



Twinwoods, 119 Ducks Hill Road

NORTHWOOD HA6 2SQ

Dynamic Summertime Overheating Analysis

1. Introduction

In the realm of sustainable building design, the assessment of overheating risk has emerged in recent years as a critical consideration. With the escalating challenges posed by climate change, the United Kingdom's Building Regulations have evolved to address the potential risks associated with overheating in buildings. Part O of the Building Regulations, in conjunction with the Chartered Institution of Building Services Engineers (CIBSE) Technical Memorandum 59 (TM59), sets the guidelines and standards for evaluating and mitigating overheating within various building types.

Part O of the UK Building Regulations, titled "Security Against Overheating," underscores the necessity for new buildings to be designed and constructed in a manner that minimizes the risk of overheating. It mandates that sufficient thermal comfort should be achieved, even during exceptionally warm weather, without relying solely on energy-intensive cooling systems. This regulation encourages the adoption of passive design strategies, intelligent architectural features, and effective ventilation to naturally manage internal temperatures.

The dynamic method for assessing overheating involves using computer simulation software to model and analyse the thermal behaviour of a building over time, particularly during periods of high external temperatures. This method takes into account a variety of factors, such as the building's design, orientation, materials, insulation, glazing, ventilation strategies, and occupancy patterns. By simulating the building's response to changing external conditions and internal heat gains, the dynamic method provides a more comprehensive and accurate assessment of the potential for overheating compared to simpler steady-state calculations.

Dynamic simulation software models how heat is transferred within and around a building, including how solar radiation enters through windows, how heat is conducted through walls and roofs, and how ventilation systems affect indoor air temperatures. It also considers the thermal mass of the building, which can help moderate temperature fluctuations by absorbing and releasing heat slowly.

Overheating assessment for the newly proposed house at **119 Ducks Hill Rd** has been carried out to check compliance with CIBSE TM59 and building regulations Part O overheating criteria.

The proposed detached house complies with CIBSE TM59 (Part O) criteria under DSY1 weather data set, with natural ventilation through openable windows.

2. Project description

The proposed development includes demolition of existing house on site and erection of a new 5-bedroom three storey single family dwelling house.



3. Inputs

The building fabric parameters applied are as follows and are in line with the SAP calculation and energy statement presented separately:

Building Elements	U Values	Thermal mass
Ground floor	0.11 W/m ² K	Insulated slab on ground
External walls	0.18 W/m ² K	Insulated cavity walls
Pitched roof	0.11 W/m ² K	Pitched roof insulated at rafter level
Internal walls	N/A	Lightweight partitions
Internal floors	N/A	Concrete slab with insulation below screed
Windows, glazed doors and rooflights	1.2 W/m ² K	N/A
Glazing g-value	0.63	N/A
External doors	1.0	N/A
Infiltration rate	0.5 AC/hr	N/A

Natural ventilation through openable openings is included in the model.

Lighting: 2 W/m² (6pm – 11pm)

Window blinds are not included in the model (in line with BR Part O)

Weather data set used for the simulation is CIBSE DSY1 (design summer year) London Heathrow for the 2020s, high emissions, 50% percentile scenario

Occupancy density equipment gains and schedules are modelled as per CIBSE TM59 guidance:

Unit/ room type	Occupancy	Equipment load
Studio	2 people at all times	Peak load of 450 W from 6 pm to 8 pm*. 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room/kitchen	1 person from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room	1 person at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
1-bedroom apartment: kitchen	1 person at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
2-bedroom apartment: living room/kitchen	2 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
2-bedroom apartment: living room	2 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
2-bedroom apartment: kitchen	2 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
3-bedroom apartment: living room/kitchen	3 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
3-bedroom apartment: living room	3 people at 5% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
3-bedroom apartment: kitchen	3 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm base load of 50 W for the rest of the day
Double bedroom	2 people at 70% gains from 11 pm to 8 am 2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm 1 person at full gain in the bedroom from 9 am to 10 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during the sleeping hours
Single bedroom (too small to accommodate double bed)	1 person at 70% gains from 11 pm to 8 am 1 person at full gains from 8 am to 11 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during sleeping hours
Communal corridors	Assumed to be zero	Pipework heat loss only; see section 3.1 above

* All times in GMT

4. Methods

Compliance is based on passing both of the following criteria:

Criterion 4.2a: Hours of Exceedence (He):

For living rooms, kitchens and bedrooms:

Same as CIBSE TM52 Criterion 1. The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).

The number of hours (He) during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.

Criterion 4.2b:

For bedrooms only:

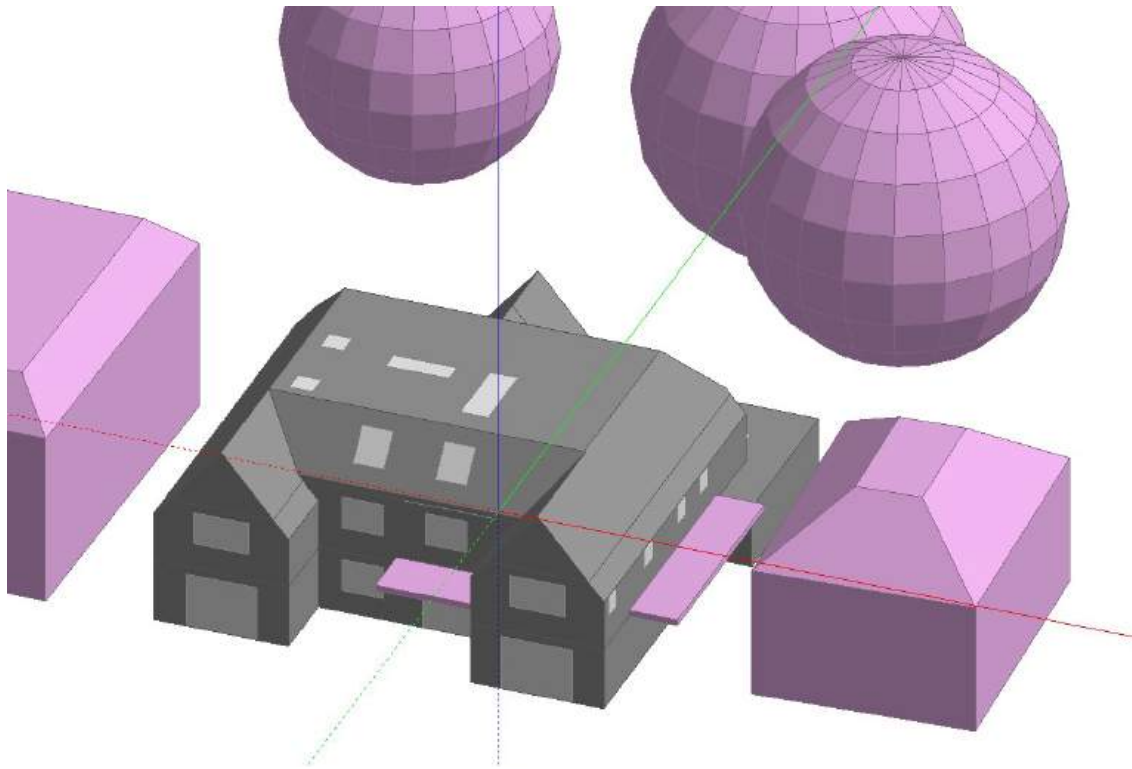
to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

The Design Summer Years (DSY1) weather dataset represents a set of weather conditions that are specifically designed to simulate the hottest and most extreme summer conditions that a building might experience. This dataset is used to assess the risk of overheating in buildings during peak hot weather periods. It provides hourly weather data for a chosen location, focusing on a design summer year that reflects the conditions that buildings need to be prepared for to ensure occupant comfort and well-being.

The DSY1 weather data takes into account factors like high outdoor temperatures, solar radiation, and other relevant parameters that contribute to overheating. This data is used in dynamic thermal simulation software to model how a building responds to these extreme summer conditions and how its design features, insulation, glazing, ventilation systems, and other elements interact to influence indoor temperatures.

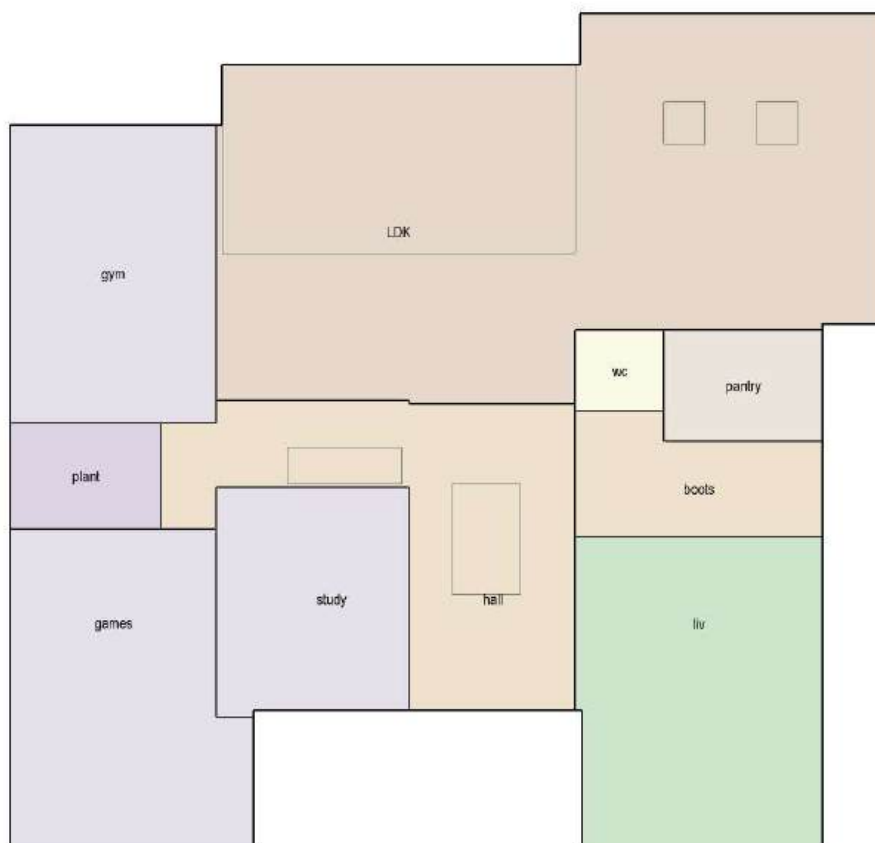
The dynamic thermal simulation has been carried out using DesignBuilder software with EnergyPlus v8.9 engine.

Axonometric View of the modelled buildings

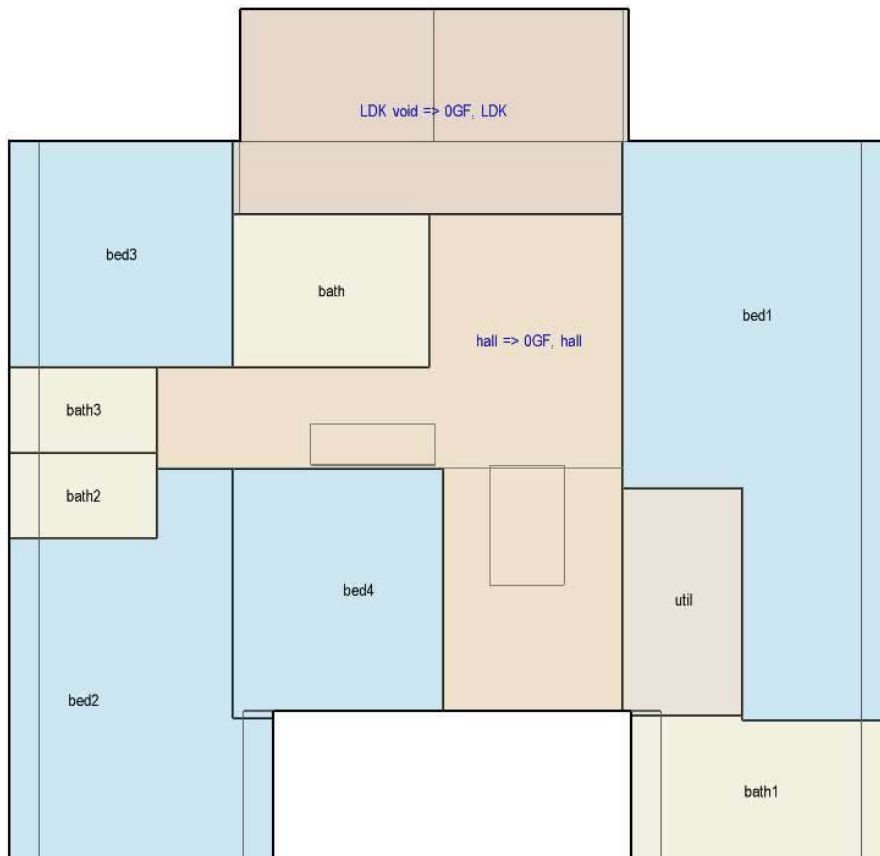


Layouts of the modelled building

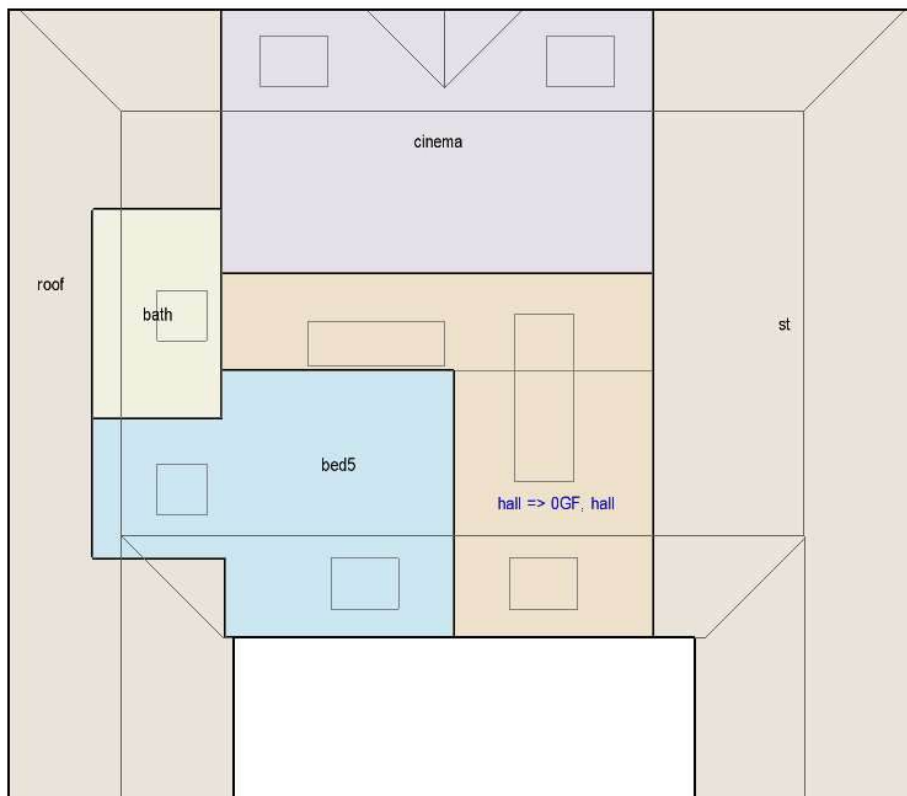
Ground floor



1st floor



2nd floor



5. Overheating mitigation measures

Windows & glazed doors have been modelled as fully open during daytime occupied hours and closed during night

All windows in the upper levels have been modelled as fully open during daytime and night.

Skylights in flat roof are modelled as permanently closed

Rooflights in the pitched roofs are modelled as fully openable at all times. To allow this, they should be equipped with automatic rain sensors.

As a minimum, this window openability has to be adhered to in order to comply with Part O and no other mitigation measures are required.

6. Results

CIBSE TM59 Results for DSY1

Criteria for predominantly naturally ventilated homes				
Block	Zone	Criterion A (%)	Criterion B (hr)	Pass/Fail
OGF	LDK	0	N/A	Pass
OGF	Liv	0	N/A	Pass
1st	Bed1	0	5	Pass
1st	Bed2	0	3	Pass
1st	Bed3	0	6	Pass
1st	Bed4	0	6	Pass
2nd	Bed5	0	24	Pass

7. Conclusion

The proposed house complies with CIBSE TM59 (Part O) criteria under DSY1 weather data set, with natural ventilation through openable windows as described in mitigation measures.

