ENERGY STATEMENT

Proposed New mixed use development at;
Heath Buildings, High Street, Oxshott, Surrey, KT22 0JP

Statement and Part L calculations prepared by:
Mike Andrews
Energy Saving Experts Ltd

[redacted]

1/ Introduction

The aim of this Energy Statement is to demonstrate compliance with Elmbridge Borough Council Core Strategy (2011) contains policy CS27 requirements:
To reduce the carbon foot print of new development the Council will expect, where viable both financially and technically, residential development of 10 or more dwellings to meet level four of the Code for Sustainable Homes in relation to the energy and CO2 emissions category (74), or higher as dictated by future legislation and guidance

The footnote (74) relating to the policy text goes on to clarify: Equivalent to an on site reduction in total (regulated and unregulated) CO2 emissions of at least 40% in comparison with total emissions from a building which complies with Building Regulations 2006.

The requirements of the above are now largely superseded by later developments in Part L. The current SAP/SBEM methodology for residential and non-residential by minimum compliance show a 31% improvement (residential) and a 27% improvement (Non-residential) on the older 2010 Regulations. Those 2010 Regulations were in effect a 25% improvement on the 2006 Regulations. Therefore, compliance with the current 2021 regulations will more than meet the requirements set out above.
The Code for Sustainable Homes was withdrawn except for legacy projects in 2015.

The proposed is a mixed-use development of 4 commercial units and 9 residential flats above.

This Statement and calculations have been completed in line with Part L 2021 and the requirements of the Elmbridge Borough as above.

Please refer to the Application drawings submitted with the planning application.

2/ Building Regulations

No Building Regulations submission has been made in respect of the proposed development.

Important Notice:

This Statement and accompanying SAP calculations are for the purpose of a Planning Application ONLY and must not be used for Building Regulations purposes. We accept no responsibility for errors arising if these calculations and statement content is used for Building Regulations compliance.

Part L1 Calculation – Methodology

The building was assessed using SAP & SBEM to establish a baseline energy use and CO2 emissions, the Notional Building, and to determine the same for the Proposed Building. The Proposed must be lower than the Notional to demonstrate a pass.

Thermal and Controlled Elements
The building elements will exceed current Building Regulations maximum requirements as indicated in the following table:

Element	Part L Maximum	Proposed
External wall U Value	0.18	0.18
Ground floor U value	0.18	0.18
Roof U value	0.15	0.14
Windows & glazed doors U value	0.14	0.13
Air Permeability	8	4.8

Mechanical & Electrical Services
A gas combi boiler to underfloor heating is proposed for the residential flats, for the commercial units a split system ASHP.
How water will be provided by the combi boiler and instant electric units in the commercial.

The heating systems will include a control system appropriate to the systems, including time and temperature zone control for underfloor heating.

The local extracts will have a maximum SFP of 0.3 W/l/s.

Ventilation strategy is for natural ventilation and will be designed to meet the requirements of Building Regulations Part F Section 5 in full.

Lighting is 100% LED low energy.

Solar PV is proposed for each unit. A 2.0kWp system for flats 1-8 and for flat 9 a 3.0kWp system.
Each commercial unit a 1.0kWp system.
The proposed PV is to be mounted on the flat roof.

CO2 emissions and Primary Energy
One Commercial unit and two residential units was calculated to be representative of the whole development

	TER kgco2/m2/yr	DER/BER kgco2/m2/yr	TPER kWh/m2/yr	DPER/BPER kWh/m2/yr
Commercial Unit	4.92	3.88	52.89	41.62
Residential unit 6	10.91	10.61	58.07	56.00
Residential unit 9	11.97	11.94	63.3	63.17

Energy
The proposed will improve on current Building Regulations requirements in terms of CO2 reductions and Primary Energy over the Notional building to which they are compared.

EPC ratings for each units will be band A

On Site renewable energy reduction
PV contribution to reduction in energy use over the 3 modelled units is 23.1%.
Additional onsite reduction from the ASHP in the commercial unit is 7.7%
Total on site reduction in energy use from renewable technology is 30.8%.

Waste and Recycling
The proposed will have internal/external waste & recycling provision.

There will be a Construction Site Waste Management plan followed during construction work, and recycling of materials identified and reused where possible.

A policy of monitoring and diverting from landfill will be adopted throughout the construction period. There is adequate site space to store materials before disposal.

Internal Water
Internal water use will be reduced by low flush W/C's, and low flow rate taps and showers. There will also be a rainwater harvesting system.

Materials
All new Materials will be Green Guide Rated.

Pollution
Any new Insulation will have a low or zero GWP.

Health and Wellbeing
Adequate daylighting will be provided by the proposed windows.

Compliant Fire & CO detection & alarm systems will be provided.

Management
The site will be subject to the Considerate Constructors Scheme.

