
Mr C Chapman

Burlow Road, Harper Hill
Energy Statement



April 2023



Contact Information

Client:	Mr C Chapman c/o Wood Goldstraw Yorath Churchill House Regent Road Hanley Stoke on Trent ST1 3RH
Client Lead:	Atilla Zirekoglu
Tel:	01782 208 000
Email:	a.zirekoglu@woodgoldstraw.co.uk
Prepared By:	Focus Consultants 2010 LLP Focus House Millennium Way West Phoenix Business Park Nottingham NG8 6AS
Project:	Burlow Road, Harper Hill
Document Title:	Energy Statement
Date:	April 2023
Authorised By:	Ben Matthews, Senior Sustainability Consultant Ben.matthews@focus-consultants.com
Signature:	

Focus Offices

NOTTINGHAM

Focus House
Millennium Way West Phoenix
Business Park Nottingham
NG8 6AS
T: 0115 976 5050
E: enquiries@focus-consultants.com

LEICESTER

Olympus House
Unit 3, Main Street
Kirby Muxloe
Leicestershire
LE9 2AL
T: 0116 275 8315
E: leicesterenquiries@focus-consultants.com

LONDON

45-46 Lower Marsh
London
SE1 7RG
T: 0203 096 9717
E: londonenquiries@focus-consultants.com

Contents Page

	Page
1.0 Introduction	3
2.0 Planning Policy	4
3.0 Maximising Energy Efficiency	6
4.0 Carbon Emissions and Energy Performance Calculations	8
5.0 Water Consumption	11
6.0 Recycling and Sustainability	12
7.0 Conclusion	14

Appendices

Appendix 1	-	Proposed Site Plan
Appendix 2	-	As Designed SAP Calculation
Appendix 3	-	Part G Water Calculations

1.0 Introduction

1.1 Purpose of the Report

Instructions were received from Wood Goldstraw Yorath on behalf of Mr C Chapman to produce an Energy Statement for the proposed development at BurLOW Road, Harper Hill. This report has been produced to support the planning application to be submitted for the development.

This statement provides a response to the relevant planning policy within the High Peak Local Plan - Adopted April 2016.

1.2 Site and Building Description

The development will be located at BurLOW Road, Harper Hill. It comprises the construction of 6No residential dwellings. A proposed site layout has been included in Appendix 1.

1.3 Methodology

The proposed site plan was reviewed to gain a good understanding of the development; following this the relevant policies were identified. The development is located in Harper Hill, therefore the High Peak Local Plan, policies Policy S1 and EQ1 have been identified as relevant.

To address the policies, sample SAP calculations have been completed to determine the approximate performance of the proposed development dwellings. The specifications and results for the buildings as proposed are compared to the target building baseline, which is the benchmark for Part L of the Building Regulations compliance.

This statement aims to demonstrate how the development is to adopt an efficient fabric specification, exceeding the minimum requirements of building regulations Part L1A. The development will also make use of efficient heating systems to the dwellings to further reduce the CO₂ emissions of the total site. Benchmark data has been produced to demonstrate the performance aligning with the Building Regulations Part L1a compliance requirements using Elmhurst accredited SAP software.

Furthermore, the total predicted energy consumption of the development and the use of Solar PV have been specified in order to address the policy requirements, requiring a sustainable contribution from the development. As well as this, the feasibility of connecting to district heating networks was explored utilising the Association of Decentralised Energy connection map.

To address Policy EQ1, in relation to high efficiency water standards, a proposed sanitaryware specification has been assessed against the 110 litre/per person/per day, to reduce overall water consumption of the development in operation.

2.0 Planning Policy

2.1 High Peak Local Plan, Adopted April 2016

The High Peak Local Plan, Adopted April 2016 addresses a broad spectrum of environmental and sustainability issues, however for the purpose of this Energy Statement, Planning policies S1 and EQ1 are to be considered.

2.2 Policy S1 Sustainable Development Principles

- 1. Minimising carbon or energy impacts associated with development according to the principles of the 'energy hierarchy' by minimising the need for energy through the appropriate siting, orientation and design of new buildings; the use of renewable energy sources and ensuring building construction and other forms of development address the challenge of climate change by meeting high environmental standards with particular regard to energy efficiency, water efficiency, use of sustainable materials, encouraging waste reduction, recycling, including where appropriate the local- or on site-sourcing of building materials;*
- 2. Further mitigating the impacts of climate change by seeking reductions in greenhouse gas emissions across the High Peak; in particular through supporting the delivery of renewable and low-carbon forms of energy (either via stand-alone installations, or installations integrated within new/existing developments), where this is considered acceptable against all other Development Plan Policies as a whole;*

2.3 Policy EQ 1 - Climate Change

- 1. Requiring new development to be designed to contribute to achieving national targets to reduce greenhouse gas emissions by using land-form, layout, building orientation, tree planting, massing and landscaping to reduce likely energy consumption and resilience to increased temperatures.*
- 2. Ensuring that renewable energy installations do not have an adverse impact on the integrity of any European sites, (including by project- level HRA where appropriate), wildlife sites, protected species or habitats, or the landscape and landscape setting of the Peak District National Park*
- 3. Supporting opportunities to deliver decentralised energy systems, particularly those which are powered by a renewable or low carbon source*
- 4. Supporting connection to an existing decentralised energy supply system where there is capacity to supply the proposed development, or design for a future connection where there a firm proposals for such a system*
- 5. Ensuring that renewable / low carbon energy generation developments and associated infrastructure are supported by requiring Design Statements to include an assessment of how any impacts on the environment and heritage assets, including cumulative landscape, noise and visual impacts, can be avoided and/or mitigated through careful consideration of location, scale, design and other measures.*

6. *Applications for new build residential development in the Buxton Sub-Area should meet the optional national technical requirement for water efficiency of 110 litres per person per day to minimise the phosphate load to the River Wye via discharges from the Buxton Sewage Treatment Works, unless it can be demonstrated that doing so would adversely impact on a scheme's viability.*
7. *Unless it can be demonstrated that it would not be technically feasible or financially viable, requiring that commercial developments over 1,000m² the Building Research Establishment Environmental Assessment Method (BREEAM) good standard as a minimum.*
8. *Promoting energy efficiency and the use of renewable / low carbon energy in new development and through retro-fitting of existing buildings*
9. *Supporting sustainable waste management by provision of space for recycling and compost*
10. *Supporting the use of sustainable design and construction techniques including the use of recycled materials in construction, including where appropriate the local or on-site sourcing of these building materials*
11. *Supporting high water efficiency standards and measures to recycle and minimise water consumption.*

3.0 Maximising Energy Efficiency

In efforts to reduce the overall carbon emissions associated with the development and to maximise the energy efficiency, as outlined in Policy S1 & EQ1, the developer has a desired 'fabric first' approach to the build specification.

This has been achieved through building fabric improvements of an uplift on the minimum requirements of Approved Document Part L, and also specification of efficient mechanical and electrical services, including a number of 'add-on' measures to improve efficiency and performance.

The table below demonstrates how the specification of the development at Burlow Road, Harper Hill, compares to the limiting values and minimum efficiencies allowed within Part L 2022:

Table 1: Comparison with Building Regulations Part L 2022		
Building Element	Limiting Part L 2022 Specification	Proposed Specification
External Walls U-Value	0.26	0.18
Roof U-Value	0.16	0.11 / 0.13
Ground Floor U-Value	0.18	0.13
Window U-Value	1.60	1.20
Door U-Value	1.40	1.20
Heating Efficiency	320%/250%/89.5%	89.6%
Pressure Test	8.00	5.00
Thermal Bridge Y-Value	0.09	Average of 0.06
Lighting Efficacy	80lm/w	80lm/w

The development is proposed to adopt a 'fabric first' approach to specification, and as detailed above, the proposed U-Values are an improvement on the minimum requirements under Part L and are in line with the 'notional' fabric specification for Part L 2022

Insulated cavity wall, roof, floors and openings provide a comfortable environment within the development and reduce the buildings' reliance on the main heating system. The use of thermal bridge details based on a standardised calculated suite will also ensure that thermal performance is enhanced by minimising heat and energy losses through thermal bridges and air gaps. The air permeability target is 5.00 m³/(h.m²), providing a significant improvement over the Notional Building target.

It is currently proposed to provide the space heating and water heating requirements for the dwellings using highly efficient, modern gas combi boilers. Other heating strategies have been examined, with direct electric being dismissed as an option due to the poor Part L performance achieved using this strategy, and the high likely bills for the end user due to current and projected electricity prices. The use of Air Source Heat Pumps was also explored, but due to site and financial reasons, this was not the preferred option for the client.

Solar Photovoltaic panels (PV) will be applied to the roofs of all houses at the proposed scheme. The current predicted output requirement for each plot is 2214.36 kWh/yr, which equates to circa 3.35 kW Peak (approximately 8-9 panels).

To summarise, all of the main building elements outlined in Table 1 have been designed to provide a thermally efficient building envelope that achieves an improvement on the minimum requirements set out within Part L. These elements when combined with efficient mechanical and electrical services, achieve an improvement on the minimum requirements set out within Part L1A 2022 and ensure enhanced energy efficiency and reduce CO₂ emissions, thus mitigating the impacts of climate change.

4.0 Carbon Emissions and Energy Performance Calculations

4.1 Carbon Emissions

To understand the overall proposed carbon performance of the development and in line with the requirement highlighted in SD1, sample SAP calculations for the proposed development have been undertaken.

Table 2 below demonstrates the development's approximate carbon performance, based on the sample house types modelled.

Table 2: Predicted Carbon Emissions	
Domestic	Predicted Carbon Emissions (kg/CO ₂)
Target Carbon Emissions	9120.42
Dwelling Carbon Emissions	9070.50
Percentage Reduction (%)	0.60%

Carbon emissions have also been calculated as demonstrated by Table 2. Overall, the Target Emission Rate (TER) for the properties is approximated to be 9120.42 kg/CO₂/yr. The Dwelling Emission Rate (DER) is calculated to be 9070.50 kg/CO₂/yr. This is an improvement of 0.60% against the target figure.

4.2 Fabric Energy Efficiency

Table 3 below demonstrates the development's approximate average building fabric energy efficiency based on the sample dwellings modelled.

Table 3: Fabric Energy Efficiency Breakdown	
Domestic	Average Fabric Efficiency (kWh/m ² /yr)
Target Fabric Energy Efficiency (TFEE)	41.59
Dwelling Fabric Energy Efficiency (DFEE)	41.25
Percentage Reduction (%)	0.81%

As a result of the SAP outputs for the development, Table 3 shows the average Target Fabric Energy Efficiency (TFEE) of the development to be 41.59 kWh/m²/yr. The average Predicted Dwelling Fabric Energy Efficiency (DFEE) is demonstrated to be an improvement against this amount, currently modelled to achieve 41.25 kWh/m²/yr.

Overall, this is an improvement in fabric energy efficiency, equating to approximately a 0.81% reduction against the notional amount.

4.3 Primary Energy Efficiency

Table 4 demonstrates the development's approximate breakdown of primary energy efficiency based on the sample dwellings modelled.

Table 4: Primary Energy Efficiency	
Domestic	Average Primary Energy Rate (kWh/m ² /yr)
Target Primary Energy Rate (TPER)	61.94
Dwelling Primary Energy Rate (DPER)	61.61
Percentage Reduction (%)	0.54%

As a result of the sample SAP outputs for the development, Table 4 confirms the forecasted Primary Energy Efficiency of Burlow Road, Harper Hill is 61.94 kWh/m²/yr. The Building Regulations requirement is 61.61 kWh/m²/yr which equates to a 0.54% improvement.

4.4 Decentralised / Renewable Energy

As part of the Policy requirements detailed in Policy EQ1, an exercise has been completed reviewing the potential for the proposed development at Burlow Road, Harper Hill to connect to an existing district heat network. The Association for Decentralised Energy's (ADE) District Heating connection map has been reviewed to confirm the closest possible connection point.

As demonstrated from the Figure 1, the closest connection point is the Sheffield District Energy scheme, approximately 29 miles from the proposed site location. Due to the extended distance between these two points, and the nature of the development, it is considered that this would not be a feasible application.



As discussed above, the client intends to introduce renewable energy to the scheme in the form of Solar Photovoltaic panels applied to the roof of every proposed dwelling.

Photovoltaic panels convert solar radiation into direct current electricity. In principle, they are an ideal source of renewable energy as they harness the most abundant source of energy on the Earth, the sun, and they produce electricity, which is the most useful form of energy.

PV's are silent in operation, have no moving parts and have a long life with low maintenance levels. Given the location of the scheme, with minimal overshadowing from other buildings, it is expected that the PV panels will be able to provide significant generation, especially the panels that are applied to the front elevation of the dwelling, which benefits from South West orientation and is therefore perfectly placed for PV. Where the PV generation is not utilised by the end user, this renewable energy will be fed back into the National Grid supply, assisting with the overall decarbonisation of the UK electricity grid.

5.0 Water Consumption

As part of Policy EQ1, it is a requirement that the development is designed to use water efficiently, therefore planned water use will not exceed 110 litres/per person/per day. The development at Burlow Road, Harper Hill will incorporate efficient, water saving sanitaryware to meet this goal. Where this is not possible, flow restrictors will be installed to limit water use of sanitaryware items.

A representative specification is listed below, whilst the final flow rates of individual sanitaryware items may change as detailed design progresses, the 110 Litre limit will be maintained. A full breakdown of calculations are available in Appendix 3. The specification outlined in Table 5 achieves 109.7 litres/ per person/ per day, this therefore meets policy EQ1's requirements.

Table 5: Proposed Sanitaryware Specification Flow Rates	
Component	Water Usage
WCs	4.5 Litres (Full Flush Volume), 3 Litres (Part Flush Volume)
Bath	190 Litres Capacity to Overflow
Showers	8 Litres/Minute
Wash-hand basin taps	5 Litres/Minute
Kitchen taps	5 Litres/Minute
Calculated Use	109.7 Litres/Person/Day

6.0 Recycling and Sustainability

6.1 Sustainable Construction

The development at Burlow Road, Harper Hill will strive to incorporate sustainable design into the scheme. Material selection will endeavour to show preference to suppliers who operate responsible sourcing practices and have current environmental management certificates. Examples including FSC/PEFC certified timber products will be utilised, this ensures all products have been obtained from sustainable and legal sources.

