proposed second floor plan:



Proposed loft plan:



3. Policies and Drivers

3.1. National and International Policy

The Climate Change Act (2008) sets a legally binding target for reducing UK carbon dioxide (CO₂) emissions to zero by 2050. It also provides for a Committee on Climate Change, which sets out carbon budgets binding on the Government for 5 year periods.

The National Planning Policy Framework (NPPF) 2021, reflects the requirements of the Climate Change Act 2008 in paragraphs 153 and 155 as follows:

“Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.”

“New development should be planned for in ways that:

- a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and
- b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government’s policy for national technical standards.”

“To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
- b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.”

3.1.1. Local Policy: Welwyn Hatfield Borough Council

Sustainability is key to Welwyn Hatfield Borough Council planning policy and should be considered with every planning application. District Plan 2005 policy R7 states:

Policy R3 - Energy Efficiency

The Council will expect all development to:

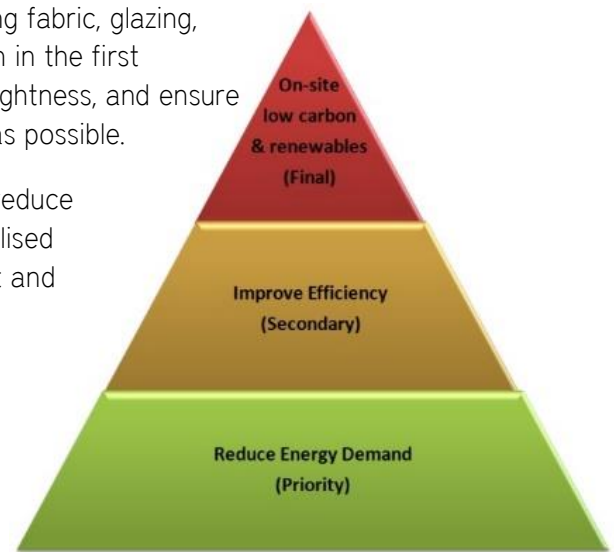
- i. Include measures to maximise energy conservation through the design of buildings, site layout and provision of landscaping; and**
- ii. Incorporate the best practical environmental option (BPEO) for energy supply.**

4. Energy hierarchy

In line with best practice the proposed energy strategy for this development will follow the principals of the energy hierarchy.

The energy hierarchy has three priorities, seeking to reduce energy use before meeting remaining demand by the cleanest means possible:

- 1) Be lean – use less energy: Optimise the building fabric, glazing, and structure to minimise energy consumption in the first instance by using low U-values and good air tightness, and ensure that active systems run as energy efficiently as possible.
- 2) Be clean – supply energy efficiently: Further reduce carbon emissions through the use of decentralised energy where feasible, such as combined heat and power (CHP).
- 3) Be green – use renewable energy: When the above design elements have been reasonably exhausted, supply energy through renewable sources where practical.



5. Energy efficient design measures (“be lean”)

Enhancing the thermal performance of the building envelope helps to future-proof the structure and also yields the greatest CO₂ savings. Adding renewable technology will then yield maximum carbon reductions with lower long-term costs for the developer.

The proposed domestic development will achieve compliance with Approved Document L1A of the Building Regulations (2013) without reliance on the contribution of renewable technologies.

The following energy-efficient design measures are proposed:

	Proposed development	L1A 2013 requirements
External wall U-value (W/m ² K)	0.16/0.18	0.30
Roof U-value (W/m ² K)	0.13	0.20
Exposed floor U-value (W/m ² K)	0.16	0.25
Window U-value (W/m ² K)	1.40	2.00
Door U-value (W/m ² K)	1.40	2.00
Air permeability	4 m ³ /h.m ²	10 m ³ /h.m ²
Thermal bridging	Accredited construction details	Y=0.15

Having reduced energy demand through improvements to the fabric, this development shall seek to reduce energy consumption further through the specification of mechanical and electrical systems with efficiencies that surpass the requirements of the Domestic Building Services Compliance Guide:

	Proposed development	L1A 2013 requirements
Low energy lighting	100%	75%
Heating system	Electric Panel Heaters	-
Heating controls	Programmer, and room thermostat.	Programmer, and appliance thermostat.

6. Energy efficient systems (“be clean”)

6.1. Combined heat and power

Combined heat and power (CHP) systems use relatively cheap and clean fuels (such as natural gas) to generate heat and electricity on site. A typical CHP system uses combustion of natural gas to drive a turbine that produces electricity. The heat generated is captured and used to produce hot water.

As losses are minimised the carbon footprint of the energy generated is very low. However this is dependent on there being sufficient year-round local heat demand to fully utilise the heat generated by the CHP plant. An example would be developments of at least 500 dwellings, universities or hospitals.

Due to its size, this development is not suitable for combined heat and power.

6.2. District heating networks

In a district heating network heat is supplied from one or more central energy centres to multiple buildings within the network. Supply to multiple buildings guarantees high year-round local heat demand which in turn allows the use of low carbon technologies within the energy centre, such as combined heat and power systems. Large plant and aggregated demand allows systems within the energy centre to run more efficiently.

Hot water is distributed within the network via highly insulated pipes. To connect to the network individual boilers are replaced with separately metered heat exchangers.

Due to the fact this proposed development is neither within the coverage of an existing district heating network, nor is it within an area designated as having potential for a future network, district heating can be discounted as a viable option.

7. Low and zero carbon energy sources (“be green”)

7.1. Photovoltaics

Solar photovoltaics (PV) capture the sun's energy using photovoltaic cells. The cells convert sunlight into electricity, which can be utilised on site or transferred into the National Grid. PV cells are made from layers of semi-conducting material, usually silicon. When light shines on the cell it creates an electric field across the layers. The stronger the sunshine, the more

electricity is produced. Groups of cells are mounted together in panels or modules that can be mounted on a roof.

The power of a PV cell is measured in kilowatts peak (kWp). This is the rate at which the cell generates energy at peak performance in full direct sunlight.

Photovoltaics offer high CO₂ savings, are simple to install and suitable for most buildings. The only limiting factor for PV is the availability of suitable roof space.

7.2. Heat Pumps

Heat pumps collect low temperature heat from renewable sources (such as the air or ground) and concentrate the heat to a usable temperature via a reverse refrigeration cycle. Useable heat is transferred to the dwelling via a heat exchanger and can be used for low temperature central heating and domestic hot water, though an immersion top-up may be required for DHW.

Heat pumps have some impact on the environment as they generally use grid supplied electricity to run the pumps. It is common for heat pumps to have a coefficient of performance of three, meaning that for every 1kWh of electricity used, over 3kWh of heat can be generated. The renewable component of the output is therefore taken as the difference between the output energy and the input energy, in this scenario the heat pump will be deemed to have delivered 2kWh of renewable energy.

Ground source heat pumps require external horizontal ground loops, or as is more likely in built-up environments, vertical loops fed into bore holes. The application of ground source heat pumps is therefore constrained by site ground conditions and available space.

Air source heat pumps have a slightly lower seasonal efficiency than ground source heat pumps, but require less space. Noise and space considerations should be assessed when determining an appropriate site for external condensing units.

Heat pumps are a very good option for sites not connected to the gas network, or as a replacement of existing electric or oil fired heating systems. When assessed against a gas central heating system on cost verses potential CO₂ savings a heat pump will perform less favourably.

7.3. Solar thermal

Solar thermal systems, use free heat from the sun to warm domestic hot water. A conventional boiler or immersion heater can be used to make the water hotter, or to provide hot water when solar energy is unavailable.

Solar thermal systems are most appropriate for buildings with high year-round domestic hot water demand.

Although a typical solar thermal system will be able to meet half the annual domestic hot water demand for a dwelling, many will use electricity to run pumps within the system. This means the resultant CO₂ and cost savings in a home with a gas boiler will be relatively low.

7.4. Wind turbines

Wind turbines use blades to catch the wind. When the wind blows, the blades are forced round, driving a turbine which generates electricity. The stronger the wind, the more electricity produced.

There are two types of domestic-sized wind turbine: Pole mounted and building mounted. Pole mounted turbines are free standing and are erected in a suitably exposed position, and are often about 5kW to 6kW in size. Building mounted turbines are smaller and can be installed on the roof of a home where there is a suitable wind resource. Often these are around 1kW to 2kW in size.

Large scale turbines, in exposed locations offer one of the best financial returns of all renewable energy systems as the payback of the system increases dramatically with the size of the turbine. However small scale systems offer much lower levels of performance and recent studies have questioned the viability and output from such systems, particularly in urban environments.

7.5. Biomass

Biomass heating systems, burn wood pellets, chips or logs to provide warmth in a single room or to power central heating and hot water boilers. The carbon dioxide emitted when wood is burned is the same amount that was absorbed over the months and years that the plant was growing. The process is sustainable as long as new plants continue to grow in place of those used for fuel. There are some carbon emissions caused by the cultivation, manufacture and transportation of the fuel, but as long as the fuel is sourced locally, these are much lower than the emissions from fossil fuels.

When specifying biomass heating systems is important to consider the potential technical issues surrounding delivery and storage of fuel.

Although the CO₂ savings from biomass are substantial, the high levels of NO_x emissions can make biomass systems unsuitable for urban environments.

7.6. Proposed low and zero carbon energy sources

With carbon emissions within the building(s) already reduced through an enhanced fabric and energy efficient systems, it is proposed that further reduction will be achieved through installation of a **heat pump hot water cylinders** to serve all of the Domestic Hot Water requirements.

8. Results: Calculated CO₂ savings

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon dioxide emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	11.6	7.6
After energy demand reduction and renewable energy	10.3	7.6

Table 2: Regulated carbon dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction and renewable energy	1.2	10.8

9. Appendix A: SAP worksheets

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	5009-1			Issued on Date	04/04/2022
Assessment Reference	001	Prop Type Ref			
Property	Flat 1, 12, Harpsfield Broadway, Hatfield, AL10 9TF				
SAP Rating	80 C	DER	33.79	TER	39.97
Environmental	82 B	% DER<TER	15.46		
CO ₂ Emissions (t/year)	1.04	DFEE	54.60	TFEE	63.69
General Requirements Compliance	Pass	% DFEE<TFEE	14.28		
Assessor Details	Mr. Harry Davey, energytest, Tel: 01892 315466, hdavey@energy-test.co.uk			Assessor ID	R434-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Mid-floor flat, total floor area 39 m²

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

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 39.97 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 33.79 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)63.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof (no roof)			
Openings	1.24 (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: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system 1: Room heaters - Electric
Panel, convector or radiant heaters

Main heating system 2:
Dimplex EDL200UK-630

Heat pump with warm air distribution - Electric

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls 1: Programmer and room thermostat OK

Hot water controls:

No cylinder

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 (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North East: 8.88 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	39.1300 (1b)	2.5000 (2b)	97.8250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	97.8250 (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)	
Air changes per hour						
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) =	0.2044 (8)
Pressure test					Yes	
Measured/design AP50					4.0000	
Infiltration rate					0.4044	(18)
Number of sides sheltered					2	(19)
Shelter factor					(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) =	0.3438 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4383	0.4297	0.4211	0.3782	0.3696	0.3266	0.3266	0.3180	0.3438	0.3696	0.3868	0.4039 (22b)
	0.5961	0.5923	0.5887	0.5715	0.5683	0.5533	0.5533	0.5506	0.5591	0.5683	0.5748	0.5816 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
DTC			1.8900	1.4000	2.6460		(26)					
Window (Uw = 1.20)			8.8800	1.1450	10.1679		(27)					
exposed floor			34.8700	0.1600	5.5792		(28b)					
External Wall 1	25.8700	8.8800	16.9900	0.1600	2.7184		(29a)					
Corridor	6.2200	1.8900	4.3300	0.1800	0.7794		(29a)					
Total net area of external elements Aum(A, m2)					66.9600		(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	21.8909	(33)					
Party Wall 1			27.8500	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0479 (36)					
Total fabric heat loss							(33) + (36) =	30.9388 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	19.2422	19.1218	19.0038	18.4494	18.3456	17.8628	17.8628	17.7733	18.0488	18.3456	18.5555	18.7748 (38)
Average = Sum(39)m / 12 =	50.1811	50.0606	49.9426	49.3882	49.2845	48.8016	48.8016	48.7122	48.9876	49.2845	49.4943	49.7137 (39)
												49.3877 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2824	1.2793	1.2763	1.2622	1.2595	1.2472	1.2472	1.2449	1.2519	1.2595	1.2649	1.2705 (40)
Days in month												1.2621 (40)
	31	28	31	30	31	30	31	31	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													1.3834 (42)	
Average daily hot water use (litres/day)													67.0560 (43)	
Daily hot water use	73.7616	71.0793	68.3971	65.7148	63.0326	60.3504	60.3504	63.0326	65.7148	68.3971	71.0793	73.7616 (44)		
Energy conte	109.3863	95.6699	98.7228	86.0689	82.5852	71.2647	66.0373	75.7787	76.6838	89.3675	97.5516	105.9348 (45)		
Energy content (annual)													Total = Sum(45)m =	1055.0515 (45)
Distribution loss (46)m = 0.15 x (45)m													16.4079	
Water storage loss:	16.4079	14.3505	14.8084	12.9103	12.3878	10.6897	9.9056	11.3668	11.5026	13.4051	14.6327	15.8902 (46)		
Store volume													201.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):													1.6100 (48)	
Temperature factor from Table 2b													0.5400 (49)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
	136.3377	120.0131	125.6742	112.1509	109.5366	97.3467	92.9887	102.7301	102.7658	116.3189	123.6336	132.8862 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h												
	136.3377	120.0131	125.6742	112.1509	109.5366	97.3467	92.9887	102.7301	102.7658	116.3189	123.6336	132.8862 (64)
Heat gains from water heating, kWh/month												
	36.3709	31.8103	32.8253	28.6179	27.4596	23.6955	21.9574	25.1964	25.4973	29.7147	32.4359	35.2233 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	10.6382	9.4487	7.6842	5.8174	4.3486	3.6713	3.9669	5.1564	6.9209	8.7877	10.2565	10.9338 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	119.3517	120.5902	117.4693	110.8251	102.4380	94.5553	89.2892	88.0507	91.1717	97.8159	106.2029	114.0856 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364 (71)
Water heating gains (Table 5)												
	48.8857	47.3367	44.1201	39.7471	36.9080	32.9105	29.5126	33.8662	35.4130	39.9391	45.0499	47.3432 (72)
Total internal gains	222.6267	221.1268	213.0247	200.1408	187.4458	174.8882	166.5199	170.8244	177.2567	190.2938	205.2605	216.1137 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m ²	Table 6a	Specific data	Specific data	factor	W					
			W/m ²	or Table 6b	or Table 6c	Table 6d						
Northeast		8.8800	11.2829	0.6300	0.7000	0.7700	30.6201 (75)					
Solar gains	30.6201	62.3282	112.2955	184.4215	247.8987	264.2863	247.2344	197.0981	136.8339	76.1700	38.5281	25.0059 (83)
Total gains	253.2468	283.4549	325.3202	384.5623	435.3445	439.1745	413.7543	367.9225	314.0906	266.4637	243.7885	241.1197 (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	54.1511	54.2814	54.4097	55.0205	55.1363	55.6818	55.6818	55.7840	55.4704	55.1363	54.9025	54.6602
alpha	4.6101	4.6188	4.6273	4.6680	4.6758	4.7121	4.7121	4.7189	4.6980	4.6758	4.6602	4.6440
util living area	0.9972	0.9948	0.9863	0.9504	0.8443	0.6631	0.5073	0.5847	0.8533	0.9769	0.9949	0.9978 (86)
MIT	19.6279	19.7713	20.0538	20.4541	20.7864	20.9502	20.9887	20.9789	20.8351	20.4064	19.9528	19.6035 (87)
Th 2	19.8546	19.8571	19.8594	19.8706	19.8727	19.8825	19.8825	19.8843	19.8787	19.8727	19.8685	19.8640 (88)
util rest of house	0.9962	0.9930	0.9812	0.9316	0.7904	0.5663	0.3844	0.4548	0.7791	0.9649	0.9927	0.9970 (89)
MIT 2	18.0414	18.2522	18.6636	19.2383	19.6703	19.8511	19.8786	19.8760	19.7463	19.1838	18.5257	18.0123 (90)
Living area fraction												fLA = Living area / (4) = 0.8676 (91)
MIT	19.4178	19.5702	19.8697	20.2931	20.6387	20.8047	20.8417	20.8329	20.6909	20.2446	19.7639	19.3929 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4178	19.5702	19.8697	20.2931	20.6387	20.8047	20.8417	20.8329	20.6909	20.2446	19.7639	19.3929 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9958	0.9924	0.9813	0.9394	0.8287	0.6473	0.4905	0.5663	0.8357	0.9695	0.9925	0.9966 (94)
Useful gains	252.1718	281.3015	319.2266	361.2723	360.7525	284.2797	202.9671	208.3591	262.4775	258.3389	241.9520	240.3012 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	758.6295	734.3994	667.7201	562.6850	440.5369	302.7992	207.0019	215.9338	322.8744	475.3268	626.7910	755.2943 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	376.8045	304.4817	259.2792	145.0172	59.3596	0.0000	0.0000	0.0000	0.0000	161.4390	277.0841	383.1549 (98)
Space heating												1966.6201 (98)
Space heating per m2												(98) / (4) = 50.2586 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1966.6201 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	376.8045	304.4817	259.2792	145.0172	59.3596	0.0000	0.0000	0.0000	0.0000	161.4390	277.0841	383.1549	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	376.8045	304.4817	259.2792	145.0172	59.3596	0.0000	0.0000	0.0000	0.0000	161.4390	277.0841	383.1549	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2													0.0000 (213)
Water heating requirement	136.3377	120.0131	125.6742	112.1509	109.5366	97.3467	92.9887	102.7301	102.7658	116.3189	123.6336	132.8862	(64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(216)
Fuel for water heating, kWh/month	39.0194	34.3474	35.9675	32.0972	31.3490	27.8603	26.6130	29.4010	29.4112	33.2901	35.3835	38.0316	(219)
Water heating fuel used													392.7714 (219)
Annual totals kWh/year													
Space heating fuel - main system													1966.6201 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													187.8731 (232)
Total delivered energy for all uses													2547.2646 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1966.6201	0.5190	1020.6758 (261)
Space heating - main system 2	0.0000	0.5190	0.0000 (262)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	392.7714	0.5190	203.8483 (264)
Space and water heating			1224.5242 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	187.8731	0.5190	97.5061 (268)
Total CO2, kg/year			1322.0303 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			33.7900 (273)

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

DER			33.7900 ZC1
Total Floor Area		TFA	39.1300
Assumed number of occupants		N	1.3834
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			18.0745 ZC2
CO2 emissions from cooking, equation (L16)			3.8896 ZC3
Total CO2 emissions			55.7541 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			55.7541 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1300 (1b)	2.5000 (2b)	97.8250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	97.8250 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.2044 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4544	(18)
Number of sides sheltered				2	(19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3863 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4925	0.4828	0.4732	0.4249	0.4153	0.3670	0.3670	0.3573	0.3863	0.4153	0.4346	0.4539 (22b)
Effective ac	0.6213	0.6166	0.6120	0.5903	0.5862	0.5673	0.5673	0.5638	0.5746	0.5862	0.5944	0.6030 (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
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			7.8900	1.3258	10.4602		(27)
exposed floor			34.8700	0.1300	4.5331		(28b)
External Wall 1	25.8700	7.8900	17.9800	0.1800	3.2364		(29a)
Corridor	6.2200	1.8900	4.3300	0.1800	0.7794		(29a)
Total net area of external elements Aum(A, m ²)			66.9600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	20.8991			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3608 (36)
Total fabric heat loss							(33) + (36) = 30.2599 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	20.0564	19.9043	19.7553	19.0553	18.9244	18.3148	18.3148	18.2019	18.5496	18.9244	19.1893	19.4663 (38)
Average = Sum(39)m / 12 =	50.3163	50.1643	50.0152	49.3153	49.1843	48.5747	48.5747	48.4618	48.8095	49.1843	49.4492	49.7262 (39)
	49.3146 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2859	1.2820	1.2782	1.2603	1.2569	1.2414	1.2414	1.2385	1.2474	1.2569	1.2637	1.2708 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	73.7616	71.0793	68.3971	65.7148	63.0326	60.3504	60.3504	63.0326	65.7148	68.3971	71.0793	73.7616 (44)
Energy conte	109.3863	95.6699	98.7228	86.0689	82.5852	71.2647	66.0373	75.7787	76.6838	89.3675	97.5516	105.9348 (45)
Energy content (annual)	Total = Sum(45)m =											1055.0515 (45)
Distribution loss (46)m = 0.15 x (45)m	16.4079	14.3505	14.8084	12.9103	12.3878	10.6897	9.9056	11.3668	11.5026	13.4051	14.6327	15.8902 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	155.9812	137.7556	145.3177	131.1608	129.1801	116.3566	112.6322	122.3736	121.7756	135.9624	142.6435	152.5297 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	155.9812	137.7556	145.3177	131.1608	129.1801	116.3566	112.6322	122.3736	121.7756	135.9624	142.6435	152.5297 (64)
Heat gains from water heating, kWh/month	73.6469	65.4788	70.1013	64.6914	64.7355	59.7690	59.2333	62.4723	61.5708	66.9906	68.5094	72.4992 (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	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.7064	9.5093	7.7335	5.8547	4.3765	3.6948	3.9924	5.1895	6.9653	8.8440	10.3223	11.0039 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.3517	120.5902	117.4693	110.8251	102.4380	94.5553	89.2892	88.0507	91.1717	97.8159	106.2029	114.0856 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364 (71)
Water heating gains (Table 5)	98.9877	97.4387	94.2221	89.8492	87.0101	83.0125	79.6147	83.9682	85.5150	90.0412	95.1519	97.4452 (72)
Total internal gains	275.7970	274.2894	266.1760	253.2801	240.5757	228.0138	219.6474	223.9595	230.4031	243.4522	258.4283	269.2859 (73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	Specific data	FF	Access	Gains					
	m ²	Table 6a	g	Specific data		factor	W					
		W/m ²	or Table 6b	or Table 6c		Table 6d						
Northeast	7.8900	11.2829	0.6300		0.7000	0.7700	27.2064 (75)					
Solar gains	27.2064	55.3794	99.7761	163.8610	220.2614	234.8219	219.6711	175.1244	121.5787	67.6780	34.2327	22.2181 (83)
Total gains	303.0034	329.6688	365.9521	417.1412	460.8371	462.8357	439.3185	399.0838	351.9819	311.1302	292.6610	291.5040 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	54.0056	54.1693	54.3307	55.1018	55.2485	55.9419	55.9419	56.0722	55.6728	55.2485	54.9525	54.6464
alpha	4.6004	4.6113	4.6220	4.6735	4.6832	4.7295	4.7295	4.7381	4.7115	4.6832	4.6635	4.6431
util living area	0.9941	0.9904	0.9786	0.9350	0.8210	0.6343	0.4781	0.5424	0.8062	0.9594	0.9892	0.9951 (86)
MIT	19.7374	19.8724	20.1390	20.5137	20.8138	20.9591	20.9913	20.9847	20.8750	20.4985	20.0645	19.7193 (87)
Th 2	20.3571	20.3590	20.3609	20.3699	20.3715	20.3793	20.3793	20.3808	20.3763	20.3715	20.3681	20.3646 (88)
util rest of house	0.9931	0.9888	0.9747	0.9231	0.7907	0.5828	0.4139	0.4753	0.7632	0.9497	0.9870	0.9942 (89)
MIT 2	19.1696	19.3054	19.5715	19.9450	20.2253	20.3533	20.3752	20.3731	20.2874	19.9357	19.5046	19.1576 (90)
Living area fraction	19.6623	19.7973	20.0639	20.4384	20.7359	20.8789	20.9097	20.9038	20.7972	20.4240	19.9904	19.6450 (92)
Temperature adjustment												0.6000
adjusted MIT	20.2623	20.3973	20.6639	21.0384	21.3359	21.4789	21.5097	21.5038	21.3972	21.0240	20.5904	20.2450 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	300.8654	326.0048	357.3898	390.3023	384.9783	310.6015	232.2359	236.9216	292.0610	298.6046	289.1050	289.7729 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	803.1622	777.4107	708.4089	598.6091	473.9354	334.1421	238.4883	247.3379	356.1731	512.6979	667.0899	797.8553 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	373.7088	303.3448	261.1582	149.9809	66.1840	0.0000	0.0000	0.0000	0.0000	159.2855	272.1491	378.0133 (98)
Space heating												1963.8246 (98)
Space heating per m2												50.1872 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													88.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2219.0108 (211)
Space heating requirement	373.7088	303.3448	261.1582	149.9809	66.1840	0.0000	0.0000	0.0000	0.0000	159.2855	272.1491	378.0133	(98)
Space heating efficiency (main heating system 1)	88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000	(210)
Space heating fuel (main heating system)	422.2699	342.7624	295.0940	169.4699	74.7842	0.0000	0.0000	0.0000	0.0000	179.9836	307.5131	427.1337	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	155.9812	137.7556	145.3177	131.1608	129.1801	116.3566	112.6322	122.3736	121.7756	135.9624	142.6435	152.5297	(64)
Efficiency of water heater (217)m	82.0440	81.8437	81.3402	80.1510	78.1116	74.8000	74.8000	74.8000	74.8000	80.2159	81.4912	82.1226	(217)
Fuel for water heating, kWh/month	190.1190	168.3155	178.6542	163.6420	165.3788	155.5569	150.5777	163.6011	162.8016	169.4957	175.0416	185.7340	(219)
Water heating fuel used													2028.9182 (219)
Annual totals kWh/year													
Space heating fuel - main system													2219.0108 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													39.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													84.0000 (231)
Electricity for lighting (calculated in Appendix L)													189.0779 (232)
Total delivered energy for all uses													4521.0069 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2219.0108	0.2160	479.3063 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2028.9182	0.2160	438.2463 (264)
Space and water heating			917.5527 (265)
Pumps and fans	84.0000	0.5190	43.5960 (267)
Energy for lighting	189.0779	0.5190	98.1314 (268)
Total CO2, kg/m2/year			1059.2801 (272)
Emissions per m2 for space and water heating			23.4488 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.5078 (272b)
Emissions per m2 for pumps and fans			1.1141 (272c)
Target Carbon Dioxide Emission Rate (TER) = (23.4488 * 1.55) + 2.5078 + 1.1141, rounded to 2 d.p.			39.9700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	5009-2			Issued on Date	04/04/2022
Assessment Reference	001	Prop Type Ref			
Property	Flat 2, 12, Harpsfield Broadway, Hatfield, AL10 9TF				
SAP Rating	82 B	DER	23.15	TER	25.30
Environmental	84 B	% DER<TER	8.51		
CO ₂ Emissions (t/year)	1.45	DFEE	39.31	TFEE	49.24
General Requirements Compliance	Pass	% DFEE<TFEE	20.16		
Assessor Details	Mr. Harry Davey, energytest, Tel: 01892 315466, hdavey@energy-test.co.uk			Assessor ID	R434-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Mid-floor flat, total floor area 82 m²

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

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 25.30 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 23.15 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof (no roof)			
Openings	1.22 (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: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system 1: Room heaters - Electric
Panel, convector or radiant heaters

Main heating system 2:
Dimplex EDL200UK-630

Heat pump with warm air distribution - Electric

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls 1: Programmer and room thermostat OK

Hot water controls:

No cylinder

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 (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North East: 8.28 m², No overhang
Windows facing South West: 6.62 m², No overhang
Windows facing North West: 2.16 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	82.2700 (1b)	x 2.5000 (2b)	= 205.6750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 205.6750 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0972 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2972 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2749 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3506	0.3437	0.3368	0.3024	0.2956	0.2612	0.2612	0.2543	0.2749	0.2956	0.3093	0.3231 (22b)
Effective ac	0.5614	0.5591	0.5567	0.5457	0.5437	0.5341	0.5341	0.5323	0.5378	0.5437	0.5478	0.5522 (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					
DTC			1.8900	1.4000	2.6460		(26)					
Window (Uw = 1.20)			17.0600	1.1450	19.5344		(27)					
exposed floor			9.0600	0.1600	1.4496		(28b)					
External Wall 1	73.4200	17.0600	56.3600	0.1600	9.0176		(29a)					
Corridor	9.0500	1.8900	7.1600	0.1800	1.2888		(29a)					
Total net area of external elements Aum(A, m ²)			91.5300				(31)					
Fabric heat loss, W/K = Sum (A x U)					33.9364		(33)					
Party Wall 1			26.8700	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4149 (36)					
Total fabric heat loss						(33) + (36) =	46.3513 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	38.1069	37.9449	37.7862	37.0406	36.9011	36.2517	36.2517	36.1314	36.5018	36.9011	37.1833	37.4783 (38)
Heat transfer coeff	84.4581	84.2962	84.1374	83.3919	83.2524	82.6030	82.6030	82.4827	82.8531	83.2524	83.5346	83.8296 (39)
Average = Sum(39)m / 12 =												83.3912 (39)
HLP	1.0266	1.0246	1.0227	1.0136	1.0119	1.0040	1.0040	1.0026	1.0071	1.0119	1.0154	1.0190 (40)
HLP (average)												1.0136 (40)
Days in month	31	28	31	30	31	30	31	31	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												2.5045 (42)
Average daily hot water use (litres/day)												93.6824 (43)
Daily hot water use	103.0506	99.3034	95.5561	91.8088	88.0615	84.3142	84.3142	88.0615	91.8088	95.5561	99.3034	103.0506 (44)
Energy conte	152.8211	133.6583	137.9234	120.2450	115.3779	99.5624	92.2592	105.8688	107.1332	124.8534	136.2872	147.9991 (45)
Energy content (annual)												Total = Sum(45)m = 1473.9890 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.9232	20.0488	20.6885	18.0367	17.3067	14.9344	13.8389	15.8803	16.0700	18.7280	20.4431	22.1999 (46)
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Enter (49) or (54) in (55)												0.8694 (55)	
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	179.7725	158.0015	164.8748	146.3270	142.3293	125.6444	119.2106	132.8202	133.2152	151.8048	162.3692	174.9505	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	179.7725	158.0015	164.8748	146.3270	142.3293	125.6444	119.2106	132.8202	133.2152	151.8048	162.3692	174.9505	(64)
Heat gains from water heating, kWh/month	50.8130	44.4414	45.8595	39.9815	38.3632	33.1045	30.6762	35.2014	35.6218	41.5137	45.3155	49.2097	(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)
(66)m	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.0541	17.8119	14.4856	10.9665	8.1976	6.9208	7.4781	9.7204	13.0467	16.5657	19.3347	20.6115	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.1193	226.4449	220.5844	208.1079	192.3586	177.5564	167.6677	165.3420	171.2026	183.6791	199.4284	214.2306	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	(71)
Water heating gains (Table 5)	68.2971	66.1330	61.6392	55.5298	51.5634	45.9785	41.2314	47.3137	49.4747	55.7981	62.9382	66.1421	(72)
Total internal gains	373.0384	370.9577	357.2770	335.1721	312.6874	291.0235	276.9451	282.9439	294.2918	316.6107	342.2691	361.5520	(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 Specific data or Table 6c	Access factor Table 6d	Gains W	(75)					
Northeast	8.2800	11.2829	0.6300	0.7700	0.7700	28.5512	(75)						
Southwest	6.6200	36.7938	0.6300	0.7700	0.7700	74.4397	(79)						
Northwest	2.1600	11.2829	0.6300	0.7700	0.7700	7.4481	(81)						
Solar gains	110.4391	200.0761	305.5143	431.7838	532.2260	549.7513	521.1240	442.9219	348.7265	229.6904	134.4581	93.1038	(83)
Total gains	483.4774	571.0339	662.7913	766.9559	844.9134	840.7748	798.0691	725.8658	643.0183	546.3012	476.7273	454.6558	(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	(85)
tau	67.6453	67.7752	67.9031	68.5102	68.6250	69.1645	69.1645	69.2653	68.9557	68.6250	68.3932	68.1525	(85)
alpha	5.5097	5.5183	5.5269	5.5673	5.5750	5.6110	5.6110	5.6177	5.5970	5.5750	5.5595	5.5435	(85)
util living area	0.9982	0.9951	0.9840	0.9376	0.8086	0.6107	0.4524	0.5161	0.7944	0.9702	0.9958	0.9987	(86)
MIT	19.9165	20.0783	20.3365	20.6606	20.8933	20.9821	20.9972	20.9944	20.9287	20.6068	20.1967	19.8840	(87)
Th 2	20.0612	20.0629	20.0645	20.0720	20.0734	20.0800	20.0800	20.0812	20.0774	20.0734	20.0705	20.0676	(88)
util rest of house	0.9976	0.9935	0.9786	0.9170	0.7562	0.5306	0.3594	0.4165	0.7202	0.9564	0.9941	0.9983	(89)
MIT 2	18.6093	18.8465	19.2212	19.6805	19.9736	20.0687	20.0789	20.0789	20.0223	19.6169	19.0258	18.5666	(90)
Living area fraction	fLA = Living area / (4) =											0.4886 (91)	
MIT	19.2480	19.4484	19.7661	20.1594	20.4230	20.5150	20.5276	20.5262	20.4652	20.1006	19.5979	19.2103	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2480	19.4484	19.7661	20.1594	20.4230	20.5150	20.5276	20.5262	20.4652	20.1006	19.5979	19.2103	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)
Useful gains	481.9680	566.5090	647.1677	705.0072	656.6262	478.5849	323.1962	337.7599	484.5205	522.7654	473.3911	453.6261	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1262.4835	1226.3783	1116.1780	938.9422	726.2128	488.5974	324.4329	340.3429	527.3741	790.9454	1044.0099	1258.3098	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	580.7035	443.4322	348.9437	168.4332	51.7724	0.0000	0.0000	0.0000	0.0000	199.5260	410.8456	598.6847	(98)
Space heating												2802.3413 (98)	
Space heating per m ²												(98) / (4) = 34.0627 (99)	

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2802.3413 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	580.7035	443.4322	348.9437	168.4332	51.7724	0.0000	0.0000	0.0000	0.0000	199.5260	410.8456	598.6847	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	580.7035	443.4322	348.9437	168.4332	51.7724	0.0000	0.0000	0.0000	0.0000	199.5260	410.8456	598.6847	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2													0.0000 (213)
Water heating requirement	179.7725	158.0015	164.8748	146.3270	142.3293	125.6444	119.2106	132.8202	133.2152	151.8048	162.3692	174.9505	(64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(216)
Fuel for water heating, kWh/month	51.4503	45.2195	47.1866	41.8783	40.7342	35.9590	34.1177	38.0127	38.1257	43.4460	46.4695	50.0703	(219)
Water heating fuel used													512.6699 (219)
Annual totals kWh/year													
Space heating fuel - main system													2802.3413 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													354.1625 (232)
Total delivered energy for all uses													3669.1738 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2802.3413	0.5190	1454.4151 (261)
Space heating - main system 2	0.0000	0.5190	0.0000 (262)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	512.6699	0.5190	266.0757 (264)
Space and water heating			1720.4908 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	354.1625	0.5190	183.8103 (268)
Total CO2, kg/year			1904.3012 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			23.1500 (273)

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

DER			23.1500 ZC1
Total Floor Area		TFA	82.2700
Assumed number of occupants		N	2.5045
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.1430 ZC2
CO2 emissions from cooking, equation (L16)			2.1771 ZC3
Total CO2 emissions			41.4701 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			41.4701 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	82.2700 (1b)	x 2.5000 (2b)	= 205.6750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 205.6750 (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				3 * 10 =	30.0000 (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) =				30.0000 / (5) =	0.1459 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3959	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4669	0.4577	0.4486	0.4028	0.3936	0.3479	0.3479	0.3387	0.3662	0.3936	0.4119	0.4303 (22b)
Effective ac	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5670	0.5775	0.5848	0.5926 (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
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			17.0600	1.3258	22.6174		(27)
exposed floor			9.0600	0.1300	1.1778		(28b)
External Wall 1	73.4200	17.0600	56.3600	0.1800	10.1448		(29a)
Corridor	9.0500	1.8900	7.1600	0.1800	1.2888		(29a)
Total net area of external elements Aum(A, m ²)			91.5300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	37.1188	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7109 (36)
Total fabric heat loss						(33) + (36) =	49.8297 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	41.3334	41.0461	40.7646	39.4422	39.1948	38.0430	38.0430	37.8297	38.4866	39.1948	39.6953	40.2186 (38)
Heat transfer coeff	91.1631	90.8759	90.5943	89.2719	89.0245	87.8727	87.8727	87.6594	88.3163	89.0245	89.5250	90.0483 (39)
Average = Sum(39)m / 12 =												89.2707 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1081	1.1046	1.1012	1.0851	1.0821	1.0681	1.0681	1.0655	1.0735	1.0821	1.0882	1.0945 (40)
HLP (average)												1.0851 (40)
Days in month	31	28	31	30	31	30	31	31	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												2.5045 (42)
Average daily hot water use (litres/day)												93.6824 (43)
Daily hot water use	103.0506	99.3034	95.5561	91.8088	88.0615	84.3142	84.3142	88.0615	91.8088	95.5561	99.3034	103.0506 (44)
Energy conte	152.8211	133.6583	137.9234	120.2450	115.3779	99.5624	92.2592	105.8688	107.1332	124.8534	136.2872	147.9991 (45)
Energy content (annual)										Total = Sum(45)m =		1473.9890 (45)
Distribution loss (46)m = 0.15 x (45)m	22.9232	20.0488	20.6885	18.0367	17.3067	14.9344	13.8389	15.8803	16.0700	18.7280	20.4431	22.1999 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	199.4160	175.7441	184.5183	165.3368	161.9728	144.6542	138.8541	152.4637	152.2250	171.4483	181.3791	194.5940 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	199.4160	175.7441	184.5183	165.3368	161.9728	144.6542	138.8541	152.4637	152.2250	171.4483	181.3791	194.5940 (64)
Heat gains from water heating, kWh/month	88.0889	78.1100	83.1355	76.0549	75.6391	69.1780	67.9521	72.4773	71.6953	78.7897	81.3890	86.4856 (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	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.0541	17.8119	14.4856	10.9665	8.1976	6.9208	7.4781	9.7204	13.0467	16.5657	19.3347	20.6115 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.1193	226.4449	220.5844	208.1079	192.3586	177.5564	167.6677	165.3420	171.2026	183.6791	199.4284	214.2306 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809 (71)
Water heating gains (Table 5)	118.3991	116.2351	111.7412	105.6319	101.6654	96.0805	91.3335	97.4157	99.5767	105.9001	113.0402	116.2441 (72)
Total internal gains	426.1404	424.0598	410.3790	388.2741	365.7895	344.1256	330.0471	336.0460	347.3939	369.7128	395.3712	414.6540 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	8.2800	11.2829	0.6300	0.7000	0.7700	28.5512 (75)						
Southwest	6.6200	36.7938	0.6300	0.7000	0.7700	74.4397 (79)						
Northwest	2.1600	11.2829	0.6300	0.7000	0.7700	7.4481 (81)						
Solar gains	110.4391	200.0761	305.5143	431.7838	532.2260	549.7513	521.1240	442.9219	348.7265	229.6904	134.4581	93.1038 (83)
Total gains	536.5795	624.1359	715.8933	820.0580	898.0155	893.8768	851.1711	778.9679	696.1203	599.4032	529.8293	507.7578 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	tau	62.6700	62.8681	63.0635	63.9977	64.1755	65.0167	65.0167	65.1749	64.6901	64.1755	63.8167	64.4459 (85)
alpha	5.1780	5.1912	5.2042	5.2665	5.2784	5.3344	5.3344	5.3450	5.3127	5.2784	5.2544	5.2297	
util living area	0.9971	0.9931	0.9802	0.9314	0.8047	0.6083	0.4505	0.5101	0.7808	0.9620	0.9935	0.9978 (86)	
MIT	19.8641	20.0293	20.2952	20.6345	20.8783	20.9785	20.9963	20.9932	20.9237	20.5963	20.1710	19.8397 (87)	
Th 2	19.9942	19.9971	19.9999	20.0130	20.0155	20.0270	20.0270	20.0291	20.0225	20.0155	20.0105	20.0053 (88)	
util rest of house	0.9961	0.9908	0.9735	0.9087	0.7500	0.5246	0.3529	0.4064	0.7024	0.9447	0.9909	0.9971 (89)	
MIT 2	18.4842	18.7266	19.1124	19.5953	19.9025	20.0135	20.0257	20.0264	19.9647	19.5551	18.9438	18.4565 (90)	
Living area fraction	19.1585	19.3632	19.6904	20.1031	20.3793	20.4850	20.5000	20.4988	20.4333	20.0639	19.5435	19.1324 (92)	
Temperature adjustment	19.1585	19.3632	19.6904	20.1031	20.3793	20.4850	20.5000	20.4988	20.4333	20.0639	19.5435	0.0000	
adjusted MIT	19.1585	19.3632	19.6904	20.1031	20.3793	20.4850	20.5000	20.4988	20.4333	20.0639	19.5435	19.1324 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	533.8903	617.2035	695.0782	747.1326	692.8253	504.9897	341.0986	356.1838	513.4205	566.8949	524.1787	505.8132 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1354.5451	1314.3522	1194.9712	1000.1194	772.6684	517.1312	342.7015	359.3013	559.3364	842.5186	1114.0022	1344.6334 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	610.5671	468.4840	371.9204	182.1506	59.4033	0.0000	0.0000	0.0000	0.0000	205.0640	424.6729	624.0822 (98)
Space heating												2946.3446 (98)
Space heating per m ²												35.8131 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3151.1707 (211)
Space heating requirement	610.5671	468.4840	371.9204	182.1506	59.4033	0.0000	0.0000	0.0000	0.0000	205.0640	424.6729	624.0822	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	653.0130	501.0524	397.7758	194.8134	63.5330	0.0000	0.0000	0.0000	0.0000	219.3198	454.1957	667.4676	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	199.4160	175.7441	184.5183	165.3368	161.9728	144.6542	138.8541	152.4637	152.2250	171.4483	181.3791	194.5940	(64)
Efficiency of water heater (217)m	87.6079	87.3065	86.6474	85.0725	82.4147	79.8000	79.8000	79.8000	79.8000	85.2923	87.0084	87.7047	(216)
Fuel for water heating, kWh/month	227.6233	201.2955	212.9532	194.3482	196.5339	181.2710	174.0026	191.0572	190.7582	201.0126	208.4615	221.8740	(219)
Water heating fuel used													2401.1911 (219)
Annual totals kWh/year													
Space heating fuel - main system													3151.1707 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													354.1625 (232)
Total delivered energy for all uses													5981.5243 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3151.1707	0.2160	680.6529 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2401.1911	0.2160	518.6573 (264)
Space and water heating			1199.3101 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	354.1625	0.5190	183.8103 (268)
Total CO2, kg/m2/year			1422.0455 (272)
Emissions per m2 for space and water heating			14.5777 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2342 (272b)
Emissions per m2 for pumps and fans			0.4731 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5777 * 1.55) + 2.2342 + 0.4731, rounded to 2 d.p.			25.3000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	5009-3			Issued on Date	04/04/2022
Assessment Reference	001	Prop Type Ref			
Property	Flat 3, 12, Harpsfield Broadway, Hatfield, AL10 9TF				
SAP Rating	83 B	DER	29.77	TER	37.25
Environmental	85 B	% DER<TER	20.09		
CO ₂ Emissions (t/year)	0.90	DFEE	47.10	TFEE	56.00
General Requirements Compliance	Pass	% DFEE<TFEE	15.89		
Assessor Details	Mr. Harry Davey, energytest, Tel: 01892 315466, hdavey@energy-test.co.uk			Assessor ID	R434-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Mid-floor flat, total floor area 39 m²