Mike Andrews DipNDEA, DipOCEA, DipHI, DipDEC
Energy Saving Experts Ltd 01225 862266 www.energy-saving-experts.com
10/01/24

Attachments:

SAP Worksheets, Summary documents, SBEM BRUKL and data input. (For DER/BER CO2 emissions figures only – NOT to be used for Building Regs compliance)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name **Shell and Core**

5847 As designed

Date: Wed Jan 10 10:35:43 2024

Administrative information

Building Details

Address: Commercial Unit, Heath Buildings, High Street, Oxshott,Leatherhead, KT220JP

Certifier details

Name: Michael Andrews

Telephone number: 01225 862266

Address: 9 woolley Drive, Bradford on Avon, BA15 1AU

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.0

Interface to calculation engine: iSBEM

Interface to calculation engine version: v6.1.e

BRUKL compliance module version: v6.1.e.0

Foundation area [m^2]: 17.24

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	4.92	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	3.88	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	52.89	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	41.62	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.18	0.18	Z0/01/s
Floors	0.18	0.18	0.18	Z0/01/f
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	-	-	No heat loss flat roofs
Windows** and roof windows	1.6	1.4	1.4	Z0/01/e/g
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HEATING

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.5	5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Default HWS

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

Shell and core configuration

Zone	**Assumed shell?**
Z0/01	YES

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
Z0/01	120	90	1.667

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
Z0/01	NO (-38.8%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	86.2	86.2
External area [m^2]	176.8	176.8
Weather	LON	LON
Infiltration [m^3/hm^2 @ 50Pa]	5	5
Average conductance [W/K]	50.07	42.51
Average U-value [W/m^2K]	0.28	0.24
Alpha value* [%]	17.73	69.05

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	6.33	10.01
Cooling	9.58	3.24
Auxiliary	0	0
Lighting	18.57	20.64
Hot water	1.7	1.7
Equipment*	20.26	20.26
TOTAL**	**36.18**	**35.58**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	8.91	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*8.91*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	196.79	146.39
Primary energy [kWh_{PE}/m^2]	41.62	52.89
Total emissions [kg/m^2]	3.88	4.92

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	74.4	122.4	6.3	9.6	0	3.26	3.55	3.5	5
	Notional	95.1	51.3	10	3.2	0	2.64	4.4	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

SBEM Data Reflection Report — Actual Building

Date: Wed Jan 10 10:35:42 2024

Project name: 5847

Building type: Retail/Financial and Professional services

Building area [m2]: 86.21

General

Building address	Commercial Unit Heath Buildings High Street Oxshott,Leatherhead KT220JP
Building / Foundation areas [m2]	86.21 / 17.24
Weather	LON
Building rotation [degrees]	0
Maximum no. of storeys	1

Accredited person/Energy assessor

Name	Michael Andrews
Telephone number	01225 862266
Address	9 woolley Drive Bradford on Avon BA15 1AU
Email	info@energy-saving-experts.com

Analysis

Compliance with	England Building Regulations Part L 2021
Asset rating	None
Stage	As designed
Shell & core building	YES
Modular & portable building	NO
Planned time of use	-
Distress purchase	-
Manufacture date of subassemblies	-

Software

SBEM version	v6.1.e.0
Interface to SBEM	iSBEM
Interface version	v6.1.e

Project building services

Electric power factor	<0.9
Submetering and M&T for lighting systems	NO
Emission factor for district heating [kgCO2/kWh]	0.36
Primary energy factor for district heating [kWhPE/kWh]	1.58
New district heating network	NO

Summary of objects

Object type	Total number	Total related area [m2]
Envelope/Door constructions	4	-
Window/Rooflight constructions	1	-
HW systems	1	-
Shower types	1	-
SE systems	0	0
PV systems	1	1e-005
Wind generators	0	-
CHP generators	0	-
Solar collectors	0	0
HVAC systems	1	-
Zones	1	86.21
Envelopes	7	318.21
Doors	0	0
Windows/Rooflights	2	14.96

Envelope/Door constructions

Name	U-value [W/m2K]	Adjusted U-value	Km [kJ/m2K]	Metal clad
EXT WALL	0.18	NO	129	NO
PARTY WALL	0.27	NO	129	NO
GF	0.18	YES	36	NO
SUSP FLOOR/CEILING	0.6	NO	4	NO

Window/Rooflight constructions

Name	U-value [W/m2K]	Solar transmittance	Light transmittance
WINDOWS AND GL DOORS	1.4	0.72	0.8

Notes

Hot water systems	
Name	Default HWS
Generator Type	Instantaneous hot water only
Fuel type	Grid Supplied Electricity
Seasonal efficiency	1
Uses CHP	NO
Storage system	NO
Storage volume [litres]	-
Insulation thickness [mm]	-
Secondary circulation	-
Circulation losses [W/m]	-
Pump power [kW]	-
Loop length [m]	-
Showers served	Default (x1)

Shower types	
Name	Default
Type	Standard flow
Above bath	NO
WWHRS fitted	NO
HR seasonal efficiency	-
Pump nominal power [W]	-

Notes

Photovoltaic systems	
(Multiplier) Name	(1) pv
Area [m2]	-
Module type	-
Peak power [kWp]	1
Orientation	South
Inclination [deg]	0
Overshading	None or very little (<20%)
Ventilation	Moderately ventilated modules

Notes

Heating, ventilation, and air conditioning systems	
Name	HEATING
Type	Split or multi-split system
Heat source	Heat pump (electric): air source
Heating fuel type	Grid Supplied Electricity
Heat generator seasonal efficiency	3.5
Uses CHP	NO
Variable speed pumping type	-
Heat generator radiant efficiency	-
Integral fan power [W/kW]	-
Cooling generator type	Heat pump (electric)
Cooling fuel type	Grid Supplied Electricity
Cooling generator seasonal EER	5
Cooling generator nominal EER	4
Mixed-mode cooling operation	NO
Heat recovery system	-
Heat recovery seasonal efficiency	-
Variable heat recovery efficiency	-
Specific fan power [W/(l/s)]	-
Air leakage via ductwork & AHU [%]	-
Submetering and M&T for this system	NO