Where possible, local suppliers of required building materials will be given preferred selection over those who operate at further distance from the development site. Through this approach, delivery materials will be transported lesser distance, reducing the associated CO₂ emissions and fuel use of delivery loads. The procurement of these materials closer to the site, will support local businesses & operations within the region. Where allowing, suppliers who possess environmental certifications such as BES 6001/ISO 14001 will be sourced from to further encourage the use of materials ascertained from responsible accredited supply chains.

Similarly, where contractors and site personnel are required to aid the construction efforts, they too will also be given preferential consideration where they are local to the site. This again will reduce the associated CO₂ emissions of travel, in addition to supporting the local economy.

The client will employ an effective site waste management system adopting waste hierarchy principles of reduce, reuse, or recycle. All waste will be handled by a licensed waste contractor who will segregate and process waste produced.

The development design is to standard material dimensions to avoid waste generation. This contributes towards the standardisation of the dwellings which reduces waste not only at the manufacturing stage, but also during construction as it reduces the need to re-size materials on site.

6.2 Recycling

Site waste will be separated into key waste groups and recycled at a waste processing plant to be refined into new products, or reused in other projects where they cannot be reformed. Site hoarding or materials where safe and appropriate are transported from other sites for reuse.

With regards to the end users of the dwellings, High Peak Borough Council operate a recycling system with a number of different bins and collections for different items. These include a brown bin for glass, plastics, paper, cans and cardboard, a green bin for compostable items, a red bag for textiles and a bookable small electrical item collection service. The client will ensure that timely representations are made to the council so that all correct receptacles are provided for all dwellings at the site, and will ensure that the end users are made aware of the collection system.

6.3 Overheating

The development will be of a traditional masonry construction. The impact of implementing this form of construction will result in an overall higher thermal mass for each dwelling. As temperatures become more extreme through changes in climate, this will assist in regulation of temperature internally.

Given the timescales of the proposed scheme, it will be assessed against the new Part O Overheating Building Regulations. Given the nature of the scheme it will initially be assessed using the Simplified Method. If this is not successful it will then be assessed using the Dynamic Thermal Modelling method, which follows the CIBSE TM59 methodology. It is currently expected that compliance will be achieved through a combination of passive measures and mechanical ventilation. Where further measures are required to ensure Part O Compliance, these will be installed in full by the client.

7.0 Conclusion

This statement has reviewed the proposed development at Land at BurLOW Road, Harper Hill which consists of 6No. residential properties, and provided an assessment of the proposed scheme against the relevant policies: namely;

Policy S1 Sustainable Development Principles.

Policy EQ 1 - Climate Change.

The statement has highlighted that the scheme currently proposes to utilise a good thermal envelope to minimise heat loss, as well as efficient heating and lighting systems, which will drive energy efficiency in the buildings. This is in line with Policy S1's objective of sustainable design and reducing energy use. The calculations confirm that, through the design specification and use of Solar PV, the policy requirements for sustainable development and all compliance metrics under Part L 2022 are achieved.

A proposed sanitaryware specification has also been provided in order to comply with Policy EQ1's requirement of efficient water use. The specification proposed achieves a total 109.7 litres, meeting the requirement.

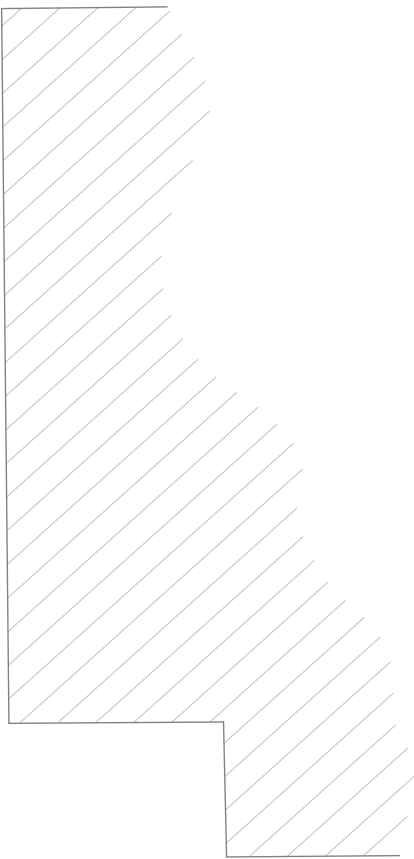
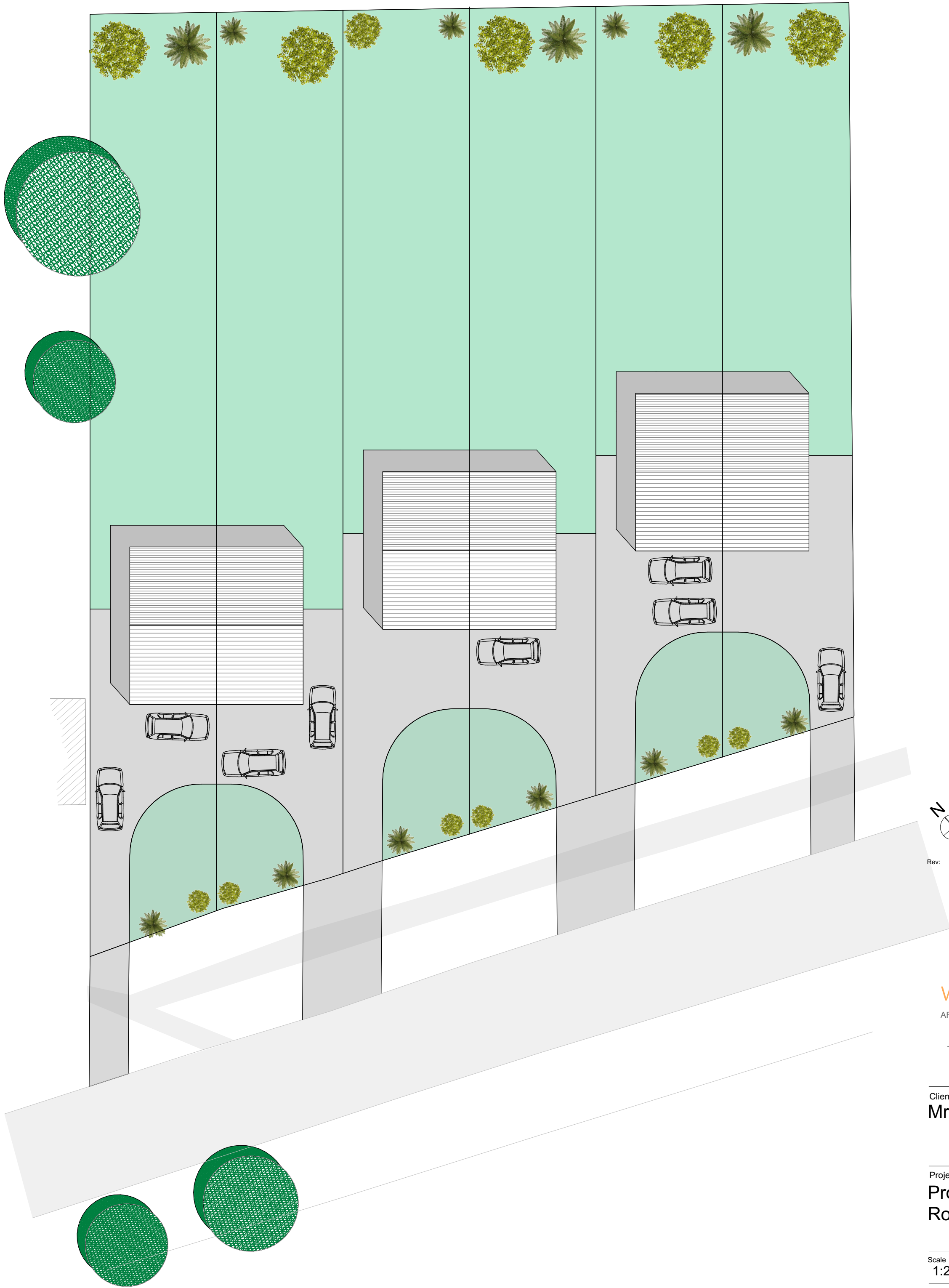
The statement has also detailed the current scheme proposals and procedures regarding Sustainable Construction, Recycling, Decentralised / Renewable Energy and Overheating.

Whilst Solar PV and the listed water sanitaryware flow rates are the preferred at present time, the strategy and required contribution may be subject to change as design develops further. Nonetheless, it will be ensured that where any changes are made, the policy requirements listed will be maintained.



Appendix 1

Proposed Site Plan



Rev: Comment: Date By:

wood | goldstraw | yorath
ARCHITECTS QUANTITY SURVEYORS CDM CO-ORDINATORS
Churchill House, Regent Road, Stoke on Trent, ST1 3RH.
Tel: 01782 208000 Fax: 01782 208712 E-mail: info@woodgoldstraw.co.uk
www.woodgoldstraw.co.uk

Client.
Mr Craig Chapman

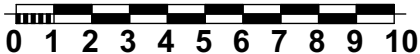
Project.
Proposed Dwellings on Burlow Road, Harper Hill

Scale 1:200		Issue Date 16/01/2023
Sheet Size A2	Drawn AZ	

Title.
Proposed Site Plan

Drawing Number	/ (Revision)	Revision ID
4894-03		

CAD file path:
X:\0 PROJECTS\4894 Mr Craig Chapman\4894-01 Proposed Dwellings, Burlow Road, Harper Hill
\Design\Arch\CAD\4894-01 Master.pln
Copyright. Wood Goldstraw Yorath LLP.
Contractors are to check all dimensions on site and refer any discrepancies to the Architect immediately. This drawing has been prepared for planning purposes only and to the best of our knowledge the original digital document is accurate at the stated scale. However, we cannot accept liability for the accuracy of third party data (OS mappings, topographical survey information, etc) used in the production of this document which we have relied upon in good faith. Key dimensions are noted for reference and any further specific dimensional information can be provided upon request.





Appendix 2

As Designed SAP Calculations

Full SAP Calculation Printout



Property Reference	Burlow Road A	Issued on Date	13/04/2023
Assessment Reference	Burlow Road A_COMBI	Prop Type Ref	
Property			
SAP Rating	93 A	DER	11.72
Environmental	89 B	% DER < TER	0.34
CO ₂ Emissions (t/year)	1.43	DFEE	41.25
Compliance Check	See BREL	% DFEE < TFEE	0.81
% DPER < TPER	0.27	DPER	61.77
Assessor Details	Mr. Benjamin Matthews	Assessor ID	P388-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.8000 (1b)	x 2.7000 (2b)	= 120.9600 (1b) -
First floor	44.8000 (1c)	x 2.7000 (2c)	= 120.9600 (1c) -
Second floor	39.7000 (1d)	x 2.7000 (2d)	= 107.1900 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.1100 (5)

2. Ventilation rate

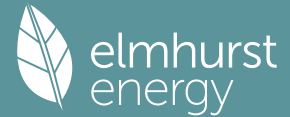
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1146 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3646 (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) = 0.3372 (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	0.4300	0.4215	0.4131	0.3710	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962 (22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5487	0.5569	0.5657	0.5720	0.5785 (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
Door			1.9100	1.2000	2.2920		(26)
HGD			5.4600	1.2000	6.5520		(26a)
Window (Uw = 1.20)			9.0400	1.1450	10.3511		(27)
Heatloss Floor 1			44.8000	0.1100	4.9280	75.0000	3360.0000 (28a)
External Wall 1	128.9400	13.8500	115.0900	0.1800	20.7162	110.0000	12659.9000 (29a)
Stud	12.2400		12.2400	0.1000	1.2240	18.0000	220.3200 (29a)

Full SAP Calculation Printout



Dormer	15.8400	2.5600	13.2800	0.1800	2.3904	18.0000	239.0400 (29a)
External Roof 1	30.7000		30.7000	0.1100	3.3770	9.0000	276.3000 (30)
External Roof 2	12.6000		12.6000	0.1300	1.6380	9.0000	113.4000 (30)
External Roof 3	2.5000		2.5000	0.1100	0.2750	9.0000	22.5000 (30)
Total net area of external elements Aum(A, m2)			247.6200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.7437			(33)
Party Wall 1			74.9400	0.0000	0.0000	110.0000	8243.4000 (32)
Internal Wall 1			135.0000			9.0000	1215.0000 (32c)
Internal Floor 1			44.8000			18.0000	806.4000 (32d)
Internal Floor 2			39.7000			18.0000	714.6000 (32d)
Internal Ceiling 1			44.8000			9.0000	403.2000 (32e)
Internal Ceiling 2			39.7000			9.0000	357.3000 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	28631.3600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.4336 (35)
Thermal bridges (User defined value 0.060 * total exposed area)		14.8572 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	68.6009 (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	68.2526	67.8391	67.4338	65.5299	65.1737	63.5154	63.5154	63.2084	64.1542	65.1737	65.8943	66.6476 (38)	
Average = Sum(39)m / 12 =	136.8536	136.4401	136.0347	134.1308	133.7746	132.1164	132.1164	131.8093	132.7551	133.7746	134.4952	135.2486 (39)	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0584	1.0552	1.0521	1.0374	1.0346	1.0218	1.0218	1.0194	1.0267	1.0346	1.0402	1.0460 (40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

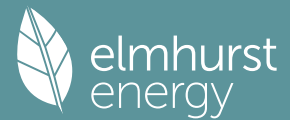
Assumed occupancy													2.8932 (42)
Hot water usage for mixer showers	72.7285	71.6355	70.0429	66.9956	64.7468	62.2389	60.8134	62.3940	64.1267	66.8194	69.9321	72.4498 (42a)	
Hot water usage for baths	31.3989	30.9325	30.2759	29.0651	28.1585	27.1532	26.6101	27.2622	27.9722	29.0479	30.2836	31.2927 (42b)	
Hot water usage for other uses	44.2588	42.6494	41.0400	39.4305	37.8211	36.2117	36.2117	37.8211	39.4305	41.0400	42.6494	44.2588 (42c)	
Average daily hot water use (litres/day)												136.4002 (43)	