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

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 37.25 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 29.77 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.24 (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: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system 1: Room heaters - Electric
Panel, convector or radiant heaters

Main heating system 2: Heat pump with warm air distribution - Electric
Dimplex EDL200UK-630

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls 1: Programmer and room thermostat OK

Hot water controls: No cylinder

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 (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North East: 8.88 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1300 (1b)	2.4500 (2b)	95.8685 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	95.8685 (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)	
Air changes per hour						
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) =	0.2086 (8)
Pressure test					Yes	
Measured/design AP50					4.0000	
Infiltration rate					0.4086	(18)
Number of sides sheltered					2	(19)
Shelter factor					(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) =	0.3473 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4428	0.4342	0.4255	0.3821	0.3734	0.3300	0.3300	0.3213	0.3473	0.3734	0.3907	0.4081 (22b)
Effective ac	0.5981	0.5942	0.5905	0.5730	0.5697	0.5544	0.5544	0.5516	0.5603	0.5697	0.5763	0.5833 (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					
DTC			1.8900	1.4000	2.6460		(26)					
Window (Uw = 1.20)			8.8800	1.1450	10.1679		(27)					
External Wall 1	25.3600	8.8800	16.4800	0.1600	2.6368		(29a)					
Corridor	5.7100	1.8900	3.8200	0.1800	0.6876		(29a)					
flat	18.3800		18.3800	0.1300	2.3894		(30)					
semi exposed	2.0300		2.0300	0.2000	0.4060		(30)					
Total net area of external elements Aum(A, m ²)					51.4800		(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	18.9337	(33)					
Party Wall 1			40.3300	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								7.4994 (36)				
Total fabric heat loss								(33) + (36) =	26.4331 (37)			
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.9204	18.7999	18.6819	18.1273	18.0235	17.5405	17.5405	17.4510	17.7266	18.0235	18.2334	18.4529 (38)
Average = Sum(39)m / 12 =	45.3535	45.2331	45.1150	44.5604	44.4567	43.9736	43.9736	43.8842	44.1597	44.4567	44.6666	44.8860 (39)
	44.5599 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1590	1.1560	1.1530	1.1388	1.1361	1.1238	1.1238	1.1215	1.1285	1.1361	1.1415	1.1471 (40)
Days in month	31	28	31	30	31	30	31	31	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												1.3834 (42)	
Average daily hot water use (litres/day)												67.0560 (43)	
Daily hot water use	73.7616	71.0793	68.3971	65.7148	63.0326	60.3504	60.3504	63.0326	65.7148	68.3971	71.0793	73.7616 (44)	
Energy conte	109.3863	95.6699	98.7228	86.0689	82.5852	71.2647	66.0373	75.7787	76.6838	89.3675	97.5516	105.9348 (45)	
Energy content (annual)												Total = Sum(45)m =	1055.0515 (45)
Distribution loss (46)m = 0.15 x (45)m	16.4079	14.3505	14.8084	12.9103	12.3878	10.6897	9.9056	11.3668	11.5026	13.4051	14.6327	15.8902 (46)	
Water storage loss:												201.0000 (47)	
Store volume												1.6100 (48)	
a) If manufacturer declared loss factor is known (kWh/day):													



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	136.3377	120.0131	125.6742	112.1509	109.5366	97.3467	92.9887	102.7301	102.7658	116.3189	123.6336	132.8862	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	136.3377	120.0131	125.6742	112.1509	109.5366	97.3467	92.9887	102.7301	102.7658	116.3189	123.6336	132.8862	(64)
Heat gains from water heating, kWh/month	36.3709	31.8103	32.8253	28.6179	27.4596	23.6955	21.9574	25.1964	25.4973	29.7147	32.4359	35.2233	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.6382	9.4487	7.6842	5.8174	4.3486	3.6713	3.9669	5.1564	6.9209	8.7877	10.2565	10.9338	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.3517	120.5902	117.4693	110.8251	102.4380	94.5553	89.2892	88.0507	91.1717	97.8159	106.2029	114.0856	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	(71)
Water heating gains (Table 5)	48.8857	47.3367	44.1201	39.7471	36.9080	32.9105	29.5126	33.8662	35.4130	39.9391	45.0499	47.3432	(72)
Total internal gains	222.6267	221.1268	213.0247	200.1408	187.4458	174.8882	166.5199	170.8244	177.2567	190.2938	205.2605	216.1137	(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					
Northeast			8.8800	11.2829	0.6300	0.7000	0.7700	30.6201 (75)					
Solar gains	30.6201	62.3282	112.2955	184.4215	247.8987	264.2863	247.2344	197.0981	136.8339	76.1700	38.5281	25.0059	(83)
Total gains	253.2468	283.4549	325.3202	384.5623	435.3445	439.1745	413.7543	367.9225	314.0906	266.4637	243.7885	241.1197	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	59.9151	60.0746	60.2319	60.9815	61.1238	61.7952	61.7952	61.9212	61.5349	61.1238	60.8366	60.5391	
alpha	4.9943	5.0050	5.0155	5.0654	5.0749	5.1197	5.1197	5.1281	5.1023	5.0749	5.0558	5.0359	
util living area	0.9972	0.9946	0.9846	0.9406	0.8131	0.6156	0.4625	0.5370	0.8232	0.9732	0.9946	0.9978	(86)
MIT	19.7903	19.9299	20.1992	20.5732	20.8569	20.9733	20.9949	20.9896	20.8888	20.5115	20.0904	19.7669	(87)
Th 2	19.9529	19.9554	19.9578	19.9693	19.9714	19.9815	19.9815	19.9833	19.9776	19.9714	19.9671	19.9626	(88)
util rest of house	0.9963	0.9927	0.9792	0.9198	0.7578	0.5281	0.3582	0.4243	0.7475	0.9601	0.9924	0.9971	(89)
MIT 2	18.3469	18.5521	18.9439	19.4778	19.8382	19.9648	19.9797	19.9792	19.8902	19.4047	18.7954	18.3197	(90)
Living area fraction	19.5992	19.7475	20.0330	20.4282	20.7221	20.8398	20.8605	20.8559	20.7566	20.3650	19.9190	19.5753	(92)
Temperature adjustment	19.5992	19.7475	20.0330	20.4282	20.7221	20.8398	20.8605	20.8559	20.7566	20.3650	19.9190	19.5753	(93)
adjusted MIT	19.5992	19.7475	20.0330	20.4282	20.7221	20.8398	20.8605	20.8559	20.7566	20.3650	19.9190	19.5753	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	252.1969	281.2580	318.7059	357.6030	347.9974	264.5690	185.5602	191.8830	253.5431	257.3498	241.9102	240.3319
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	693.8723	671.5986	610.5413	513.7006	401.0904	274.3854	187.3491	195.5419	293.9539	434.1182	572.5798	690.1374
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000
Space heating kWh	328.6065	262.3089	217.1256	112.3902	39.5012	0.0000	0.0000	0.0000	0.0000	131.5157	238.0821	334.6553
Space heating												1664.1855
Space heating per m2												42.5297

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1664.1855 (211)
Space heating requirement	328.6065	262.3089	217.1256	112.3902	39.5012	0.0000	0.0000	0.0000	0.0000	131.5157	238.0821	334.6553	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	328.6065	262.3089	217.1256	112.3902	39.5012	0.0000	0.0000	0.0000	0.0000	131.5157	238.0821	334.6553	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2													0.0000 (213)
Water heating requirement	136.3377	120.0131	125.6742	112.1509	109.5366	97.3467	92.9887	102.7301	102.7658	116.3189	123.6336	132.8862	(64)
Efficiency of water heater	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(216)
Fuel for water heating, kWh/month	39.0194	34.3474	35.9675	32.0972	31.3490	27.8603	26.6130	29.4010	29.4112	33.2901	35.3835	38.0316	(219)
Water heating fuel used													392.7714 (219)
Annual totals kWh/year													
Space heating fuel - main system													1664.1855 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													187.8731 (232)
Total delivered energy for all uses													2244.8300 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1664.1855	0.5190	863.7123	(261)
Space heating - main system 2	0.0000	0.5190	0.0000	(262)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	392.7714	0.5190	203.8483	(264)
Space and water heating			1067.5606	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	187.8731	0.5190	97.5061	(268)
Total CO2, kg/year			1165.0668	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			29.7700	(273)

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

DER		29.7700	ZC1
Total Floor Area		39.1300	TFA
Assumed number of occupants		1.3834	N
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	EF
CO2 emissions from appliances, equation (L14)		18.0745	ZC2
CO2 emissions from cooking, equation (L16)		3.8896	ZC3
Total CO2 emissions		51.7341	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		51.7341	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1300 (1b)	2.4500 (2b)	95.8685 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	95.8685 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.2086 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4586	(18)
Number of sides sheltered				2	(19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3898 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4970	0.4873	0.4775	0.4288	0.4191	0.3703	0.3703	0.3606	0.3898	0.4191	0.4386	0.4580 (22b)
Effective ac	0.6235	0.6187	0.6140	0.5919	0.5878	0.5686	0.5686	0.5650	0.5760	0.5878	0.5962	0.6049 (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					
TER Opaque door			1.8900	1.0000	1.8900		(26)					
TER Opening Type (Uw = 1.40)			7.8900	1.3258	10.4602		(27)					
External Wall 1	25.3600	7.8900	17.4700	0.1800	3.1446		(29a)					
Corridor	5.7100	1.8900	3.8200	0.1800	0.6876		(29a)					
flat	18.3800		18.3800	0.1300	2.3894		(30)					
semi exposed	2.0300		2.0300	0.1300	0.2639		(30)					
Total net area of external elements Aum(A, m ²)			51.4800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	18.8357	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4832 (36)					
Total fabric heat loss						(33) + (36) =	26.3189 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
Jan	19.7260	19.5743	19.4255	18.7269	18.5962	17.9878	17.9878	17.8751	18.2221	18.5962	18.8606	19.1371 (38)
Heat transfer coeff	46.0449	45.8932	45.7445	45.0459	44.9151	44.3067	44.3067	44.1940	44.5411	44.9151	45.1796	45.4560 (39)
Average = Sum(39)m / 12 =												45.0452 (39)
HLP	1.1767	1.1728	1.1690	1.1512	1.1478	1.1323	1.1323	1.1294	1.1383	1.1478	1.1546	1.1617 (40)
HLP (average)												1.1512 (40)
Days in month	31	28	31	30	31	30	31	31	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												1.3834 (42)
Average daily hot water use (litres/day)												67.0560 (43)
Daily hot water use	73.7616	71.0793	68.3971	65.7148	63.0326	60.3504	60.3504	63.0326	65.7148	68.3971	71.0793	73.7616 (44)
Energy conte	109.3863	95.6699	98.7228	86.0689	82.5852	71.2647	66.0373	75.7787	76.6838	89.3675	97.5516	105.9348 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m												1055.0515 (45)
Water storage loss:												
Store volume	16.4079	14.3505	14.8084	12.9103	12.3878	10.6897	9.9056	11.3668	11.5026	13.4051	14.6327	15.8902 (46)
a) If manufacturer declared loss factor is known (kWh/day):												150.0000 (47)
Temperature factor from Table 2b												1.3938 (48)
												0.5400 (49)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325 (56)
If cylinder contains dedicated solar storage												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325 (57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Total heat required for water heating calculated for each month												
155.9812	137.7556	145.3177	131.1608	129.1801	116.3566	112.6322	122.3736	121.7756	135.9624	142.6435	152.5297	152.5297 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
											Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h												
155.9812	137.7556	145.3177	131.1608	129.1801	116.3566	112.6322	122.3736	121.7756	135.9624	142.6435	152.5297	152.5297 (64)
											Total per year (kWh/year) = Sum(64)m =	1603.6689 (64)
Heat gains from water heating, kWh/month												
73.6469	65.4788	70.1013	64.6914	64.7355	59.7690	59.2333	62.4723	61.5708	66.9906	68.5094	72.4992	65 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705	69.1705 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
10.7064	9.5093	7.7335	5.8547	4.3765	3.6948	3.9924	5.1895	6.9653	8.8440	10.3223	11.0039	67 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
119.3517	120.5902	117.4693	110.8251	102.4380	94.5553	89.2892	88.0507	91.1717	97.8159	106.2029	114.0856	68 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170	29.9170 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364	-55.3364 (71)
Water heating gains (Table 5)												
98.9877	97.4387	94.2221	89.8492	87.0101	83.0125	79.6147	83.9682	85.5150	90.0412	95.1519	97.4452	72 (72)
Total internal gains												
275.7970	274.2894	266.1760	253.2801	240.5757	228.0138	219.6474	223.9595	230.4031	243.4522	258.4283	269.2859	73 (73)