Ondrej Gajdos, Consult JA Ltd, 20/01/2025



Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 23 Dec 2024 15:56:31

Project Information			
Assessed By	Ondrej Gajdos	Building Type	House, Detached
OCDEA Registration	EES/027207	Assessment Date	2024-12-23

Dwelling Details			
Assessment Type	As designed	Total Floor Area	832 m ²
Site Reference	Twinwoods	Plot Reference	Be Green
Address	119 Ducks Hill Road Twinwoods Northwood, LONDON, HA6 2SQ		

Client Details	
Name	Client
Company	Client
Address	AddressLine1, Northwood, Town, Postcode

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	6.01 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	5.39 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	32.8 kWh _{PE} /m ²		
Dwelling primary energy	30.19 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	37.3 kWh/m ²		
Dwelling fabric energy efficiency	35.0 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.1	ground floor (0.1)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	1 (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	348.229	0.18
Ground floor: ground floor, ground floor	354	0.1 (!)
Exposed roof: Roof (1)	231.23499389648	0.11
Exposed roof: Roof (2)	37.5	0.11
Exposed roof: Roof (3)	104.64340305176	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
1, 1	2.3	North West	0.7	1.2
1, 1	1.196	North West	0.7	1.2
1, 1	1.196	North West	0.7	1.2
2, 1	7.5215	North West	0.7	1.2
2, 1	7.5215	North West	0.7	1.2
3, 1	2.61	North West	0.7	1.2
3, 1	2.61	North West	0.7	1.2
3, 1	2.61	North West	0.7	1.2
4, 1	3.48	North West	0.7	1.2
4, 1	3.48	North West	0.7	1.2
5, 1	13.23	South East	0.7	1.2
6, 1	11.4	South East	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
7, 1	35.91	South East	0.7	1.2
8, 1	3.48	South East	0.7	1.2
9, 1	6.396	South East	0.7	1.2
10, 1	0.81	North East	0.7	1.2
10, 1	0.81	North East	0.7	1.2
10, 1	0.81	North East	0.7	1.2
10, 1	0.81	North East	0.7	1.2
10, 1	0.81	North East	0.7	1.2
11, 1	0.81	South West	0.7	1.2
11, 1	0.81	South West	0.7	1.2
11, 1	0.81	South West	0.7	1.2
11, 1	0.81	South West	0.7	1.2
12, 1	1.53	South West	0.7	1.2
13, 1	1.96	South West	0.7	1.2
1, 1	2.565	North West	0.7	1.2
1, 1	2.565	North West	0.7	1.2
2, 1	2.565	South East	0.7	1.2
2, 1	2.565	South East	0.7	1.2
3, 1	0.2025	South West	0.7	1.2
3, 1	0.2025	South West	0.7	1.2
4, 4	1	Horizontal	0.7	1.2
4, 4	1	Horizontal	0.7	1.2
5, 4	1	Horizontal	0.7	1.2
5, 4	1	Horizontal	0.7	1.2
6, 4	3.18	Horizontal	0.7	1.2
7, 4	3.9766	Horizontal	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.04	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Boiler with radiators or underfloor heating - Mains gas

Efficiency	88.7%
Emitter type	Radiators
Flow temperature	
System type	Regular boiler
Manufacturer	Vaillant Group UK Ltd
Model	ecoTEC plus 635
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

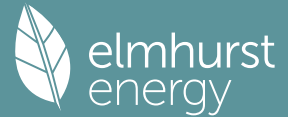
5 Hot water

Cylinder/store - type: Cylinder

Capacity	500 litres
Declared heat loss	2.14 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		
6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.66 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	86%	OK
Manufacturer/Model	MAXIPLUS/BY/AT	
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	11 kWp	
Orientation	South West	
Pitch	30°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	Twinwoods				Issued on Date	23/12/2024
Assessment Reference	Be Green	Prop Type Ref	HOUSE			
Property	Twinwoods, 119 Ducks Hill Road, Northwood, LONDON, HA6 2SQ					
SAP Rating	96 A	DER	5.39	TER	6.01	
Environmental	94 A	% DER < TER				10.32
CO ₂ Emissions (t/year)	3.39	DFEE	34.97	TFEE	37.31	
Compliance Check	See BREL	% DFEE < TFEE				6.27
% DPER < TPER	7.97	DPER	30.19	TPER	32.80	
Assessor Details	Mr. Ondrej Gajdos				Assessor ID	W452-0001
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	354.0000 (1b)	x	2.8000 (2b)	=	991.2000 (1b)	- (3b)
First floor	308.0000 (1c)	x	2.7000 (2c)	=	831.6000 (1c)	- (3c)
Second floor	170.0000 (1d)	x	2.3500 (2d)	=	399.5000 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	832.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2222.3000	(5)

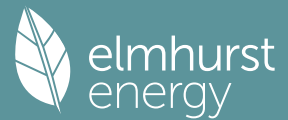
2. Ventilation rate

											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											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes		
Pressure Test Method											Blower Door		
Measured/design AP50											4.0000 (17)		
Infiltration rate											0.2000 (18)		
Number of sides sheltered											2 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1700 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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													
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													77.4000 (23c)
Effective ac	0.3297	0.3255	0.3213	0.3000	0.2957	0.2745	0.2745	0.2702	0.2830	0.2957	0.3043	0.3127 (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	
1			2.3000	1.0000	2.3000			(26a)
1 (Uw = 1.20)			114.2300	1.1450	130.7977			(27)
1			5.1300	1.1450	5.8740			(27a)
2			5.1300	1.1450	5.8740			(27a)
3			0.4100	1.1450	0.4695			(27a)
4			2.0000	1.1450	2.2901			(27a)
5			2.0000	1.1450	2.2901			(27a)
6			3.1800	1.1450	3.6412			(27a)
7			3.9800	1.1450	4.5573			(27a)
ground floor			354.0000	0.1000	35.4000	110.0000	38940.0000	(28a)
exposed wall	464.7550	116.5300	348.2250	0.1800	62.6805	60.0000	20893.5003	(29a)
pitched (rafters)	241.9000	10.6700	231.2300	0.1100	25.4353	9.0000	2081.0699	(30)
flat roof	39.5000	2.0000	37.5000	0.1100	4.1250	9.0000	337.5000	(30)

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main flat roof 113.8000 9.1600 104.6400 0.1100 11.5104 9.0000 941.7600 (30)
Total net area of external elements Aum(A, m2) 1213.9550 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 297.2451 (33)
iw 1162.2800 9.0000 10460.5203 (32c)
if 478.0000 18.0000 8604.0000 (32d)
ic 478.0000 9.0000 4302.0000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 86560.3505 (34)
List of Thermal Bridges 104.0389 (35)
K1 Element Length Psi-value Total
E2 Other lintels (including other steel lintels) 1213.9550 0.0400 48.5582
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 48.5582 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 345.8033 (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 241.8251 238.7084 235.5916 220.0077 216.8909 201.3070 201.3070 198.1903 207.5406 216.8909 223.1245 229.3580 (38)
Average = Sum(39)m / 12 = 587.6284 584.5117 581.3949 565.8110 562.6942 547.1103 547.1103 543.9936 553.3439 562.6942 568.9278 575.1613 (39)
565.0318
HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP (average) 0.7063 0.7025 0.6988 0.6801 0.6763 0.6576 0.6576 0.6538 0.6651 0.6763 0.6838 0.6913 (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 3.8235 (42)
Hot water usage for mixer showers 88.3281 87.0007 85.0664 81.3655 78.6344 75.5886 73.8574 75.7770 77.8813 81.1515 84.9319 87.9897 (42a)
Hot water usage for baths 38.1072 37.5413 36.7443 35.2748 34.1745 32.9544 32.2954 33.0868 33.9485 35.2540 36.7537 37.9784 (42b)
Hot water usage for other uses 53.7868 51.8309 49.8750 47.9191 45.9632 44.0074 44.0074 45.9632 47.9191 49.8750 51.8309 53.7868 (42c)
Average daily hot water use (litres/day) 165.6640 (43)
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Energy conte 180.2221 176.3729 171.6857 164.5595 158.7721 152.5504 150.1601 154.8270 159.7489 166.2805 173.5165 179.7548 (44)
Energy content (annual) 285.4277 251.1526 263.8746 225.2737 213.7378 187.5785 181.6057 191.7082 196.9864 225.6411 247.2061 281.4527 (45)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 2751.6450
42.8142 37.6729 39.5812 33.7911 32.0607 28.1368 27.2408 28.7562 29.5480 33.8462 37.0809 42.2179 (46)
Water storage loss:
Store volume 500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1400 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1556 (55)
Total storage loss 35.8236 32.3568 35.8236 34.6680 35.8236 34.6680 35.8236 35.8236 34.6680 35.8236 34.6680 35.8236 (56)
If cylinder contains dedicated solar storage 35.8236 32.3568 35.8236 34.6680 35.8236 34.6680 35.8236 35.8236 34.6680 35.8236 34.6680 35.8236 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
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 344.5137 304.5206 322.9606 282.4537 272.8238 244.7585 240.6917 250.7942 254.1664 284.7271 304.3861 340.5387 (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 344.5137 304.5206 322.9606 282.4537 272.8238 244.7585 240.6917 250.7942 254.1664 284.7271 304.3861 340.5387 (64)
Total per year (kWh/year) = Sum(64)m = 3447.3350 (64)
12Total per year (kWh/year) 3447 (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 142.1735 126.2026 135.0071 120.6475 118.3366 108.1138 107.6527 111.0118 111.2420 122.2945 127.9400 140.8518 (65)

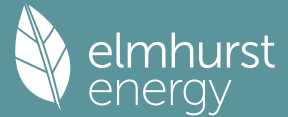
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(66)m 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 424.1108 469.5512 424.1108 438.2478 424.1108 438.2478 424.1108 438.2478 424.1108 438.2478 424.1108 438.2478 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 814.3205 822.7706 801.4766 756.1443 698.9203 645.1379 609.2079 600.7578 622.0518 667.3841 724.6081 778.3905 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 (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) -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 (71)
Water heating gains (Table 5) 191.0934 187.8016 181.4612 167.5660 159.0546 150.1581 144.6945 149.2094 154.5027 164.3743 177.6945 189.3169 (72)
Total internal gains 1512.8777 1563.4764 1490.4015 1445.3110 1365.4387 1313.8968 1258.3661 1254.4309 1295.1553 1339.2222 1423.9034 1475.1712 (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 4.8600 11.2829 0.6300 0.7000 0.7700 16.7583 (75)
Southeast 70.4200 36.7938 0.6300 0.7000 0.7700 791.8499 (77)
Southwest 6.7300 36.7938 0.6300 0.7000 0.7700 75.6767 (79)

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Northwest			32.2200		11.2829		0.6300		0.7000		0.7700		111.1014 (81)
Southeast			5.1300		40.5020		0.6300		0.7000		1.0000		82.4659 (82)
Southwest			0.4100		40.5020		0.6300		0.7000		1.0000		6.5908 (82)
Northwest			5.1300		15.9165		0.6300		0.7000		1.0000		32.4076 (82)
Horizontal			11.1600		26.0000		0.6300		0.7000		1.0000		115.1645 (82)

Solar gains	1232.0151	2205.5057	3281.3512	4474.5002	5360.8505	5469.1920	5212.1382	4532.6386	3693.9075	2510.6137	1495.6358	1041.1621 (83)
Total gains	2744.8928	3768.9820	4771.7528	5919.8112	6726.2892	6783.0888	6470.5043	5787.0695	4989.0628	3849.8359	2919.5391	2516.3333 (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	40.9179	41.1361	41.3566	42.4957	42.7311	43.9482	43.9482	44.2000	43.4532	42.7311	42.2629	41.8049	
alpha	3.7279	3.7424	3.7571	3.8330	3.8487	3.9299	3.9299	3.9467	3.8969	3.8487	3.8175	3.7870	
util living area	0.9937	0.9802	0.9452	0.8465	0.6846	0.4969	0.3672	0.4233	0.6785	0.9214	0.9858	0.9955 (86)	
MIT	19.0051	19.3882	19.8930	20.4778	20.8210	20.9624	20.9910	20.9848	20.8761	20.3433	19.5711	18.9727 (87)	
Th 2	20.3353	20.3386	20.3419	20.3585	20.3618	20.3785	20.3785	20.3818	20.3718	20.3618	20.3552	20.3485 (88)	
util rest of house	0.9928	0.9775	0.9377	0.8275	0.6515	0.4534	0.3170	0.3694	0.6337	0.9073	0.9835	0.9948 (89)	
MIT 2	17.9156	18.4065	19.0471	19.7800	20.1820	20.3468	20.3726	20.3714	20.2583	19.6305	18.6528	17.8827 (90)	
Living area fraction												0.1959 (91)	
MIT	18.1291	18.5988	19.2129	19.9167	20.3072	20.4674	20.4937	20.4915	20.3793	19.7702	18.8327	18.0962 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.9791	18.4488	19.0629	19.7667	20.1572	20.3174	20.3437	20.3415	20.2293	19.6202	18.6827	17.9462 (93)	

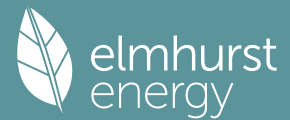
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9665	0.9193	0.8078	0.6403	0.4490	0.3142	0.3658	0.6228	0.8871	0.9746	0.9910 (94)	
Useful gains	2711.7602	3642.5552	4386.7463	4782.2910	4306.9190	3045.7391	2032.9499	2117.1590	3107.3174	3415.1735	2845.3867	2493.7762 (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	8038.2165	7919.4532	7303.9873	6148.4862	4758.8365	3128.0298	2048.2391	2144.1775	3391.6263	5075.5983	6589.7181	7906.2949 (97)	
Space heating kWh	3962.8835	2874.0755	2170.4273	983.6605	336.2266	0.0000	0.0000	0.0000	0.0000	1235.3561	2695.9186	4026.9139 (98a)	
Space heating requirement - total per year (kWh/year)												18285.4620	
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	3962.8835	2874.0755	2170.4273	983.6605	336.2266	0.0000	0.0000	0.0000	0.0000	1235.3561	2695.9186	4026.9139 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												18285.4620	
Space heating per m2										(98c) / (4) =		21.9777 (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 %)													88.7000 (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	3962.8835	2874.0755	2170.4273	983.6605	336.2266	0.0000	0.0000	0.0000	0.0000	1235.3561	2695.9186	4026.9139 (98)	
Space heating efficiency (main heating system 1)	88.7000	88.7000	88.7000	88.7000	88.7000	0.0000	0.0000	0.0000	0.0000	88.7000	88.7000	88.7000 (210)	
Space heating fuel (main heating system)	4467.7379	3240.2204	2446.9304	1108.9747	379.0605	0.0000	0.0000	0.0000	0.0000	1392.7352	3039.3671	4539.9255 (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	344.5137	304.5206	322.9606	282.4537	272.8238	244.7585	240.6917	250.7942	254.1664	284.7271	304.3861	340.5387 (64)	
Efficiency of water heater (217)m	87.9060	87.7507	87.4213	86.5204	84.4292	79.7000	79.7000	79.7000	79.7000	86.8627	87.6953	87.9258 (217)	
Fuel for water heating, kWh/month	391.9113	347.0294	369.4300	326.4591	323.1390	307.0997	301.9971	314.6728	318.9038	327.7898	347.0950	387.3022 (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	220.0706	198.7735	220.0706	212.9716	220.0706	212.9716	220.0706	220.0706	212.9716	220.0706	212.9716	220.0706 (221)	
Lighting	88.1218	70.6946	63.6527	46.6347	36.0220	29.4303	32.8604	42.7132	55.4803	72.7931	82.2197	90.5710 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-155.0002	-223.4073	-329.1014	-376.3739	-409.4882	-384.8612	-381.1695	-358.5473	-316.4336	-259.8807	-172.1509	-133.1457 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	-87.4479	-192.2220	-403.3387	-633.1103	-856.0824	-865.5188	-850.2050	-706.1290	-498.7829	-278.5934	-117.7213	-68.1314 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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												20614.9515 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	