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	148.3861	145.2174	141.3587	135.4912	130.7263	125.6038	123.6353	127.4774	131.5294	136.9072	142.8651	148.0013 (44)	
Energy content (annual)	235.0073	206.7877	217.2630	185.4807	175.9828	154.4445	149.5262	157.8436	162.1890	185.7818	203.5375	231.7343 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2265.5784	
Water storage loss:	35.2511	31.0182	32.5895	27.8221	26.3974	23.1667	22.4289	23.6765	24.3283	27.8673	30.5306	34.7601 (46)	
Total storage 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 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Primary 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)	
Combi loss	16.6101	14.9797	16.5356	15.8981	16.3622	15.7678	16.2511	16.2860	15.8003	16.4034	15.9740	16.5964 (61)	
Total heat required for water heating calculated for each month	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
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 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2459.0429 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Heat gains from water heating, kWh/month	82.2925	72.5018	76.3738	65.6469	62.6048	55.2947	53.7802	56.5545	57.8779	65.8733	71.6697	81.2007 (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	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576 (66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	185.1366	204.9727	185.1366	191.3078	185.1366	191.3078	185.1366	185.1366	191.3078	185.1366	191.3078	185.1366 (67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	296.8749	299.9555	292.1924	275.6657	254.8037	235.1964	222.0975	219.0168	226.7799	243.3066	264.1686	283.7760 (68)	
Pumps, fans	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658 (69)	
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)	
Water heating gains (Table 5)	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261 (71)	
	110.6082	107.8896	102.6530	91.1762	84.1463	76.7982	72.2852	76.0141	80.3860	88.5394	99.5413	109.1408 (72)	

Full SAP Calculation Printout



Total internal gains
662.0170 682.2151 649.3794 627.5470 593.4839 569.6998 545.9166 546.5649 564.8710 586.3799 624.4151 647.4507 (73)

6. Solar gains

[Jan]				Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast				3.4600	11.2829		0.6300		0.7000	0.7700	11.9308 (75)
Southwest				5.5800	36.7938		0.6300		0.7000	0.7700	62.7453 (79)
Solar gains	74.6761	131.1640	189.9905	253.0511	299.5426	304.4602	290.5842	254.8165	211.6583	147.8023	63.4402 (83)
Total gains	736.6930	813.3791	839.3699	880.5981	893.0265	874.1600	836.5008	801.3813	776.5293	734.1822	710.8909 (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, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.1143	58.2905	58.4642	59.2940	59.4519	60.1981	60.1981	60.3383	59.9085	59.4519	59.1334	58.8040
alpha	4.8743	4.8860	4.8976	4.9529	4.9635	5.0132	5.0132	5.0226	4.9939	4.9635	4.9422	4.9203
util living area	0.9973	0.9951	0.9912	0.9773	0.9368	0.8195	0.6564	0.7008	0.8938	0.9798	0.9947	0.9977 (86)
MIT	19.5603	19.7112	19.9398	20.2891	20.6198	20.8792	20.9699	20.9582	20.7926	20.3731	19.9202	19.5453 (87)
Th 2	20.0349	20.0376	20.0402	20.0523	20.0546	20.0652	20.0652	20.0672	20.0611	20.0546	20.0500	20.0452 (88)
util rest of house	0.9965	0.9936	0.9883	0.9689	0.9105	0.7453	0.5349	0.5833	0.8409	0.9706	0.9927	0.9971 (89)
MIT 2	18.3441	18.5389	18.8325	19.2834	19.6901	19.9806	20.0528	20.0481	19.8952	19.3936	18.8156	18.3322 (90)
Living area fraction	18.6686	18.8517	19.1280	19.5517	19.9381	20.2203	20.2975	20.2909	20.1347	19.6550	19.1103	18.6559 (92)
MIT	18.6686	18.8517	19.1280	19.5517	19.9381	20.2203	20.2975	20.2909	20.1347	19.6550	19.1103	18.6559 (93)
Temperature adjustment												0.0000
adjusted MIT	18.6686	18.8517	19.1280	19.5517	19.9381	20.2203	20.2975	20.2909	20.1347	19.6550	19.1103	18.6559 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9948	0.9910	0.9844	0.9630	0.9066	0.7592	0.5669	0.6137	0.8459	0.9654	0.9900	0.9956 (94)
Useful gains	732.8342	806.0194	826.3141	848.0281	809.5840	663.6239	474.2300	491.8057	656.8534	708.8101	707.4491	707.7664 (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	1966.3942	1903.5645	1717.8399	1428.7235	1102.0542	742.5392	488.4966	512.8607	801.1340	1211.3233	1615.3305	1955.1384 (97)
Space heating kWh	917.7686	737.5503	663.2953	418.1007	217.5979	0.0000	0.0000	0.0000	0.0000	373.8698	653.6746	928.0448 (98a)
Space heating requirement - total per year (kWh/year)												4909.9020
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	917.7686	737.5503	663.2953	418.1007	217.5979	0.0000	0.0000	0.0000	0.0000	373.8698	653.6746	928.0448 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4909.9020
Space heating per m ²										(98c) / (4) =		37.9729 (99)

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 %)												84.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	917.7686	737.5503	663.2953	418.1007	217.5979	0.0000	0.0000	0.0000	0.0000	373.8698	653.6746	928.0448 (98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)
Space heating fuel (main heating system)	1092.5817	878.0361	789.6372	497.7389	259.0451	0.0000	0.0000	0.0000	0.0000	445.0831	778.1840	1104.8153 (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)
Space heating fuel (secondary)	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	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (64)
Efficiency of water heater												87.3000 (216)

Full SAP Calculation Printout



(217)m	88.6286	88.6012	88.5506	88.4402	88.1942	87.3000	87.3000	87.3000	87.3000	88.3958	88.5664	88.6356	(217)
Fuel for water heating, kWh/month	283.9008	250.2985	264.0282	227.7006	218.0926	194.9739	189.8938	199.4612	203.8823	228.7270	247.8495	280.1702	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.4677	30.8602	27.7862	20.3574	15.7246	12.8472	14.3445	18.6456	24.2187	31.7763	35.8913	39.5369	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-47.7186	-69.0282	-101.8100	-116.1659	-125.5736	-117.1039	-115.4768	-108.8203	-96.6110	-79.7469	-52.9062	-40.9231	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-26.1179	-57.5498	-121.2514	-191.2679	-259.8502	-263.6936	-259.5327	-215.4221	-151.6595	-84.2429	-35.3731	-20.3749	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5845.1214	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.3000	
Water heating fuel used												2788.9788	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												310.4566	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-2758.2204	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												6272.3364	(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	5845.1214	0.2100	1227.4755 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2788.9788	0.2100	585.6855 (264)
Space and water heating			1813.1610 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	310.4566	0.1443	44.8085 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1071.8845	0.1343	-143.9367
PV Unit electricity exported	-1686.3359	0.1247	-210.2200
Total			-354.1567 (269)
Total CO2, kg/year			1515.7421 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.7200 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5845.1214	1.1300	6604.9872 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2788.9788	1.1300	3151.5460 (278)
Space and water heating			9756.5332 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	310.4566	1.5338	476.1887 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1071.8845	1.4963	-1603.8363
PV Unit electricity exported	-1686.3359	0.4575	-771.5607
Total			-2375.3969 (283)
Total Primary energy kWh/year			7987.4258 (286)
Dwelling Primary energy Rate (DPER)			61.7700 (287)

Full SAP Calculation Printout



SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.8000 (1b)	x 2.7000 (2b)	= 120.9600 (1b) -
First floor	44.8000 (1c)	x 2.7000 (2c)	= 120.9600 (1c) -
Second floor	39.7000 (1d)	x 2.7000 (2d)	= 107.1900 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.1100 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1146 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3646 (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) = 0.3372 (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	0.4300	0.4215	0.4131	0.3710	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962 (22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5487	0.5569	0.5657	0.5720	0.5785 (25)

3. Heat losses and heat loss parameter

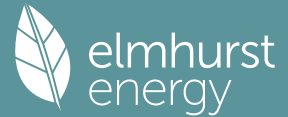
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9100	1.0000	1.9100		(26)
TER Semi-glazed door			5.4600	1.0000	5.4600		(26a)
TER Opening Type (Uw = 1.20)			9.0400	1.1450	10.3511		(27)
Heatloss Floor 1			44.8000	0.1300	5.8240		(28a)
External Wall 1	128.9400	13.8500	115.0900	0.1800	20.7162		(29a)
Stud	12.2400		12.2400	0.1800	2.2032		(29a)
Dormer	15.8400	2.5600	13.2800	0.1800	2.3904		(29a)
External Roof 1	30.7000		30.7000	0.1100	3.3770		(30)
External Roof 2	12.6000		12.6000	0.1100	1.3860		(30)
External Roof 3	2.5000		2.5000	0.1100	0.2750		(30)
Total net area of external elements Aum(A, m ²)			247.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.8929		(33)
Party Wall 1			74.9400	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

List of Thermal Bridges 221.4336 (35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.5800	0.0500	0.5790
E3 Sill	8.0500	0.0500	0.4025
E4 Jamb	32.2200	0.0500	1.6110
E5 Ground floor (normal)	19.1000	0.1600	3.0560
E6 Intermediate floor within a dwelling	40.1000	0.0000	0.0000
E16 Corner (normal)	27.0000	0.0900	2.4300
E18 Party wall between dwellings	16.2000	0.0600	0.9720
E17 Corner (inverted - internal area greater than external area)	10.8000	-0.0900	-0.9720
P1 Party wall - Ground floor	9.1000	0.0800	0.7280
P4 Party wall - Roof (insulation at ceiling level)	9.2000	0.1200	1.1040
P5 Party wall - Roof (insulation at rafter level)	3.3000	0.0800	0.2640
E10 Eaves (insulation at ceiling level)	7.2000	0.0600	0.4320
E12 Gable (insulation at ceiling level)	6.2000	0.0600	0.3720
E13 Gable (insulation at rafter level)	3.3000	0.0800	0.2640

Full SAP Calculation Printout



E14 Flat roof	4.0000	0.0800	0.3200
E24 Eaves (insulation at ceiling level - inverted)	10.4000	0.2400	2.4960
R6 Flat ceiling	10.4000	0.0600	0.6240
R8 Roof to wall (rafter)	10.4000	0.0600	0.6240
R7 Flat ceiling (inverted)	2.0000	0.0400	0.0800
R9 Roof to wall (flat ceiling)	2.0000	0.0400	0.0800
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			15.4665 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	69.3594 (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	68.2526	67.8391	67.4338	65.5299	65.1737	63.5154	63.5154	63.2084	64.1542	65.1737	65.8943	66.6476	(38)
Average = Sum(39)m / 12 =	137.6121	137.1986	136.7932	134.8893	134.5331	132.8749	132.8749	132.5678	133.5136	134.5331	135.2537	136.0071	(39)
												134.8876	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0643	1.0611	1.0580	1.0432	1.0405	1.0276	1.0276	1.0253	1.0326	1.0405	1.0460	1.0519	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8932 (42)
Hot water usage for mixer showers	72.7285	71.6355	70.0429	66.9956	64.7468	62.2389	60.8134	62.3940	64.1267	66.8194	69.9321	72.4498	(42a)
Hot water usage for baths	31.3989	30.9325	30.2759	29.0651	28.1585	27.1532	26.6101	27.2622	27.9722	29.0479	30.2836	31.2927	(42b)
Hot water usage for other uses	44.2588	42.6494	41.0400	39.4305	37.8211	36.2117	36.2117	37.8211	39.4305	41.0400	42.6494	44.2588	(42c)
Average daily hot water use (litres/day)												136.4002	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	148.3861	145.2174	141.3587	135.4912	130.7263	125.6038	123.6353	127.4774	131.5294	136.9072	142.8651	148.0013	(44)
Energy content (annual)	235.0073	206.7877	217.2630	185.4807	175.9828	154.4445	149.5262	157.8436	162.1890	185.7818	203.5375	231.7343	(45)
Distribution loss (46)m = 0.15 x (45)m	35.2511	31.0182	32.5895	27.8221	26.3974	23.1667	22.4289	23.6765	24.3283	27.8673	30.5306	34.7601	(46)
Water storage loss:													
Total storage 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	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary 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)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	285.9662	252.8151	268.2219	234.7957	226.9417	203.7596	200.4851	208.8025	211.5040	236.7407	252.8526	282.6932	(62)
WWHRS	-33.2484	-29.4052	-30.7914	-25.4965	-23.7618	-20.3332	-19.0591	-20.2674	-21.0375	-24.8009	-28.0964	-32.6327	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
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	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.7178	223.4099	237.4305	209.2992	203.1799	183.4264	181.4260	188.5351	190.4666	211.9399	224.7562	250.0605	(64)
12Total per year (kWh/year)												2556.6479	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	90.8797	80.2638	84.9797	74.0011	71.2540	63.6816	62.4572	65.2227	66.2566	74.5122	80.0050	89.7914	(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	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	185.1366	204.9727	185.1366	191.3078	185.1366	191.3078	185.1366	185.1366	191.3078	185.1366	191.3078	185.1366	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	296.8749	299.9555	292.1924	275.6657	254.8037	235.1964	222.0975	219.0168	226.7799	243.3066	264.1686	283.7760	(68)
Pumps, fans	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	(71)
Total internal gains	122.1501	119.4401	114.2200	102.7793	95.7715	88.4466	83.9478	87.6650	92.0230	100.1508	111.1181	120.6873	(72)
	673.5589	693.7656	660.9463	639.1501	605.1091	581.3481	557.5792	558.2157	576.5081	597.9913	635.9918	658.9972	(73)