6. Solar gains

[Jan]	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
Northeast	7.8900		11.2829		0.6300		0.7000		0.7700		27.2064 (75)	
Solar gains	27.2064	55.3794	99.7761	163.8610	220.2614	234.8219	219.6711	175.1244	121.5787	67.6780	34.2327	22.2181 (83)
Total gains	303.0034	329.6688	365.9521	417.1412	460.8371	462.8357	439.3185	399.0838	351.9819	311.1302	292.6610	291.5040 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
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
59.0154	59.2105	59.4031	60.3243	60.4999	61.3307	61.3307	61.4871	61.0080	60.4999	60.1458	59.7800	59.7800 (85)
alpha	4.9344	4.9474	4.9602	5.0216	5.0333	5.0887	5.0887	5.0991	5.0672	5.0333	5.0097	4.9853
util living area												
0.9939	0.9897	0.9758	0.9234	0.7907	0.5920	0.4398	0.5012	0.7738	0.9527	0.9882	0.9949	86 (86)
MIT	19.8826	20.0138	20.2677	20.6164	20.8720	20.9770	20.9958	20.9922	20.9159	20.5902	20.1876	19.8656 (87)
Th 2	20.4116	20.4136	20.4155	20.4244	20.4261	20.4339	20.4339	20.4353	20.4309	20.4261	20.4227	20.4192 (88)
util rest of house												
0.9928	0.9880	0.9717	0.9105	0.7602	0.5454	0.3848	0.4428	0.7311	0.9422	0.9860	0.9941	89 (89)
MIT 2	19.3583	19.4903	19.7434	20.0901	20.3262	20.4193	20.4319	20.4314	20.3716	20.0703	19.6712	19.3474 (90)
Living area fraction												
MIT	19.8132	19.9445	20.1983	20.5468	20.7998	20.9031	20.9211	20.9179	20.8439	20.5213	20.1192	19.7970 (92)
Temperature adjustment												
adjusted MIT	20.4132	20.5445	20.7983	21.1468	21.3998	21.5031	21.5211	21.5179	21.4439	21.1213	20.7192	20.3970 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9928	0.9884	0.9745	0.9264	0.8100	0.6312	0.4891	0.5527	0.8031	0.9547	0.9872	0.9940	94 (94)	
Useful gains	300.8329	325.8403	356.6138	386.4452	373.2658	292.1542	214.8869	220.5900	282.6850	297.0312	288.9092	289.7605 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W													
741.9327	717.9765	654.0666	551.6657	435.6662	305.8555	218.0392	226.1815	327.1033	472.5675	615.3105	736.2519	97 (97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)	
Space heating kWh													
328.1783	263.5155	221.3049	118.9588	46.4259	0.0000	0.0000	0.0000	0.0000	130.5990	235.0089	332.1896	98 (98)	
Space heating													
											1676.1809	98 (98)	
											(98) / (4) =	42.8362	99 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													88.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1893.9897 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	328.1783	263.5155	221.3049	118.9588	46.4259	0.0000	0.0000	0.0000	0.0000	130.5990	235.0089	332.1896	(98)
Space heating efficiency (main heating system 1)	88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000	(210)
Space heating fuel (main heating system)	370.8229	297.7576	250.0620	134.4167	52.4587	0.0000	0.0000	0.0000	0.0000	147.5695	265.5468	375.3554	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	155.9812	137.7556	145.3177	131.1608	129.1801	116.3566	112.6322	122.3736	121.7756	135.9624	142.6435	152.5297	(64)
Efficiency of water heater (217)m	81.7333	81.4978	80.9123	79.5339	77.3595	74.8000	74.8000	74.8000	74.8000	79.6859	81.1172	74.8000	(216)
Fuel for water heating, kWh/month	190.8417	169.0299	179.5990	164.9118	166.9867	155.5569	150.5777	163.6011	162.8016	170.6230	175.8487	186.4276	(219)
Water heating fuel used													2036.8059 (219)
Annual totals kWh/year													
Space heating fuel - main system													1893.9897 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													39.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													84.0000 (231)
Electricity for lighting (calculated in Appendix L)													189.0779 (232)
Total delivered energy for all uses													4203.8735 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1893.9897	0.2160	409.1018 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2036.8059	0.2160	439.9501 (264)
Space and water heating			849.0518 (265)
Pumps and fans	84.0000	0.5190	43.5960 (267)
Energy for lighting	189.0779	0.5190	98.1314 (268)
Total CO2, kg/m2/year			990.7793 (272)
Emissions per m2 for space and water heating			21.6982 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.5078 (272b)
Emissions per m2 for pumps and fans			1.1141 (272c)
Target Carbon Dioxide Emission Rate (TER) = (21.6982 * 1.55) + 2.5078 + 1.1141, rounded to 2 d.p.			37.2500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	5009-4			Issued on Date	04/04/2022
Assessment Reference	001	Prop Type Ref			
Property	Flat 4, 12, Harpsfield Broadway, Hatfield, AL10 9TF				
SAP Rating	81 B	DER	23.93	TER	25.87
Environmental	83 B	% DER<TER	7.50		
CO ₂ Emissions (t/year)	1.51	DFEE	40.80	TFEE	51.10
General Requirements Compliance	Pass	% DFEE<TFEE	20.15		
Assessor Details	Mr. Harry Davey, energytest, Tel: 01892 315466, hdavey@energy-test.co.uk			Assessor ID	R434-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Mid-floor flat, total floor area 82 m²

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

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 25.87 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 23.93 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.22 (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: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system 1: Room heaters - Electric
Panel, convector or radiant heaters

Main heating system 2: Heat pump with warm air distribution - Electric
Dimplex EDL200UK-630

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls 1: Programmer and room thermostat OK

Hot water controls: No cylinder

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 (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North East: 8.28 m², No overhang
Windows facing South West: 6.62 m², No overhang
Windows facing North West: 2.16 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	82.2700 (1b)	2.4500 (2b)	201.5615 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	201.5615 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0992 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2992 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2768 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3529	0.3460	0.3391	0.3045	0.2975	0.2629	0.2629	0.2560	0.2768	0.2975	0.3114	0.3252 (22b)
Effective ac	0.5623	0.5599	0.5575	0.5463	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529 (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					
DTC			1.8900	1.4000	2.6460		(26)					
Window (Uw = 1.20)			17.0600	1.1450	19.5344		(27)					
External Wall 1	71.9600	17.0600	54.9000	0.1600	8.7840		(29a)					
Corridor	8.8700	1.8900	6.9800	0.1800	1.2564		(29a)					
External Roof 1	21.7700		21.7700	0.1300	2.8301		(30)					
Total net area of external elements Aum (A, m ²)			102.6000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.0509	(33)					
Party Wall 1			26.3400	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1270 (36)					
Total fabric heat loss							(33) + (36) =	49.1779 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	37.3995	37.2386	37.0810	36.3405	36.2020	35.5571	35.5571	35.4376	35.8055	36.2020	36.4823	36.7753 (38)
Average = Sum(39)m / 12 =	86.5773	86.4165	86.2588	85.5184	85.3798	84.7349	84.7349	84.6155	84.9833	85.3798	85.6601	85.9531 (39)
												85.5177 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0524	1.0504	1.0485	1.0395	1.0378	1.0300	1.0300	1.0285	1.0330	1.0378	1.0412	1.0448 (40)
Days in month												1.0395 (40)
	31	28	31	30	31	30	31	31	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													2.5045 (42)	
Average daily hot water use (litres/day)													93.6824 (43)	
Daily hot water use	103.0506	99.3034	95.5561	91.8088	88.0615	84.3142	84.3142	88.0615	91.8088	95.5561	99.3034	103.0506 (44)		
Energy conte	152.8211	133.6583	137.9234	120.2450	115.3779	99.5624	92.2592	105.8688	107.1332	124.8534	136.2872	147.9991 (45)		
Energy content (annual)													Total = Sum(45)m =	1473.9890 (45)
Distribution loss (46)m = 0.15 x (45)m													22.9232	
Water storage loss:	22.9232	20.0488	20.6885	18.0367	17.3067	14.9344	13.8389	15.8803	16.0700	18.7280	20.4431	22.1999 (46)		
Store volume													201.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):													1.6100 (48)	
Temperature factor from Table 2b													0.5400 (49)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	179.7725	158.0015	164.8748	146.3270	142.3293	125.6444	119.2106	132.8202	133.2152	151.8048	162.3692	174.9505 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	179.7725	158.0015	164.8748	146.3270	142.3293	125.6444	119.2106	132.8202	133.2152	151.8048	162.3692	174.9505 (64)
Heat gains from water heating, kWh/month	50.8130	44.4414	45.8595	39.9815	38.3632	33.1045	30.6762	35.2014	35.6218	41.5137	45.3155	49.2097 (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	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.0541	17.8119	14.4856	10.9665	8.1976	6.9208	7.4781	9.7204	13.0467	16.5657	19.3347	20.6115 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.1193	226.4449	220.5844	208.1079	192.3586	177.5564	167.6677	165.3420	171.2026	183.6791	199.4284	214.2306 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809 (71)
Water heating gains (Table 5)	68.2971	66.1330	61.6392	55.5298	51.5634	45.9785	41.2314	47.3137	49.4747	55.7981	62.9382	66.1421 (72)
Total internal gains	373.0384	370.9577	357.2770	335.1721	312.6874	291.0235	276.9451	282.9439	294.2918	316.6107	342.2691	361.5520 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	8.2800	11.2829	0.6300	0.7700	0.7700	0.7700	28.5512 (75)	
Southwest	6.6200	36.7938	0.6300	0.7700	0.7700	0.7700	74.4397 (79)	
Northwest	2.1600	11.2829	0.6300	0.7700	0.7700	0.7700	7.4481 (81)	

Solar gains	110.4391	200.0761	305.5143	431.7838	532.2260	549.7513	521.1240	442.9219	348.7265	229.6904	134.4581	93.1038 (83)
Total gains	483.4774	571.0339	662.7913	766.9559	844.9134	840.7748	798.0691	725.8658	643.0183	546.3012	476.7273	454.6558 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9982	0.9952	0.9847	0.9409	0.8178	0.6232	0.4633	0.5280	0.8042	0.9717	0.9959	0.9987 (86)
MIT	19.8805	20.0431	20.3043	20.6352	20.8799	20.9786	20.9964	20.9930	20.9192	20.5838	20.1662	19.8478 (87)
Th 2	20.0399	20.0415	20.0431	20.0506	20.0520	20.0584	20.0584	20.0596	20.0559	20.0520	20.0491	20.0462 (88)
util rest of house	0.9976	0.9936	0.9794	0.9209	0.7657	0.5406	0.3663	0.4243	0.7299	0.9583	0.9942	0.9983 (89)
MIT 2	18.5413	18.7796	19.1588	19.6287	19.9390	20.0448	20.0571	20.0568	19.9930	19.5681	18.9656	18.4981 (90)
Living area fraction	19.1957	19.3970	19.7186	20.1205	20.3988	20.5011	20.5161	20.5143	20.4456	20.0644	19.5522	19.1576 (92)
MIT	19.1957	19.3970	19.7186	20.1205	20.3988	20.5011	20.5161	20.5143	20.4456	20.0644	19.5522	19.1576 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	481.9619	566.5655	647.6237	707.6167	664.0994	487.9574	330.2662	344.9254	490.5256	523.6277	473.4270	453.6163 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1289.6265	1252.7781	1140.2186	959.5581	742.6989	500.0281	331.8319	348.1333	539.2708	808.0683	1066.6604	1285.6548 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	600.9024	461.1349	366.4906	181.3978	58.4780	0.0000	0.0000	0.0000	0.0000	211.6238	427.1281	619.0367 (98)
Space heating per m2												(98) / (4) = 35.5682 (99)

8c. Space cooling requirement
Not applicable



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

 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)
Fraction of main heating from main system 2																		0.0000 (203)
Fraction of total heating from main system 1																		1.0000 (204)
Fraction of total heating from main system 2																		0.0000 (205)
Efficiency of main space heating system 1 (in %)																		100.0000 (206)
Efficiency of main space heating system 2 (in %)																		0.0000 (207)
Efficiency of secondary/supplementary heating system, %																		0.0000 (208)
Space heating requirement																		2926.1923 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Space heating requirement	600.9024	461.1349	366.4906	181.3978	58.4780	0.0000	0.0000	0.0000	0.0000	211.6238	427.1281	619.0367	(98)					
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)					
Space heating fuel (main heating system)	600.9024	461.1349	366.4906	181.3978	58.4780	0.0000	0.0000	0.0000	0.0000	211.6238	427.1281	619.0367	(211)					
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)					
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)					
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)					
Space heating fuel used, main system 2													(213)					
Water heating requirement	179.7725	158.0015	164.8748	146.3270	142.3293	125.6444	119.2106	132.8202	133.2152	151.8048	162.3692	174.9505	(64)					
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(216)					
Fuel for water heating, kWh/month	51.4503	45.2195	47.1866	41.8783	40.7342	35.9590	34.1177	38.0127	38.1257	43.4460	46.4695	50.0703	(219)					
Water heating fuel used													(219)					
Annual totals kWh/year																		
Space heating fuel - main system													(211)					
Space heating fuel - secondary													(215)					
Electricity for pumps and fans:																		
Total electricity for the above, kWh/year													(231)					
Electricity for lighting (calculated in Appendix L)													(232)					
Total delivered energy for all uses													(238)					

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2926.1923	0.5190	1518.6938 (261)
Space heating - main system 2	0.0000	0.5190	0.0000 (262)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	512.6699	0.5190	266.0757 (264)
Space and water heating			1784.7695 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	354.1625	0.5190	183.8103 (268)
Total CO2, kg/year			1968.5799 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			23.9300 (273)