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Efficiency of water heater	79.7000	
Water heating fuel used	4062.8292 (219)	
Space cooling fuel	0.0000 (221)	
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9240)		
mechanical ventilation fans (SFP = 0.9240)	2505.1543 (230a)	
central heating pump	41.0000 (230c)	
main heating flue fan	45.0000 (230e)	
Total electricity for the above, kWh/year	2591.1543 (231)	
Electricity for lighting (calculated in Appendix L)	711.1938 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-9056.8431 (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	18923.2858 (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	20614.9515	0.2100	4329.1398 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	4062.8292	0.2100	853.1941 (264)
Space and water heating			5182.3340 (265)
Pumps, fans and electric keep-hot	2591.1543	0.1387	359.4251 (267)
Energy for lighting	711.1938	0.1443	102.6472 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3499.5598	0.1342	-469.5333
PV Unit electricity exported	-5557.2832	0.1248	-693.8094
Total			-1163.3427 (269)
Total CO2, kg/year			4481.0636 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.3900 (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	20614.9515	1.1300	23294.8952 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	4062.8292	1.1300	4590.9970 (278)
Space and water heating			27885.8923 (279)
Pumps, fans and electric keep-hot	2591.1543	1.5128	3919.8983 (281)
Energy for lighting	711.1938	1.5338	1090.8528 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3499.5598	1.4958	-5234.8011
PV Unit electricity exported	-5557.2832	0.4582	-2546.5365
Total			-7781.3375 (283)
Total Primary energy kWh/year			25115.3058 (286)
Dwelling Primary energy Rate (DPER)			30.1900 (287)

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

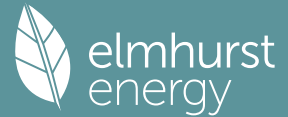
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	354.0000 (1b)	x 2.8000 (2b)	= 991.2000 (1b) - (3b)
First floor	308.0000 (1c)	x 2.7000 (2c)	= 831.6000 (1c) - (3c)
Second floor	170.0000 (1d)	x 2.3500 (2d)	= 399.5000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	832.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2222.3000 (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)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0180 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)

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Infiltration rate	0.2680 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = $1 - [0.075 \times (19)] = 0.8500 (20)$
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2278 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.2904	0.2847	0.2791	0.2506	0.2449	0.2164	0.2164	0.2107	0.2278	0.2449	0.2563	0.2677	(22b)
	0.5422	0.5405	0.5389	0.5314	0.5300	0.5234	0.5234	0.5222	0.5259	0.5300	0.5328	0.5358	(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 Semi-glazed door			2.3000	1.0000	2.3000			(26a)
TER Opening Type (Uw = 1.20)			114.2300	1.1450	130.7977			(27)
1			5.1300	1.4151	7.2594			(27a)
2			5.1300	1.4151	7.2594			(27a)
3			0.4100	1.4151	0.5802			(27a)
4			2.0000	1.5918	3.1835			(27a)
5			2.0000	1.5918	3.1835			(27a)
6			3.1800	1.5918	5.0618			(27a)
7			3.9800	1.5918	6.3352			(27a)
ground floor			354.0000	0.1300	46.0200			(28a)
exposed wall	464.7550	116.5300	348.2250	0.1800	62.6805			(29a)
pitched (rafters)	241.9000	10.6700	231.2300	0.1100	25.4353			(30)
flat roof	39.5000	2.0000	37.5000	0.1100	4.1250			(30)
main flat roof	113.8000	9.1600	104.6400	0.1100	11.5104			(30)
Total net area of external elements Aum(A, m2)			1213.9550					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 315.7320			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				104.0389 (35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	1213.9550	0.0500	60.6977	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				60.6977 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss		(33) + (36) +	(36a) =	376.4298 (37)

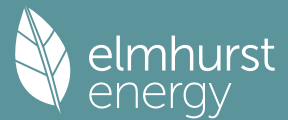
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	397.6118	396.4107	395.2333	389.7033	388.6687	383.8522	383.8522	382.9603	385.7075	388.6687	390.7618	392.9500	(38)
Average = Sum(39)m / 12 =	774.0416	772.8404	771.6631	766.1331	765.0984	760.2820	760.2820	759.3901	762.1372	765.0984	767.1915	769.3797	(39)
												766.1281	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9303	0.9289	0.9275	0.9208	0.9196	0.9138	0.9138	0.9127	0.9160	0.9196	0.9221	0.9247	(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													3.8235 (42)
Hot water usage for mixer showers	88.3281	87.0007	85.0664	81.3655	78.6344	75.5886	73.8574	75.7770	77.8813	81.1515	84.9319	87.9897	(42a)
Hot water usage for baths	38.1072	37.5413	36.7443	35.2748	34.1745	32.9544	32.2954	33.0868	33.9485	35.2540	36.7537	37.9784	(42b)
Hot water usage for other uses	53.7868	51.8309	49.8750	47.9191	45.9632	44.0074	44.0074	45.9632	47.9191	49.8750	51.8309	53.7868	(42c)
Average daily hot water use (litres/day)													165.6640 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	180.2221	176.3729	171.6857	164.5595	158.7721	152.5504	150.1601	154.8270	159.7489	166.2805	173.5165	179.7548	(44)
Energy content (annual)	23.2624	21.0112	23.2624	22.5120	21.3738	187.5785	181.6057	191.7082	196.9864	225.6411	247.2061	281.4527	(45)
Distribution loss (46)m = 0.15 x (45)m	42.8142	37.6729	39.5812	33.7911	32.0607	28.1368	27.2408	28.7562	29.5480	33.8462	37.0809	42.2179	(46)
Water storage loss:													
Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.9009 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.5665 (55)
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	(56)
If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	357.2509	316.0251	335.6977	294.7799	285.5609	257.0847	253.4288	263.5313	266.4926	297.4642	316.7124	353.2758	(62)
WWHRS	-40.3799	-35.7123	-37.3959	-30.9653	-28.8585	-24.6945	-23.1471	-24.6146	-25.5498	-30.1204	-34.1228	-39.6322	(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	316.8709	280.3128	298.3018	263.8147	256.7023	232.3903	230.2817	238.9167	240.9428	267.3438	282.5896	313.6436	(64)
12Total per year (kWh/year)													3222.1108 (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	152.3632	135.4062	145.1968	130.5085	128.5263	117.9748	117.8424	121.2015	121.1030	132.4842	137.8010	151.0415	(65)

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

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Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	424.1108	469.5512	424.1108	438.2478	424.1108	438.2478	424.1108	424.1108	438.2478	424.1108	438.2478	424.1108 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	814.3205	822.7706	801.4766	756.1443	698.9203	645.1379	609.2079	600.7578	622.0518	667.3841	724.6081	778.3905 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176 (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)												
	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412 (71)
Water heating gains (Table 5)												
	204.7893	201.4974	195.1570	181.2618	172.7504	163.8539	158.3903	162.9052	168.1985	178.0701	191.3903	203.0128 (72)
Total internal gains												
	1526.5735	1577.1722	1504.0974	1459.0069	1379.1345	1327.5926	1272.0619	1268.1267	1308.8511	1352.9180	1437.5992	1488.8670 (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					4.8600	11.2829	0.6300	0.7000	0.7700		16.7583 (75)		
Southeast					70.4200	36.7938	0.6300	0.7000	0.7700		791.8499 (77)		
Southwest					6.7300	36.7938	0.6300	0.7000	0.7700		75.6767 (79)		
Northwest					32.2200	11.2829	0.6300	0.7000	0.7700		111.1014 (81)		
Southeast					5.1300	40.5020	0.6300	0.7000	1.0000		82.4659 (82)		
Southwest					0.4100	40.5020	0.6300	0.7000	1.0000		6.5908 (82)		
Northwest					5.1300	15.9165	0.6300	0.7000	1.0000		32.4076 (82)		
Horizontal					11.1600	26.0000	0.6300	0.7000	1.0000		115.1645 (82)		
Solar gains	1232.0152	2205.5057	3281.3513	4474.5003	5360.8507	5469.1921	5212.1383	4532.6387	3693.9076	2510.6138	1495.6358	1041.1621 (83)	
Total gains	2758.5887	3782.6779	4785.4487	5933.5072	6739.9851	6796.7847	6484.2002	5800.7655	5002.7587	3863.5318	2933.2350	2530.0292 (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	31.0636	31.1119	31.1594	31.3843	31.4267	31.6258	31.6258	31.6630	31.5488	31.4267	31.3410	31.2519
alpha	3.0709	3.0741	3.0773	3.0923	3.0951	3.1084	3.1084	3.1109	3.1033	3.0951	3.0894	3.0835
util living area	0.9931	0.9820	0.9567	0.8920	0.7759	0.6195	0.4817	0.5457	0.7748	0.9420	0.9865	0.9947 (86)
MIT	18.3668	18.7426	19.2894	19.9683	20.5106	20.8296	20.9424	20.9148	20.6408	19.8796	18.9854	18.3039 (87)
Th 2	20.1418	20.1430	20.1442	20.1498	20.1509	20.1558	20.1558	20.1567	20.1539	20.1509	20.1488	20.1465 (88)
util rest of house	0.9920	0.9791	0.9498	0.8746	0.7399	0.5590	0.4004	0.4627	0.7249	0.9292	0.9840	0.9939 (89)
MIT 2	16.9822	17.4626	18.1574	19.0083	19.6584	20.0141	20.1201	20.1004	19.8246	18.9130	17.7784	16.9044 (90)
Living area fraction	17.2535	17.7134	18.3792	19.1964	19.8254	20.1739	20.2812	20.2600	19.9845	19.1024	18.0149	17.1786 (92)
MIT	17.2535	17.7134	18.3792	19.1964	19.8254	20.1739	20.2812	20.2600	19.9845	19.1024	18.0149	17.1786 (93)
Temperature adjustment	17.2535	17.7134	18.3792	19.1964	19.8254	20.1739	20.2812	20.2600	19.9845	19.1024	18.0149	17.1786 (93)
adjusted MIT	17.2535	17.7134	18.3792	19.1964	19.8254	20.1739	20.2812	20.2600	19.9845	19.1024	18.0149	17.1786 (93)

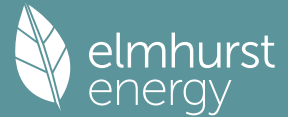
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9862	0.9673	0.9304	0.8507	0.7245	0.5604	0.4130	0.4735	0.7135	0.9082	0.9742	0.9891 (94)
Useful gains	2720.3862	3658.8980	4452.4611	5047.8070	4882.8265	3808.6956	2678.1614	2746.6050	3569.5387	3508.7287	2857.6198	2502.5287 (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	10026.5279	9902.7028	9166.7338	7888.3832	6216.6946	4237.7004	2798.7661	2931.2274	4484.8087	6505.1665	8373.7874	9985.4685 (97)
Space heating kWh	5435.7695	4195.8368	3507.4188	2045.2149	992.3979	0.0000	0.0000	0.0000	0.0000	2229.3497	3971.6407	5567.3072 (98a)
Space heating requirement - total per year (kWh/year)												27944.9355
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	5435.7695	4195.8368	3507.4188	2045.2149	992.3979	0.0000	0.0000	0.0000	0.0000	2229.3497	3971.6407	5567.3072 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												27944.9355
Space heating per m ²												(98c) / (4) = 33.5877 (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 %)												92.3000 (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	5435.7695	4195.8368	3507.4188	2045.2149	992.3979	0.0000	0.0000	0.0000	0.0000	2229.3497	3971.6407	5567.3072 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	5889.2410	4545.8687	3800.0204	2215.8341	1075.1873	0.0000	0.0000	0.0000	0.0000	2415.3302	4302.9693	6031.7521 (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)

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Water heating												
Water heating requirement												
	316.8709	280.3128	298.3018	263.8147	256.7023	232.3903	230.2817	238.9167	240.9428	267.3438	282.5896	313.6436 (64)
Efficiency of water heater												79.8000 (216)
(217)m	88.2518	88.1772	88.0219	87.6703	86.7884	79.8000	79.8000	79.8000	79.8000	87.7404	88.1397	88.2691 (217)
Fuel for water heating, kWh/month												
	359.0534	317.8970	338.8951	300.9168	295.7794	291.2159	288.5735	299.3944	301.9333	304.6987	320.6156	355.3267 (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	88.1218	70.6946	63.6527	46.6347	36.0220	29.4303	32.8604	42.7132	55.4803	72.7931	82.2197	90.5710 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-250.6316	-319.1330	-414.2758	-418.4544	-413.9117	-372.4425	-366.3686	-362.1808	-352.4562	-338.4725	-262.2612	-220.7711 (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	-267.6941	-541.4570	-1039.3865	-1511.5641	-1954.1163	-1948.8531	-1927.1578	-1652.7096	-1239.3348	-758.4589	-351.7009	-213.5444 (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												30276.2031 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												3774.2997 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												711.1938 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-17497.3369 (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												17350.3596 (238)

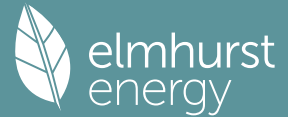
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	30276.2031	0.2100	6358.0027 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3774.2997	0.2100	792.6029 (264)
Space and water heating			7150.6056 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	711.1938	0.1443	102.6472 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4091.3593	0.1370	-560.3171
PV Unit electricity exported	-13405.9776	0.1269	-1700.6666
Total			-2260.9837 (269)
Total CO2, kg/year			5004.1984 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			6.0100 (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	30276.2031	1.1300	34212.1095 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3774.2997	1.1300	4264.9586 (278)
Space and water heating			38477.0681 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	711.1938	1.5338	1090.8528 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4091.3593	1.5063	-6162.7193
PV Unit electricity exported	-13405.9776	0.4657	-6243.1565
Total			-12405.8758 (283)
Total Primary energy kWh/year			27292.1460 (286)
Target Primary Energy Rate (TPER)			32.8000 (287)

Full SAP Calculation Printout



Property Reference	Twinwoods			Issued on Date	23/12/2024
Assessment Reference	Be Lean	Prop Type Ref	HOUSE		
Property	Twinwoods, 119 Ducks Hill Road, Northwood, LONDON, HA6 2SQ				
SAP Rating	90 B	DER	6.78	TER	6.01
Environmental	92 A	% DER < TER			-12.81
CO ₂ Emissions (t/year)	4.62	DFEE	34.97	TFEE	37.31
Compliance Check	See BREL	% DFEE < TFEE			6.27
% DPER < TPER	-20.55	DPER	39.54	TPER	32.80
Assessor Details	Mr. Ondrej Gajdos			Assessor ID	W452-0001
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	354.0000 (1b)	x	2.8000 (2b)	=	991.2000 (1b)	- (3b)
First floor	308.0000 (1c)	x	2.7000 (2c)	=	831.6000 (1c)	- (3c)
Second floor	170.0000 (1d)	x	2.3500 (2d)	=	399.5000 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	832.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2222.3000	(5)

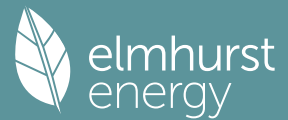
2. Ventilation rate

											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											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1700 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =											77.4000 (23c)	
Effective ac	0.3297	0.3255	0.3213	0.3000	0.2957	0.2745	0.2745	0.2702	0.2830	0.2957	0.3043	0.3127 (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	
1			2.3000	1.0000	2.3000			(26a)
1 (Uw = 1.20)			114.2300	1.1450	130.7977			(27)
1			5.1300	1.1450	5.8740			(27a)
2			5.1300	1.1450	5.8740			(27a)
3			0.4100	1.1450	0.4695			(27a)
4			2.0000	1.1450	2.2901			(27a)
5			2.0000	1.1450	2.2901			(27a)
6			3.1800	1.1450	3.6412			(27a)
7			3.9800	1.1450	4.5573			(27a)
ground floor			354.0000	0.1000	35.4000	110.0000	38940.0000	(28a)
exposed wall	464.7550	116.5300	348.2250	0.1800	62.6805	60.0000	20893.5003	(29a)
pitched (rafters)	241.9000	10.6700	231.2300	0.1100	25.4353	9.0000	2081.0699	(30)
flat roof	39.5000	2.0000	37.5000	0.1100	4.1250	9.0000	337.5000	(30)

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main flat roof 113.8000 9.1600 104.6400 0.1100 11.5104 9.0000 941.7600 (30)
Total net area of external elements Aum(A, m2) 1213.9550 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 297.2451 (33)
iw 1162.2800 9.0000 10460.5203 (32c)
if 478.0000 18.0000 8604.0000 (32d)
ic 478.0000 9.0000 4302.0000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 86560.3505 (34)
List of Thermal Bridges 104.0389 (35)