Notes

Zone name: Z0/01 | **Activity:** Retail Warehouse Sales area - general | **Multiplier:** 1

Area [m2]: 86.21 | **Height [m]:** 3.4 | **Air permeability @ 50pa [m3/hm2]:** 5

HVAC system, ventilation, and exhaust

Name	HEATING
Destratification fans	NO
Ventilation type	Natural
SFP for local mechanical supply & extract [W/(l/s)]	-
Heat Recovery system	-
Heat recovery seasonal efficiency	-
Variable heat recovery efficiency	-
Local mechanical exhaust	NO
Exhaust air flow rate [l/s.m2]	-
SFP for mechanical exhaust [W/(l/s)]	-
Exhaust fans location	-
SFP for system terminal units [W/(l/s)]	-
Demand-controlled ventilation	None
Flow regulation type for ventilation control	-
Night cooling maximum hours [hours/month]	-
Night cooling maximum air flow rate [l/s.m2]	-
SFP for night cooling [W/(l/s)]	-

General Lighting and controls

Design illuminance [Lux]	300
Total power [W]	-
Lamp & ballast efficacy [lm/W]	120
Light output ratio	1
Lamp type	-
Air-extracting luminaires	NO
Controls	MANUAL
Type of photoelectric control	-
Constant illumincance control	NO
Controls parasitic power [W/m2]	-
Automatic zoning for daylight	YES
Occupancy sensing	NONE
Occupancy sensing parasitic power [W/m2]	-

Display lighting

Efficient lamps	YES
Lamp & ballast efficacy [lm/W]	90
Time switching	NO

Thermal bridges Psi values [W/mK]

Junction type	Metal clad	Not metal clad
Roof-wall	0.42	0.12
Wall-ground floor	1.725	0.16
Wall-wall (corner)	0.375	0.09
Wall-not ground floor	0.04	0.07
Lintel (window/door)	1.905	0.3
Sill (window)	1.905	0.04
Jamb (window/door)	1.905	0.05

Hot water system

Name	Default HWS
Dead leg length in this zone [m]	0

Shell & core

Shell area for fit-out	YES

Envelopes

(Multiplier) Name	(1) Z0/01/s	(1) Z0/01/e	(1) Z0/01/ni	(1) Z0/01/w	(1) Z0/01/cu	(1) Z0/01/f	(1) Z0/01/ei
Type	Wall	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling	Wall
Area [m2]	52.73	17.66	52.73	20.17	86.21	86.21	2.5
Orientation	South	East	North	West	Horizontal	Horizontal	East
Adjacent space	Exterior	Exterior	Conditioned	Exterior	Conditioned	Underground	Conditioned
Construction name	EXT WALL	EXT WALL	PARTY WALL	EXT WALL	SUSP FLOOR/CEILING	GF	PARTY WALL

Windows & rooflights

(Multiplier) Name	(1) Z0/01/e/g	(1) Z0/01/w/g
In envelope	Z0/01/e	Z0/01/w
Area [m2]	11.34	3.62
Glazing name	WINDOWS AND GL DOORS	WINDOWS AND GL DOORS
Shading position	None (no shading)	None (no shading)
Shading colour	-	-
Shading translucency	-	-
Transmission factor	1	1
Frame / Aspect ratios	0.44 / 0.62	0.32 / 1.73

Notes

Full SAP Calculation Printout

Property Reference	5847-SUST-WHD-HEATH BDGS 6	**Issued on Date**	10/01/2024
Assessment Reference	00001	**Prop Type Ref**	
Property	Heath Buildings, UNIT 6, High St, Oxshott, Leatherhead, KT22 0JP		

SAP Rating	93 A	**DER**	10.61	**TER**	10.91
Environmental	91 B	**% DER < TER**			2.75
CO_2 Emissions (t/year)	0.88	**DFEE**	27.63	**TFEE**	27.64
Compliance Check	See BREL	**% DFEE < TFEE**			0.05
% DPER < TPER	3.57	**DPER**	56.00	**TPER**	58.07

Assessor Details	Mr. Michael Andrews	**Assessor ID**	N388-0001
Client	WOLSEY HOUSE DESIGNS, WOLSEY HOUSE DESIGNS		