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

DER			23.9300 ZC1
Total Floor Area		TFA	82.2700
Assumed number of occupants		N	2.5045
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.1430 ZC2
CO2 emissions from cooking, equation (L16)			2.1771 ZC3
Total CO2 emissions			42.2501 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			42.2501 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	82.2700 (1b)	2.4500 (2b)	201.5615 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	201.5615 (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				3 * 10 =	30.0000 (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) =				30.0000 / (5) =	0.1488 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3988	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3689 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4704	0.4612	0.4519	0.4058	0.3966	0.3505	0.3505	0.3413	0.3689	0.3966	0.4150	0.4335 (22b)
Effective ac	0.6106	0.6063	0.6021	0.5823	0.5786	0.5614	0.5614	0.5582	0.5681	0.5786	0.5861	0.5940 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			17.0600	1.3258	22.6174		(27)
External Wall 1	71.9600	17.0600	54.9000	0.1800	9.8820		(29a)
Corridor	8.8700	1.8900	6.9800	0.1800	1.2564		(29a)
External Roof 1	21.7700		21.7700	0.1300	2.8301		(30)
Total net area of external elements Aum(A, m2)			102.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	38.4759	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3790 (36)
Total fabric heat loss	(33) + (36) = 52.8549 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	40.6161	40.3304	40.0503	38.7348	38.4886	37.3429	37.3429	37.1307	37.7842	38.4886	38.9866	39.5071 (38)
Heat transfer coeff	93.4711	93.1853	92.9052	91.5897	91.3436	90.1978	90.1978	89.9856	90.6391	91.3436	91.8415	92.3620 (39)
Average = Sum(39)m / 12 =												91.5885 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1361	1.1327	1.1293	1.1133	1.1103	1.0964	1.0964	1.0938	1.1017	1.1103	1.1163	1.1227 (40)
HLP (average)												1.1133 (40)
Days in month	31	28	31	30	31	30	31	31	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												2.5045 (42)
Average daily hot water use (litres/day)												93.6824 (43)
Daily hot water use	103.0506	99.3034	95.5561	91.8088	88.0615	84.3142	84.3142	88.0615	91.8088	95.5561	99.3034	103.0506 (44)
Energy conte	152.8211	133.6583	137.9234	120.2450	115.3779	99.5624	92.2592	105.8688	107.1332	124.8534	136.2872	147.9991 (45)
Energy content (annual)												Total = Sum(45)m = 1473.9890 (45)
Distribution loss (46)m = 0.15 x (45)m	22.9232	20.0488	20.6885	18.0367	17.3067	14.9344	13.8389	15.8803	16.0700	18.7280	20.4431	22.1999 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	199.4160	175.7441	184.5183	165.3368	161.9728	144.6542	138.8541	152.4637	152.2250	171.4483	181.3791	194.5940	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	199.4160	175.7441	184.5183	165.3368	161.9728	144.6542	138.8541	152.4637	152.2250	171.4483	181.3791	194.5940	(64)
Heat gains from water heating, kWh/month	88.0889	78.1100	83.1355	76.0549	75.6391	69.1780	67.9521	72.4773	71.6953	78.7897	81.3890	86.4856	(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	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	125.2261	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.0541	17.8119	14.4856	10.9665	8.1976	6.9208	7.4781	9.7204	13.0467	16.5657	19.3347	20.6115	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.1193	226.4449	220.5844	208.1079	192.3586	177.5564	167.6677	165.3420	171.2026	183.6791	199.4284	214.2306	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	35.5226	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	-100.1809	(71)
Water heating gains (Table 5)	118.3991	116.2351	111.7412	105.6319	101.6654	96.0805	91.3335	97.4157	99.5767	105.9001	113.0402	116.2441	(72)
Total internal gains	426.1404	424.0598	410.3790	388.2741	365.7895	344.1256	330.0471	336.0460	347.3939	369.7128	395.3712	414.6540	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
Northeast	8.2800	11.2829	0.6300	0.7000	0.7700	28.5512 (75)							
Southwest	6.6200	36.7938	0.6300	0.7000	0.7700	74.4397 (79)							
Northwest	2.1600	11.2829	0.6300	0.7000	0.7700	7.4481 (81)							
Solar gains	110.4391	200.0761	305.5143	431.7838	532.2260	549.7513	521.1240	442.9219	348.7265	229.6904	134.4581	93.1038	(83)
Total gains	536.5795	624.1359	715.8933	820.0580	898.0155	893.8768	851.1711	778.9679	696.1203	599.4032	529.8293	507.7578	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	61.1226	61.3100	61.4949	62.3781	62.5462	63.3407	63.3407	63.4901	63.0323	62.5462	62.2071	61.8565	
alpha	5.0748	5.0873	5.0997	5.1585	5.1697	5.2227	5.2227	5.2327	5.2022	5.1697	5.1471	5.1238	
util living area	0.9971	0.9932	0.9809	0.9348	0.8138	0.6208	0.4616	0.5221	0.7907	0.9638	0.9936	0.9978	(86)
MIT	19.8259	19.9918	20.2611	20.6074	20.8635	20.9743	20.9954	20.9917	20.9137	20.5719	20.1384	19.8011	(87)
Th 2	19.9714	19.9742	19.9770	19.9900	19.9924	20.0038	20.0038	20.0059	19.9994	19.9924	19.9875	19.9824	(88)
util rest of house	0.9961	0.9910	0.9744	0.9128	0.7593	0.5346	0.3596	0.4141	0.7121	0.9470	0.9911	0.9971	(89)
MIT 2	18.4120	18.6556	19.0463	19.5402	19.8650	19.9877	20.0022	20.0026	19.9336	19.5035	18.8797	18.3836	(90)
Living area fraction	fLA = Living area / (4) = 0.4886 (91)												
MIT	19.1029	19.3085	19.6399	20.0617	20.3529	20.4698	20.4875	20.4859	20.4125	20.0256	19.4948	19.0762	(92)
Temperature adjustment	0.0000												
adjusted MIT	19.1029	19.3085	19.6399	20.0617	20.3529	20.4698	20.4875	20.4859	20.4125	20.0256	19.4948	19.0762	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9950	0.9890	0.9717	0.9146	0.7801	0.5760	0.4096	0.4671	0.7469	0.9477	0.9895	0.9961	(94)
Ext temp.	533.8869	617.2908	695.6417	749.9966	700.5664	514.8783	348.6294	363.8176	519.9552	568.0367	524.2508	505.8029	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1383.6386	1342.6614	1220.7651	1022.2939	790.3893	529.4401	350.6454	367.6723	572.1577	860.9653	1138.3537	1373.9999	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	632.2153	487.4490	390.6918	196.0541	66.8283	0.0000	0.0000	0.0000	0.0000	217.9389	442.1541	645.9386	(98)
												3079.2702 (98)	
												(98) / (4) = 37.4288 (99)	

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3293.3371 (211)
Space heating requirement	632.2153	487.4490	390.6918	196.0541	66.8283	0.0000	0.0000	0.0000	0.0000	217.9389	442.1541	645.9386	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	676.1661	521.3359	417.8522	209.6835	71.4741	0.0000	0.0000	0.0000	0.0000	233.0897	472.8921	690.8434	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	199.4160	175.7441	184.5183	165.3368	161.9728	144.6542	138.8541	152.4637	152.2250	171.4483	181.3791	194.5940	(64)
Efficiency of water heater (217)m	87.6809	87.3947	86.7679	85.2692	82.6543	79.8000	79.8000	79.8000	79.8000	85.4549	87.1027	87.7752	(216)
Fuel for water heating, kWh/month	227.4339	201.0924	212.6574	193.8998	195.9641	181.2710	174.0026	191.0572	190.7582	200.6301	208.2360	221.6958	(219)
Water heating fuel used													2398.6984 (219)
Annual totals kWh/year													
Space heating fuel - main system													3293.3371 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													354.1625 (232)
Total delivered energy for all uses													6121.1980 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3293.3371	0.2160	711.3608 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2398.6984	0.2160	518.1189 (264)
Space and water heating			1229.4797 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	354.1625	0.5190	183.8103 (268)
Total CO2, kg/m2/year			1452.2150 (272)
Emissions per m2 for space and water heating			14.9444 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2342 (272b)
Emissions per m2 for pumps and fans			0.4731 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9444 * 1.55) + 2.2342 + 0.4731, rounded to 2 d.p.			25.8700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	5009-5			Issued on Date	04/04/2022
Assessment Reference	001	Prop Type Ref			
Property	Flat 5, 12, Harpsfield Broadway, Hatfield, AL10 9TF				
SAP Rating	80 C	DER	25.64	TER	28.50
Environmental	82 B	% DER<TER	10.04		
CO ₂ Emissions (t/year)	1.52	DFEE	43.51	TFEE	55.40
General Requirements Compliance	Pass	% DFEE<TFEE	21.46		
Assessor Details	Mr. Harry Davey, energytest, Tel: 01892 315466, hdavey@energy-test.co.uk			Assessor ID	R434-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Top-floor flat, total floor area 71 m²

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

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 28.50 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 25.64 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.23 (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: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system 1: Room heaters - Electric
Panel, convector or radiant heaters

Main heating system 2: Heat pump with warm air distribution - Electric
Dimplex EDL200UK-630

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls 1: Programmer and room thermostat OK

Hot water controls: No cylinder

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 (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North East: 1.62 m², No overhang
Windows facing East: 0.81 m², No overhang
Windows facing South East: 3.24 m², No overhang
Windows facing North West: 4.55 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	71.2400 (1b)	2.3900 (2b)	170.2636 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	170.2636 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1175 (8)
Pressure test				Yes	
Measured/design AP50					4.0000
Infiltration rate					0.3175 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2698 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.3441	0.3373	0.3306	0.2968	0.2901	0.2564	0.2564	0.2496	0.2698	0.2901	0.3036	0.3171 (22b)
Effective ac	0.5592	0.5569	0.5546	0.5441	0.5421	0.5329	0.5329	0.5312	0.5364	0.5421	0.5461	0.5503 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			1.8900	1.4000	2.6460		(26)
Window (Uw = 1.20)			10.2200	1.1450	11.7023		(27)
External Wall 1	78.0900	10.2200	67.8700	0.1800	12.2166		(29a)
Corridor	9.7500	1.8900	7.8600	0.1800	1.4148		(29a)
External Roof 1	59.5600		59.5600	0.1300	7.7428		(30)
Total net area of external elements Aum(A, m2)			147.4000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.7225	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4375 (36)
Total fabric heat loss						(33) + (36) =	46.1600 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	31.4190	31.2898	31.1633	30.5688	30.4575	29.9397	29.9397	29.8438	30.1392	30.4575	30.6825	30.9178 (38)
Average = Sum(39)m / 12 =	77.5790	77.4498	77.3233	76.7287	76.6175	76.0997	76.0997	76.0038	76.2992	76.6175	76.8425	77.0778 (39)
HLP	1.0890	1.0872	1.0854	1.0770	1.0755	1.0682	1.0682	1.0669	1.0710	1.0755	1.0786	1.0819 (40)
HLP (average)												1.0770 (40)
Days in month	31	28	31	30	31	30	31	31	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												2.2758 (42)
Average daily hot water use (litres/day)												88.2514 (43)
Daily hot water use	97.0765	93.5465	90.0164	86.4864	82.9563	79.4263	79.4263	82.9563	86.4864	90.0164	93.5465	97.0765 (44)
Energy conte	143.9617	125.9098	129.9277	113.2741	108.6892	93.7905	86.9107	99.7313	100.9224	117.6153	128.3863	139.4192 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m	21.5943	18.8865	19.4892	16.9911	16.3034	14.0686	13.0366	14.9597	15.1384	17.6423	19.2579	20.9129 (46)
Water storage loss:												201.0000 (47)
Store volume												1.6100 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8694 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	170.9131	150.2530	156.8791	139.3561	135.6406	119.8725	113.8621	126.6827	127.0044	144.5667	154.4683	166.3706	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	170.9131	150.2530	156.8791	139.3561	135.6406	119.8725	113.8621	126.6827	127.0044	144.5667	154.4683	166.3706	(64)
Heat gains from water heating, kWh/month	47.8673	41.8650	43.2010	37.6636	36.1392	31.1853	28.8978	33.1607	33.5567	39.1071	42.6885	46.3569	(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	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0442	16.9149	13.7561	10.4143	7.7848	6.5722	7.1015	9.2309	12.3896	15.7315	18.3610	19.5735	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.1737	202.2508	197.0164	185.8730	171.8064	158.5857	149.7535	147.6764	152.9108	164.0542	178.1208	191.3415	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	(71)
Water heating gains (Table 5)	64.3377	62.2991	58.0658	52.3106	48.5741	43.3130	38.8411	44.5708	46.6065	52.5633	59.2895	62.3077	(72)
Total internal gains	340.6933	338.6026	325.9761	305.7356	285.3030	265.6087	252.8339	258.6157	269.0447	289.4867	312.9090	330.3604	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
Northeast	1.6200	11.2829	0.6300	0.7000	0.7700	5.5861	(75)						
East	0.8100	19.6403	0.6300	0.7000	0.7700	4.8619	(76)						
Southeast	3.2400	36.7938	0.6300	0.7000	0.7700	36.4327	(77)						
Northwest	4.5500	11.2829	0.6300	0.7000	0.7700	15.6894	(81)						
Solar gains	62.5701	114.8762	178.5993	256.1923	318.0834	329.2805	311.8589	263.7504	205.2324	132.7976	76.4703	52.5516	(83)
Total gains	403.2634	453.4788	504.5753	561.9278	603.3864	594.8892	564.6929	522.3661	474.2770	422.2844	389.3793	382.9120	(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	25.5081	25.5506	25.5924	25.7907	25.8282	26.0039	26.0039	26.0367	25.9359	25.8282	25.7525	25.6739		
alpha	2.7005	2.7034	2.7062	2.7194	2.7219	2.7336	2.7336	2.7358	2.7291	2.7219	2.7168	2.7116		
util living area	0.9701	0.9577	0.9332	0.8808	0.7889	0.6554	0.5255	0.5743	0.7688	0.9079	0.9580	0.9738	(86)	
MIT	18.6831	18.9167	19.3317	19.8848	20.3911	20.7493	20.9017	20.8719	20.5827	19.9357	19.2127	18.6319	(87)	
Th 2	20.0098	20.0113	20.0128	20.0196	20.0209	20.0269	20.0269	20.0280	20.0246	20.0209	20.0183	20.0156	(88)	
util rest of house	0.9657	0.9513	0.9227	0.8609	0.7511	0.5890	0.4300	0.4801	0.7140	0.8884	0.9507	0.9699	(89)	
MIT 2	16.8978	17.2367	17.8363	18.6275	19.3260	19.7903	19.9589	19.9336	19.5964	18.7138	17.6738	16.8270	(90)	
Living area fraction	fLA = Living area / (4) =												0.4836	(91)
MIT	17.7611	18.0491	18.5594	19.2355	19.8410	20.2540	20.4148	20.3873	20.0733	19.3047	18.4180	17.6998	(92)	
Temperature adjustment													0.0000	
adjusted MIT	17.7611	18.0491	18.5594	19.2355	19.8410	20.2540	20.4148	20.3873	20.0733	19.3047	18.4180	17.6998	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
	0.9516	0.9345	0.9029	0.8419	0.7433	0.6056	0.4699	0.5170	0.7171	0.8707	0.9345	0.9569	(94)		
Useful gains	383.7327	423.7595	455.6059	473.0850	448.5172	360.2780	265.3415	270.0449	340.1048	367.6638	363.8614	366.4183	(95)		
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)		
Heat loss rate W	1044.3013	1018.3939	932.4740	793.0297	623.7441	430.2710	290.3071	303.0510	455.7604	666.9312	869.7036	1040.5341	(97)		
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)		
Space heating kWh	491.4631	399.5943	354.7899	230.3602	130.3688	0.0000	0.0000	0.0000	0.0000	222.6549	364.2064	501.5422	(98)		
Space heating													2694.9798	(98)	
Space heating per m2													(98) / (4) =	37.8296	(99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2694.9798 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	491.4631	399.5943	354.7899	230.3602	130.3688	0.0000	0.0000	0.0000	0.0000	222.6549	364.2064	501.5422	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	491.4631	399.5943	354.7899	230.3602	130.3688	0.0000	0.0000	0.0000	0.0000	222.6549	364.2064	501.5422	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2													0.0000 (213)
Water heating requirement	170.9131	150.2530	156.8791	139.3561	135.6406	119.8725	113.8621	126.6827	127.0044	144.5667	154.4683	166.3706	(64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(216)
Fuel for water heating, kWh/month	48.9148	43.0019	44.8983	39.8833	38.8199	34.3071	32.5870	36.2562	36.3482	41.3745	44.2083	47.6147	(219)
Water heating fuel used													488.2142 (219)
Annual totals kWh/year													
Space heating fuel - main system													2694.9798 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													336.3266 (232)
Total delivered energy for all uses													3519.5207 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2694.9798	0.5190	1398.6945 (261)
Space heating - main system 2	0.0000	0.5190	0.0000 (262)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	488.2142	0.5190	253.3832 (264)
Space and water heating			1652.0777 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	336.3266	0.5190	174.5535 (268)
Total CO2, kg/year			1826.6312 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			25.6400 (273)