K1 Element Length Psi-value Total
E2 Other lintels (including other steel lintels) 1213.9550 0.0400 48.5582
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 48.5582 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 345.8033 (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 241.8251 238.7084 235.5916 220.0077 216.8909 201.3070 201.3070 198.1903 207.5406 216.8909 223.1245 229.3580 (38)
Average = Sum(39)m / 12 = 587.6284 584.5117 581.3949 565.8110 562.6942 547.1103 547.1103 543.9936 553.3439 562.6942 568.9278 575.1613 (39)
565.0318

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP (average) 0.7063 0.7025 0.6988 0.6801 0.6763 0.6576 0.6576 0.6538 0.6651 0.6763 0.6838 0.6913 (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 3.8235 (42)
Hot water usage for mixer showers 88.3281 87.0007 85.0664 81.3655 78.6344 75.5886 73.8574 75.7770 77.8813 81.1515 84.9319 87.9897 (42a)
Hot water usage for baths 38.1072 37.5413 36.7443 35.2748 34.1745 32.9544 32.2954 33.0868 33.9485 35.2540 36.7537 37.9784 (42b)
Hot water usage for other uses 53.7868 51.8309 49.8750 47.9191 45.9632 44.0074 44.0074 45.9632 47.9191 49.8750 51.8309 53.7868 (42c)
Average daily hot water use (litres/day) 165.6640 (43)

Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Energy conte 180.2221 176.3729 171.6857 164.5595 158.7721 152.5504 150.1601 154.8270 159.7489 166.2805 173.5165 179.7548 (44)
Energy content (annual) 285.4277 251.1526 263.8746 225.2737 213.7378 187.5785 181.6057 191.7082 196.9864 225.6411 247.2061 281.4527 (45)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 2751.6450
42.8142 37.6729 39.5812 33.7911 32.0607 28.1368 27.2408 28.7562 29.5480 33.8462 37.0809 42.2179 (46)

Water storage loss:
Store volume 500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1400 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1556 (55)
Total storage loss

35.8236 32.3568 35.8236 34.6680 35.8236 34.6680 35.8236 35.8236 34.6680 35.8236 34.6680 35.8236 (56)
If cylinder contains dedicated solar storage 35.8236 32.3568 35.8236 34.6680 35.8236 34.6680 35.8236 35.8236 34.6680 35.8236 34.6680 35.8236 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
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 344.5137 304.5206 322.9606 282.4537 272.8238 244.7585 240.6917 250.7942 254.1664 284.7271 304.3861 340.5387 (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 344.5137 304.5206 322.9606 282.4537 272.8238 244.7585 240.6917 250.7942 254.1664 284.7271 304.3861 340.5387 (64)
Total per year (kWh/year) = Sum(64)m = 3447.3350 (64)
3447 (64)

12Total per year (kWh/year)
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 142.1735 126.2026 135.0071 120.6475 118.3366 108.1138 107.6527 111.0118 111.2420 122.2945 127.9400 140.8518 (65)

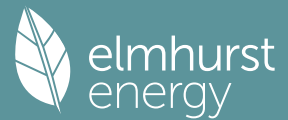
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(66)m 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 424.1108 469.5512 424.1108 438.2478 424.1108 438.2478 424.1108 438.2478 424.1108 438.2478 424.1108 438.2478 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 814.3205 822.7706 801.4766 756.1443 698.9203 645.1379 609.2079 600.7578 622.0518 667.3841 724.6081 778.3905 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 (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) -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 (71)
Water heating gains (Table 5) 191.0934 187.8016 181.4612 167.5660 159.0546 150.1581 144.6945 149.2094 154.5027 164.3743 177.6945 189.3169 (72)
Total internal gains 1512.8777 1563.4764 1490.4015 1445.3110 1365.4387 1313.8968 1258.3661 1254.4309 1295.1553 1339.2222 1423.9034 1475.1712 (73)

6. Solar gains

[Jan] Area Solar flux g Specific data FF Access Gains
m2 Table 6a W/m2 or Table 6b Specific data or Table 6c factor Table 6d W
Northeast 4.8600 11.2829 0.6300 0.7000 0.7700 16.7583 (75)
Southeast 70.4200 36.7938 0.6300 0.7000 0.7700 791.8499 (77)
Southwest 6.7300 36.7938 0.6300 0.7000 0.7700 75.6767 (79)

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Northwest			32.2200		11.2829		0.6300		0.7000		0.7700		111.1014 (81)
Southeast			5.1300		40.5020		0.6300		0.7000		1.0000		82.4659 (82)
Southwest			0.4100		40.5020		0.6300		0.7000		1.0000		6.5908 (82)
Northwest			5.1300		15.9165		0.6300		0.7000		1.0000		32.4076 (82)
Horizontal			11.1600		26.0000		0.6300		0.7000		1.0000		115.1645 (82)

Solar gains	1232.0151	2205.5057	3281.3512	4474.5002	5360.8505	5469.1920	5212.1382	4532.6386	3693.9075	2510.6137	1495.6358	1041.1621 (83)
Total gains	2744.8928	3768.9820	4771.7528	5919.8112	6726.2892	6783.0888	6470.5043	5787.0695	4989.0628	3849.8359	2919.5391	2516.3333 (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	40.9179	41.1361	41.3566	42.4957	42.7311	43.9482	43.9482	44.2000	43.4532	42.7311	42.2629	41.8049	
alpha	3.7279	3.7424	3.7571	3.8330	3.8487	3.9299	3.9299	3.9467	3.8969	3.8487	3.8175	3.7870	
util living area	0.9937	0.9802	0.9452	0.8465	0.6846	0.4969	0.3672	0.4233	0.6785	0.9214	0.9858	0.9955 (86)	
MIT	19.0051	19.3882	19.8930	20.4778	20.8210	20.9624	20.9910	20.9848	20.8761	20.3433	19.5711	18.9727 (87)	
Th 2	20.3353	20.3386	20.3419	20.3585	20.3618	20.3785	20.3785	20.3818	20.3718	20.3618	20.3552	20.3485 (88)	
util rest of house	0.9928	0.9775	0.9377	0.8275	0.6515	0.4534	0.3170	0.3694	0.6337	0.9073	0.9835	0.9948 (89)	
MIT 2	17.9156	18.4065	19.0471	19.7800	20.1820	20.3468	20.3726	20.3714	20.2583	19.6305	18.6528	17.8827 (90)	
Living area fraction												0.1959 (91)	
MIT	18.1291	18.5988	19.2129	19.9167	20.3072	20.4674	20.4937	20.4915	20.3793	19.7702	18.8327	18.0962 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.9791	18.4488	19.0629	19.7667	20.1572	20.3174	20.3437	20.3415	20.2293	19.6202	18.6827	17.9462 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9665	0.9193	0.8078	0.6403	0.4490	0.3142	0.3658	0.6228	0.8871	0.9746	0.9910 (94)	
Useful gains	2711.7602	3642.5552	4386.7463	4782.2910	4306.9190	3045.7391	2032.9499	2117.1590	3107.3174	3415.1735	2845.3867	2493.7762 (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	8038.2165	7919.4532	7303.9873	6148.4862	4758.8365	3128.0298	2048.2391	2144.1775	3391.6263	5075.5983	6589.7181	7906.2949 (97)	
Space heating kWh	3962.8835	2874.0755	2170.4273	983.6605	336.2266	0.0000	0.0000	0.0000	0.0000	1235.3561	2695.9186	4026.9139 (98a)	
Space heating requirement - total per year (kWh/year)												18285.4620	
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	3962.8835	2874.0755	2170.4273	983.6605	336.2266	0.0000	0.0000	0.0000	0.0000	1235.3561	2695.9186	4026.9139 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												18285.4620	
Space heating per m2										(98c) / (4) =		21.9777 (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 %)													88.7000 (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	3962.8835	2874.0755	2170.4273	983.6605	336.2266	0.0000	0.0000	0.0000	0.0000	1235.3561	2695.9186	4026.9139 (98)	
Space heating efficiency (main heating system 1)	88.7000	88.7000	88.7000	88.7000	88.7000	0.0000	0.0000	0.0000	0.0000	88.7000	88.7000	88.7000 (210)	
Space heating fuel (main heating system)	4467.7379	3240.2204	2446.9304	1108.9747	379.0605	0.0000	0.0000	0.0000	0.0000	1392.7352	3039.3671	4539.9255 (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	344.5137	304.5206	322.9606	282.4537	272.8238	244.7585	240.6917	250.7942	254.1664	284.7271	304.3861	340.5387 (64)	
Efficiency of water heater (217)m	87.9060	87.7507	87.4213	86.5204	84.4292	79.7000	79.7000	79.7000	79.7000	86.8627	87.6953	87.9258 (217)	
Fuel for water heating, kWh/month	391.9113	347.0294	369.4300	326.4591	323.1390	307.0997	301.9971	314.6728	318.9038	327.7898	347.0950	387.3022 (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	220.0706	198.7735	220.0706	212.9716	220.0706	212.9716	220.0706	220.0706	212.9716	220.0706	212.9716	220.0706 (223)	
Lighting	88.1218	70.6946	63.6527	46.6347	36.0220	29.4303	32.8604	42.7132	55.4803	72.7931	82.2197	90.5710 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)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 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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												20614.9515 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	

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Efficiency of water heater	79.7000	
Water heating fuel used	4062.8292 (219)	
Space cooling fuel	0.0000 (221)	
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9240)		
mechanical ventilation fans (SFP = 0.9240)	2505.1543 (230a)	
central heating pump	41.0000 (230c)	
main heating flue fan	45.0000 (230e)	
Total electricity for the above, kWh/year	2591.1543 (231)	
Electricity for lighting (calculated in Appendix L)	711.1938 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000 (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	27980.1289 (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	20614.9515	0.2100	4329.1398 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	4062.8292	0.2100	853.1941 (264)
Space and water heating			5182.3340 (265)
Pumps, fans and electric keep-hot	2591.1543	0.1387	359.4251 (267)
Energy for lighting	711.1938	0.1443	102.6472 (268)
Total CO2, kg/year			5644.4063 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.7800 (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	20614.9515	1.1300	23294.8952 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	4062.8292	1.1300	4590.9970 (278)
Space and water heating			27885.8923 (279)
Pumps, fans and electric keep-hot	2591.1543	1.5128	3919.8983 (281)
Energy for lighting	711.1938	1.5338	1090.8528 (282)
Total Primary energy kWh/year			32896.6433 (286)
Dwelling Primary energy Rate (DPER)			39.5400 (287)

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

1. Overall dwelling characteristics

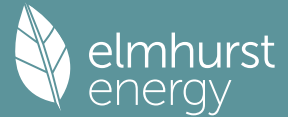
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	354.0000 (1b)	x 2.8000 (2b)	= 991.2000 (1b) - (3b)
First floor	308.0000 (1c)	x 2.7000 (2c)	= 831.6000 (1c) - (3c)
Second floor	170.0000 (1d)	x 2.3500 (2d)	= 399.5000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	832.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2222.3000 (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)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0180 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2680 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2278 (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)

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Adj infilt rate	0.2904	0.2847	0.2791	0.2506	0.2449	0.2164	0.2164	0.2107	0.2278	0.2449	0.2563	0.2677 (22b)
Effective ac	0.5422	0.5405	0.5389	0.5314	0.5300	0.5234	0.5234	0.5222	0.5259	0.5300	0.5328	0.5358 (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 Semi-glazed door			2.3000	1.0000	2.3000			(26a)
TER Opening Type (Uw = 1.20)			114.2300	1.1450	130.7977			(27)
1			5.1300	1.4151	7.2594			(27a)
2			5.1300	1.4151	7.2594			(27a)
3			0.4100	1.4151	0.5802			(27a)
4			2.0000	1.5918	3.1835			(27a)
5			2.0000	1.5918	3.1835			(27a)
6			3.1800	1.5918	5.0618			(27a)
7			3.9800	1.5918	6.3352			(27a)
ground floor			354.0000	0.1300	46.0200			(28a)
exposed wall	464.7550	116.5300	348.2250	0.1800	62.6805			(29a)
pitched (rafters)	241.9000	10.6700	231.2300	0.1100	25.4353			(30)
flat roof	39.5000	2.0000	37.5000	0.1100	4.1250			(30)
main flat roof	113.8000	9.1600	104.6400	0.1100	11.5104			(30)
Total net area of external elements Aum(A, m2)			1213.9550					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		315.7320			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												104.0389 (35)
List of Thermal Bridges												
K1 Element												
E2 Other lintels (including other steel lintels)												
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												60.6977 (36)
Point Thermal bridges												0.0000
Total fabric heat loss												(33) + (36) + (36a) = 376.4298 (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	397.6118	396.4107	395.2333	389.7033	388.6687	383.8522	383.8522	382.9603	385.7075	388.6687	390.7618	392.9500 (38)
Average = Sum(39)m / 12 =	774.0416	772.8404	771.6631	766.1331	765.0984	760.2820	760.2820	759.3901	762.1372	765.0984	767.1915	769.3797 (39)
												766.1281
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9303	0.9289	0.9275	0.9208	0.9196	0.9138	0.9138	0.9127	0.9160	0.9196	0.9221	0.9247 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

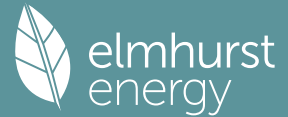
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.8235 (42)
Hot water usage for mixer showers	88.3281	87.0007	85.0664	81.3655	78.6344	75.5886	73.8574	75.7770	77.8813	81.1515	84.9319	87.9897	(42a)
Hot water usage for baths	38.1072	37.5413	36.7443	35.2748	34.1745	32.9544	32.2954	33.0868	33.9485	35.2540	36.7537	37.9784	(42b)
Hot water usage for other uses	53.7868	51.8309	49.8750	47.9191	45.9632	44.0074	44.0074	45.9632	47.9191	49.8750	51.8309	53.7868	(42c)
Average daily hot water use (litres/day)													165.6640 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	180.2221	176.3729	171.6857	164.5595	158.7721	152.5504	150.1601	154.8270	159.7489	166.2805	173.5165	179.7548	(44)
Distribution loss (46)m = 0.15 x (45)m	285.4277	251.1526	263.8746	225.2737	213.7378	187.5785	181.6057	191.7082	196.9864	225.6411	247.2061	281.4527	(45)
	42.8142	37.6729	39.5812	33.7911	32.0607	28.1368	27.2408	28.7562	29.5480	33.8462	37.0809	42.2179	(46)
Water storage loss:													
Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.9009 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.5665 (55)
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	(56)
If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	357.2509	316.0251	335.6977	294.7799	285.5609	257.0847	253.4288	263.5313	266.4926	297.4642	316.7124	353.2758	(62)
WWHRS	-40.3799	-35.7123	-37.3959	-30.9653	-28.8585	-24.6945	-23.1471	-24.6146	-25.5498	-30.1204	-34.1228	-39.6322	(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	316.8709	280.3128	298.3018	263.8147	256.7023	232.3903	230.2817	238.9167	240.9428	267.3438	282.5896	313.6436	(64)
12Total per year (kWh/year)													3222.1108 (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)
													0.0000 (64a)
Heat gains from water heating, kWh/month	152.3632	135.4062	145.1968	130.5085	128.5263	117.9748	117.8424	121.2015	121.1030	132.4842	137.8010	151.0415	(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												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												