6. Solar gains

Full SAP Calculation Printout



[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W			
Northeast			3.4600		11.2829	0.6300	0.7000		11.9308 (75)			
Southwest			5.5800		36.7938	0.6300	0.7000	0.7700	62.7453 (79)			
Solar gains	74.6761	131.1640	189.9905	253.0511	299.5426	304.4602	290.5842	254.8165	211.6583	147.8023	90.1664	63.4402 (83)
Total gains	748.2350	824.9296	850.9368	892.2012	904.6517	885.8083	848.1634	813.0322	788.1664	745.7936	726.1583	722.4374 (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	57.7940	57.9682	58.1400	58.9606	59.1167	59.8545	59.8545	59.9931	59.5681	59.1167	58.8018	58.4760
alpha	4.8529	4.8645	4.8760	4.9307	4.9411	4.9903	4.9903	4.9995	4.9712	4.9411	4.9201	4.8984
util living area	0.9971	0.9948	0.9907	0.9763	0.9347	0.8156	0.6518	0.6959	0.8903	0.9786	0.9943	0.9976 (86)
MIT	19.5608	19.7118	19.9411	20.2912	20.6221	20.8805	20.9703	20.9588	20.7951	20.3764	19.9222	19.5458 (87)
Th 2	20.0301	20.0327	20.0353	20.0475	20.0497	20.0604	20.0604	20.0623	20.0563	20.0497	20.0451	20.0403 (88)
util rest of house	0.9962	0.9932	0.9877	0.9675	0.9077	0.7406	0.5301	0.5780	0.8362	0.9691	0.9923	0.9968 (89)
MIT 2	18.3413	18.5362	18.8307	19.2821	19.6885	19.9770	20.0482	20.0437	19.8932	19.3938	18.8146	18.3294 (90)
Living area fraction	fLA = Living area / (4) = 0.2668 (91)											
MIT	18.6667	18.8499	19.1270	19.5513	19.9376	20.2181	20.2942	20.2879	20.1338	19.6560	19.1101	18.6540 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.6667	18.8499	19.1270	19.5513	19.9376	20.2181	20.2942	20.2879	20.1338	19.6560	19.1101	18.6540 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9944	0.9904	0.9837	0.9615	0.9038	0.7547	0.5622	0.6085	0.8415	0.9637	0.9894	0.9953 (94)
Useful gains	744.0552	817.0476	837.0425	857.8932	817.6381	668.5451	476.8400	494.7430	663.2443	718.7357	718.4482	719.0374 (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	1977.0338	1913.9060	1727.2812	1436.7533	1108.2251	746.5020	490.8670	515.4041	805.5996	1218.3277	1624.4100	1965.8424 (97)
Space heating kWh	917.3361	737.0889	662.3376	416.7792	216.1968	0.0000	0.0000	0.0000	0.0000	371.6964	652.2925	927.6229 (98a)
Space heating requirement - total per year (kWh/year)												4901.3503
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	917.3361	737.0889	662.3376	416.7792	216.1968	0.0000	0.0000	0.0000	0.0000	371.6964	652.2925	927.6229 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4901.3503
Space heating per m2	(98c) / (4) =											37.9068 (99)
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 %)										92.4000 (206)		
Efficiency of main space heating system 2 (in %)										0.0000 (207)		
Efficiency of secondary/supplementary heating system, %										0.0000 (208)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	917.3361	737.0889	662.3376	416.7792	216.1968	0.0000	0.0000	0.0000	0.0000	371.6964	652.2925	927.6229 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	992.7880	797.7152	716.8155	451.0598	233.9792	0.0000	0.0000	0.0000	0.0000	402.2688	705.9442	1003.9209 (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)
Space heating fuel (secondary)	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	252.7178	223.4099	237.4305	209.2992	203.1799	183.4264	181.4260	188.5351	190.4666	211.9399	224.7562	250.0605 (64)
Efficiency of water heater (217)m	86.8901	86.7393	86.4566	85.8271	84.5148	80.3000	80.3000	80.3000	80.3000	85.5720	86.5253	86.9233 (216)
Fuel for water heating, kWh/month	290.8478	257.5649	274.6238	243.8614	240.4075	228.4264	225.9352	234.7884	237.1937	247.6744	259.7579	287.6794 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	38.4677	30.8602	27.7862	20.3574	15.7246	12.8472	14.3445	18.6456	24.2187	31.7763	35.8913	39.5369 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-43.4929	-62.1170	-90.3747	-102.8121	-111.7854	-104.5868	-103.2766	-97.0842	-86.2543	-71.5989	-48.0957	-37.5072 (233a)

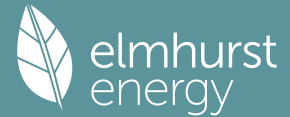
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

13a. Primary energy - Individual heating systems including micro-CHP

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

Page 8 of 30

Full SAP Calculation Printout



	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.8000 (1b)	x 2.7000 (2b)	= 120.9600 (1b) -
First floor	44.8000 (1c)	x 2.7000 (2c)	= 120.9600 (1c) -
Second floor	39.7000 (1d)	x 2.7000 (2d)	= 107.1900 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.1100 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1146 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3646 (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) = 0.3372 (21)

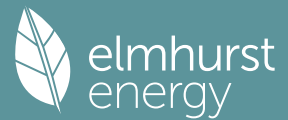
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4300	0.4215	0.4131	0.3710	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5487	0.5569	0.5657	0.5720	0.5785 (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
Door			1.9100	1.2000	2.2920		(26)
HGD			5.4600	1.2000	6.5520		(26a)
Window (Uw = 1.20)			9.0400	1.1450	10.3511		(27)
Heatloss Floor 1			44.8000	0.1100	4.9280	75.0000	3360.0000 (28a)
External Wall 1	128.9400	13.8500	115.0900	0.1800	20.7162	110.0000	12659.9000 (29a)
Stud			12.2400	0.1000	1.2240	18.0000	220.3200 (29a)
Dormer	15.8400	2.5600	13.2800	0.1800	2.3904	18.0000	239.0400 (29a)
External Roof 1	30.7000		30.7000	0.1100	3.3770	9.0000	276.3000 (30)
External Roof 2	12.6000		12.6000	0.1300	1.6380	9.0000	113.4000 (30)
External Roof 3	2.5000		2.5000	0.1100	0.2750	9.0000	22.5000 (30)
Total net area of external elements Aum(A, m ²)			247.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7437		(33)
Party Wall 1			74.9400	0.0000	0.0000	110.0000	8243.4000 (32)
Internal Wall 1			135.0000			9.0000	1215.0000 (32c)
Internal Floor 1			44.8000			18.0000	806.4000 (32d)
Internal Floor 2			39.7000			18.0000	714.6000 (32d)
Internal Ceiling 1			44.8000			9.0000	403.2000 (32e)
Internal Ceiling 2			39.7000			9.0000	357.3000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28631.3600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							221.4336 (35)
Thermal bridges (User defined value 0.060 * total exposed area)							14.8572 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	68.6009 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	68.2526	67.8391	67.4338	65.5299	65.1737	63.5154	63.5154	63.2084	64.1542	65.1737	65.8943	66.6476 (38)
Heat transfer coeff	136.8536	136.4401	136.0347	134.1308	133.7746	132.1164	132.1164	131.8093	132.7551	133.7746	134.4952	135.2486 (39)
Average = Sum(39)m / 12 =												134.1291
HLP	1.0584	1.0552	1.0521	1.0374	1.0346	1.0218	1.0218	1.0194	1.0267	1.0346	1.0402	1.0460 (40)
HLP (average)												1.0373
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

Full SAP Calculation Printout



4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8932 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths												
31.3989	30.9325	30.2759	29.0651	28.1585	27.1532	26.6101	27.2622	27.9722	29.0479	30.2836	31.2927	(42b)
Hot water usage for other uses												
44.2588	42.6494	41.0400	39.4305	37.8211	36.2117	36.2117	37.8211	39.4305	41.0400	42.6494	44.2588	(42c)
Average daily hot water use (litres/day)												69.3469 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	75.6576	73.5819	71.3158	68.4956	65.9796	63.3649	62.8219	65.0834	67.4028	70.0879	72.9330	75.5515 (44)
Energy content (annual)	119.8232	104.7796	109.6098	93.7671	88.8212	77.9145	75.9776	80.5868	83.1143	95.1086	103.9064	118.2954 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1151.7045
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:												
Total storage 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 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary 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)
Combi 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 (61)
Total heat required for water heating calculated for each month	101.8497	89.0627	93.1683	79.7020	75.4980	66.2273	64.5810	68.4988	70.6472	80.8423	88.3205	100.5511 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
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 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	101.8497	89.0627	93.1683	79.7020	75.4980	66.2273	64.5810	68.4988	70.6472	80.8423	88.3205	100.5511 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 978.9489 (64)
Electric shower(s)	58.2434	51.8953	56.6677	54.0773	55.0921	52.5525	54.3042	55.0921	54.0773	56.6677	55.6022	58.2434 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 662.5153 (64a)												
Heat gains from water heating, kWh/month	40.0233	35.2395	37.4590	33.4448	32.6475	29.6950	29.7213	30.8977	31.1811	34.3775	35.9807	39.6986 (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	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	185.1366	204.9727	185.1366	191.3078	185.1366	191.3078	185.1366	185.1366	191.3078	185.1366	191.3078	185.1366	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.8749	299.9555	292.1924	275.6657	254.8037	235.1964	222.0975	219.0168	226.7799	243.3066	264.1686	283.7760	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	(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)	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	(71)
Water heating gains (Table 5)	53.7947	52.4398	50.3481	46.4512	43.8811	41.2430	39.9480	41.5292	43.3071	46.2063	49.9731	53.3584	(72)
Total internal gains	602.2035	623.7652	594.0745	579.8220	550.2187	534.1445	513.5794	512.0799	527.7922	541.0469	571.8469	588.6682	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				3.4600	11.2829	0.6300	0.7000	0.7700	11.9308 (75)			
Southwest				5.5800	36.7938	0.6300	0.7000	0.7700	62.7453 (79)			
Solar gains	74.6761	131.1640	189.9905	253.0511	299.5426	304.4602	290.5842	254.8165	211.6583	147.8023	90.1664	63.4402 (83)
Total gains	676.8796	754.9292	784.0650	832.8731	849.7613	838.6047	804.1636	766.8964	739.4504	688.8491	662.0133	652.1084 (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	58.1143	58.2905	58.4642	59.2940	59.4519	60.1981	60.1981	60.3383	59.9085	59.4519	59.1334	58.8040
alpha	4.8743	4.8860	4.8976	4.9529	4.9635	5.0132	5.0132	5.0226	4.9939	4.9635	4.9422	4.9203
util living area	0.9981	0.9964	0.9934	0.9818	0.9467	0.8371	0.6770	0.7234	0.9085	0.9843	0.9962	0.9985 (86)
MIT	19.5054	19.6581	19.8904	20.2491	20.5899	20.8657	20.9655	20.9518	20.7718	20.3346	19.8724	19.4912 (87)

Full SAP Calculation Printout



Th 2	20.0349	20.0376	20.0402	20.0523	20.0546	20.0652	20.0652	20.0672	20.0611	20.0546	20.0500	20.0452 (88)
util rest of house	0.9976	0.9953	0.9912	0.9749	0.9236	0.7658	0.5542	0.6058	0.8601	0.9771	0.9948	0.9980 (89)
MIT 2	18.6626	18.8169	19.0503	19.4146	19.7441	19.9905	20.0539	20.0496	19.9159	19.5025	19.0406	18.6563 (90)
Living area fraction									fLA = Living area / (4) =			0.2668 (91)
MIT	18.8875	19.0413	19.2745	19.6373	19.9698	20.2240	20.2971	20.2903	20.1443	19.7246	19.2626	18.8790 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8875	19.0413	19.2745	19.6373	19.9698	20.2240	20.2971	20.2903	20.1443	19.7246	19.2626	18.8790 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9938	0.9888	0.9709	0.9210	0.7795	0.5868	0.6365	0.8653	0.9737	0.9932	0.9972	(94)
Useful gains	674.5790	750.2207	775.2554	808.6321	782.6450	653.7183	471.8730	488.0929	639.8236	670.7102	657.4845	650.2762	(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	1996.3497	1929.4449	1737.7723	1440.1992	1106.2851	743.0276	488.4503	512.7842	802.4115	1220.6356	1635.8071	1985.3178	(97)
Space heating kWh	983.3974	792.4387	716.1126	454.7283	240.7882	0.0000	0.0000	0.0000	0.0000	409.1445	704.3923	993.2710	(98a)
Space heating requirement - total per year (kWh/year)												5294.2729	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	983.3974	792.4387	716.1126	454.7283	240.7882	0.0000	0.0000	0.0000	0.0000	409.1445	704.3923	993.2710	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5294.2729	
Space heating per m2												(98c) / (4) =	40.9457 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	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	0.0000	0.0000	0.0000	0.0000	0.0000	1241.8940	977.6612	1001.7507	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6651	0.7657	0.7299	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	825.9481	748.6151	731.1625	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	877.4588	841.6990	802.1240	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	37.0877	69.2544	52.7954	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	9.2719	17.3136	13.1988	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												39.7844	(107)
Energy for space heating												40.9457	(99)
Energy for space cooling												0.3077	(108)
Total												41.2533	(109)
Fabric Energy Efficiency (DFEE)												41.3	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

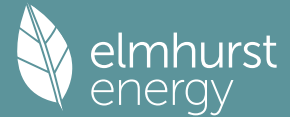
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	44.8000 (1b)	x 2.7000 (2b)	= 120.9600 (1b)	-
First floor	44.8000 (1c)	x 2.7000 (2c)	= 120.9600 (1c)	-
Second floor	39.7000 (1d)	x 2.7000 (2d)	= 107.1900 (1d)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.3000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	349.1100	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)

Full SAP Calculation Printout



Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000	Air changes per hour	0.1146 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50				5.0000 (17)
Infiltration rate				0.3646 (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) =			0.3372 (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	0.4300	0.4215	0.4131	0.3710	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5487	0.5569	0.5657	0.5720	0.5785	(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			1.9100	1.0000	1.9100			(26)
TER Semi-glazed door			5.4600	1.0000	5.4600			(26a)
TER Opening Type (Uw = 1.20)			9.0400	1.1450	10.3511			(27)
Heatloss Floor 1			44.8000	0.1300	5.8240			(28a)
External Wall 1	128.9400	13.8500	115.0900	0.1800	20.7162			(29a)
Stud	12.2400		12.2400	0.1800	2.2032			(29a)
Dormer	15.8400	2.5600	13.2800	0.1800	2.3904			(29a)
External Roof 1	30.7000		30.7000	0.1100	3.3770			(30)
External Roof 2	12.6000		12.6000	0.1100	1.3860			(30)
External Roof 3	2.5000		2.5000	0.1100	0.2750			(30)
Total net area of external elements Aum(A, m2)			247.6200					(31)
Fabric heat loss, W/K = Sum (A x U)								(33)
Party Wall 1			74.9400	0.0000	0.0000			(32)
					53.8929			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.4336 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	11.5800	0.0500	0.5790	
E3 Sill	8.0500	0.0500	0.4025	
E4 Jamb	32.2200	0.0500	1.6110	
E5 Ground floor (normal)	19.1000	0.1600	3.0560	
E6 Intermediate floor within a dwelling	40.1000	0.0000	0.0000	
E16 Corner (normal)	27.0000	0.0900	2.4300	
E18 Party wall between dwellings	16.2000	0.0600	0.9720	
E17 Corner (inverted - internal area greater than external area)	10.8000	-0.0900	-0.9720	
P1 Party wall - Ground floor	9.1000	0.0800	0.7280	
P4 Party wall - Roof (insulation at ceiling level)	9.2000	0.1200	1.1040	
P5 Party wall - Roof (insulation at rafter level)	3.3000	0.0800	0.2640	
E10 Eaves (insulation at ceiling level)	7.2000	0.0600	0.4320	
E12 Gable (insulation at ceiling level)	6.2000	0.0600	0.3720	
E13 Gable (insulation at rafter level)	3.3000	0.0800	0.2640	
E14 Flat roof	4.0000	0.0800	0.3200	
E24 Eaves (insulation at ceiling level - inverted)	10.4000	0.2400	2.4960	
R6 Flat ceiling	10.4000	0.0600	0.6240	
R8 Roof to wall (rafter)	10.4000	0.0600	0.6240	
R7 Flat ceiling (inverted)	2.0000	0.0400	0.0800	
R9 Roof to wall (flat ceiling)	2.0000	0.0400	0.0800	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.4665 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 69.3594 (37)