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	99.0500 (1b)	x	2.7200 (2b)	=	269.4160 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	269.4160	(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	5 * 10 =	50.0000 (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) =	50.0000 / (5) =	0.1856 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.8000 (17)
Infiltration rate		0.4256 (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) =	0.3617 (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	0.4612	0.4522	0.4431	0.3979	0.3889	0.3437	0.3437	0.3346	0.3617	0.3889	0.4070	0.4251	(22b)
Effective ac	0.6064	0.6022	0.5982	0.5792	0.5756	0.5591	0.5591	0.5560	0.5654	0.5756	0.5828	0.5903	(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	
Entrance door			1.9100	1.0000	1.9100			(26)
WINDOWS AND GL DOORS (Uw = 1.30)			8.4700	1.2357	10.4667			(27)
External Wall 1	63.0500	10.3800	52.6700	0.1800	9.4806	70.0000	3686.9000	(29a)
External Roof 1	40.3500		40.3500	0.1400	5.6490	9.0000	363.1500	(30)
External Roof 2	25.0600		25.0600	0.1400	3.5084	9.0000	225.5400	(30)
Total net area of external elements Aum(A, m2)			128.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.0147			(33)
Party Wall 1			49.2000	0.0000	0.0000	45.0000	2214.0000	(32)
Party Floor 1			99.0500			135.0000	13371.7500	(32d)
Party Ceiling 1			33.6400			135.0000	4541.4000	(32b)
Internal Wall 1			152.9300			9.0000	1376.3700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25779.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		260.2636 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	4.7900	0.0300	0.1437
E3	Sill	4.7900	0.0300	0.1437
E4	Jamb	17.6800	0.0300	0.5304
E7	Party floor between dwellings (in blocks of flats)	23.1800	0.0600	1.3908

E16 Corner (normal)	2.7200	0.0600	0.1632
E14 Flat roof	12.1400	0.0600	0.7284
E17 Corner (inverted – internal area greater than external area)	2.7200	-0.0900	-0.2448
E10 Eaves (insulation at ceiling level)	12.9500	0.0600	0.7770
E18 Party wall between dwellings	10.8800	0.0600	0.6528
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	26.2200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.3400	0.0600	0.3204

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.6056 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 35.6203 (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	53.9104	53.5432	53.1832	51.4926	51.1763	49.7037	49.7037	49.4311	50.2709	51.1763	51.8162	52.4851	(38)
Heat transfer coeff	89.5307	89.1635	88.8035	87.1129	86.7966	85.3241	85.3241	85.0514	85.8913	86.7966	87.4365	88.1055	(39)

Average = Sum(39)m / 12 = 87.1114

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9039	0.9002	0.8966	0.8795	0.8763	0.8614	0.8614	0.8587	0.8672	0.8763	0.8828	0.8895	(40)
HLP (average)												0.8795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7306 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	70.0022	68.9502	67.4173	64.4842	62.3197	59.9058	58.5338	60.0552	61.7229	64.3146	67.3107	69.7340	(42a)
Hot water usage for baths	30.2265	29.7776	29.1454	27.9798	27.1071	26.1393	25.6166	26.2443	26.9278	27.9633	29.1529	30.1243	(42b)
Hot water usage for other uses	42.5936	41.0448	39.4959	37.9470	36.3982	34.8493	34.8493	36.3982	37.9470	39.4959	41.0448	42.5936	(42c)

Average daily hot water use (litres/day) 131.2859 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8223	139.7726	136.0586	130.4111	125.8249	120.8945	118.9997	122.6976	126.5977	131.7738	137.5083	142.4519	(44)
Energy conte	226.1956	199.0343	209.1170	178.5263	169.3846	148.6538	143.9198	151.9253	156.1076	178.8158	195.9058	223.0453	(45)

Energy content (annual) Total = Sum(45)m = 2180.6312

Distribution loss (46)m = 0.15 x (45)m	33.9293	29.8551	31.3675	26.7789	25.4077	22.2981	21.5880	22.7888	23.4161	26.8224	29.3859	33.4568	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	31.0015	27.9971	30.9878	29.9691	30.9560	29.9452	30.9356	30.9421	29.9512	30.9636	29.9830	30.9989	(61)
Total heat required for water heating calculated for each month	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(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	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(64)

Total per year (kWh/year) = Sum(64)m = 2545.2624 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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

Heat gains from water heating, kWh/month	82.9604	73.1782	77.2783	66.8523	64.0594	56.9137	55.5872	58.2507	59.3936	67.1972	72.6344	81.9123	(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	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.3599	32.2946	26.2637	19.8833	14.8630	12.5480	13.5585	17.6239	23.6548	30.0352	35.0555	37.3705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	380.2728	384.2188	374.2749	353.1055	326.3830	301.2676	284.4889	280.5429	290.4868	311.6562	338.3787	363.4941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	(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)	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	(71)
Water heating gains (Table 5)	111.5059	108.8961	103.8687	92.8504	86.1013	79.0468	74.7140	78.2939	82.4911	90.3188	100.8812	110.0972	(72)
Total internal gains	639.8636	637.1345	616.1324	577.5642	539.0723	501.5874	481.4865	485.1857	505.3576	543.7351	586.0403	622.6868	(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	
South	1.2300	46.7521	0.7200	0.7000	0.7700	20.0849	(78)
West	7.2400	19.6403	0.7200	0.7000	0.7700	49.6649	(80)