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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)											
Water heating gains (Table 5)	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412 (71)
Total internal gains	204.7893	201.4974	195.1570	181.2618	172.7504	163.8539	158.3903	162.9052	168.1985	178.0701	191.3903	203.0128 (72)
	1526.5735	1577.1722	1504.0974	1459.0069	1379.1345	1327.5926	1272.0619	1268.1267	1308.8511	1352.9180	1437.5992	1488.8670 (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						4.8600	11.2829	0.6300	0.7000			0.7700	16.7583 (75)	
Southeast						70.4200	36.7938	0.6300	0.7000			0.7700	791.8499 (77)	
Southwest						6.7300	36.7938	0.6300	0.7000			0.7700	75.6767 (79)	
Northwest						32.2200	11.2829	0.6300	0.7000			0.7700	111.1014 (81)	
Southeast						5.1300	40.5020	0.6300	0.7000			1.0000	82.4659 (82)	
Southwest						0.4100	40.5020	0.6300	0.7000			1.0000	6.5908 (82)	
Northwest						5.1300	15.9165	0.6300	0.7000			1.0000	32.4076 (82)	
Horizontal						11.1600	26.0000	0.6300	0.7000			1.0000	115.1645 (82)	
Solar gains	1232.0152	2205.5057	3281.3513	4474.5003	5360.8507	5469.1921	5212.1383	4532.6387	3693.9076	2510.6138	1495.6358	1041.1621	(83)	
Total gains	2758.5887	3782.6779	4785.4487	5933.5072	6739.9851	6796.7847	6484.2002	5800.7655	5002.7587	3863.5318	2933.2350	2530.0292	(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)												
tau	31.0636	31.1119	31.1594	31.3843	31.4267	31.6258	31.6258	31.6630	31.5488	31.4267	31.3410	31.2519
alpha	3.0709	3.0741	3.0773	3.0923	3.0951	3.1084	3.1084	3.1109	3.1033	3.0951	3.0894	3.0835
util living area	0.9931	0.9820	0.9567	0.8920	0.7759	0.6195	0.4817	0.5457	0.7748	0.9420	0.9865	0.9947 (86)
MIT	18.3668	18.7426	19.2894	19.9683	20.5106	20.8296	20.9424	20.9148	20.6408	19.8796	18.9854	18.3039 (87)
Th 2	20.1418	20.1430	20.1442	20.1498	20.1509	20.1558	20.1558	20.1567	20.1539	20.1509	20.1488	20.1465 (88)
util rest of house	0.9920	0.9791	0.9498	0.8746	0.7399	0.5590	0.4004	0.4627	0.7249	0.9292	0.9840	0.9939 (89)
MIT 2	16.9822	17.4626	18.1574	19.0083	19.6584	20.0141	20.1201	20.1004	19.8246	18.9130	17.7784	16.9044 (90)
Living area fraction									fLA = Living area / (4) =			0.1959 (91)
MIT	17.2535	17.7134	18.3792	19.1964	19.8254	20.1739	20.2812	20.2600	19.9845	19.1024	18.0149	17.1786 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2535	17.7134	18.3792	19.1964	19.8254	20.1739	20.2812	20.2600	19.9845	19.1024	18.0149	17.1786 (93)

8. Space heating requirement

Utilisation	0.9862	0.9673	0.9304	0.8507	0.7245	0.5604	0.4130	0.4735	0.7135	0.9082	0.9742	0.9891 (94)
Useful gains	2720.3862	3658.8980	4452.4611	5047.8070	4882.8265	3808.6956	2678.1614	2746.6050	3569.5387	3508.7287	2857.6198	2502.5287 (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	10026.5279	9902.7028	9166.7338	7888.3832	6216.6946	4237.7004	2798.7661	2931.2274	4484.8087	6505.1665	8373.7874	9985.4685 (97)
Space heating kWh	5435.7695	4195.8368	3507.4188	2045.2149	992.3979	0.0000	0.0000	0.0000	0.0000	2229.3497	3971.6407	5567.3072 (98a)
Space heating requirement - total per year (kWh/year)												27944.9355
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	5435.7695	4195.8368	3507.4188	2045.2149	992.3979	0.0000	0.0000	0.0000	0.0000	2229.3497	3971.6407	5567.3072 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												27944.9355
Space heating per m2										(98c) / (4) =		33.5877 (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 %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	5435.7695	4195.8368	3507.4188	2045.2149	992.3979	0.0000	0.0000	0.0000	0.0000	2229.3497	3971.6407	5567.3072 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	5889.2410	4545.8687	3800.0204	2215.8341	1075.1873	0.0000	0.0000	0.0000	0.0000	2415.3302	4302.9693	6031.7521 (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	316.8709	280.3128	298.3018	263.8147	256.7023	232.3903	230.2817	238.9167	240.9428	267.3438	282.5896	313.6436 (64)
Efficiency of water heater (217)m	88.2518	88.1772	88.0219	87.6703	86.7884	79.8000	79.8000	79.8000	79.8000	87.7404	88.1397	88.2691 (217)
Fuel for water heating, kWh/month	359.0534	317.8970	338.8951	300.9168	295.7794	291.2159	288.5735	299.3944	301.9333	304.6987	320.6156	355.3267 (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)

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Lighting	88.1218	70.6946	63.6527	46.6347	36.0220	29.4303	32.8604	42.7132	55.4803	72.7931	82.2197	90.5710	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-250.6316	-319.1330	-414.2758	-418.4544	-413.9117	-372.4425	-366.3686	-362.1808	-352.4562	-338.4725	-262.2612	-220.7711	(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	-267.6941	-541.4570	-1039.3865	-1511.5641	-1954.1163	-1948.8531	-1927.1578	-1652.7096	-1239.3348	-758.4589	-351.7009	-213.5444	(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												30276.2031	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3774.2997	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												711.1938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-17497.3369	(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												17350.3596	(238)

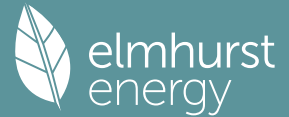
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	30276.2031	0.2100	6358.0027	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3774.2997	0.2100	792.6029	(264)
Space and water heating			7150.6056	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	711.1938	0.1443	102.6472	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4091.3593	0.1370	-560.3171	
PV Unit electricity exported	-13405.9776	0.1269	-1700.6666	
Total			-2260.9837	(269)
Total CO2, kg/year			5004.1984	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			6.0100	(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	30276.2031	1.1300	34212.1095	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3774.2997	1.1300	4264.9586	(278)
Space and water heating			38477.0681	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	711.1938	1.5338	1090.8528	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4091.3593	1.5063	-6162.7193	
PV Unit electricity exported	-13405.9776	0.4657	-6243.1565	
Total			-12405.8758	(283)
Total Primary energy kWh/year			27292.1460	(286)
Target Primary Energy Rate (TPER)			32.8000	(287)

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Property Reference	Twinwoods			Issued on Date	23/12/2024
Assessment Reference	Be Green	Prop Type Ref	HOUSE		
Property	Twinwoods, 119 Ducks Hill Road, Northwood, LONDON, HA6 2SQ				
SAP Rating	96 A	DER	5.39	TER	6.01
Environmental	94 A	% DER < TER			10.32
CO ₂ Emissions (t/year)	3.39	DFEE	34.97	TFEE	37.31
Compliance Check	See BREL	% DFEE < TFEE			6.27
% DPER < TPER	7.97	DPER	30.19	TPER	32.80
Assessor Details	Mr. Ondrej Gajdos			Assessor ID	W452-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	354.0000 (1b)	x	2.8000 (2b)	=	991.2000 (1b)	- (3b)
First floor	308.0000 (1c)	x	2.7000 (2c)	=	831.6000 (1c)	- (3c)
Second floor	170.0000 (1d)	x	2.3500 (2d)	=	399.5000 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	832.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2222.3000	(5)

2. Ventilation rate

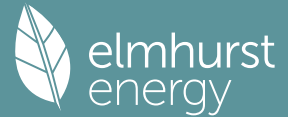
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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) =	0.0180 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2180	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1853 (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	0.2363	0.2316	0.2270	0.2038	0.1992	0.1760	0.1760	0.1714	0.1853	0.1992	0.2085	0.2177	(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	0.5279	0.5268	0.5258	0.5208	0.5198	0.5155	0.5155	0.5147	0.5172	0.5198	0.5217	0.5237	(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	
1			2.3000	1.0000	2.3000			(26a)
1 (Uw = 1.20)			114.2300	1.1450	130.7977			(27)
1			5.1300	1.1450	5.8740			(27a)
2			5.1300	1.1450	5.8740			(27a)
3			0.4100	1.1450	0.4695			(27a)
4			2.0000	1.1450	2.2901			(27a)
5			2.0000	1.1450	2.2901			(27a)
6			3.1800	1.1450	3.6412			(27a)
7			3.9800	1.1450	4.5573			(27a)
ground floor			354.0000	0.1000	35.4000	110.0000	38940.0000	(28a)
exposed wall	464.7550	116.5300	348.2250	0.1800	62.6805	60.0000	20893.5003	(29a)
pitched (rafters)	241.9000	10.6700	231.2300	0.1100	25.4353	9.0000	2081.0699	(30)
flat roof	39.5000	2.0000	37.5000	0.1100	4.1250	9.0000	337.5000	(30)
main flat roof	113.8000	9.1600	104.6400	0.1100	11.5104	9.0000	941.7600	(30)
Total net area of external elements Aum(A, m ²)			1213.9550					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	297.2451			(33)

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iw 1162.2800 9.0000 10460.5203 (32c)
if 478.0000 18.0000 8604.0000 (32d)
ic 478.0000 9.0000 4302.0000 (32e)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 86560.3505 (34)
Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 104.0389 (35)

List of Thermal Bridges
K1 Element
E2 Other lintels (including other steel lintels)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal Bridges
Total fabric heat loss

	Length	Psi-value	Total
	1213.9550	0.0400	48.5582
			48.5582 (36)
			(36a) = 0.0000
			(33) + (36) + (36a) = 345.8033 (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	387.1466	386.3518	385.5728	381.9137	381.2291	378.0422	378.0422	377.4520	379.2698	381.2291	382.6141	384.0619 (38)
Heat transfer coeff	732.9499	732.1551	731.3761	727.7170	727.0324	723.8455	723.8455	723.2553	725.0731	727.0324	728.4174	729.8652 (39)
Average = Sum(39)m / 12 =												727.7137

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8809	0.8800	0.8791	0.8747	0.8738	0.8700	0.8700	0.8693	0.8715	0.8738	0.8755	0.8772 (40)
HLP (average)												0.8747
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.8235 (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 38.1072 37.5413 36.7443 35.2748 34.1745 32.9544 32.2954 33.0868 33.9485 35.2540 36.7537 37.9784 (42b)

Hot water usage for other uses 53.7868 51.8309 49.8750 47.9191 45.9632 44.0074 44.0074 45.9632 47.9191 49.8750 51.8309 53.7868 (42c)

Average daily hot water use (litres/day) 84.2284 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	91.8940	89.3721	86.6193	83.1939	80.1377	76.9618	76.3027	79.0500	81.8676	85.1290	88.5846	91.7651 (44)
Energy conte	145.5376	127.2647	133.1306	113.8883	107.8808	94.6335	92.2816	97.8804	100.9509	115.5192	126.2050	143.6820 (45)
Energy content (annual)												Total = Sum(45)m = 1398.8548
Distribution loss (46)m = 0.15 x (45)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 (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												
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 (57)
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 (59)
Total heat required for water heating calculated for each month	123.7069	108.1750	113.1610	96.8051	91.6987	80.4385	78.4393	83.1984	85.8083	98.1914	107.2743	122.1297 (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	123.7069	108.1750	113.1610	96.8051	91.6987	80.4385	78.4393	83.1984	85.8083	98.1914	107.2743	122.1297 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1189.0266 (64)
Electric shower(s)	70.7361	63.0265	68.8225	65.6764	66.9088	63.8245	65.9520	66.9088	65.6764	68.8225	67.5283	70.7361 (64a)
Heat gains from water heating, kWh/month	48.6108	42.8004	45.4959	40.6204	39.6519	36.0657	36.0978	37.5268	37.8712	41.7535	43.7007	48.2165 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												804.6191 (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	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	424.1108	469.5512	424.1108	438.2478	424.1108	438.2478	424.1108	424.1108	438.2478	424.1108	438.2478	424.1108 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	814.3205	822.7706	801.4766	756.1443	698.9203	645.1379	609.2079	600.7578	622.0518	667.3841	724.6081	778.3905 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176 (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)	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412 (71)
Water heating gains (Table 5)	65.3370	63.6910	61.1504	56.4172	53.2955	50.0913	48.5186	50.4393	52.5989	56.1202	60.6954	64.8071 (72)
Total internal gains	1384.1213	1436.3658	1367.0908	1331.1623	1256.6796	1213.8300	1162.1902	1155.6608	1193.2514	1227.9681	1303.9042	1347.6614 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	4.8600	11.2829	0.6300	0.7000	0.7700	16.7583 (75)
Southeast	70.4200	36.7938	0.6300	0.7000	0.7700	791.8499 (77)
Southwest	6.7300	36.7938	0.6300	0.7000	0.7700	75.6767 (79)
Northwest	32.2200	11.2829	0.6300	0.7000	0.7700	111.1014 (81)
Southeast	5.1300	40.5020	0.6300	0.7000	1.0000	82.4659 (82)
Southwest	0.4100	40.5020	0.6300	0.7000	1.0000	6.5908 (82)
Northwest	5.1300	15.9165	0.6300	0.7000	1.0000	32.4076 (82)
Horizontal	11.1600	26.0000	0.6300	0.7000	1.0000	115.1645 (82)

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Solar gains	1232.0151	2205.5057	3281.3512	4474.5002	5360.8505	5469.1920	5212.1382	4532.6386	3693.9075	2510.6137	1495.6358	1041.1621 (83)
Total gains	2616.1364	3641.8715	4648.4420	5805.6624	6617.5301	6683.0220	6374.3284	5688.2994	4887.1589	3738.5819	2799.5400	2388.8234 (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	32.8052	32.8408	32.8758	33.0411	33.0722	33.2178	33.2178	33.2449	33.1615	33.0722	33.0093	32.9438
alpha	3.1870	3.1894	3.1917	3.2027	3.2048	3.2145	3.2145	3.2163	3.2108	3.2048	3.2006	3.1963
util living area	0.9942	0.9836	0.9583	0.8914	0.7703	0.6099	0.4713	0.5366	0.7714	0.9442	0.9881	0.9957 (86)
MIT	18.4625	18.8391	19.3798	20.0421	20.5608	20.8529	20.9522	20.9274	20.6742	19.9360	19.0589	18.3947 (87)
Th 2	20.1837	20.1845	20.1853	20.1891	20.1898	20.1931	20.1931	20.1937	20.1918	20.1898	20.1884	20.1869 (88)
util rest of house	0.9933	0.9810	0.9517	0.8743	0.7350	0.5516	0.3942	0.4573	0.7226	0.9321	0.9859	0.9950 (89)
MIT 2	17.8031	18.1785	18.7141	19.3607	19.8444	20.0973	20.1697	20.1559	19.9579	19.2694	18.4016	17.7376 (90)
Living area fraction	17.9323	18.3079	18.8445	19.4942	19.9848	20.2453	20.3230	20.3071	20.0982	19.4000	18.5304	0.1959 (91)
MIT	17.9323	18.3079	18.8445	19.4942	19.9848	20.2453	20.3230	20.3071	20.0982	19.4000	18.5304	17.8663 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9323	18.3079	18.8445	19.4942	19.9848	20.2453	20.3230	20.3071	20.0982	19.4000	18.5304	17.8663 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9896	0.9730	0.9379	0.8570	0.7252	0.5555	0.4070	0.4690	0.7163	0.9170	0.9795	0.9921 (94)
Useful gains	2589.0582	3543.3842	4359.5650	4975.6153	4798.8460	3712.7251	2594.4989	2667.6823	3500.7224	3428.4308	2742.1874	2369.9253 (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	9991.8128	9816.6681	9028.4869	7709.5983	6023.3035	4086.3298	2694.8890	2825.8107	4349.1607	6397.8605	8326.1092	9974.5892 (97)
Space heating kWh	5507.6494	4215.6468	3473.6778	1968.4677	910.9964	0.0000	0.0000	0.0000	0.0000	2209.2557	4020.4237	5657.8699 (98a)
Space heating requirement - total per year (kWh/year)												27963.9875
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	5507.6494	4215.6468	3473.6778	1968.4677	910.9964	0.0000	0.0000	0.0000	0.0000	2209.2557	4020.4237	5657.8699 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												27963.9875
Space heating per m2												(98c) / (4) = 33.6106 (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	6804.1478	5356.4568	5496.7406	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7895	0.8521	0.8079	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	5371.9943	4564.3381	4440.8019	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	7314.1578	6975.9902	6224.5847	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1398.3577	1794.2692	1327.1344	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	349.5894	448.5673	331.7836	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												1129.9403 (107)
Energy for space heating												33.6106 (99)
Energy for space cooling												1.3581 (108)
Total												34.9687 (109)
Fabric Energy Efficiency (DFEE)												35.0 (109)