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

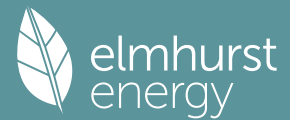
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	68.2526	67.8391	67.4338	65.5299	65.1737	63.5154	63.5154	63.2084	64.1542	65.1737	65.8943	66.6476	(38)
Heat transfer coeff	137.6121	137.1986	136.7932	134.8893	134.5331	132.8749	132.8749	132.5678	133.5136	134.5331	135.2537	136.0071	(39)
Average = Sum(39)m / 12 =												134.8876	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0643	1.0611	1.0580	1.0432	1.0405	1.0276	1.0276	1.0253	1.0326	1.0405	1.0460	1.0519	(40)
HLP (average)												1.0432	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8932 (42)

Full SAP Calculation Printout



Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.3989	30.9325	30.2759	29.0651	28.1585	27.1532	26.6101	27.2622	27.9722	29.0479	30.2836	31.2927 (42b)
Hot water usage for other uses	44.2588	42.6494	41.0400	39.4305	37.8211	36.2117	36.2117	37.8211	39.4305	41.0400	42.6494	44.2588 (42c)
Average daily hot water use (litres/day)												69.3469 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	75.6576	73.5819	71.3158	68.4956	65.9796	63.3649	62.8219	65.0834	67.4028	70.0879	72.9330	75.5515 (44)
Distribution loss (46)m = 0.15 x (45)m	119.8232	104.7796	109.6098	93.7671	88.8212	77.9145	75.9776	80.5868	83.1143	95.1086	103.9064	118.2954 (45)
Total = Sum(45)m =	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1151.7045
Water storage loss:												
Total storage 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 (46)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary 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)
Combi 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 (61)
Total heat required for water heating calculated for each month	101.8497	89.0627	93.1683	79.7020	75.4980	66.2273	64.5810	68.4988	70.6472	80.8423	88.3205	100.5511 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
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 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	101.8497	89.0627	93.1683	79.7020	75.4980	66.2273	64.5810	68.4988	70.6472	80.8423	88.3205	100.5511 (64)
Total per year (kWh/year)												978.9489 (64)
Electric shower(s)	58.2434	51.8953	56.6677	54.0773	55.0921	52.5525	54.3042	55.0921	54.0773	56.6677	55.6022	58.2434 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												662.5153 (64a)
Heat gains from water heating, kWh/month	40.0233	35.2395	37.4590	33.4448	32.6475	29.6950	29.7213	30.8977	31.1811	34.3775	35.9807	39.6986 (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	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576	144.6576 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	185.1366	204.9727	185.1366	191.3078	185.1366	191.3078	185.1366	185.1366	191.3078	185.1366	191.3078	185.1366 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.8749	299.9555	292.1924	275.6657	254.8037	235.1964	222.0975	219.0168	226.7799	243.3066	264.1686	283.7760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658	37.4658 (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)	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261 (71)
Water heating gains (Table 5)	53.7947	52.4398	50.3481	46.4512	43.8811	41.2430	39.9480	41.5292	43.3071	46.2063	49.9731	53.3584 (72)
Total internal gains	602.2035	623.7652	594.0745	579.8220	550.2187	534.1445	513.5794	512.0799	527.7922	541.0469	571.8469	588.6682 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W		

Northeast				3.4600	11.2829	0.6300		0.7000	0.7700	11.9308 (75)		
Southwest				5.5800	36.7938	0.6300		0.7000	0.7700	62.7453 (79)		

Solar gains	74.6761	131.1640	189.9905	253.0511	299.5426	304.4602	290.5842	254.8165	211.6583	147.8023	90.1664	63.4402 (83)
Total gains	676.8796	754.9292	784.0650	832.8731	849.7613	838.6047	804.1636	766.8964	739.4504	688.8491	662.0133	652.1084 (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, n _{l,m} (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.7940	57.9682	58.1400	58.9606	59.1167	59.8545	59.8545	59.9931	59.5681	59.1167	58.8018	58.4760
alpha	4.8529	4.8645	4.8760	4.9307	4.9411	4.9903	4.9903	4.9995	4.9712	4.9411	4.9201	4.8984
util living area	0.9981	0.9964	0.9934	0.9819	0.9473	0.8388	0.6796	0.7259	0.9095	0.9845	0.9962	0.9985 (86)
MIT	19.4954	19.6484	19.8815	20.2416	20.5842	20.8627	20.9643	20.9503	20.7679	20.3282	19.8640	19.4811 (87)
Th 2	20.0301	20.0327	20.0353	20.0475	20.0497	20.0604	20.0604	20.0623	20.0563	20.0497	20.0451	20.0403 (88)
util rest of house	0.9976	0.9953	0.9912	0.9750	0.9242	0.7676	0.5562	0.6078	0.8613	0.9772	0.9948	0.9980 (89)
MIT 2	18.6490	18.8035	19.0378	19.4034	19.7349	19.9839	20.0486	20.0442	19.9085	19.4924	19.0285	18.6425 (90)

Full SAP Calculation Printout



Living area fraction									fLA = Living area / (4) =			0.2668 (91)
MIT	18.8748	19.0289	19.2629	19.6270	19.9615	20.2184	20.2930	20.2860	20.1378	19.7154	19.2514	18.8663 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8748	19.0289	19.2629	19.6270	19.9615	20.2184	20.2930	20.2860	20.1378	19.7154	19.2514	18.8663 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9938	0.9888	0.9710	0.9216	0.7812	0.5889	0.6385	0.8663	0.9738	0.9932	0.9972	(94)
Useful gains	674.5724	750.2187	775.2711	808.7567	783.1427	655.1096	473.5538	489.6821	640.5971	670.7951	657.4845	650.2698	(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	2005.6721	1938.4664	1745.8793	1446.9621	1111.4426	746.5388	490.7029	515.1570	806.1240	1226.3206	1643.5210	1994.7173	(97)
Space heating kWh	990.3382	798.5025	722.1325	459.5079	244.2551	0.0000	0.0000	0.0000	0.0000	413.3109	709.9463	1000.2690	(98a)
Space heating requirement - total per year (kWh/year)												5338.2624	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	990.3382	798.5025	722.1325	459.5079	244.2551	0.0000	0.0000	0.0000	0.0000	413.3109	709.9463	1000.2690	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5338.2624	
Space heating per m2												(98c) / (4) =	41.2859 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	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	0.0000	0.0000	0.0000	0.0000	0.0000	1249.0239	983.2741	1007.5153	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6617	0.7624	0.7265	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	826.4926	749.6336	731.9429	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	877.4588	841.6990	802.1240	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	36.6957	68.4967	52.2148	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	9.1739	17.1242	13.0537	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												39.3518	(107)
Energy for space heating												41.2859	(99)
Energy for space cooling												0.3043	(108)
Total												41.5902	(109)
Fabric Energy Efficiency (TFEE)												41.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

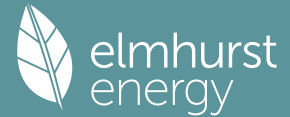
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	44.8000 (1b)	x 2.7000 (2b)	=	120.9600 (1b) -
First floor	44.8000 (1c)	x 2.7000 (2c)	=	120.9600 (1c) -
Second floor	39.7000 (1d)	x 2.7000 (2d)	=	107.1900 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.3000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	349.1100 (5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)

Full SAP Calculation Printout



Number of flueless gas fires

0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
 Pressure test
 Pressure Test Method
 Measured/design AP50
 Infiltration rate
 Number of sides sheltered

Air changes per hour
 40.0000 / (5) = 0.1146 (8)
 Yes
 Blower Door
 5.0000 (17)
 0.3646 (18)
 1 (19)

Shelter factor
 Infiltration rate adjusted to include shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
 (21) = (18) x (20) = 0.3372 (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	0.4300	0.4215	0.4131	0.3710	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5487	0.5569	0.5657	0.5720	0.5785	(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	
Door			1.9100	1.2000	2.2920			(26)
HGD			5.4600	1.2000	6.5520			(26a)
Window (Uw = 1.20)			9.0400	1.1450	10.3511			(27)
Heatloss Floor 1			44.8000	0.1100	4.9280	75.0000	3360.0000	(28a)
External Wall 1	128.9400	13.8500	115.0900	0.1800	20.7162	110.0000	12659.9000	(29a)
Stud	12.2400		12.2400	0.1000	1.2240	18.0000	220.3200	(29a)
Dormer	15.8400	2.5600	13.2800	0.1800	2.3904	18.0000	239.0400	(29a)
External Roof 1	30.7000		30.7000	0.1100	3.3770	9.0000	276.3000	(30)
External Roof 2	12.6000		12.6000	0.1300	1.6380	9.0000	113.4000	(30)
External Roof 3	2.5000		2.5000	0.1100	0.2750	9.0000	22.5000	(30)
Total net area of external elements Aum(A, m2)			247.6200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 53.7437			(33)
Party Wall 1			74.9400	0.0000	0.0000	110.0000	8243.4000	(32)
Internal Wall 1			135.0000			9.0000	1215.0000	(32c)
Internal Floor 1			44.8000			18.0000	806.4000	(32d)
Internal Floor 2			39.7000			18.0000	714.6000	(32d)
Internal Ceiling 1			44.8000			9.0000	403.2000	(32e)
Internal Ceiling 2			39.7000			9.0000	357.3000	(32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 28631.3600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							221.4336	(35)
Thermal bridges (User defined value 0.060 * total exposed area)							14.8572	(36)
Point Thermal bridges							(36a) = 0.0000	
Total fabric heat loss							(33) + (36) + (36a) = 68.6009	(37)

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

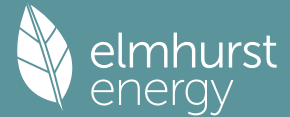
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	68.2526	67.8391	67.4338	65.5299	65.1737	63.5154	63.5154	63.2084	64.1542	65.1737	65.8943	66.6476	(38)
Heat transfer coeff													
	136.8536	136.4401	136.0347	134.1308	133.7746	132.1164	132.1164	131.8093	132.7551	133.7746	134.4952	135.2486	(39)
Average = Sum(39)m / 12 =												134.1291	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0584	1.0552	1.0521	1.0374	1.0346	1.0218	1.0218	1.0194	1.0267	1.0346	1.0402	1.0460	(40)
HLP (average)												1.0373	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8932 (42)
Hot water usage for mixer showers													
	72.7285	71.6355	70.0429	66.9956	64.7468	62.2389	60.8134	62.3940	64.1267	66.8194	69.9321	72.4498	(42a)
Hot water usage for baths													
	31.3989	30.9325	30.2759	29.0651	28.1585	27.1532	26.6101	27.2622	27.9722	29.0479	30.2836	31.2927	(42b)
Hot water usage for other uses													
	44.2588	42.6494	41.0400	39.4305	37.8211	36.2117	36.2117	37.8211	39.4305	41.0400	42.6494	44.2588	(42c)
Average daily hot water use (litres/day)												136.4002	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.3861	145.2174	141.3587	135.4912	130.7263	125.6038	123.6353	127.4774	131.5294	136.9072	142.8651	148.0013	(44)
Energy conte	235.0073	206.7877	217.2630	185.4807	175.9828	154.4445	149.5262	157.8436	162.1890	185.7818	203.5375	231.7343	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
	35.2511	31.0182	32.5895	27.8221	26.3974	23.1667	22.4289	23.6765	24.3283	27.8673	30.5306	34.7601	(46)
Water storage loss:													
Total storage 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	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary 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)
Combi loss	16.6101	14.9797	16.5356	15.8981	16.3622	15.7678	16.2511	16.2860	15.8003	16.4034	15.9740	16.5964	(61)

Full SAP Calculation Printout



Total heat required for water heating calculated for each month

	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
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 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (64)
	Total per year (kWh/year) = Sum(64)m =											2459.0429 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	82.2925	72.5018	76.3738	65.6469	62.6048	55.2947	53.7802	56.5545	57.8779	65.8733	71.6697	81.2007 (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	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	43.9483	39.0345	31.7450	24.0330	17.9650	15.1668	16.3882	21.3021	28.5916	36.3036	42.3716	45.1698 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	443.0969	447.6948	436.1081	411.4414	380.3041	351.0394	331.4888	326.8908	338.4775	363.1442	394.2816	423.5462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261 (71)
Water heating gains (Table 5)	110.6082	107.8896	102.6530	91.1762	84.1463	76.7982	72.2852	76.0141	80.3860	88.5394	99.5413	109.1408 (72)
Total internal gains	713.7685	710.7341	686.6213	642.7657	598.5304	556.1195	533.2774	537.3221	560.5702	604.1023	652.3096	693.9720 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W		
Northeast				3.4600	11.2829	0.6300		0.7000	0.7700	11.9308 (75)		
Southwest				5.5800	36.7938	0.6300		0.7000	0.7700	62.7453 (79)		
Solar gains	74.6761	131.1640	189.9905	253.0511	299.5426	304.4602	290.5842	254.8165	211.6583	147.8023	90.1664	63.4402 (83)
Total gains	788.4446	841.8980	876.6118	895.8168	898.0730	860.5797	823.8616	792.1386	772.2284	751.9046	742.4760	757.4121 (84)