Solar gains	69.7498	130.0490	201.9016	280.7086	335.3300	340.2441	325.1145	284.4727	229.8579	150.7619	85.7338	58.1972	(83)
Total gains	709.6135	767.1835	818.0340	858.2728	874.4023	841.8315	806.6010	769.6585	735.2155	694.4969	671.7741	680.8840	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9822	80.3116	80.6371	82.2021	82.5017	83.9255	83.9255	84.1946	83.3713	82.5017	81.8979	81.2760	
alpha	6.3321	6.3541	6.3758	6.4801	6.5001	6.5950	6.5950	6.6130	6.5581	6.5001	6.4599	6.4184	
util living area	0.9953	0.9912	0.9790	0.9375	0.8296	0.6350	0.4638	0.5055	0.7588	0.9512	0.9902	0.9963	(86)
MIT	20.3026	20.3959	20.5507	20.7461	20.8846	20.9434	20.9518	20.9512	20.9238	20.7522	20.4980	20.2909	(87)
Th 2	20.1642	20.1673	20.1704	20.1850	20.1877	20.2004	20.2004	20.2028	20.1955	20.1877	20.1822	20.1764	(88)
util rest of house	0.9938	0.9884	0.9722	0.9174	0.7823	0.5617	0.3805	0.4194	0.6881	0.9312	0.9865	0.9951	(89)
MIT 2	19.3471	19.4683	19.6657	19.9162	20.0706	20.1346	20.1396	20.1418	20.1160	19.9298	19.6111	19.3424	(90)
Living area fraction									fLA = Living area / (4) =			0.4959	(91)
MIT	19.8209	19.9283	20.1046	20.3278	20.4743	20.5357	20.5424	20.5432	20.5166	20.3377	20.0509	19.8127	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.6709	19.7783	19.9546	20.1778	20.3243	20.3857	20.3924	20.3932	20.3666	20.1877	19.9009	19.6627	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9868	0.9700	0.9172	0.7909	0.5791	0.4006	0.4402	0.7041	0.9312	0.9849	0.9941	(94)
Useful gains	704.3879	757.0342	793.4892	787.2186	691.5469	487.5092	323.1122	338.7766	517.6420	646.7306	661.6208	676.8897	(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	1376.1698	1326.6008	1194.8155	982.4381	748.5570	493.6594	323.5817	339.6267	538.2483	832.1754	1119.2637	1362.3513	(97)
Space heating kWh	499.8058	382.7488	298.5868	140.5580	42.4156	0.0000	0.0000	0.0000	0.0000	137.9709	329.5029	509.9834	(98a)
Space heating requirement - total per year (kWh/year)												2341.5723	
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	499.8058	382.7488	298.5868	140.5580	42.4156	0.0000	0.0000	0.0000	0.0000	137.9709	329.5029	509.9834	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2341.5723	
Space heating per m2											(98c) / (4) =	23.6403	(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	499.8058	382.7488	298.5868	140.5580	42.4156	0.0000	0.0000	0.0000	0.0000	137.9709	329.5029	509.9834	(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)	563.4789	431.5093	336.6255	158.4645	47.8191	0.0000	0.0000	0.0000	0.0000	155.5478	371.4802	574.9531	(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	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5295	88.5132	88.4764	88.4007	88.2870	88.2000	88.2000	88.2000	88.2000	88.3977	88.4960	88.5331	(217)
Fuel for water heating, kWh/month	290.5214	256.4944	271.3771	235.8527	226.9198	202.4933	198.2488	207.3326	210.9510	237.3132	255.2533	286.9483	(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	31.8256	25.5317	22.9885	16.8423	13.0095	10.6289	11.8677	15.4261	20.0370	26.2896	29.6940	32.7102	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-22.8890	-37.4397	-62.6995	-79.1729	-90.7492	-86.4079	-84.8445	-77.0647	-63.4160	-46.1065	-26.5587	-18.9810	(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	-8.0614	-20.6211	-51.5789	-93.6271	-137.8076	-143.9921	-140.1411	-109.8281	-69.0640	-32.4599	-11.4573	-6.0174	(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	2639.8785	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	2879.7059	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	256.8512	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1520.9856	(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		4341.4500 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2639.8785	3.6400	96.0916	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2879.7059	3.6400	104.8213	(247)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	86.0000	18.5800	15.9788	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	256.8512	18.5800	47.7230	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-696.3295	18.5800	-129.3780	
PV Unit electricity exported	-824.6561	5.5900	-46.0983	
Total			-175.4763	(252)
Total energy cost			181.1383	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4527 (257)
SAP value		92.6619
SAP rating (Section 12)		93 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2639.8785	0.2100	554.3745	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2879.7059	0.2100	604.7382	(264)
Space and water heating			1159.1127	(265)
Pumps, fans and electric keep-hot	86.0000	0.1432	12.3154	(267)
Energy for lighting	256.8512	0.1490	38.2759	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-696.3295	0.1366	-95.1166	
PV Unit electricity exported	-824.6561	0.1215	-100.1949	
Total			-195.3115	(269)
Total CO2, kg/year			1014.3926	(272)
CO2 emissions per m2			10.2400	(273)
EI value			90.5638	
EI rating			91	(274)
EI band			B	