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

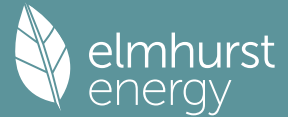
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	354.0000 (1b)	x 2.8000 (2b)	= 991.2000 (1b) - (3b)	
First floor	308.0000 (1c)	x 2.7000 (2c)	= 831.6000 (1c) - (3c)	
Second floor	170.0000 (1d)	x 2.3500 (2d)	= 399.5000 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	832.0000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2222.3000 (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)

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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) =	0.0180 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.2680	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2278	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
	0.2904	0.2847	0.2791	0.2506	0.2449	0.2164	0.2164	0.2107	0.2278	0.2449	0.2563	0.2677	(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	0.5422	0.5405	0.5389	0.5314	0.5300	0.5234	0.5234	0.5222	0.5259	0.5300	0.5328	0.5358	(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 Semi-glazed door			2.3000	1.0000	2.3000			(26a)
TER Opening Type (Uw = 1.20)			114.2300	1.1450	130.7977			(27)
1			5.1300	1.4151	7.2594			(27a)
2			5.1300	1.4151	7.2594			(27a)
3			0.4100	1.4151	0.5802			(27a)
4			2.0000	1.5918	3.1835			(27a)
5			2.0000	1.5918	3.1835			(27a)
6			3.1800	1.5918	5.0618			(27a)
7			3.9800	1.5918	6.3352			(27a)
ground floor			354.0000	0.1300	46.0200			(28a)
exposed wall	464.7550	116.5300	348.2250	0.1800	62.6805			(29a)
pitched (rafters)	241.9000	10.6700	231.2300	0.1100	25.4353			(30)
flat roof	39.5000	2.0000	37.5000	0.1100	4.1250			(30)
main flat roof	113.8000	9.1600	104.6400	0.1100	11.5104			(30)
Total net area of external elements Aum(A, m2)			1213.9550					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	315.7320		(33)

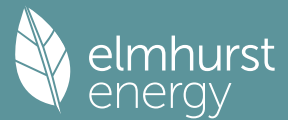
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												104.0389	(35)
List of Thermal Bridges													
K1 Element													
E2 Other lintels (including other steel lintels)													
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												60.6977	(36)
Point Thermal bridges												(36a) =	0.0000
Total fabric heat loss												(33) + (36) + (36a) =	376.4298 (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	397.6118	396.4107	395.2333	389.7033	388.6687	383.8522	383.8522	382.9603	385.7075	388.6687	390.7618	392.9500	(38)
	774.0416	772.8404	771.6631	766.1331	765.0984	760.2820	760.2820	759.3901	762.1372	765.0984	767.1915	769.3797	(39)
Average = Sum(39)m / 12 =												766.1281	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9303	0.9289	0.9275	0.9208	0.9196	0.9138	0.9138	0.9127	0.9160	0.9196	0.9221	0.9247	(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													3.8235	(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	0.0000	(42a)
Hot water usage for baths	38.1072	37.5413	36.7443	35.2748	34.1745	32.9544	32.2954	33.0868	33.9485	35.2540	36.7537	37.9784		(42b)
Hot water usage for other uses	53.7868	51.8309	49.8750	47.9191	45.9632	44.0074	44.0074	45.9632	47.9191	49.8750	51.8309	53.7868		(42c)
Average daily hot water use (litres/day)													84.2284	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	91.8940	89.3721	86.6193	83.1939	80.1377	76.9618	76.3027	79.0500	81.8676	85.1290	88.5846	91.7651		(44)
Energy content (annual)	145.5376	127.2647	133.1306	113.8883	107.8808	94.6335	92.2816	97.8804	100.9509	115.5192	126.2050	143.6820		(45)
Distribution loss (46)m = 0.15 x (45)m										Total =	Sum(45)m =	1398.8548		
Water 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)
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	123.7069	108.1750	113.1610	96.8051	91.6987	80.4385	78.4393	83.1984	85.8083	98.1914	107.2743	122.1297		(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	123.7069	108.1750	113.1610	96.8051	91.6987	80.4385	78.4393	83.1984	85.8083	98.1914	107.2743	122.1297		(64)
12Total per year (kWh/year)									Total per year (kWh/year) =	Sum(64)m =		1189.0266		(64)
Electric shower(s)												1189		(64)

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	70.7361	63.0265	68.8225	65.6764	66.9088	63.8245	65.9520	66.9088	65.6764	68.8225	67.5283	70.7361 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											804.6191 (64a)
Heat gains from water heating, kWh/month	48.6108	42.8004	45.4959	40.6204	39.6519	36.0657	36.0978	37.5268	37.8712	41.7535	43.7007	48.2165 (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	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	424.1108	469.5512	424.1108	438.2478	424.1108	438.2478	424.1108	424.1108	438.2478	424.1108	438.2478	424.1108	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	814.3205	822.7706	801.4766	756.1443	698.9203	645.1379	609.2079	600.7578	622.0518	667.3841	724.6081	778.3905	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	(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)	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	(71)
Water heating gains (Table 5)	65.3370	63.6910	61.1504	56.4172	53.2955	50.0913	48.5186	50.4393	52.5989	56.1202	60.6954	64.8071	(72)
Total internal gains	1384.1213	1436.3658	1367.0907	1331.1623	1256.6796	1213.8300	1162.1902	1155.6608	1193.2514	1227.9681	1303.9042	1347.6613	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.8600	11.2829	0.6300	0.7000	0.7700	16.7583	(75)
Southeast	70.4200	36.7938	0.6300	0.7000	0.7700	791.8499	(77)
Southwest	6.7300	36.7938	0.6300	0.7000	0.7700	75.6767	(79)
Northwest	32.2200	11.2829	0.6300	0.7000	0.7700	111.1014	(81)
Southeast	5.1300	40.5020	0.6300	0.7000	1.0000	82.4659	(82)
Southwest	0.4100	40.5020	0.6300	0.7000	1.0000	6.5908	(82)
Northwest	5.1300	15.9165	0.6300	0.7000	1.0000	32.4076	(82)
Horizontal	11.1600	26.0000	0.6300	0.7000	1.0000	115.1645	(82)

Solar gains	1232.0152	2205.5057	3281.3513	4474.5003	5360.8507	5469.1921	5212.1383	4532.6387	3693.9076	2510.6138	1495.6358	1041.1621	(83)
Total gains	2616.1365	3641.8715	4648.4421	5805.6626	6617.5303	6683.0221	6374.3286	5688.2995	4887.1590	3738.5819	2799.5400	2388.8235	(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	31.0636	31.1119	31.1594	31.3843	31.4267	31.6258	31.6258	31.6630	31.5488	31.4267	31.3410	31.2519
alpha	3.0709	3.0741	3.0773	3.0923	3.0951	3.1084	3.1084	3.1109	3.1033	3.0951	3.0894	3.0835
util living area	0.9941	0.9837	0.9597	0.8969	0.7825	0.6267	0.4886	0.5540	0.7833	0.9464	0.9881	0.9955 (86)
MIT	18.3309	18.7085	19.2591	19.9460	20.4973	20.8239	20.9400	20.9111	20.6282	19.8533	18.9523	18.2680 (87)
Th 2	20.1418	20.1430	20.1442	20.1498	20.1509	20.1558	20.1558	20.1567	20.1539	20.1509	20.1488	20.1465 (88)
util rest of house	0.9931	0.9811	0.9532	0.8800	0.7470	0.5662	0.4066	0.4705	0.7341	0.9344	0.9859	0.9948 (89)
MIT 2	17.6437	18.0204	18.5663	19.2394	19.7557	20.0413	20.1268	20.1108	19.8872	19.1611	18.2688	17.5841 (90)
Living area fraction	17.7783	18.1552	18.7020	19.3778	19.9010	20.1946	20.2861	20.2676	20.0324	19.2967	18.4027	17.7181 (92)
MIT	17.7783	18.1552	18.7020	19.3778	19.9010	20.1946	20.2861	20.2676	20.0324	19.2967	18.4027	17.7181 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7783	18.1552	18.7020	19.3778	19.9010	20.1946	20.2861	20.2676	20.0324	19.2967	18.4027	17.7181 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9728	0.9389	0.8616	0.7353	0.5691	0.4198	0.4821	0.7261	0.9188	0.9792	0.9917	(94)
Useful gains	2588.0160	3542.7272	4364.3104	5002.4292	4866.1181	3803.5698	2676.0854	2742.4214	3548.6303	3434.8860	2741.3077	2369.0543	(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	10432.7928	10244.1451	9415.8663	8027.4031	6274.5769	4253.4822	2802.4859	2936.9869	4521.3073	6653.8427	8671.3401	10400.5627	(97)
Space heating kWh	5836.5139	4503.3528	3758.3576	2177.9812	1047.8933	0.0000	0.0000	0.0000	0.0000	2394.9038	4269.6233	5975.4422	(98a)
Space heating requirement - total per year (kWh/year)												29964.0681	
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	5836.5139	4503.3528	3758.3576	2177.9812	1047.8933	0.0000	0.0000	0.0000	0.0000	2394.9038	4269.6233	5975.4422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												29964.0681	
Space heating per m2												36.0145	(99)

8c. Space cooling requirement

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

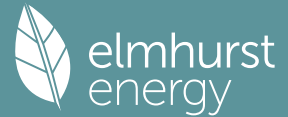
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	7146.6507	5626.0867	5771.3644	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7653	0.8310	0.7845	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	5469.2418	4675.0989	4527.8962	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	7314.1579	6975.9904	6224.5848	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1328.3396	1711.8632	1262.3364	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction													(105)

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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	332.0849	427.9658	315.5841	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												1075.6348 (107)
Energy for space heating												36.0145 (99)
Energy for space cooling												1.2928 (108)
Total												37.3073 (109)
Fabric Energy Efficiency (TFEE)												37.3 (109)

Full SAP Calculation Printout



Property Reference	Twinwoods			Issued on Date	23/12/2024
Assessment Reference	Be Green	Prop Type Ref	HOUSE		
Property	Twinwoods, 119 Ducks Hill Road, Northwood, LONDON, HA6 2SQ				
SAP Rating	96 A	DER	5.39	TER	6.01
Environmental	94 A	% DER < TER			10.32
CO ₂ Emissions (t/year)	3.39	DFEE	34.97	TFEE	37.31
Compliance Check	See BREL	% DFEE < TFEE			6.27
% DPER < TPER	7.97	DPER	30.19	TPER	32.80
Assessor Details	Mr. Ondrej Gajdos			Assessor ID	W452-0001
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	354.0000 (1b)	x	2.8000 (2b)	=	991.2000 (1b)	- (3b)
First floor	308.0000 (1c)	x	2.7000 (2c)	=	831.6000 (1c)	- (3c)
Second floor	170.0000 (1d)	x	2.3500 (2d)	=	399.5000 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	832.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2222.3000	(5)

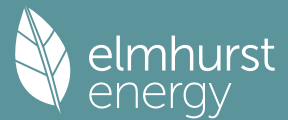
2. Ventilation rate

											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											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes		
Pressure Test Method											Blower Door		
Measured/design AP50											4.0000 (17)		
Infiltration rate											0.2000 (18)		
Number of sides sheltered											2 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1700 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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													
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													
													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													77.4000 (23c)
Effective ac	0.3297	0.3255	0.3213	0.3000	0.2957	0.2745	0.2745	0.2702	0.2830	0.2957	0.3043	0.3127 (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	
1			2.3000	1.0000	2.3000			(26a)
1 (Uw = 1.20)			114.2300	1.1450	130.7977			(27)
1			5.1300	1.1450	5.8740			(27a)
2			5.1300	1.1450	5.8740			(27a)
3			0.4100	1.1450	0.4695			(27a)
4			2.0000	1.1450	2.2901			(27a)
5			2.0000	1.1450	2.2901			(27a)
6			3.1800	1.1450	3.6412			(27a)
7			3.9800	1.1450	4.5573			(27a)
ground floor			354.0000	0.1000	35.4000	110.0000	38940.0000	(28a)
exposed wall	464.7550	116.5300	348.2250	0.1800	62.6805	60.0000	20893.5003	(29a)
pitched (rafters)	241.9000	10.6700	231.2300	0.1100	25.4353	9.0000	2081.0699	(30)
flat roof	39.5000	2.0000	37.5000	0.1100	4.1250	9.0000	337.5000	(30)

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main flat roof 113.8000 9.1600 104.6400 0.1100 11.5104 9.0000 941.7600 (30)
Total net area of external elements Aum(A, m2) 1213.9550 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 297.2451 (33)
iw 1162.2800 9.0000 10460.5203 (32c)
if 478.0000 18.0000 8604.0000 (32d)
ic 478.0000 9.0000 4302.0000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 86560.3505 (34)
List of Thermal Bridges 104.0389 (35)

K1 Element Length Psi-value Total
E2 Other lintels (including other steel lintels) 1213.9550 0.0400 48.5582
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 48.5582 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 345.8033 (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 241.8251 238.7084 235.5916 220.0077 216.8909 201.3070 201.3070 198.1903 207.5406 216.8909 223.1245 229.3580 (38)
Average = Sum(39)m / 12 = 587.6284 584.5117 581.3949 565.8110 562.6942 547.1103 547.1103 543.9936 553.3439 562.6942 568.9278 575.1613 (39)
565.0318

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP (average) 0.7063 0.7025 0.6988 0.6801 0.6763 0.6576 0.6576 0.6538 0.6651 0.6763 0.6838 0.6913 (40)
Days in mont 31 28 31 30 31 30 31 31 30 31 30 31
0.6791
31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.8235 (42)
Hot water usage for mixer showers 88.3281 87.0007 85.0664 81.3655 78.6344 75.5886 73.8574 75.7770 77.8813 81.1515 84.9319 87.9897 (42a)
Hot water usage for baths 38.1072 37.5413 36.7443 35.2748 34.1745 32.9544 32.2954 33.0868 33.9485 35.2540 36.7537 37.9784 (42b)
Hot water usage for other uses 53.7868 51.8309 49.8750 47.9191 45.9632 44.0074 44.0074 45.9632 47.9191 49.8750 51.8309 53.7868 (42c)
Average daily hot water use (litres/day) 165.6640 (43)

Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Energy conte 180.2221 176.3729 171.6857 164.5595 158.7721 152.5504 150.1601 154.8270 159.7489 166.2805 173.5165 179.7548 (44)
Energy content (annual) 285.4277 251.1526 263.8746 225.2737 213.7378 187.5785 181.6057 191.7082 196.9864 225.6411 247.2061 281.4527 (45)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 2751.6450
42.8142 37.6729 39.5812 33.7911 32.0607 28.1368 27.2408 28.7562 29.5480 33.8462 37.0809 42.2179 (46)

Water storage loss:
Store volume 500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1400 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1556 (55)
Total storage loss

35.8236 32.3568 35.8236 34.6680 35.8236 34.6680 35.8236 35.8236 34.6680 35.8236 34.6680 35.8236 (56)
If cylinder contains dedicated solar storage 35.8236 32.3568 35.8236 34.6680 35.8236 34.6680 35.8236 35.8236 34.6680 35.8236 34.6680 35.8236 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
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 344.5137 304.5206 322.9606 282.4537 272.8238 244.7585 240.6917 250.7942 254.1664 284.7271 304.3861 340.5387 (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 344.5137 304.5206 322.9606 282.4537 272.8238 244.7585 240.6917 250.7942 254.1664 284.7271 304.3861 340.5387 (64)
Total per year (kWh/year) = Sum(64)m = 3447.3350 (64)
3447 (64)

12Total per year (kWh/year)
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 142.1735 126.2026 135.0071 120.6475 118.3366 108.1138 107.6527 111.0118 111.2420 122.2945 127.9400 140.8518 (65)

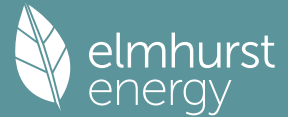
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(66)m 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 191.1765 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 424.1108 469.5512 424.1108 438.2478 424.1108 438.2478 424.1108 438.2478 424.1108 438.2478 424.1108 438.2478 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 814.3205 822.7706 801.4766 756.1443 698.9203 645.1379 609.2079 600.7578 622.0518 667.3841 724.6081 778.3905 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 42.1176 (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) -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 -152.9412 (71)
Water heating gains (Table 5) 191.0934 187.8016 181.4612 167.5660 159.0546 150.1581 144.6945 149.2094 154.5027 164.3743 177.6945 189.3169 (72)
Total internal gains 1512.8777 1563.4764 1490.4015 1445.3110 1365.4387 1313.8968 1258.3661 1254.4309 1295.1553 1339.2222 1423.9034 1475.1712 (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 4.8600 11.2829 0.6300 0.7000 0.7700 16.7583 (75)
Southeast 70.4200 36.7938 0.6300 0.7000 0.7700 791.8499 (77)
Southwest 6.7300 36.7938 0.6300 0.7000 0.7700 75.6767 (79)