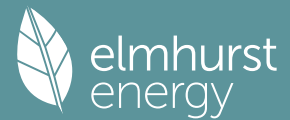
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _l ,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.1143	58.2905	58.4642	59.2940	59.4519	60.1981	60.1981	60.3383	59.9085	59.4519	59.1334	58.8040
alpha	4.8743	4.8860	4.8976	4.9529	4.9635	5.0132	5.0132	5.0226	4.9939	4.9635	4.9422	4.9203
util living area	0.9963	0.9943	0.9894	0.9757	0.9356	0.8263	0.6644	0.7068	0.8956	0.9778	0.9937	0.9970 (86)
MIT	19.6075	19.7369	19.9726	20.3017	20.6232	20.8742	20.9682	20.9566	20.7903	20.3879	19.9454	19.5880 (87)
Th 2	20.0349	20.0376	20.0402	20.0523	20.0546	20.0652	20.0652	20.0672	20.0611	20.0546	20.0500	20.0452 (88)
util rest of house	0.9953	0.9926	0.9860	0.9668	0.9090	0.7531	0.5423	0.5892	0.8432	0.9679	0.9915	0.9961 (89)
MIT 2	18.4044	18.5716	18.8740	19.2988	19.6939	19.9765	20.0520	20.0472	19.8930	19.4117	18.8476	18.3867 (90)
Living area fraction	18.7254	18.8825	19.1672	19.5664	19.9418	20.2160	20.2965	20.2899	20.1324	19.6722	19.1405	18.7073 (92)
MIT	18.7254	18.8825	19.1672	19.5664	19.9418	20.2160	20.2965	20.2899	20.1324	19.6722	19.1405	18.7073 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7254	18.8825	19.1672	19.5664	19.9418	20.2160	20.2965	20.2899	20.1324	19.6722	19.1405	18.7073 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9931	0.9897	0.9817	0.9608	0.9051	0.7664	0.5744	0.6196	0.8479	0.9625	0.9884	0.9943 (94)
Useful gains	783.0196	833.1860	860.5896	860.7030	812.8144	659.5636	473.2578	490.7773	654.8035	723.7085	733.8710	753.0963 (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	1974.1688	1907.7796	1723.1754	1430.6884	1102.5486	741.9648	488.3640	512.7207	800.8315	1213.6253	1619.3872	1962.0873 (97)
Space heating kWh	886.2150	722.1269	641.7639	410.3895	215.5623	0.0000	0.0000	0.0000	0.0000	364.4981	637.5717	899.4893 (98a)
Space heating requirement - total per year (kWh/year)												4777.6167
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000

Full SAP Calculation Printout



Space heating kWh	886.2150	722.1269	641.7639	410.3895	215.5623	0.0000	0.0000	0.0000	0.0000	364.4981	637.5717	899.4893 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4777.6167
Space heating per m2										(98c) / (4) =		36.9499 (99)

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 %)												84.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	886.2150	722.1269	641.7639	410.3895	215.5623	0.0000	0.0000	0.0000	0.0000	364.4981	637.5717	899.4893 (98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)
Space heating fuel (main heating system)	1055.0178	859.6749	764.0046	488.5590	256.6217	0.0000	0.0000	0.0000	0.0000	433.9263	759.0139	1070.8206 (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)
Space heating fuel (secondary)	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	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (64)
Efficiency of water heater	88.6184	88.5947	88.5396	88.4331	88.1902	87.3000	87.3000	87.3000	87.3000	88.3859	88.5583	87.3000 (216)
Fuel for water heating, kWh/month	283.9337	250.3168	264.0610	227.7187	218.1024	194.9739	189.8938	199.4612	203.8823	228.7527	247.8722	280.1987 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	38.4677	30.8602	27.7862	20.3574	15.7246	12.8472	14.3445	18.6456	24.2187	31.7763	35.8913	39.5369 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-47.7186	-69.0282	-101.8100	-116.1659	-125.5736	-117.1039	-115.4768	-108.8203	-96.6110	-79.7469	-52.9062	-40.9231 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-26.1179	-57.5498	-121.2514	-191.2679	-259.8502	-263.6936	-259.5327	-215.4221	-151.6595	-84.2429	-35.3731	-20.3749 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												5687.6389 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												87.3000
Water heating fuel used												2789.1675 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												310.4566 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2758.2204 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												6115.0426 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5687.6389	3.6400	207.0301 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2789.1675	3.6400	101.5257 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814 (249)
Energy for lighting	310.4566	16.4900	51.1943 (250)
Additional standing charges			92.0000 (251)

Full SAP Calculation Printout



Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1071.8845	16.4900	-176.7538
PV Unit electricity exported	-1686.3359	5.5900	-94.2662
Total			-271.0199 (252)
Total energy cost			194.9115 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4026 (257)
SAP value		93.4743
SAP rating (Section 12)		93 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	5687.6389	0.2100	1194.4042 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	2789.1675	0.2100	585.7252 (264)
Space and water heating			1780.1293 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	310.4566	0.1443	44.8085 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1071.8845	0.1343	-143.9367
PV Unit electricity exported	-1686.3359	0.1247	-210.2200
Total			-354.1567 (269)
Total CO ₂ , kg/year			1482.7104 (272)
CO ₂ emissions per m ²			11.4700 (273)
EI value			88.6011
EI rating			89 (274)
EI band			B

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

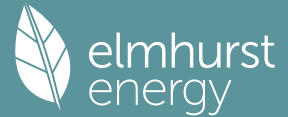
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.8000 (1b)	x 2.7000 (2b)	= 120.9600 (1b) -
First floor	44.8000 (1c)	x 2.7000 (2c)	= 120.9600 (1c) -
Second floor	39.7000 (1d)	x 2.7000 (2d)	= 107.1900 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	349.1100 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1146 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3646 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)

Full SAP Calculation Printout



Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3372 \quad (21)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.8000	4.7000	4.6000	4.2000	4.1000	3.7000	3.7000	3.7000	3.7000	4.2000	4.3000	4.5000	(22)
Wind factor	1.2000	1.1750	1.1500	1.0500	1.0250	0.9250	0.9250	0.9250	0.9250	1.0500	1.0750	1.1250	(22a)
Adj infilt rate													
Effective ac	0.4047	0.3962	0.3878	0.3541	0.3457	0.3119	0.3119	0.3119	0.3119	0.3541	0.3625	0.3794	(22b)
	0.5819	0.5785	0.5752	0.5627	0.5597	0.5487	0.5487	0.5487	0.5487	0.5627	0.5657	0.5720	(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	
Door			1.9100	1.2000	2.2920			(26)
HGD			5.4600	1.2000	6.5520			(26a)
Window (Uw = 1.20)			9.0400	1.1450	10.3511			(27)
Heatloss Floor 1			44.8000	0.1100	4.9280	75.0000	3360.0000	(28a)
External Wall 1	128.9400	13.8500	115.0900	0.1800	20.7162	110.0000	12659.9000	(29a)
Stud	12.2400		12.2400	0.1000	1.2240	18.0000	220.3200	(29a)
Dormer	15.8400	2.5600	13.2800	0.1800	2.3904	18.0000	239.0400	(29a)
External Roof 1	30.7000		30.7000	0.1100	3.3770	9.0000	276.3000	(30)
External Roof 2	12.6000		12.6000	0.1300	1.6380	9.0000	113.4000	(30)
External Roof 3	2.5000		2.5000	0.1100	0.2750	9.0000	22.5000	(30)
Total net area of external elements Aum(A, m2)			247.6200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 53.7437			(33)
Party Wall 1			74.9400	0.0000	0.0000	110.0000	8243.4000	(32)
Internal Wall 1			135.0000			9.0000	1215.0000	(32c)
Internal Floor 1			44.8000			18.0000	806.4000	(32d)
Internal Floor 2			39.7000			18.0000	714.6000	(32d)
Internal Ceiling 1			44.8000			9.0000	403.2000	(32e)
Internal Ceiling 2			39.7000			9.0000	357.3000	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28631.3600 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.4336 (35)

Thermal bridges (User defined value 0.060 * total exposed area) 14.8572 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 68.6009 (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	67.0366	66.6476	66.2669	64.8256	64.4858	63.2084	63.2084	63.2084	63.2084	64.8256	65.1737	65.8943	(38)
Heat transfer coeff	135.6376	135.2486	134.8678	133.4266	133.0868	131.8093	131.8093	131.8093	131.8093	133.4266	133.7746	134.4952	(39)
Average = Sum(39)m / 12 =												133.4334	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0490	1.0460	1.0431	1.0319	1.0293	1.0194	1.0194	1.0194	1.0194	1.0319	1.0346	1.0402	(40)
HLP (average)												1.0320	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8932 (42)
Hot water usage for mixer showers													
	72.7285	71.6355	70.0429	66.9956	64.7468	62.2389	60.8134	62.3940	64.1267	66.8194	69.9321	72.4498	(42a)
Hot water usage for baths													
	31.3989	30.9325	30.2759	29.0651	28.1585	27.1532	26.6101	27.2622	27.9722	29.0479	30.2836	31.2927	(42b)
Hot water usage for other uses													
	44.2588	42.6494	41.0400	39.4305	37.8211	36.2117	36.2117	37.8211	39.4305	41.0400	42.6494	44.2588	(42c)
Average daily hot water use (litres/day)												136.4002	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.3861	145.2174	141.3587	135.4912	130.7263	125.6038	123.6353	127.4774	131.5294	136.9072	142.8651	148.0013	(44)
Energy conte	235.0073	206.7877	217.2630	185.4807	175.9828	154.4445	149.5262	157.8436	162.1890	185.7818	203.5375	231.7343	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
	35.2511	31.0182	32.5895	27.8221	26.3974	23.1667	22.4289	23.6765	24.3283	27.8673	30.5306	34.7601	(46)
Water storage loss:													
Total storage 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	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary 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)
Combi loss	16.6101	14.9797	16.5356	15.8981	16.3622	15.7678	16.2511	16.2860	15.8003	16.4034	15.9740	16.5964	(61)
Total heat required for water heating calculated for each month													
	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
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	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306	(64)
												2459.0429	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Full SAP Calculation Printout



Heat gains from water heating, kWh/month
 82.2925 72.5018 76.3738 65.6469 62.6048 55.2947 53.7802 56.5545 57.8779 65.8733 71.6697 81.2007 (65)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

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	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	43.9483	39.0345	31.7450	24.0330	17.9650	15.1668	16.3882	21.3021	28.5916	36.3036	42.3716	45.1698	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	443.0969	447.6948	436.1081	411.4414	380.3041	351.0394	331.4888	326.8908	338.4775	363.1442	394.2816	423.5462	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	(71)
Water heating gains (Table 5)	110.6082	107.8896	102.6530	91.1762	84.1463	76.7982	72.2852	76.0141	80.3860	88.5394	99.5413	109.1408	(72)
Total internal gains	713.7685	710.7341	686.6213	642.7657	598.5304	556.1195	533.2774	537.3221	560.5702	604.1023	652.3096	693.9720	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				3.4600	10.4150	0.6300	0.7000	0.7700	11.0131 (75)			
Southwest				5.5800	33.9635	0.6300	0.7000	0.7700	57.9187 (79)			
Solar gains	68.9318	123.8771	188.0114	256.4251	297.9825	309.0271	285.9717	246.7013	211.6583	145.5628	84.7018	60.4192 (83)
Total gains	782.7003	834.6111	874.6327	899.1908	896.5129	865.1466	819.2491	784.0234	772.2284	749.6652	737.0114	754.3912 (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	58.6354	58.8040	58.9700	59.6070	59.7592	60.3383	60.3383	60.3383	60.3383	59.6070	59.4519	59.1334	
alpha	4.9090	4.9203	4.9313	4.9738	4.9839	5.0226	5.0226	5.0226	5.0226	4.9738	4.9635	4.9422	
util living area	0.9960	0.9940	0.9888	0.9735	0.9279	0.8164	0.6894	0.7231	0.8941	0.9771	0.9930	0.9967	(86)
MIT	19.6686	19.7832	20.0093	20.3350	20.6583	20.8839	20.9611	20.9508	20.7950	20.4009	19.9980	19.6452	(87)
Th 2	20.0427	20.0452	20.0476	20.0568	20.0590	20.0672	20.0672	20.0672	20.0672	20.0568	20.0546	20.0500	(88)
util rest of house	0.9949	0.9922	0.9852	0.9637	0.8979	0.7405	0.5722	0.6083	0.8415	0.9668	0.9905	0.9957	(89)
MIT 2	18.4882	18.6362	18.9260	19.3437	19.7384	19.9869	20.0496	20.0436	19.9030	19.4296	18.9180	18.4635	(90)
Living area fraction									fLA = Living area / (4) =			0.2668	(91)
MIT	18.8031	18.9422	19.2151	19.6082	19.9838	20.2263	20.2928	20.2857	20.1410	19.6888	19.2061	18.7788	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8031	18.9422	19.2151	19.6082	19.9838	20.2263	20.2928	20.2857	20.1410	19.6888	19.2061	18.7788	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9926	0.9892	0.9808	0.9576	0.8950	0.7550	0.6026	0.6376	0.8465	0.9615	0.9873	0.9938	(94)
Useful gains	776.9182	825.5829	857.8207	861.1093	802.3963	653.2067	493.6663	499.8614	653.6694	720.7686	727.6465	749.7116	(95)
Ext temp.	4.7000	5.2000	6.7000	9.1000	12.0000	14.7000	16.4000	16.3000	14.1000	10.7000	7.5000	4.6000	(96)
Heat loss rate W	1912.9148	1858.6187	1687.8806	1402.0689	1062.5391	728.4136	513.1138	525.3514	796.2658	1199.3383	1565.9825	1906.9790	(97)
Space heating kWh	845.1815	694.2001	617.5645	389.4909	193.5462	0.0000	0.0000	0.0000	0.0000	356.0558	603.6019	861.0069	(98a)
Space heating requirement - total per year (kWh/year)												4560.6478	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	845.1815	694.2001	617.5645	389.4909	193.5462	0.0000	0.0000	0.0000	0.0000	356.0558	603.6019	861.0069	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4560.6478	
Space heating per m2										(98c) / (4) =		35.2718	(99)

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

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

Full SAP Calculation Printout



Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													84.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	845.1815	694.2001	617.5645	389.4909	193.5462	0.0000	0.0000	0.0000	0.0000	356.0558	603.6019	861.0069	(98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)	1006.1684	826.4286	735.1958	463.6797	230.4122	0.0000	0.0000	0.0000	0.0000	423.8760	718.5737	1025.0082	(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)
Space heating fuel (secondary)	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	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306	(64)
Efficiency of water heater	88.6042	88.5824	88.5266	88.4132	88.1444	87.3000	87.3000	87.3000	87.3000	88.3767	88.5402	87.3000	(216)
Fuel for water heating, kWh/month	283.9792	250.3516	264.0998	227.7700	218.2156	194.9739	189.8938	199.4612	203.8823	228.7766	247.9230	280.2395	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.4677	30.8602	27.7862	20.3574	15.7246	12.8472	14.3445	18.6456	24.2187	31.7763	35.8913	39.5369	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.8253	-66.3412	-101.1720	-116.9393	-125.2934	-117.7949	-114.7391	-107.2584	-96.6110	-78.9799	-50.5063	-39.3641	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-23.3314	-53.2047	-119.5657	-194.5936	-258.1230	-268.7146	-254.3179	-206.6578	-151.6595	-82.5252	-32.4227	-19.0150	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													5429.3426 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													87.3000
Water heating fuel used													2789.5666 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
central heating pump													41.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													86.0000 (231)
Electricity for lighting (calculated in Appendix L)													310.4566 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-2723.9560 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)
Total delivered energy for all uses													5891.4098 (238)