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		99.0500 (1b)	x	2.7200 (2b)	=	269.4160	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.0500						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	269.4160	(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		5 * 10 =	50.0000 (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) =		50.0000 / (5) =	0.1856 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			4.8000 (17)
Infiltration rate			0.4256 (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) =		0.3617 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.7000	3.4000	3.4000	3.2000	3.1000	2.9000	3.0000	2.8000	2.7000	2.8000	2.9000	3.2000	(22)
Wind factor	0.9250	0.8500	0.8500	0.8000	0.7750	0.7250	0.7500	0.7000	0.6750	0.7000	0.7250	0.8000	(22a)
Adj infilt rate	0.3346	0.3075	0.3075	0.2894	0.2804	0.2623	0.2713	0.2532	0.2442	0.2532	0.2623	0.2894	(22b)
Effective ac	0.5560	0.5473	0.5473	0.5419	0.5393	0.5344	0.5368	0.5321	0.5298	0.5321	0.5344	0.5419	(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	
Entrance door			1.9100	1.0000	1.9100			(26)
WINDOWS AND GL DOORS (Uw = 1.30)			8.4700	1.2357	10.4667			(27)
External Wall 1	63.0500	10.3800	52.6700	0.1800	9.4806	70.0000	3686.9000	(29a)
External Roof 1	40.3500		40.3500	0.1400	5.6490	9.0000	363.1500	(30)
External Roof 2	25.0600		25.0600	0.1400	3.5084	9.0000	225.5400	(30)
Total net area of external elements Aum(A, m2)			128.4600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0147			(33)
Party Wall 1			49.2000	0.0000	0.0000	45.0000	2214.0000	(32)
Party Floor 1			99.0500			135.0000	13371.7500	(32d)
Party Ceiling 1			33.6400			135.0000	4541.4000	(32b)
Internal Wall 1			152.9300			9.0000	1376.3700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25779.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 260.2636 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	4.7900	0.0300	0.1437
E3	Sill	4.7900	0.0300	0.1437
E4	Jamb	17.6800	0.0300	0.5304
E7	Party floor between dwellings (in blocks of flats)	23.1800	0.0600	1.3908
E16	Corner (normal)	2.7200	0.0600	0.1632
E14	Flat roof	12.1400	0.0600	0.7284
E17	Corner (inverted – internal area greater than external area)	2.7200	-0.0900	-0.2448
E10	Eaves (insulation at ceiling level)	12.9500	0.0600	0.7770
E18	Party wall between dwellings	10.8800	0.0600	0.6528
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	26.2200	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	5.3400	0.0600	0.3204

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.6056 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 35.6203 (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	49.4311	48.6566	48.6566	48.1767	47.9477	47.5114	47.7259	47.3041	47.1041	47.3041	47.5114	48.1767	(38)
Heat transfer coeff	85.0514	84.2770	84.2770	83.7970	83.5680	83.1317	83.3462	82.9244	82.7245	82.9244	83.1317	83.7970	(39)
Average = Sum(39)m / 12 =												83.5792	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8587	0.8509	0.8509	0.8460	0.8437	0.8393	0.8415	0.8372	0.8352	0.8372	0.8393	0.8460	(40)
HLP (average)												0.8438	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7306 (42)
Hot water usage for mixer showers

70.0022	68.9502	67.4173	64.4842	62.3197	59.9058	58.5338	60.0552	61.7229	64.3146	67.3107	69.7340	(42a)

Hot water usage for baths

30.2265	29.7776	29.1454	27.9798	27.1071	26.1393	25.6166	26.2443	26.9278	27.9633	29.1529	30.1243	(42b)

Hot water usage for other uses

42.5936	41.0448	39.4959	37.9470	36.3982	34.8493	34.8493	36.3982	37.9470	39.4959	41.0448	42.5936	(42c)

Average daily hot water use (litres/day) 131.2859 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8223	139.7726	136.0586	130.4111	125.8249	120.8945	118.9997	122.6976	126.5977	131.7738	137.5083	142.4519	(44)
Energy conte	226.1956	199.0343	209.1170	178.5263	169.3846	148.6538	143.9198	151.9253	156.1076	178.8158	195.9058	223.0453	(45)
Energy content (annual)										Total = Sum(45)m =		2180.6312	
Distribution loss (46)m = 0.15 x (45)m	33.9293	29.8551	31.3675	26.7789	25.4077	22.2981	21.5880	22.7888	23.4161	26.8224	29.3859	33.4568	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	31.0015	27.9971	30.9878	29.9691	30.9560	29.9452	30.9356	30.9421	29.9512	30.9636	29.9830	30.9989	(61)
Total heat required for water heating calculated for each month	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(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	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(64)
										Total per year (kWh/year) = Sum(64)m =		2545.2624	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	82.9604	73.1782	77.2783	66.8523	64.0594	56.9137	55.5872	58.2507	59.3936	67.1972	72.6344	81.9123	(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	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	36.3599	32.2946	26.2637	19.8833	14.8630	12.5480	13.5585	17.6239	23.6548	30.0352	35.0555	37.3705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	380.2728	384.2188	374.2749	353.1055	326.3830	301.2676	284.4889	280.5429	290.4868	311.6562	338.3787	363.4941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	(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)													
	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	(71)
Water heating gains (Table 5)													
	111.5059	108.8961	103.8687	92.8504	86.1013	79.0468	74.7140	78.2939	82.4911	90.3188	100.8812	110.0972	(72)
Total internal gains													
	639.8636	637.1345	616.1324	577.5642	539.0723	501.5874	481.4865	485.1857	505.3576	543.7351	586.0403	622.6868	(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	
South	1.2300	52.2144	0.7200	0.7000	0.7700	22.4315	(78)
West	7.2400	23.0226	0.7200	0.7000	0.7700	58.2178	(80)