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Northwest			32.2200		11.2829		0.6300		0.7000		0.7700		111.1014 (81)
Southeast			5.1300		40.5020		0.6300		0.7000		1.0000		82.4659 (82)
Southwest			0.4100		40.5020		0.6300		0.7000		1.0000		6.5908 (82)
Northwest			5.1300		15.9165		0.6300		0.7000		1.0000		32.4076 (82)
Horizontal			11.1600		26.0000		0.6300		0.7000		1.0000		115.1645 (82)

Solar gains	1232.0151	2205.5057	3281.3512	4474.5002	5360.8505	5469.1920	5212.1382	4532.6386	3693.9075	2510.6137	1495.6358	1041.1621 (83)
Total gains	2744.8928	3768.9820	4771.7528	5919.8112	6726.2892	6783.0888	6470.5043	5787.0695	4989.0628	3849.8359	2919.5391	2516.3333 (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	40.9179	41.1361	41.3566	42.4957	42.7311	43.9482	43.9482	44.2000	43.4532	42.7311	42.2629	41.8049	
alpha	3.7279	3.7424	3.7571	3.8330	3.8487	3.9299	3.9299	3.9467	3.8969	3.8487	3.8175	3.7870	
util living area	0.9937	0.9802	0.9452	0.8465	0.6846	0.4969	0.3672	0.4233	0.6785	0.9214	0.9858	0.9955 (86)	
MIT	19.0051	19.3882	19.8930	20.4778	20.8210	20.9624	20.9910	20.9848	20.8761	20.3433	19.5711	18.9727 (87)	
Th 2	20.3353	20.3386	20.3419	20.3585	20.3618	20.3785	20.3785	20.3818	20.3718	20.3618	20.3552	20.3485 (88)	
util rest of house	0.9928	0.9775	0.9377	0.8275	0.6515	0.4534	0.3170	0.3694	0.6337	0.9073	0.9835	0.9948 (89)	
MIT 2	17.9156	18.4065	19.0471	19.7800	20.1820	20.3468	20.3726	20.3714	20.2583	19.6305	18.6528	17.8827 (90)	
Living area fraction												0.1959 (91)	
MIT	18.1291	18.5988	19.2129	19.9167	20.3072	20.4674	20.4937	20.4915	20.3793	19.7702	18.8327	18.0962 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.9791	18.4488	19.0629	19.7667	20.1572	20.3174	20.3437	20.3415	20.2293	19.6202	18.6827	17.9462 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9665	0.9193	0.8078	0.6403	0.4490	0.3142	0.3658	0.6228	0.8871	0.9746	0.9910 (94)	
Useful gains	2711.7602	3642.5552	4386.7463	4782.2910	4306.9190	3045.7391	2032.9499	2117.1590	3107.3174	3415.1735	2845.3867	2493.7762 (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	8038.2165	7919.4532	7303.9873	6148.4862	4758.8365	3128.0298	2048.2391	2144.1775	3391.6263	5075.5983	6589.7181	7906.2949 (97)	
Space heating kWh	3962.8835	2874.0755	2170.4273	983.6605	336.2266	0.0000	0.0000	0.0000	0.0000	1235.3561	2695.9186	4026.9139 (98a)	
Space heating requirement - total per year (kWh/year)												18285.4620	
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	3962.8835	2874.0755	2170.4273	983.6605	336.2266	0.0000	0.0000	0.0000	0.0000	1235.3561	2695.9186	4026.9139 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												18285.4620	
Space heating per m2										(98c) / (4) =		21.9777 (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 %)													88.7000 (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	3962.8835	2874.0755	2170.4273	983.6605	336.2266	0.0000	0.0000	0.0000	0.0000	1235.3561	2695.9186	4026.9139 (98)	
Space heating efficiency (main heating system 1)	88.7000	88.7000	88.7000	88.7000	88.7000	0.0000	0.0000	0.0000	0.0000	88.7000	88.7000	88.7000 (210)	
Space heating fuel (main heating system)	4467.7379	3240.2204	2446.9304	1108.9747	379.0605	0.0000	0.0000	0.0000	0.0000	1392.7352	3039.3671	4539.9255 (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	344.5137	304.5206	322.9606	282.4537	272.8238	244.7585	240.6917	250.7942	254.1664	284.7271	304.3861	340.5387 (64)	
Efficiency of water heater (217)m	87.9060	87.7507	87.4213	86.5204	84.4292	79.7000	79.7000	79.7000	79.7000	86.8627	87.6953	87.9258 (217)	
Fuel for water heating, kWh/month	391.9113	347.0294	369.4300	326.4591	323.1390	307.0997	301.9971	314.6728	318.9038	327.7898	347.0950	387.3022 (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	220.0706	198.7735	220.0706	212.9716	220.0706	212.9716	220.0706	220.0706	212.9716	220.0706	212.9716	220.0706 (221)	
Lighting	88.1218	70.6946	63.6527	46.6347	36.0220	29.4303	32.8604	42.7132	55.4803	72.7931	82.2197	90.5710 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-155.0002	-223.4073	-329.1014	-376.3739	-409.4882	-384.8612	-381.1695	-358.5473	-316.4336	-259.8807	-172.1509	-133.1457 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	-87.4479	-192.2220	-403.3387	-633.1103	-856.0824	-865.5188	-850.2050	-706.1290	-498.7829	-278.5934	-117.7213	-68.1314 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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												20614.9515 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	

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Efficiency of water heater	79.7000	
Water heating fuel used	4062.8292 (219)	
Space cooling fuel	0.0000 (221)	
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9240)		
mechanical ventilation fans (SFP = 0.9240)	2505.1543 (230a)	
central heating pump	41.0000 (230c)	
main heating flue fan	45.0000 (230e)	
Total electricity for the above, kWh/year	2591.1543 (231)	
Electricity for lighting (calculated in Appendix L)	711.1938 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-9056.8431 (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	18923.2858 (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	20614.9515	0.2100	4329.1398 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	4062.8292	0.2100	853.1941 (264)
Space and water heating			5182.3340 (265)
Pumps, fans and electric keep-hot	2591.1543	0.1387	359.4251 (267)
Energy for lighting	711.1938	0.1443	102.6472 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3499.5598	0.1342	-469.5333
PV Unit electricity exported	-5557.2832	0.1248	-693.8094
Total			-1163.3427 (269)
Total CO2, kg/year			4481.0636 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.3900 (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	20614.9515	1.1300	23294.8952 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	4062.8292	1.1300	4590.9970 (278)
Space and water heating			27885.8923 (279)
Pumps, fans and electric keep-hot	2591.1543	1.5128	3919.8983 (281)
Energy for lighting	711.1938	1.5338	1090.8528 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3499.5598	1.4958	-5234.8011
PV Unit electricity exported	-5557.2832	0.4582	-2546.5365
Total			-7781.3375 (283)
Total Primary energy kWh/year			25115.3058 (286)
Dwelling Primary energy Rate (DPER)			30.1900 (287)

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

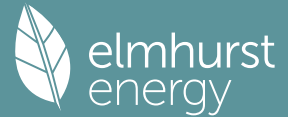
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	354.0000 (1b)	x 2.8000 (2b)	= 991.2000 (1b) - (3b)
First floor	308.0000 (1c)	x 2.7000 (2c)	= 831.6000 (1c) - (3c)
Second floor	170.0000 (1d)	x 2.3500 (2d)	= 399.5000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	832.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2222.3000 (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)
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) = 0.0180 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)

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Infiltration rate	0.2680	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = $1 - [0.075 \times (19)]$	= 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	= 0.2278 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.2904	0.2847	0.2791	0.2506	0.2449	0.2164	0.2164	0.2107	0.2278	0.2449	0.2563	0.2677	(22b)
	0.5422	0.5405	0.5389	0.5314	0.5300	0.5234	0.5234	0.5222	0.5259	0.5300	0.5328	0.5358	(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 Semi-glazed door			2.3000	1.0000	2.3000			(26a)
TER Opening Type (Uw = 1.20)			114.2300	1.1450	130.7977			(27)
1			5.1300	1.4151	7.2594			(27a)
2			5.1300	1.4151	7.2594			(27a)
3			0.4100	1.4151	0.5802			(27a)
4			2.0000	1.5918	3.1835			(27a)
5			2.0000	1.5918	3.1835			(27a)
6			3.1800	1.5918	5.0618			(27a)
7			3.9800	1.5918	6.3352			(27a)
ground floor			354.0000	0.1300	46.0200			(28a)
exposed wall	464.7550	116.5300	348.2250	0.1800	62.6805			(29a)
pitched (rafters)	241.9000	10.6700	231.2300	0.1100	25.4353			(30)
flat roof	39.5000	2.0000	37.5000	0.1100	4.1250			(30)
main flat roof	113.8000	9.1600	104.6400	0.1100	11.5104			(30)
Total net area of external elements Aum(A, m2)			1213.9550					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	315.7320		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				104.0389 (35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	1213.9550	0.0500	60.6977	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				60.6977 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss		(33) + (36) +	(36a) =	376.4298 (37)

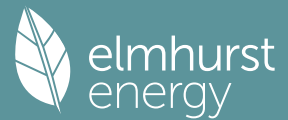
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	397.6118	396.4107	395.2333	389.7033	388.6687	383.8522	383.8522	382.9603	385.7075	388.6687	390.7618	392.9500	(38)
Average = Sum(39)m / 12 =	774.0416	772.8404	771.6631	766.1331	765.0984	760.2820	760.2820	759.3901	762.1372	765.0984	767.1915	769.3797	(39)
												766.1281	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9303	0.9289	0.9275	0.9208	0.9196	0.9138	0.9138	0.9127	0.9160	0.9196	0.9221	0.9247	(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													3.8235	(42)
Hot water usage for mixer showers	88.3281	87.0007	85.0664	81.3655	78.6344	75.5886	73.8574	75.7770	77.8813	81.1515	84.9319	87.9897	(42a)	
Hot water usage for baths	38.1072	37.5413	36.7443	35.2748	34.1745	32.9544	32.2954	33.0868	33.9485	35.2540	36.7537	37.9784	(42b)	
Hot water usage for other uses	53.7868	51.8309	49.8750	47.9191	45.9632	44.0074	44.0074	45.9632	47.9191	49.8750	51.8309	53.7868	(42c)	
Average daily hot water use (litres/day)													165.6640	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content (annual)	180.2221	176.3729	171.6857	164.5595	158.7721	152.5504	150.1601	154.8270	159.7489	166.2805	173.5165	179.7548	(44)	
Distribution loss (46)m = 0.15 x (45)m	285.4277	251.1526	263.8746	225.2737	213.7378	187.5785	181.6057	191.7082	196.9864	225.6411	247.2061	281.4527	(45)	
	42.8142	37.6729	39.5812	33.7911	32.0607	28.1368	27.2408	28.7562	29.5480	33.8462	37.0809	42.2179	(46)	
Water storage loss:														
Store volume													500.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													2.9009	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.5665	(55)
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	(56)	
If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
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	357.2509	316.0251	335.6977	294.7799	285.5609	257.0847	253.4288	263.5313	266.4926	297.4642	316.7124	353.2758	(62)	
WWHRS	-40.3799	-35.7123	-37.3959	-30.9653	-28.8585	-24.6945	-23.1471	-24.6146	-25.5498	-30.1204	-34.1228	-39.6322	(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	316.8709	280.3128	298.3018	263.8147	256.7023	232.3903	230.2817	238.9167	240.9428	267.3438	282.5896	313.6436	(64)	
12Total per year (kWh/year)													3222.1108	(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)	
													0.0000	(64a)
Heat gains from water heating, kWh/month	152.3632	135.4062	145.1968	130.5085	128.5263	117.9748	117.8424	121.2015	121.1030	132.4842	137.8010	151.0415	(65)	

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

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Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765	191.1765 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	424.1108	469.5512	424.1108	438.2478	424.1108	438.2478	424.1108	424.1108	438.2478	424.1108	438.2478	424.1108 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	814.3205	822.7706	801.4766	756.1443	698.9203	645.1379	609.2079	600.7578	622.0518	667.3841	724.6081	778.3905 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176	42.1176 (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)												
	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412	-152.9412 (71)
Water heating gains (Table 5)												
	204.7893	201.4974	195.1570	181.2618	172.7504	163.8539	158.3903	162.9052	168.1985	178.0701	191.3903	203.0128 (72)
Total internal gains												
	1526.5735	1577.1722	1504.0974	1459.0069	1379.1345	1327.5926	1272.0619	1268.1267	1308.8511	1352.9180	1437.5992	1488.8670 (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				4.8600	11.2829		0.6300		0.7000		0.7700		16.7583 (75)
Southeast				70.4200	36.7938		0.6300		0.7000		0.7700		791.8499 (77)
Southwest				6.7300	36.7938		0.6300		0.7000		0.7700		75.6767 (79)
Northwest				32.2200	11.2829		0.6300		0.7000		0.7700		111.1014 (81)
Southeast				5.1300	40.5020		0.6300		0.7000		1.0000		82.4659 (82)
Southwest				0.4100	40.5020		0.6300		0.7000		1.0000		6.5908 (82)
Northwest				5.1300	15.9165		0.6300		0.7000		1.0000		32.4076 (82)
Horizontal				11.1600	26.0000		0.6300		0.7000		1.0000		115.1645 (82)
Solar gains	1232.0152	2205.5057	3281.3513	4474.5003	5360.8507	5469.1921	5212.1383	4532.6387	3693.9076	2510.6138	1495.6358	1041.1621	(83)
Total gains	2758.5887	3782.6779	4785.4487	5933.5072	6739.9851	6796.7847	6484.2002	5800.7655	5002.7587	3863.5318	2933.2350	2530.0292	(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	31.0636	31.1119	31.1594	31.3843	31.4267	31.6258	31.6258	31.6630	31.5488	31.4267	31.3410	31.2519
alpha	3.0709	3.0741	3.0773	3.0923	3.0951	3.1084	3.1084	3.1109	3.1033	3.0951	3.0894	3.0835
util living area	0.9931	0.9820	0.9567	0.8920	0.7759	0.6195	0.4817	0.5457	0.7748	0.9420	0.9865	0.9947 (86)
MIT	18.3668	18.7426	19.2894	19.9683	20.5106	20.8296	20.9424	20.9148	20.6408	19.8796	18.9854	18.3039 (87)
Th 2	20.1418	20.1430	20.1442	20.1498	20.1509	20.1558	20.1558	20.1567	20.1539	20.1509	20.1488	20.1465 (88)
util rest of house	0.9920	0.9791	0.9498	0.8746	0.7399	0.5590	0.4004	0.4627	0.7249	0.9292	0.9840	0.9939 (89)
MIT 2	16.9822	17.4626	18.1574	19.0083	19.6584	20.0141	20.1201	20.1004	19.8246	18.9130	17.7784	16.9044 (90)
Living area fraction	17.2535	17.7134	18.3792	19.1964	19.8254	20.1739	20.2812	20.2600	19.9845	19.1024	18.0149	17.1786 (92)
MIT	17.2535	17.7134	18.3792	19.1964	19.8254	20.1739	20.2812	20.2600	19.9845	19.1024	18.0149	17.1786 (93)
Temperature adjustment	17.2535	17.7134	18.3792	19.1964	19.8254	20.1739	20.2812	20.2600	19.9845	19.1024	18.0149	17.1786 (93)
adjusted MIT	17.2535	17.7134	18.3792	19.1964	19.8254	20.1739	20.2812	20.2600	19.9845	19.1024	18.0149	17.1786 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9862	0.9673	0.9304	0.8507	0.7245	0.5604	0.4130	0.4735	0.7135	0.9082	0.9742	0.9891 (94)
Useful gains	2720.3862	3658.8980	4452.4611	5047.8070	4882.8265	3808.6956	2678.1614	2746.6050	3569.5387	3508.7287	2857.6198	2502.5287 (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	10026.5279	9902.7028	9166.7338	7888.3832	6216.6946	4237.7004	2798.7661	2931.2274	4484.8087	6505.1665	8373.7874	9985.4685 (97)
Space heating kWh	5435.7695	4195.8368	3507.4188	2045.2149	992.3979	0.0000	0.0000	0.0000	0.0000	2229.3497	3971.6407	5567.3072 (98a)
Space heating requirement - total per year (kWh/year)												27944.9355
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	5435.7695	4195.8368	3507.4188	2045.2149	992.3979	0.0000	0.0000	0.0000	0.0000	2229.3497	3971.6407	5567.3072 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												27944.9355
Space heating per m ²												(98c) / (4) = 33.5877 (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 %)												92.3000 (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	5435.7695	4195.8368	3507.4188	2045.2149	992.3979	0.0000	0.0000	0.0000	0.0000	2229.3497	3971.6407	5567.3072 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	5889.2410	4545.8687	3800.0204	2215.8341	1075.1873	0.0000	0.0000	0.0000	0.0000	2415.3302	4302.9693	6031.7521 (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)