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5429.3426	3.5000	190.0270 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2789.5666	3.5000	97.6348 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	18.3900	15.8154 (249)
Energy for lighting	310.4566	18.3900	57.0930 (250)
Additional standing charges			94.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1059.8249	18.3900	-194.9018
PV Unit electricity exported	-1664.1311	5.8100	-96.6860
Total			-291.5878 (252)
Total energy cost			162.9824 (255)

Full SAP Calculation Printout



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	5429.3426	0.2100	1140.1620 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2789.5666	0.2100	585.8090 (264)
Space and water heating			1725.9709 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	310.4566	0.1443	44.8085 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1059.8249	0.1341	-142.1165
PV Unit electricity exported	-1664.1311	0.1244	-207.0731
Total			-349.1896 (269)
Total CO2, kg/year			1433.5191 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5429.3426	1.1300	6135.1572 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2789.5666	1.1300	3152.2102 (278)
Space and water heating			9287.3674 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	310.4566	1.5338	476.1887 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1059.8249	1.4956	-1585.0424
PV Unit electricity exported	-1664.1311	0.4568	-760.1044
Total			-2345.1469 (283)
Total Primary energy kWh/year			7548.5101 (286)

SAP 10 EPC IMPROVEMENTS

Burflow Road A_COMBI

Current energy efficiency rating: A 93
Current environmental impact rating: B 89

N Solar water heating SAP increase too small
U Solar photovoltaic panels Already installed
V2 Wind turbine Recommended

Recommended measures: SAP change Cost change CO2 change
V2 Wind turbine + 15.8 -£ 523 -496 kg (34.6%)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.4 -£ 11 -134 kg (9.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Wind turbine	£523 3.84 kg/m²	A 109	A 92
Total Savings	£523 3.84 kg/m²		

Potential energy efficiency rating: A 109
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 514 TEST (30 Mar 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£73	£73	£0
Mains gas	£382	£382	£0
Space heating	£300	£300	£0
Water heating	£98	£98	£0
Lighting	£57	£57	£0
Generated (PV)	-£292	-£292	£0
Generated (wind)	-£0	-£523	£523
Total cost of fuels	£163	-£360	£523
Total cost of uses	£163	-£360	£523
Delivered energy	46 kWh/m²	18 kWh/m²	28 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.9 tonnes	0.5 tonnes
CO2 emissions per m²	11 kg/m²	7 kg/m²	4 kg/m²
Primary energy	58 kWh/m²	25 kWh/m²	34 kWh/m²

Full SAP Calculation Printout



SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.8000 (1b)	x 2.7000 (2b)	= 120.9600 (1b) -
First floor	44.8000 (1c)	x 2.7000 (2c)	= 120.9600 (1c) -
Second floor	39.7000 (1d)	x 2.7000 (2d)	= 107.1900 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.1100 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1146 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3646 (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) = 0.3372 (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	0.4300	0.4215	0.4131	0.3710	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962 (22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5487	0.5569	0.5657	0.5720	0.5785 (25)

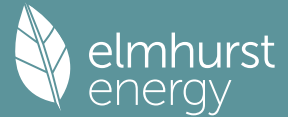
3. Heat losses and heat loss parameter

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	
Door			1.9100	1.2000	2.2920			(26)
HGD			5.4600	1.2000	6.5520			(26a)
Window (Uw = 1.20)			9.0400	1.1450	10.3511			(27)
Heatloss Floor 1			44.8000	0.1100	4.9280	75.0000	3360.0000	(28a)
External Wall 1	128.9400	13.8500	115.0900	0.1800	20.7162	110.0000	12659.9000	(29a)
Stud	12.2400		12.2400	0.1000	1.2240	18.0000	220.3200	(29a)
Dormer	15.8400	2.5600	13.2800	0.1800	2.3904	18.0000	239.0400	(29a)
External Roof 1	30.7000		30.7000	0.1100	3.3770	9.0000	276.3000	(30)
External Roof 2	12.6000		12.6000	0.1300	1.6380	9.0000	113.4000	(30)
External Roof 3	2.5000		2.5000	0.1100	0.2750	9.0000	22.5000	(30)
Total net area of external elements Aum(A, m2)			247.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7437			(33)
Party Wall 1			74.9400	0.0000	0.0000	110.0000	8243.4000	(32)
Internal Wall 1			135.0000			9.0000	1215.0000	(32c)
Internal Floor 1			44.8000			18.0000	806.4000	(32d)
Internal Floor 2			39.7000			18.0000	714.6000	(32d)
Internal Ceiling 1			44.8000			9.0000	403.2000	(32e)
Internal Ceiling 2			39.7000			9.0000	357.3000	(32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =	28631.3600			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							221.4336	(35)
Thermal bridges (User defined value 0.060 * total exposed area)							14.8572	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss				(33) + (36) + (36a) =	68.6009			(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
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Full SAP Calculation Printout



(38)m	68.2526	67.8391	67.4338	65.5299	65.1737	63.5154	63.5154	63.2084	64.1542	65.1737	65.8943	66.6476 (38)
Heat transfer coeff	136.8536	136.4401	136.0347	134.1308	133.7746	132.1164	132.1164	131.8093	132.7551	133.7746	134.4952	135.2486 (39)
Average = Sum(39)m / 12 =												134.1291

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0584	1.0552	1.0521	1.0374	1.0346	1.0218	1.0218	1.0194	1.0267	1.0346	1.0402	1.0460 (40)
HLP (average)												1.0373
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8932 (42)
Hot water usage for mixer showers	72.7285	71.6355	70.0429	66.9956	64.7468	62.2389	60.8134	62.3940	64.1267	66.8194	69.9321	72.4498 (42a)
Hot water usage for baths	31.3989	30.9325	30.2759	29.0651	28.1585	27.1532	26.6101	27.2622	27.9722	29.0479	30.2836	31.2927 (42b)
Hot water usage for other uses	44.2588	42.6494	41.0400	39.4305	37.8211	36.2117	36.2117	37.8211	39.4305	41.0400	42.6494	44.2588 (42c)
Average daily hot water use (litres/day)												136.4002 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	148.3861	145.2174	141.3587	135.4912	130.7263	125.6038	123.6353	127.4774	131.5294	136.9072	142.8651	148.0013 (44)
Distribution loss (46)m = 0.15 x (45)m	235.0073	206.7877	217.2630	185.4807	175.9828	154.4445	149.5262	157.8436	162.1890	185.7818	203.5375	231.7343 (45)
	35.2511	31.0182	32.5895	27.8221	26.3974	23.1667	22.4289	23.6765	24.3283	27.8673	30.5306	34.7601 (46)
Total storage 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 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary 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)
Combi loss	16.6101	14.9797	16.5356	15.8981	16.3622	15.7678	16.2511	16.2860	15.8003	16.4034	15.9740	16.5964 (61)
Total heat required for water heating calculated for each month	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
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 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (64)
	Total per year (kWh/year) = Sum(64)m =											2459.0429 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	82.2925	72.5018	76.3738	65.6469	62.6048	55.2947	53.7802	56.5545	57.8779	65.8733	71.6697	81.2007 (65)

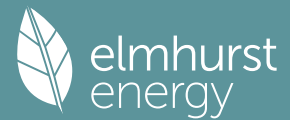
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	43.9483	39.0345	31.7450	24.0330	17.9650	15.1668	16.3882	21.3021	28.5916	36.3036	42.3716	45.1698 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	443.0969	447.6948	436.1081	411.4414	380.3041	351.0394	331.4888	326.8908	338.4775	363.1442	394.2816	423.5462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261 (71)
Water heating gains (Table 5)												
	110.6082	107.8896	102.6530	91.1762	84.1463	76.7982	72.2852	76.0141	80.3860	88.5394	99.5413	109.1408 (72)
Total internal gains												
	713.7685	710.7341	686.6213	642.7657	598.5304	556.1195	533.2774	537.3221	560.5702	604.1023	652.3096	693.9720 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Northeast					3.4600	11.2829	0.6300	0.7000			0.7700	11.9308 (75)
Southwest					5.5800	36.7938	0.6300	0.7000			0.7700	62.7453 (79)
Solar gains	74.6761	131.1640	189.9905	253.0511	299.5426	304.4602	290.5842	254.8165	211.6583	147.8023	90.1664	63.4402 (83)
Total gains	788.4446	841.8980	876.6118	895.8168	898.0730	860.5797	823.8616	792.1386	772.2284	751.9046	742.4760	757.4121 (84)

Full SAP Calculation Printout



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	58.1143	58.2905	58.4642	59.2940	59.4519	60.1981	60.1981	60.3383	59.9085	59.4519	59.1334	58.8040
alpha	4.8743	4.8860	4.8976	4.9529	4.9635	5.0132	5.0132	5.0226	4.9939	4.9635	4.9422	4.9203
util living area	0.9963	0.9943	0.9894	0.9757	0.9356	0.8263	0.6644	0.7068	0.8956	0.9778	0.9937	0.9970 (86)
MIT	19.6075	19.7369	19.9726	20.3017	20.6232	20.8742	20.9682	20.9566	20.7903	20.3879	19.9454	19.5880 (87)
Th 2	20.0349	20.0376	20.0402	20.0523	20.0546	20.0652	20.0652	20.0672	20.0611	20.0546	20.0500	20.0452 (88)
util rest of house	0.9953	0.9926	0.9860	0.9668	0.9090	0.7531	0.5423	0.5892	0.8432	0.9679	0.9915	0.9961 (89)
MIT 2	18.4044	18.5716	18.8740	19.2988	19.6939	19.9765	20.0520	20.0472	19.8930	19.4117	18.8476	18.3867 (90)
Living area fraction									fLA = Living area / (4) =			0.2668 (91)
MIT	18.7254	18.8825	19.1672	19.5664	19.9418	20.2160	20.2965	20.2899	20.1324	19.6722	19.1405	18.7073 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7254	18.8825	19.1672	19.5664	19.9418	20.2160	20.2965	20.2899	20.1324	19.6722	19.1405	18.7073 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9931	0.9897	0.9817	0.9608	0.9051	0.7664	0.5744	0.6196	0.8479	0.9625	0.9884	0.9943 (94)
Useful gains	783.0196	833.1860	860.5896	860.7030	812.8144	659.5636	473.2578	490.7773	654.8035	723.7085	733.8710	753.0963 (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	1974.1688	1907.7796	1723.1754	1430.6884	1102.5486	741.9648	488.3640	512.7207	800.8315	1213.6253	1619.3872	1962.0873 (97)
Space heating kWh	886.2150	722.1269	641.7639	410.3895	215.5623	0.0000	0.0000	0.0000	0.0000	364.4981	637.5717	899.4893 (98a)
Space heating requirement - total per year (kWh/year)												4777.6167
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	886.2150	722.1269	641.7639	410.3895	215.5623	0.0000	0.0000	0.0000	0.0000	364.4981	637.5717	899.4893 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4777.6167
Space heating per m2										(98c) / (4) =		36.9499 (99)

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 %)												84.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	886.2150	722.1269	641.7639	410.3895	215.5623	0.0000	0.0000	0.0000	0.0000	364.4981	637.5717	899.4893 (98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)
Space heating fuel (main heating system)	1055.0178	859.6749	764.0046	488.5590	256.6217	0.0000	0.0000	0.0000	0.0000	433.9263	759.0139	1070.8206 (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)
Space heating fuel (secondary)	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	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (64)
Efficiency of water heater (217)m	88.6184	88.5947	88.5396	88.4331	88.1902	87.3000	87.3000	87.3000	87.3000	88.3859	88.5583	87.3000 (216)
Fuel for water heating, kWh/month	283.9337	250.3168	264.0610	227.7187	218.1024	194.9739	189.8938	199.4612	203.8823	228.7527	247.8722	280.1987 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	38.4677	30.8602	27.7862	20.3574	15.7246	12.8472	14.3445	18.6456	24.2187	31.7763	35.8913	39.5369 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-47.7186	-69.0282	-101.8100	-116.1659	-125.5736	-117.1039	-115.4768	-108.8203	-96.6110	-79.7469	-52.9062	-40.9231 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-26.1179	-57.5498	-121.2514	-191.2679	-259.8502	-263.6936	-259.5327	-215.4221	-151.6595	-84.2429	-35.3731	-20.3749 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

Full SAP Calculation Printout



(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5687.6389	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.3000	
Water heating fuel used												2789.1675	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												310.4566	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2758.2204	(233)
Wind generation												-3575.5408	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2539.5019	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5687.6389	3.6400	207.0301 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2789.1675	3.6400	101.5257 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814 (249)
Energy for lighting	310.4566	16.4900	51.1943 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1071.8845	16.4900	-176.7538
PV Unit electricity exported	-1686.3359	5.5900	-94.2662
Total			-271.0199 (252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618
Total			-472.6865 (252)
Total energy cost			-277.7750 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	-0.5737 (257)
SAP value		109.3000
SAP rating (Section 12)		109 (258)
SAP band		A

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	5687.6389	0.2100	1194.4042 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2789.1675	0.2100	585.7252 (264)
Space and water heating			1780.1293 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	310.4566	0.1443	44.8085 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1071.8845	0.1343	-143.9367
PV Unit electricity exported	-1686.3359	0.1247	-210.2200
Total			-354.1567 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO2, kg/year			986.7388 (272)
CO2 emissions per m2			7.6300 (273)
EI value			92.4141
EI rating			92 (274)
EI band			A

Full SAP Calculation Printout



SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.8000 (1b)	x 2.7000 (2b)	= 120.9600 (1b) -
First floor	44.8000 (1c)	x 2.7000 (2c)	= 120.9600 (1c) -
Second floor	39.7000 (1d)	x 2.7000 (2d)	= 107.1900 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.1100 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1146 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3646 (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) = 0.3372 (21)