Solar gains	80.6494	128.7114	203.1905	290.2136	339.2879	368.1903	349.8648	308.2974	248.2752	166.7106	98.3064	64.4750	(83)
Total gains	720.5130	765.8458	819.3228	867.7779	878.3602	869.7777	831.3513	793.4831	753.6328	710.4457	684.3468	687.1617	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	84.1946	84.9682	84.9682	85.4549	85.6891	86.1388	85.9171	86.3541	86.5628	86.3541	86.1388	85.4549	
alpha	6.6130	6.6645	6.6645	6.6970	6.7126	6.7426	6.7278	6.7569	6.7709	6.7569	6.7426	6.6970	
util living area													
	0.9932	0.9884	0.9703	0.9109	0.7625	0.5315	0.3607	0.3863	0.6729	0.9217	0.9852	0.9946	(86)
MIT	20.4112	20.4905	20.6409	20.8097	20.9200	20.9512	20.9536	20.9537	20.9424	20.8226	20.5881	20.4006	(87)
Th 2	20.2028	20.2095	20.2095	20.2136	20.2156	20.2194	20.2175	20.2212	20.2229	20.2212	20.2194	20.2136	(88)
util rest of house													
	0.9910	0.9847	0.9608	0.8844	0.7071	0.4593	0.2824	0.3052	0.5980	0.8924	0.9798	0.9929	(89)
MIT 2	19.5177	19.6236	19.8114	20.0152	20.1309	20.1590	20.1582	20.1621	20.1574	20.0404	19.7562	19.5135	(90)
Living area fraction										fLA = Living area / (4) =		0.4959	(91)
MIT	19.9608	20.0535	20.2228	20.4092	20.5222	20.5519	20.5527	20.5547	20.5467	20.4283	20.1688	19.9534	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.8108	19.9035	20.0728	20.2592	20.3722	20.4019	20.4027	20.4047	20.3967	20.2783	20.0188	19.8034	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9896	0.9830	0.9588	0.8861	0.7187	0.4763	0.3010	0.3244	0.6153	0.8949	0.9780	0.9917	(94)
Useful gains	713.0117	752.8011	785.6046	768.9306	631.2817	414.3119	250.2077	257.3687	463.7099	635.7560	669.3004	681.4486	(95)
Ext temp.	4.9000	5.4000	7.1000	9.5000	12.5000	15.4000	17.4000	17.3000	14.7000	11.2000	7.6000	4.9000	(96)
Heat loss rate W													
	1268.1828	1222.3089	1093.3051	901.5885	657.8666	415.8147	250.2620	257.4553	471.2571	752.8148	1032.3932	1248.8608	(97)
Space heating kWh													
	413.0473	315.5093	228.9292	95.5137	19.7791	0.0000	0.0000	0.0000	0.0000	87.0918	261.4269	422.1547	(98a)
Space heating requirement - total per year (kWh/year)												1843.4519	
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													
	413.0473	315.5093	228.9292	95.5137	19.7791	0.0000	0.0000	0.0000	0.0000	87.0918	261.4269	422.1547	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1843.4519	
Space heating per m2											(98c) / (4) =	18.6113	(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													
	413.0473	315.5093	228.9292	95.5137	19.7791	0.0000	0.0000	0.0000	0.0000	87.0918	261.4269	422.1547	(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)													
	465.6677	355.7038	258.0938	107.6817	22.2989	0.0000	0.0000	0.0000	0.0000	98.1869	294.7315	475.9354	(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													
	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5075	88.4901	88.4433	88.3565	88.2447	88.2000	88.2000	88.2000	88.2000	88.3461	88.4675	88.5115	(217)
Fuel for water heating, kWh/month													
	290.5937	256.5614	271.4786	235.9707	227.0285	202.4933	198.2488	207.3326	210.9510	237.4518	255.3353	287.0184	(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	31.8256	25.5317	22.9885	16.8423	13.0095	10.6289	11.8677	15.4261	20.0370	26.2896	29.6940	32.7102 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-26.5272	-37.9757	-64.0467	-81.6623	-91.9820	-90.3128	-88.5059	-81.1786	-67.3998	-50.5422	-30.4002	-21.2749 (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	-10.3752	-21.1603	-53.8029	-100.3537	-142.5268	-161.9752	-156.7165	-124.7606	-78.9042	-38.7378	-14.5278	-7.2947 (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	2078.2997 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	88.2000
Water heating fuel used	2880.4641 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	256.8512 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1642.9440 (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	3658.6710 (238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2078.2997	6.1900	128.6468	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2880.4641	6.1900	178.3007	(247)
Energy for instantaneous electric shower(s)	0.0000	28.2800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*29.80 + 0.10*14.60)	86.0000	28.2800	24.3208	(249)
Energy for lighting (0.90*29.80 + 0.10*14.60)	256.8512	28.2800	72.6375	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-731.8084	28.2800	-206.9554	
PV Unit electricity exported	-911.1356	5.8100	-52.9370	
Total			-259.8924	(252)
Total energy cost			246.0134	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2078.2997	0.2100	436.4429	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2880.4641	0.2100	604.8975	(264)
Space and water heating			1041.3404	(265)
Pumps, fans and electric keep-hot	86.0000	0.1432	12.3154	(267)
Energy for lighting	256.8512	0.1490	38.2759	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-731.8084	0.1367	-100.0538	
PV Unit electricity exported	-911.1356	0.1211	-110.3171	
Total			-210.3710	(269)
Total CO2, kg/year			881.5608	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2078.2997	1.1300	2348.4787	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2880.4641	1.1300	3254.9244	(278)
Space and water heating			5603.4031	(279)
Pumps, fans and electric keep-hot	86.0000	1.5335	131.8797	(281)
Energy for lighting	256.8512	1.5547	399.3380	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-731.8084	1.5098	-1104.8920	
PV Unit electricity exported	-911.1356	0.4441	-404.6597	
Total			-1509.5517	(283)
Total Primary energy kWh/year			4625.0692	(286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: A 93
Current environmental impact rating: B 91