Full SAP Calculation Printout



Water heating													
Water heating requirement	316.8709	280.3128	298.3018	263.8147	256.7023	232.3903	230.2817	238.9167	240.9428	267.3438	282.5896	313.6436	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.2518	88.1772	88.0219	87.6703	86.7884	79.8000	79.8000	79.8000	79.8000	87.7404	88.1397	88.2691	(217)
Fuel for water heating, kWh/month	359.0534	317.8970	338.8951	300.9168	295.7794	291.2159	288.5735	299.3944	301.9333	304.6987	320.6156	355.3267	(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	88.1218	70.6946	63.6527	46.6347	36.0220	29.4303	32.8604	42.7132	55.4803	72.7931	82.2197	90.5710	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-250.6316	-319.1330	-414.2758	-418.4544	-413.9117	-372.4425	-366.3686	-362.1808	-352.4562	-338.4725	-262.2612	-220.7711	(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	-267.6941	-541.4570	-1039.3865	-1511.5641	-1954.1163	-1948.8531	-1927.1578	-1652.7096	-1239.3348	-758.4589	-351.7009	-213.5444	(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												30276.2031	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3774.2997	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												711.1938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-17497.3369	(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												17350.3596	(238)

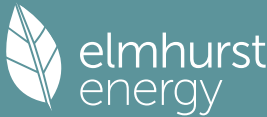
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	30276.2031	0.2100	6358.0027 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3774.2997	0.2100	792.6029 (264)
Space and water heating			7150.6056 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	711.1938	0.1443	102.6472 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4091.3593	0.1370	-560.3171
PV Unit electricity exported	-13405.9776	0.1269	-1700.6666
Total			-2260.9837 (269)
Total CO2, kg/year			5004.1984 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			6.0100 (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	30276.2031	1.1300	34212.1095 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3774.2997	1.1300	4264.9586 (278)
Space and water heating			38477.0681 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	711.1938	1.5338	1090.8528 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4091.3593	1.5063	-6162.7193
PV Unit electricity exported	-13405.9776	0.4657	-6243.1565
Total			-12405.8758 (283)
Total Primary energy kWh/year			27292.1460 (286)
Target Primary Energy Rate (TPER)			32.8000 (287)

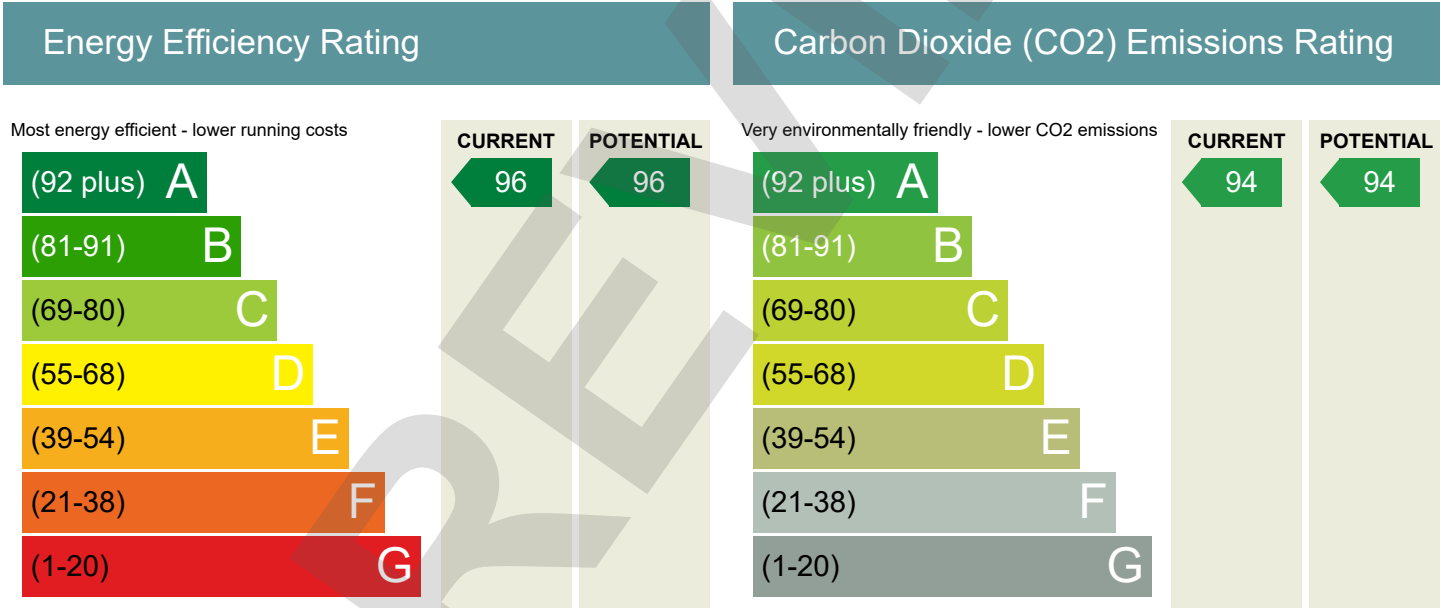
Energy Report



Dwelling Address	Twinwoods, 119 Ducks Hill Road, Northwood, LONDON, HA6 2SQ
Reference	Twinwoods-Be Green
Assessment Date	23/12/2024
Submission Date	
Property Type	House, Detached
Total Floor Area	832

This Energy Report has been generated using the UK's National Calculation Methodology for dwellings, Standard Assessment Procedure (SAP). This methodology is used to assess the energy efficiency of dwellings which is calculated based on a dwelling's heating, hot water, ventilation and lighting usage.

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations



Additional ratings for your home

	Primary Energy	Energy	Carbon	Cost	HTC
CURRENT	23.10 kWh	13493 kWh	3388 kg	774.88 £	565 W/K
POTENTIAL	23.10 kWh	13493 kWh	3388 kg	774.88 £	565 W/K

PREVIEW

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor	Poor	Average	Good	Very Good
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Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.1 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Boiler and radiators, mains gas	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Good lighting efficiency	Good
Air tightness	Air permeability [AP50] = 4.0 m ³ /h.m ² (assumed)	Good

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measures	Cumulative savings (per year)	Cumulative rating	Typical costs	Incremental savings (per year)	Cumulative CO2 rating
Solar water heating	£45	A 96			A 94

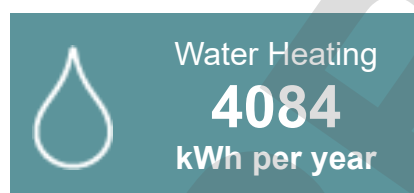
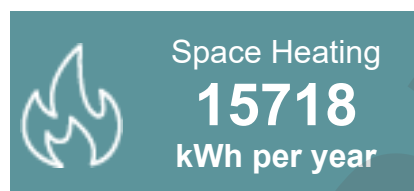
The typical cost is based on average installation prices across the country so may not be representative of the actual costs in your area.

Estimated energy costs of the dwelling

The table below shows the estimated running costs of the space and water heating and lighting within the dwelling. It does not include the energy used from household appliances. The estimated annual costs after potential improvements indicates the total energy cost if all recommended measures named above were installed.

		Estimated annual costs	Estimated annual costs after potential improvements	Potential future savings
Lighting		£181	£181	
Heating		£1654	£1654	
Hot Water		£229	£229	
New Technologies e.g. Impact of PV		-(£1289)	-(£1289)	
TOTAL		£775	£775	

Estimated energy use and potential savings



About this document

Created by:
Company/Trading name:
Phone number:
Email address:

Disclaimer

This Energy Report should not under any circumstances be treated as a Condition Survey and cannot be used to indicate that any element of the dwelling (e.g. heating system) is working correctly.
This Energy Report must not be used in situations where an Energy Performance Certificate (EPC) is required.
This Energy Report is generated from a set of data inputs which may not reflect the actual dimensions, services or construction of the dwelling.
The calculation used to generate this report reflects the SAP Methodology current at the time of report generation.

Glossary terms for additional metrics

Primary Energy	The measure of the energy required for lighting, heating and hot water in a property. This includes the efficiency of the property's heating system, power station efficiency for electricity and the energy used to produce the fuel and deliver it to the property.
Energy Used	The estimated amount of fuel energy for lighting, heating and hot water for the property. The estimate is based on typical usage which is likely to be different to actual consumption.
Carbon (CO ₂)	The current emissions based on the energy estimates.
Cost	The estimated cost of energy. The cost of each unit of fuel is based on an industry standard which is likely to be different to those the occupier actually pays.
Heat Transfer Coefficient	Heat flow through the property envelope where internal and external temperatures are different.

Predicted Energy Assessment



Twinwoods, 119 Ducks Hill Road, Northwood, LONDON,
HA6 2SQ

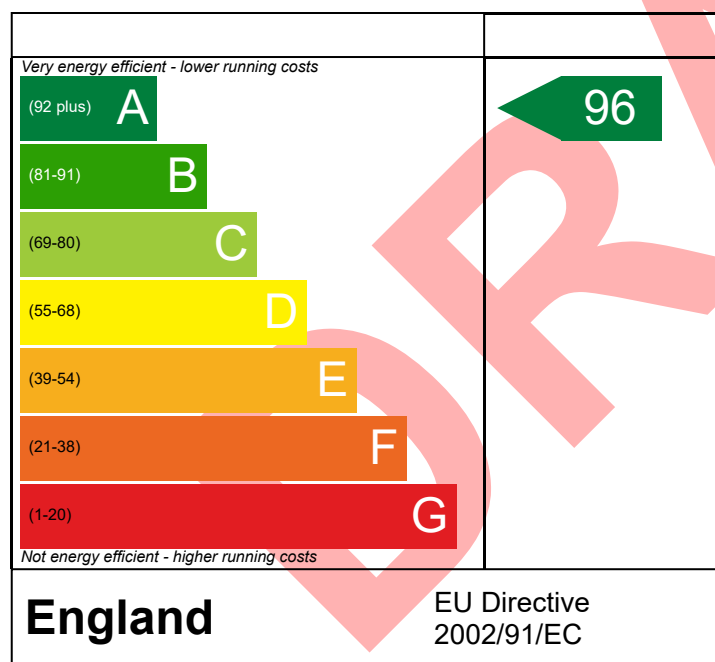
Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Detached
23/12/2024
Ondrej Gajdos
832 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

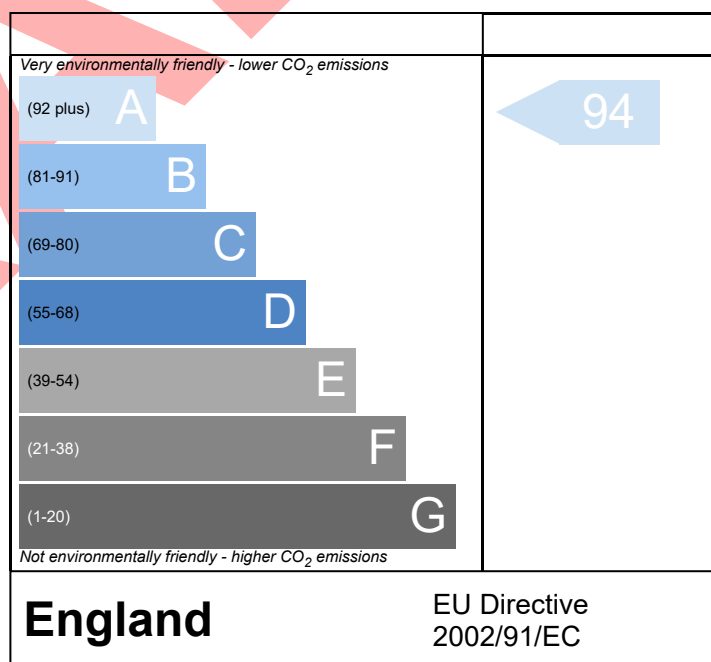
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Site Information	
Site Name	Twinwoods
Reg Number	
Street 1	119 Ducks Hill Rd
Street 2	
Area	
Town or City	Nortwood
Post Code	HA6 2SQ

Installation Type	Average Capacity/Flow Rate	Litres/Person/Day
Single Flush WC's	0	0
Dual Flush WC's	3.99	17.64
All WC's	3.99	17.64
Kitchen/Utility Room Taps	8	13.88
Other Taps	6	11.06
Baths	160	17.6
Showers	8	34.96
Dishwashers	0.5	1.8
Washing Machines	6	12.6
Water Softener		
Waste Disposal Unit	Not Present	0
Total Water Use	109.54 Litres/Person/Day	
Contribution from Rain Water	0 Litres/Person/Day	
Contribution from Grey Water	0 Litres/Person/Day	
Normalisation Factor	0.91 Litres/Person/Day	

Code for Sustainable Homes - Consumptions & Credits	
Water Consumption (Code for Sustainable Homes)	99.7 Litres/Person/Day
Credits Scored	3

Building Regulations 2000 AD Part G (2010 Ed) - Consumption	
External Water Use	5 Litres/Person/Day
Water Consumption (Building Regulation 17 K)	104.7 Litres/Person/Day

Kitchen/Utility Room Taps						
Description	Flow Rate	Qty	Total Water	Grey Water	Rain Water	Net Water
Kitchen tap 8 l/min	8	2	16	0	0	16
Total Litres/Person/Day Gross						13.88
Total Litres/Person/Day Gross						13.88

Other Taps						
Description	Flow Rate	Qty	Total Water	Grey Water	Rain Water	Net Water
Basin taps 8 l/min	6	6	36	0	0	36
Total Litres/Person/Day Gross						11.06
Total Litres/Person/Day Gross						11.06

Baths						
Description	Capacity	Qty	Total Water	Grey Water	Rain Water	Net Water
170 l bath	160	3	480	0	0	480
Total Litres/Person/Day Gross						17.6
Total Litres/Person/Day Gross						17.6

Showers						
Description	Flow Rate	Qty	Total Water	Grey Water	Rain Water	Net Water
Shower 8 l/min	8	6	48	0	0	48
Total Litres/Person/Day Gross						34.96
Total Litres/Person/Day Gross						34.96

Washing Machines						
Description	L/Kg Dry Load	Qty	Total Water	Grey Water	Rain Water	Net Water
Washing Machine 6 l/kg	6	1	6			6
Total Litres/Person/Day Gross						12.6
Total Litres/Person/Day Gross						12.6

Dishwashers						
Description	L/Place Setting	Qty	Total Water	Grey Water	Rain Water	Net Water
DW 0.5 L/ps	0.5	1	0.5	0	0	0.5
Total Litres/Person/Day Gross						1.8
Total Litres/Person/Day Gross						1.8

Single Flush WC's						
Description	Flush Volume	Qty	Total Water	Grey Water	Rain Water	Net Water
Total Litres/Person/Day Gross						0
Total Litres/Person/Day Gross						0

Dual Flush WC's						
Description	Flush Vol (P/F)	Qty	Total Water	Grey Water	Rain Water	Net Water
WC dual flush 3/6	3/6	3	11.97			0
Total Litres/Person/Day Gross						17.64
Total Litres/Person/Day Gross						17.64

Ion Exchange Water Softener	
% of Total Capacity Used Per	
Water Consumed Per Regeneration	
Average Regeneration Cycles Per Day	
Occupants Served by the System	
Water Consumed Beyond 4%	
Water Consumed Beyond 4%	

Rain Water Collection	
Collection Area	
Yield Co-Efficient	
Hydraulic Filter Efficiency	
Average Rainfall	
Daily Rain Water Collection	
Number of Occupants	
Daily Rain Water Per Person	