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

DER			25.6400 ZC1
Total Floor Area		TFA	71.2400
Assumed number of occupants		N	2.2758
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.6506 ZC2
CO2 emissions from cooking, equation (L16)			2.4371 ZC3
Total CO2 emissions			44.7277 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			44.7277 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	71.2400 (1b)	2.3900 (2b)	170.2636 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	170.2636 (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				3 * 10 =	30.0000 (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) =				30.0000 / (5) =	0.1762 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4262 (18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3623 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4619	0.4528	0.4438	0.3985	0.3894	0.3442	0.3442	0.3351	0.3623	0.3894	0.4076	0.4257 (22b)
Effective ac	0.6067	0.6025	0.5985	0.5794	0.5758	0.5592	0.5592	0.5561	0.5656	0.5758	0.5830	0.5906 (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
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			10.2200	1.3258	13.5492		(27)
External Wall 1	78.0900	10.2200	67.8700	0.1800	12.2166		(29a)
Corridor	9.7500	1.8900	7.8600	0.1800	1.4148		(29a)
External Roof 1	59.5600		59.5600	0.1300	7.7428		(30)
Total net area of external elements Aum(A, m ²)			147.4000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	36.8134	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.6537 (36)
Total fabric heat loss						(33) + (36) =	48.4671 (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	34.0871	33.8543	33.6262	32.5547	32.3542	31.4210	31.4210	31.2481	31.7804	32.3542	32.7598	33.1838 (38)
Heat transfer coeff	82.5542	82.3215	82.0933	81.0218	80.8213	79.8881	79.8881	79.7153	80.2476	80.8213	81.2269	81.6509 (39)
Average = Sum(39)m / 12 =												81.0209 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1588	1.1556	1.1523	1.1373	1.1345	1.1214	1.1214	1.1190	1.1264	1.1345	1.1402	1.1461 (40)
HLP (average)												1.1373 (40)
Days in month	31	28	31	30	31	30	31	31	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												2.2758 (42)
Average daily hot water use (litres/day)												88.2514 (43)
Daily hot water use	97.0765	93.5465	90.0164	86.4864	82.9563	79.4263	79.4263	82.9563	86.4864	90.0164	93.5465	97.0765 (44)
Energy conte	143.9617	125.9098	129.9277	113.2741	108.6892	93.7905	86.9107	99.7313	100.9224	117.6153	128.3863	139.4192 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m	21.5943	18.8865	19.4892	16.9911	16.3034	14.0686	13.0366	14.9597	15.1384	17.6423	19.2579	20.9129 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	190.5566	167.9956	176.5226	158.3659	155.2841	138.8823	133.5056	146.3262	146.0142	164.2102	173.4782	186.0141 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	190.5566	167.9956	176.5226	158.3659	155.2841	138.8823	133.5056	146.3262	146.0142	164.2102	173.4782	186.0141 (64)
Heat gains from water heating, kWh/month	85.1432	75.5336	80.4769	73.7371	73.4151	67.2588	66.1737	70.4366	69.6302	76.3830	78.7619	83.6328 (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	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924	113.7924 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0442	16.9149	13.7561	10.4143	7.7848	6.5722	7.1015	9.2309	12.3896	15.7315	18.3610	19.5735 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.1737	202.2508	197.0164	185.8730	171.8064	158.5857	149.7535	147.6764	152.9108	164.0542	178.1208	191.3415 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792	34.3792 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340	-91.0340 (71)
Water heating gains (Table 5)	114.4398	112.4012	108.1678	102.4127	98.6762	93.4150	88.9432	94.6728	96.7086	102.6653	109.3916	112.4097 (72)
Total internal gains	393.7954	391.7046	379.0781	358.8376	338.4051	318.7107	305.9360	311.7178	322.1467	342.5888	366.0111	383.4624 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
Northeast	1.6200	11.2829	0.6300	0.7000	0.7700	5.5861 (75)						
East	0.8100	19.6403	0.6300	0.7000	0.7700	4.8619 (76)						
Southeast	3.2400	36.7938	0.6300	0.7000	0.7700	36.4327 (77)						
Northwest	4.5500	11.2829	0.6300	0.7000	0.7700	15.6894 (81)						
Solar gains	62.5701	114.8762	178.5993	256.1923	318.0834	329.2805	311.8589	263.7504	205.2324	132.7976	76.4703	52.5516 (83)
Total gains	456.3655	506.5808	557.6774	615.0299	656.4885	647.9913	617.7949	575.4681	527.3791	475.3864	442.4814	436.0140 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9973	0.9950	0.9880	0.9628	0.8865	0.7246	0.5549	0.6128	0.8560	0.9752	0.9947	0.9979 (86)
MIT	19.7845	19.9183	20.1575	20.4870	20.7757	20.9446	20.9885	20.9814	20.8646	20.5017	20.0902	19.7643 (87)
Th 2	19.9531	19.9557	19.9583	19.9705	19.9728	19.9834	19.9834	19.9854	19.9793	19.9728	19.9681	19.9633 (88)
util rest of house	0.9964	0.9933	0.9837	0.9484	0.8431	0.6340	0.4339	0.4897	0.7865	0.9629	0.9925	0.9972 (89)
MIT 2	18.3386	18.5356	18.8847	19.3634	19.7498	19.9461	19.9791	19.9776	19.8687	19.3923	18.7958	18.3165 (90)
Living area fraction	0.9937	0.9906	0.9802	0.9608	0.9249	0.8290	0.6722	0.6630	0.3503	19.9288	19.4217	19.0166 (92)
MIT	19.0378	19.2042	19.5002	19.9068	20.2459	20.4290	20.4672	20.4630	20.3503	19.9288	19.4217	19.0166 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT	19.0378	19.2042	19.5002	19.9068	20.2459	20.4290	20.4672	20.4630	20.3503	19.9288	19.4217	19.0166 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	454.2318	502.3237	547.2105	582.6269	561.9624	437.9360	304.4628	316.2721	429.6323	457.4367	438.4842	434.3816 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1216.6670	1177.5463	1067.2312	891.7885	690.6939	465.6642	308.9458	323.8848	501.5720	753.9643	1000.8561	1209.7921 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	567.2518	453.7496	386.8954	222.5963	95.7763	0.0000	0.0000	0.0000	0.0000	220.6166	404.9077	576.9054 (98)
Space heating												2928.6992 (98)
Space heating per m2												(98) / (4) = 41.1103 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3132.2986 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	567.2518	453.7496	386.8954	222.5963	95.7763	0.0000	0.0000	0.0000	0.0000	220.6166	404.9077	576.9054	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	606.6864	485.2937	413.7919	238.0710	102.4345	0.0000	0.0000	0.0000	0.0000	235.9536	433.0564	617.0111	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	190.5566	167.9956	176.5226	158.3659	155.2841	138.8823	133.5056	146.3262	146.0142	164.2102	173.4782	186.0141	(64)
Efficiency of water heater (217)m	87.5482	87.3358	86.8514	85.7219	83.5693	79.8000	79.8000	79.8000	79.8000	85.6022	87.0011	79.8000	(216)
Fuel for water heating, kWh/month	217.6592	192.3558	203.2467	184.7438	185.8147	174.0380	167.3002	183.3662	182.9752	191.8294	199.3977	212.2601	(219)
Water heating fuel used													2294.9871 (219)
Annual totals kWh/year													
Space heating fuel - main system													3132.2986 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													336.3266 (232)
Total delivered energy for all uses													5838.6123 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3132.2986	0.2160	676.5765 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2294.9871	0.2160	495.7172 (264)
Space and water heating			1172.2937 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	336.3266	0.5190	174.5535 (268)
Total CO2, kg/m2/year			1385.7722 (272)
Emissions per m2 for space and water heating			16.4556 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.4502 (272b)
Emissions per m2 for pumps and fans			0.5464 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4556 * 1.55) + 2.4502 + 0.5464, rounded to 2 d.p.			28.5000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	5009-6			Issued on Date	04/04/2022
Assessment Reference	001	Prop Type Ref			
Property	Flat 6, 12, Harpsfield Broadway, Hatfield, AL10 9TF				
SAP Rating	78 C	DER	26.40	TER	28.51
Environmental	80 C	% DER<TER	7.40		
CO ₂ Emissions (t/year)	1.80	DFEE	46.25	TFEE	59.21
General Requirements Compliance	Pass	% DFEE<TFEE	21.88		
Assessor Details	Mr. Harry Davey, energytest, Tel: 01892 315466, hdavey@energy-test.co.uk			Assessor ID	R434-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Top-floor flat, total floor area 82 m²

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

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 28.51 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 26.40 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.22 (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: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system 1: Room heaters - Electric
Panel, convector or radiant heaters

Main heating system 2:
Dimplex EDL200UK-630

Heat pump with warm air distribution - Electric

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls 1: Programmer and room thermostat OK

Hot water controls:

No cylinder

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 (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North East: 8.91 m², No overhang
Windows facing South West: 4.32 m², No overhang
Windows facing North West: 2.12 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.5000 (1b)	2.3800 (2b)	193.9700 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	193.9700 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1031 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3031	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2804 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3575	0.3505	0.3435	0.3084	0.3014	0.2664	0.2664	0.2593	0.2804	0.3014	0.3154	0.3294 (22b)
Effective ac	0.5639	0.5614	0.5590	0.5476	0.5454	0.5355	0.5355	0.5336	0.5393	0.5454	0.5497	0.5543 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			1.8900	1.4000	2.6460		(26)
Window (Uw = 1.20)			15.3500	1.1450	17.5763		(27)
External Wall 1	86.3800	15.3500	71.0300	0.1800	12.7854		(29a)
Corridor	9.7500	1.8900	7.8600	0.1800	1.4148		(29a)
External Roof 1	67.5900		67.5900	0.1300	8.7867		(30)
Total net area of external elements Aum(A, m2)			163.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	43.2092	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.3271 (36)
Total fabric heat loss						(33) + (36) =	57.5363 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	36.0950	35.9362	35.7805	35.0493	34.9125	34.2757	34.2757	34.1577	34.5210	34.9125	35.1893	35.4786 (38)
Average = Sum(39)m / 12 =	93.6313	93.4725	93.3169	92.5857	92.4489	91.8120	91.8120	91.6941	92.0573	92.4489	92.7256	92.5850 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1489	1.1469	1.1450	1.1360	1.1343	1.1265	1.1265	1.1251	1.1295	1.1343	1.1377	1.1413 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4907 (42)											
Average daily hot water use (litres/day)	93.3543 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	102.6897	98.9555	95.2214	91.4872	87.7530	84.0188	84.0188	87.7530	91.4872	95.2214	98.9555	102.6897 (44)
Energy content (annual)	152.2859	133.1902	137.4403	119.8238	114.9738	99.2136	91.9360	105.4979	106.7579	124.4161	135.8099	147.4807 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1468.8262 (45)											
Water storage loss:	22.8429	19.9785	20.6161	17.9736	17.2461	14.8820	13.7904	15.8247	16.0137	18.6624	20.3715	22.1221 (46)
Store volume	201.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.6100 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.8694 (55)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	179.2373	157.5334	164.3917	145.9058	141.9252	125.2956	118.8874	132.4493	132.8399	151.3675	161.8919	174.4321	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	179.2373	157.5334	164.3917	145.9058	141.9252	125.2956	118.8874	132.4493	132.8399	151.3675	161.8919	174.4321	(64)
Heat gains from water heating, kWh/month	50.6350	44.2857	45.6989	39.8414	38.2288	32.9885	30.5687	35.0781	35.4970	41.3683	45.1568	49.0373	(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	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1271	17.8767	14.5383	11.0064	8.2274	6.9460	7.5054	9.7557	13.0941	16.6260	19.4050	20.6865	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.5469	224.8563	219.0368	206.6478	191.0090	176.3107	166.4914	164.1820	170.0015	182.3904	198.0293	212.7276	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	(71)
Water heating gains (Table 5)	68.0579	65.9014	61.4233	55.3353	51.3828	45.8174	41.0870	47.1479	49.3014	55.6026	62.7177	65.9104	(72)
Total internal gains	371.0925	368.9950	355.3590	333.3502	310.9798	289.4347	275.4443	281.4463	292.7576	314.9797	340.5126	359.6851	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
Northeast	8.9100	11.2829	0.6300	0.7000	0.7700	30.7236 (75)							
Southwest	4.3200	36.7938	0.6300	0.7000	0.7700	48.5770 (79)							
Northwest	2.1200	11.2829	0.6300	0.7000	0.7700	7.3102 (81)							
Solar gains	86.6108	160.1635	252.6990	369.3517	465.0429	484.2620	457.4826	382.6403	292.5513	186.0624	106.0404	72.6321	(83)
Total gains	457.7033	529.1584	608.0579	702.7019	776.0228	773.6967	732.9270	664.0866	585.3090	501.0421	446.5530	432.3171	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	24.1787	24.2198	24.2602	24.4518	24.4880	24.6579	24.6579	24.6896	24.5922	24.4880	24.4149	24.3390	
alpha	2.6119	2.6147	2.6173	2.6301	2.6325	2.6439	2.6439	2.6460	2.6395	2.6325	2.6277	2.6226	
util living area	0.9711	0.9568	0.9282	0.8660	0.7607	0.6200	0.4934	0.5489	0.7542	0.9050	0.9588	0.9749	(86)
MIT	18.5457	18.8086	19.2680	19.8728	20.4062	20.7616	20.9064	20.8734	20.5722	19.8803	19.1051	18.4908	(87)
Th 2	19.9611	19.9627	19.9643	19.9715	19.9729	19.9792	19.9792	19.9804	19.9768	19.9729	19.9701	19.9673	(88)
util rest of house	0.9666	0.9502	0.9168	0.8439	0.7194	0.5508	0.3970	0.4524	0.6961	0.8845	0.9513	0.9710	(89)
MIT 2	16.6723	17.0535	17.7161	18.5775	19.3062	19.7601	19.9168	19.8901	19.5449	18.6062	17.4920	16.5961	(90)
Living area fraction	17.6310	17.9518	18.5103	19.2404	19.8691	20.2726	20.4233	20.3934	20.0707	19.2583 / (4) =	18.3176	17.5658	(91)
Temperature adjustment	17.6310	17.9518	18.5103	19.2404	19.8691	20.2726	20.4233	20.3934	20.0707	19.2583	18.3176	17.5658	(92)
adjusted MIT	17.6310	17.9518	18.5103	19.2404	19.8691	20.2726	20.4233	20.3934	20.0707	19.2583	18.3176	17.5658	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	436.0296	493.6909	545.0251	579.8502	554.6974	442.5223	322.9873	327.7899	410.9257	434.2648	417.5779	414.2585	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1248.2033	1219.9810	1120.7673	957.3731	755.2253	520.8161	351.0207	366.1671	549.6436	800.4458	1040.1547	1243.2175	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	604.2572	488.0670	428.3522	271.8165	149.1927	0.0000	0.0000	0.0000	0.0000	272.4387	448.2553	616.7455	(98)
Space heating													3279.1251 (98)
Space heating per m2													(98) / (4) = 40.2347 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)
Fraction of main heating from main system 2																		0.0000 (203)
Fraction of total heating from main system 1																		1.0000 (204)
Fraction of total heating from main system 2																		0.0000 (205)
Efficiency of main space heating system 1 (in %)																		100.0000 (206)
Efficiency of main space heating system 2 (in %)																		0.0000 (207)
Efficiency of secondary/supplementary heating system, %																		0.0000 (208)
Space heating requirement																		3279.1251 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Space heating requirement	604.2572	488.0670	428.3522	271.8165	149.1927	0.0000	0.0000	0.0000	0.0000	272.4387	448.2553	616.7455						(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000						(210)
Space heating fuel (main heating system)	604.2572	488.0670	428.3522	271.8165	149.1927	0.0000	0.0000	0.0000	0.0000	272.4387	448.2553	616.7455						(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						(213)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						(215)
Space heating fuel used, main system 2																		0.0000 (213)
Water heating requirement	179.2373	157.5334	164.3917	145.9058	141.9252	125.2956	118.8874	132.4493	132.8399	151.3675	161.8919	174.4321						(64)
Efficiency of water heater	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100						(216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100						(217)
Fuel for water heating, kWh/month	51.2971	45.0855	47.0484	41.7578	40.6185	35.8592	34.0252	37.9066	38.0184	43.3209	46.3329	49.9219						(219)
Water heating fuel used																		511.1923 (219)
Annual totals kWh/year																		
Space heating fuel - main system																		3279.1251 (211)
Space heating fuel - secondary																		0.0000 (215)
Electricity for pumps and fans:																		
Total electricity for the above, kWh/year																		0.0000 (231)
Electricity for lighting (calculated in Appendix L)																		355.4510 (232)
Total delivered energy for all uses																		4145.7685 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3279.1251	0.5190	1701.8659	(261)
Space heating - main system 2	0.0000	0.5190	0.0000	(262)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	511.1923	0.5190	265.3088	(264)
Space and water heating			1967.1748	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	355.4510	0.5190	184.4791	(268)
Total CO2, kg/year			2151.6538	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			26.4000	(273)

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

DER			26.4000	ZC1
Total Floor Area		TFA	81.5000	
Assumed number of occupants		N	2.4907	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.1812	ZC2
CO2 emissions from cooking, equation (L16)			2.1936	ZC3
Total CO2 emissions			44.7748	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			44.7748	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.5000 (1b)	x 2.3800 (2b)	= 193.9700 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.9700 (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				3 * 10 =	30.0000 (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) =				30.0000 / (5) =	0.1547 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4047 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3743 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4772	0.4679	0.4585	0.4117	0.4024	0.3556	0.3556	0.3462	0.3743	0.4024	0.4211	0.4398 (22b)
Effective ac	0.6139	0.6095	0.6051	0.5848	0.5810	0.5632	0.5632	0.5599	0.5701	0.5810	0.5887	0.5967 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			15.3500	1.3258	20.3504		(27)
External Wall 1	86.3800	15.3500	71.0300	0.1800	12.7854		(29a)
Corridor	9.7500	1.8900	7.8600	0.1800	1.4148		(29a)
External Roof 1	67.5900		67.5900	0.1300	8.7867		(30)
Total net area of external elements Aum(A, m2)			163.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.2273	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4545 (36)
Total fabric heat loss						(33) + (36) =	60.6818 (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	39.2947	39.0117	38.7342	37.4310	37.1872	36.0521	36.0521	35.8419	36.4893	37.1872	37.6804	38.1961 (38)
Heat transfer coeff	99.9765	99.6935	99.4160	98.1128	97.8689	96.7339	96.7339	96.5237	97.1711	97.8689	98.3622	98.8779 (39)
Average = Sum(39)m / 12 =												98.1116 (39)
HLP	1.2267	1.2232	1.2198	1.2038	1.2008	1.1869	1.1869	1.1843	1.1923	1.2008	1.2069	1.2132 (40)
HLP (average)												1.2038 (40)
Days in month	31	28	31	30	31	30	31	31	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												2.4907 (42)
Average daily hot water use (litres/day)												93.3543 (43)
Daily hot water use	102.6897	98.9555	95.2214	91.4872	87.7530	84.0188	84.0188	87.7530	91.4872	95.2214	98.9555	102.6897 (44)
Energy conte	152.2859	133.1902	137.4403	119.8238	114.9738	99.2136	91.9360	105.4979	106.7579	124.4161	135.8099	147.4807 (45)
Energy content (annual)												Total = Sum(45)m = 1468.8262 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8429	19.9785	20.6161	17.9736	17.2461	14.8820	13.7904	15.8247	16.0137	18.6624	20.3715	22.1221 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	198.8808	175.2759	184.0352	164.9157	161.5687	144.3055	138.5309	152.0928	151.8498	171.0110	180.9017	194.0756 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	198.8808	175.2759	184.0352	164.9157	161.5687	144.3055	138.5309	152.0928	151.8498	171.0110	180.9017	194.0756 (64)
Heat gains from water heating, kWh/month	87.9110	77.9543	82.9748	75.9149	75.5047	69.0620	67.8447	72.3540	71.5705	78.6443	81.2303	86.3133 (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	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353	124.5353 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1271	17.8767	14.5383	11.0064	8.2274	6.9460	7.5054	9.7557	13.0941	16.6260	19.4050	20.6865 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.5469	224.8563	219.0368	206.6478	191.0090	176.3107	166.4914	164.1820	170.0015	182.3904	198.0293	212.7276 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535	35.4535 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282	-99.6282 (71)
Water heating gains (Table 5)	118.1599	116.0034	111.5253	105.4373	101.4848	95.9195	91.1890	97.2500	99.4034	105.7047	112.8198	116.0124 (72)
Total internal gains	424.1945	422.0970	408.4610	386.4522	364.0819	342.5367	328.5464	334.5483	345.8597	368.0817	393.6147	412.7871 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	8.9100	11.2829	0.6300	0.7000	0.7700	30.7236 (75)						
Southwest	4.3200	36.7938	0.6300	0.7000	0.7700	48.5770 (79)						
Northwest	2.1200	11.2829	0.6300	0.7000	0.7700	7.3102 (81)						
Solar gains	86.6108	160.1635	252.6990	369.3517	465.0429	484.2620	457.4826	382.6403	292.5513	186.0624	106.0404	72.6321 (83)
Total gains	510.8053	582.2605	661.1600	755.8040	829.1248	826.7987	786.0290	717.1886	638.4110	554.1441	499.6551	485.4192 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	56.6105	56.7712	56.9297	57.6859	57.8296	58.5082	58.5082	58.6356	58.2449	57.8296	57.5396	57.2395
alpha	4.7740	4.7847	4.7953	4.8457	4.8553	4.9005	4.9005	4.9090	4.8830	4.8553	4.8360	4.8160
util living area	0.9976	0.9950	0.9870	0.9561	0.8654	0.6931	0.5289	0.5953	0.8497	0.9755	0.9951	0.9981 (86)
MIT	19.6816	19.8336	20.1022	20.4699	20.7801	20.9473	20.9886	20.9805	20.8536	20.4551	20.0077	19.6595 (87)
Th 2	19.8987	19.9015	19.9042	19.9169	19.9193	19.9305	19.9305	19.9325	19.9262	19.9193	19.9145	19.9094 (88)
util rest of house	0.9967	0.9933	0.9822	0.9394	0.8164	0.5989	0.4068	0.4689	0.7766	0.9631	0.9931	0.9975 (89)
MIT 2	18.1503	18.3738	18.7656	19.2970	19.7061	19.8962	19.9264	19.9247	19.8084	19.2866	18.6378	18.1255 (90)
Living area fraction	18.9340	19.1209	19.4497	19.8973	20.2557	20.4341	20.4700	20.4650	20.3433	19.8846	19.3389	18.9106 (92)
Temperature adjustment	18.9340	19.1209	19.4497	19.8973	20.2557	20.4341	20.4700	20.4650	20.3433	19.8846	19.3389	0.0000
adjusted MIT	18.9340	19.1209	19.4497	19.8973	20.2557	20.4341	20.4700	20.4650	20.3433	19.8846	19.3389	18.9106 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9957	0.9916	0.9797	0.9390	0.8333	0.6453	0.4696	0.5339	0.8082	0.9626	0.9916	0.9966 (94)
Ext temp.	508.6126	577.3763	647.7087	709.7179	690.8911	533.5507	369.1261	382.8985	515.9497	533.4090	495.4719	483.7780 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1463.0595	1417.7298	1287.4024	1078.9724	837.3420	564.3585	374.3646	392.3676	606.6679	908.6719	1203.8456	1454.5529 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	710.1085	564.7176	475.9321	265.8633	108.9595	0.0000	0.0000	0.0000	0.0000	279.1956	510.0290	722.2565 (98)
												3637.0621 (98)
												(98) / (4) = 44.6265 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3889.9060 (211)
Space heating requirement	710.1085	564.7176	475.9321	265.8633	108.9595	0.0000	0.0000	0.0000	0.0000	279.1956	510.0290	722.2565	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	759.4743	603.9760	509.0183	284.3457	116.5342	0.0000	0.0000	0.0000	0.0000	298.6049	545.4856	772.4669	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	198.8808	175.2759	184.0352	164.9157	161.5687	144.3055	138.5309	152.0928	151.8498	171.0110	180.9017	194.0756	(64)
Efficiency of water heater (217)m	87.9207	87.7142	87.2381	86.0813	83.7901	79.8000	79.8000	79.8000	79.8000	86.1140	87.4306	88.0009	(216)
Fuel for water heating, kWh/month	226.2048	199.8261	210.9573	191.5813	192.8256	180.8339	173.5977	190.5925	190.2879	198.5867	206.9089	220.5383	(219)
Water heating fuel used													2382.7410 (219)
Annual totals kWh/year													
Space heating fuel - main system													3889.9060 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													355.4510 (232)
Total delivered energy for all uses													6703.0980 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3889.9060	0.2160	840.2197	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2382.7410	0.2160	514.6721	(264)
Space and water heating			1354.8917	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.4510	0.5190	184.4791	(268)
Total CO2, kg/m2/year			1578.2958	(272)
Emissions per m2 for space and water heating			16.6244	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.2635	(272b)
Emissions per m2 for pumps and fans			0.4776	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.6244 * 1.55) + 2.2635 + 0.4776, rounded to 2 d.p.			28.5100	(273)