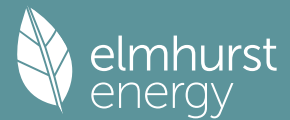
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.7000	4.6000	4.2000	4.1000	3.7000	3.7000	3.7000	3.7000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2000	1.1750	1.1500	1.0500	1.0250	0.9250	0.9250	0.9250	0.9250	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.4047	0.3962	0.3878	0.3541	0.3457	0.3119	0.3119	0.3119	0.3119	0.3541	0.3625	0.3794 (22b)
Effective ac	0.5819	0.5785	0.5752	0.5627	0.5597	0.5487	0.5487	0.5487	0.5487	0.5627	0.5657	0.5720 (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
Door			1.9100	1.2000	2.2920		(26)
HGD			5.4600	1.2000	6.5520		(26a)
Window (Uw = 1.20)			9.0400	1.1450	10.3511		(27)
Heatloss Floor 1			44.8000	0.1100	4.9280	75.0000	3360.0000 (28a)
External Wall 1	128.9400	13.8500	115.0900	0.1800	20.7162	110.0000	12659.9000 (29a)
Stud	12.2400		12.2400	0.1000	1.2240	18.0000	220.3200 (29a)
Dormer	15.8400	2.5600	13.2800	0.1800	2.3904	18.0000	239.0400 (29a)
External Roof 1	30.7000		30.7000	0.1100	3.3770	9.0000	276.3000 (30)
External Roof 2	12.6000		12.6000	0.1300	1.6380	9.0000	113.4000 (30)
External Roof 3	2.5000		2.5000	0.1100	0.2750	9.0000	22.5000 (30)
Total net area of external elements Aum(A, m ²)			247.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7437		(33)
Party Wall 1			74.9400	0.0000	0.0000	110.0000	8243.4000 (32)
Internal Wall 1			135.0000			9.0000	1215.0000 (32c)
Internal Floor 1			44.8000			18.0000	806.4000 (32d)
Internal Floor 2			39.7000			18.0000	714.6000 (32d)
Internal Ceiling 1			44.8000			9.0000	403.2000 (32e)
Internal Ceiling 2			39.7000			9.0000	357.3000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28631.3600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							221.4336 (35)
Thermal bridges (User defined value 0.060 * total exposed area)							14.8572 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	68.6009 (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	67.0366	66.6476	66.2669	64.8256	64.4858	63.2084	63.2084	63.2084	63.2084	64.8256	65.1737	65.8943 (38)
Heat transfer coeff	135.6376	135.2486	134.8678	133.4266	133.0868	131.8093	131.8093	131.8093	131.8093	133.4266	133.7746	134.4952 (39)
Average = Sum(39)m / 12 =												133.4334

Full SAP Calculation Printout



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0490	1.0460	1.0431	1.0319	1.0293	1.0194	1.0194	1.0194	1.0194	1.0319	1.0346	1.0402 (40)
HLP (average)												1.0320
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8932 (42)
Hot water usage for mixer showers												
72.7285	71.6355	70.0429	66.9956	64.7468	62.2389	60.8134	62.3940	64.1267	66.8194	69.9321	72.4498 (42a)	
Hot water usage for baths												
31.3989	30.9325	30.2759	29.0651	28.1585	27.1532	26.6101	27.2622	27.9722	29.0479	30.2836	31.2927 (42b)	
Hot water usage for other uses												
44.2588	42.6494	41.0400	39.4305	37.8211	36.2117	36.2117	37.8211	39.4305	41.0400	42.6494	44.2588 (42c)	
Average daily hot water use (litres/day)												136.4002 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
148.3861	145.2174	141.3587	135.4912	130.7263	125.6038	123.6353	127.4774	131.5294	136.9072	142.8651	148.0013 (44)	
Energy conte	235.0073	206.7877	217.2630	185.4807	175.9828	154.4445	149.5262	157.8436	162.1890	185.7818	203.5375	231.7343 (45)
Energy content (annual)										Total = Sum(45)m =		2265.5784
Distribution loss (46)m = 0.15 x (45)m												
35.2511	31.0182	32.5895	27.8221	26.3974	23.1667	22.4289	23.6765	24.3283	27.8673	30.5306	34.7601 (46)	
Water storage loss:												
Total storage 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 (56)	
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	16.6101	14.9797	16.5356	15.8981	16.3622	15.7678	16.2511	16.2860	15.8003	16.4034	15.9740	16.5964 (61)
Total heat required for water heating calculated for each month												
251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h												
251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (64)	
									Total per year (kWh/year) = Sum(64)m =			2459.0429 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month												
82.2925	72.5018	76.3738	65.6469	62.6048	55.2947	53.7802	56.5545	57.8779	65.8733	71.6697	81.2007 (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	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892	173.5892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	43.9483	39.0345	31.7450	24.0330	17.9650	15.1668	16.3882	21.3021	28.5916	36.3036	42.3716	45.1698 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	443.0969	447.6948	436.1081	411.4414	380.3041	351.0394	331.4888	326.8908	338.4775	363.1442	394.2816	423.5462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521	55.2521 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261	-115.7261 (71)
Water heating gains (Table 5)												
	110.6082	107.8896	102.6530	91.1762	84.1463	76.7982	72.2852	76.0141	80.3860	88.5394	99.5413	109.1408 (72)
Total internal gains												
	713.7685	710.7341	686.6213	642.7657	598.5304	556.1195	533.2774	537.3221	560.5702	604.1023	652.3096	693.9720 (73)

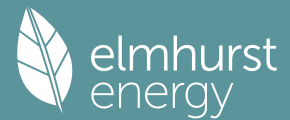
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast				3.4600	10.4150	0.6300	0.7000	0.7700	11.0131 (75)						
Southwest				5.5800	33.9635	0.6300	0.7000	0.7700	57.9187 (79)						
Solar gains				68.9318	123.8771	188.0114	256.4251	297.9825	309.0271	285.9717	246.7013	211.6583	145.5628	84.7018	60.4192 (83)
Total gains				782.7003	834.6111	874.6327	899.1908	896.5129	865.1466	819.2491	784.0234	772.2284	749.6652	737.0114	754.3912 (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)	

Full SAP Calculation Printout



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.6354	58.8040	58.9700	59.6070	59.7592	60.3383	60.3383	60.3383	60.3383	59.6070	59.4519	59.1334
alpha	4.9090	4.9203	4.9313	4.9738	4.9839	5.0226	5.0226	5.0226	5.0226	4.9738	4.9635	4.9422
util living area	0.9960	0.9940	0.9888	0.9735	0.9279	0.8164	0.6894	0.7231	0.8941	0.9771	0.9930	0.9967 (86)
MIT	19.6686	19.7832	20.0093	20.3350	20.6583	20.8839	20.9611	20.9508	20.7950	20.4009	19.9980	19.6452 (87)
Th 2	20.0427	20.0452	20.0476	20.0568	20.0590	20.0672	20.0672	20.0672	20.0672	20.0568	20.0546	20.0500 (88)
util rest of house	0.9949	0.9922	0.9852	0.9637	0.8979	0.7405	0.5722	0.6083	0.8415	0.9668	0.9905	0.9957 (89)
MIT 2	18.4882	18.6362	18.9260	19.3437	19.7384	19.9869	20.0496	20.0436	19.9030	19.4296	18.9180	18.4635 (90)
Living area fraction	18.8031	18.9422	19.2151	19.6082	19.9838	20.2263	20.2928	20.2857	fLA = Living area / (4) =			0.2668 (91)
MIT	18.8031	18.9422	19.2151	19.6082	19.9838	20.2263	20.2928	20.2857	20.1410	19.6888	19.2061	18.7788 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8031	18.9422	19.2151	19.6082	19.9838	20.2263	20.2928	20.2857	20.1410	19.6888	19.2061	18.7788 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9926	0.9892	0.9808	0.9576	0.8950	0.7550	0.6026	0.6376	0.8465	0.9615	0.9873	0.9938 (94)
Useful gains	776.9182	825.5829	857.8207	861.1093	802.3963	653.2067	493.6663	499.8614	653.6694	720.7686	727.6465	749.7116 (95)
Ext temp.	4.7000	5.2000	6.7000	9.1000	12.0000	14.7000	16.4000	16.3000	14.1000	10.7000	7.5000	4.6000 (96)
Heat loss rate W	1912.9148	1858.6187	1687.8806	1402.0689	1062.5391	728.4136	513.1138	525.3514	796.2658	1199.3383	1565.9825	1906.9790 (97)
Space heating kWh	845.1815	694.2001	617.5645	389.4909	193.5462	0.0000	0.0000	0.0000	0.0000	356.0558	603.6019	861.0069 (98a)
Space heating requirement - total per year (kWh/year)												4560.6478
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	845.1815	694.2001	617.5645	389.4909	193.5462	0.0000	0.0000	0.0000	0.0000	356.0558	603.6019	861.0069 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4560.6478
Space heating per m2										(98c) / (4) =		35.2718 (99)

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 %)	84.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	845.1815	694.2001	617.5645	389.4909	193.5462	0.0000	0.0000	0.0000	0.0000	356.0558	603.6019	861.0069 (98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)
Space heating fuel (main heating system)	1006.1684	826.4286	735.1958	463.6797	230.4122	0.0000	0.0000	0.0000	0.0000	423.8760	718.5737	1025.0082 (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)
Space heating fuel (secondary)	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	251.6174	221.7673	233.7986	201.3788	192.3450	170.2123	165.7772	174.1297	177.9893	202.1852	219.5115	248.3306 (64)	
Efficiency of water heater												87.3000 (216)	
(217)m	88.6042	88.5824	88.5266	88.4132	88.1444	87.3000	87.3000	87.3000	87.3000	88.3767	88.5402	88.6137 (217)	
Fuel for water heating, kWh/month	283.9792	250.3516	264.0998	227.7700	218.2156	194.9739	189.8938	199.4612	203.8823	228.7766	247.9230	280.2395 (219)	
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)	
Lighting	38.4677	30.8602	27.7862	20.3574	15.7246	12.8472	14.3445	18.6456	24.2187	31.7763	35.8913	39.5369 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.8253	-66.3412	-101.1720	-116.9393	-125.2934	-117.7949	-114.7391	-107.2584	-96.6110	-78.9799	-50.5063	-39.3641 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-23.3314	-53.2047	-119.5657	-194.5936	-258.1230	-268.7146	-254.3179	-206.6578	-151.6595	-82.5252	-32.4227	-19.0150 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)	
Annual totals kWh/year													
Space heating fuel - main system 1												5429.3426 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	

Full SAP Calculation Printout



Efficiency of water heater	87.3000
Water heating fuel used	2789.5666 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	310.4566 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2723.9560 (233)
Wind generation	-3575.5408 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2315.8691 (238)

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5429.3426	3.5000	190.0270 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2789.5666	3.5000	97.6348 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	18.3900	15.8154 (249)
Energy for lighting	310.4566	18.3900	57.0930 (250)
Additional standing charges			94.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1059.8249	18.3900	-194.9018
PV Unit electricity exported	-1664.1311	5.8100	-96.6860
Total			-291.5878 (252)
Wind Turbine electricity used in dwelling	-2502.8785	18.3900	-460.2794
Wind Turbine electricity exported	-1072.6622	5.8100	-62.3217
Total			-522.6010 (252)
Total energy cost			-359.6187 (255)

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	5429.3426	0.2100	1140.1620 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2789.5666	0.2100	585.8090 (264)
Space and water heating			1725.9709 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	310.4566	0.1443	44.8085 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1059.8249	0.1341	-142.1165
PV Unit electricity exported	-1664.1311	0.1244	-207.0731
Total			-349.1896 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO2, kg/year			937.5475 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5429.3426	1.1300	6135.1572 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2789.5666	1.1300	3152.2102 (278)
Space and water heating			9287.3674 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	310.4566	1.5338	476.1887 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1059.8249	1.4956	-1585.0424
PV Unit electricity exported	-1664.1311	0.4568	-760.1044
Total			-2345.1469 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	-1072.6622	0.5128	-550.0612
Total			-4336.4158 (283)
Total Primary energy kWh/year			3212.0943 (286)



Appendix 3

Part G Water Calculations



Job no:	R2263
Date:	Apr-23
Assessor name:	Ben Matthews
Registration no:	
Development name:	Burlow Road, Harper Hill

BRE Global 2010. BRE Certification is a registered trademark owned by BRE Global and may not be used without BRE Global's written permission.

Permission is given for this tool to be copied without infringement of copyright for use only on projects where a Code for Sustainable Homes assessment is carried out. Whilst every care is taken in preparing the Wat 1 assessment tool, BREG cannot accept responsibility for any inaccuracies or for consequential loss incurred as a result of such inaccuracies arising through the use of the Wat 1 tool.

PRINTING: before printing please make sure that in "Page Setup" you have selected the page to be as "Landscape" and that the Scale has been set up to 70% (maximum)

WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS - (BASIC CALCULATOR)

		House Type:	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Type 10	
		Description:	Burlow Road										
Installation Type	Unit of measure	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day
Is a dual or single flush WC specified?		Dual		Select option:		Select option:		Select option:		Select option:		Select option:	
WC	Full flush volume	4.5	6.57		0.00		0.00		0.00		0.00		0.00
	Part flush volume	3	8.88		0.00		0.00		0.00		0.00		0.00
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	5	9.48		0.00		0.00		0.00		0.00		0.00
Are both a Bath & Shower Present?		Bath & Shower		Select option:		Select option:		Select option:		Select option:		Select option:	
Bath	Capacity to overflow	190	20.90		0.00		0.00		0.00		0.00		0.00
Shower	Flow rate (litres / minute)	8	34.96		0.00		0.00		0.00		0.00		0.00
Kitchen sink taps	Flow rate (litres / minute)	5	12.56		0.00		0.00		0.00		0.00		0.00
Has a washing machine been specified?		No		Select option:		Select option:		Select option:		Select option:		Select option:	
Washing Machine	Litres / kg		17.16		0.00		0.00		0.00		0.00		0.00
Has a dishwasher been specified?		No		Select option:		Select option:		Select option:		Select option:		Select option:	
Dishwasher	Litres / place setting		4.50		0.00		0.00		0.00		0.00		0.00
Has a waste disposal unit been specified?		No		Select option:		Select option:		Select option:		Select option:		Select option:	
Water Softener	Litres / person / day		0.00		0.00		0.00		0.00		0.00		0.00
Calculated Use		115.0		0.0		0.0		0.0		0.0		0.0	
Normalisation factor		0.91		0.91		0.91		0.91		0.91		0.91	
Code for Sustainable Homes	Total Consumption	104.7		0.0		0.0		0.0		0.0		0.0	
	Mandatory level	Level 3/4		-		-		-		-		-	
Building Regulations 17.K	External use	5.0		5.0		5.0		5.0		5.0		5.0	
	Total Consumption	109.7		0.0		0.0		0.0		0.0		0.0	
	17.K Compliance?	Yes		-		-		-		-		-	