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Typical annual savings | Energy efficiency | Environmental impact

Recommended measures
(none)

Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: A 93
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£97	£97	£0
Mains gas	£409	£409	£0
Space heating	£255	£255	£0
Water heating	£178	£178	£0
Lighting	£73	£73	£0
Generated (PV)	-£260	-£260	£0
Total cost of fuels	£246	£246	£0
Total cost of uses	£246	£246	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	47 kWh/m²	47 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	99.0500 (1b)	x	2.7200 (2b)	=	269.4160 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	269.4160	(5)

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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	5 * 10 =	50.0000	(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) =	50.0000 / (5) =	0.1856	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.8000	(17)
Infiltration rate		0.4256	(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) =	0.3617	(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	0.4612	0.4522	0.4431	0.3979	0.3889	0.3437	0.3437	0.3346	0.3617	0.3889	0.4070	0.4251	(22b)
Effective ac	0.6064	0.6022	0.5982	0.5792	0.5756	0.5591	0.5591	0.5560	0.5654	0.5756	0.5828	0.5903	(25)

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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	
Entrance door			1.9100	1.0000	1.9100			(26)

WINDOWS AND GL DOORS (Uw = 1.30)			8.4700	1.2357	10.4667			(27)
External Wall 1	63.0500	10.3800	52.6700	0.1800	9.4806	70.0000	3686.9000	(29a)
External Roof 1	40.3500		40.3500	0.1400	5.6490	9.0000	363.1500	(30)
External Roof 2	25.0600		25.0600	0.1400	3.5084	9.0000	225.5400	(30)
Total net area of external elements Aum(A, m2)			128.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.0147			(33)
Party Wall 1			49.2000	0.0000	0.0000	45.0000	2214.0000	(32)
Party Floor 1			99.0500			135.0000	13371.7500	(32d)
Party Ceiling 1			33.6400			135.0000	4541.4000	(32b)
Internal Wall 1			152.9300			9.0000	1376.3700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25779.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		260.2636 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	4.7900	0.0300	0.1437
E3 Sill	4.7900	0.0300	0.1437
E4 Jamb	17.6800	0.0300	0.5304
E7 Party floor between dwellings (in blocks of flats)	23.1800	0.0600	1.3908
E16 Corner (normal)	2.7200	0.0600	0.1632
E14 Flat roof	12.1400	0.0600	0.7284
E17 Corner (inverted – internal area greater than external area)	2.7200	-0.0900	-0.2448
E10 Eaves (insulation at ceiling level)	12.9500	0.0600	0.7770
E18 Party wall between dwellings	10.8800	0.0600	0.6528
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	26.2200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.3400	0.0600	0.3204

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.6056 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	35.6203 (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	53.9104	53.5432	53.1832	51.4926	51.1763	49.7037	49.7037	49.4311	50.2709	51.1763	51.8162	52.4851	(38)
Heat transfer coeff	89.5307	89.1635	88.8035	87.1129	86.7966	85.3241	85.3241	85.0514	85.8913	86.7966	87.4365	88.1055	(39)
Average = Sum(39)m / 12 =												87.1114	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9039	0.9002	0.8966	0.8795	0.8763	0.8614	0.8614	0.8587	0.8672	0.8763	0.8828	0.8895	(40)
HLP (average)												0.8795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7306	(42)
Hot water usage for mixer showers	70.0022	68.9502	67.4173	64.4842	62.3197	59.9058	58.5338	60.0552	61.7229	64.3146	67.3107	69.7340	(42a)
Hot water usage for baths	30.2265	29.7776	29.1454	27.9798	27.1071	26.1393	25.6166	26.2443	26.9278	27.9633	29.1529	30.1243	(42b)
Hot water usage for other uses	42.5936	41.0448	39.4959	37.9470	36.3982	34.8493	34.8493	36.3982	37.9470	39.4959	41.0448	42.5936	(42c)
Average daily hot water use (litres/day)												131.2859	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8223	139.7726	136.0586	130.4111	125.8249	120.8945	118.9997	122.6976	126.5977	131.7738	137.5083	142.4519	(44)
Energy conte	226.1956	199.0343	209.1170	178.5263	169.3846	148.6538	143.9198	151.9253	156.1076	178.8158	195.9058	223.0453	(45)
Energy content (annual)										Total = Sum(45)m =		2180.6312	
Distribution loss (46)m = 0.15 x (45)m	33.9293	29.8551	31.3675	26.7789	25.4077	22.2981	21.5880	22.7888	23.4161	26.8224	29.3859	33.4568	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	31.0015	27.9971	30.9878	29.9691	30.9560	29.9452	30.9356	30.9421	29.9512	30.9636	29.9830	30.9989	(61)
Total heat required for water heating calculated for each month	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(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	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(64)
								Total per year (kWh/year) = Sum(64)m =				2545.2624	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month	82.9604	73.1782	77.2783	66.8523	64.0594	56.9137	55.5872	58.2507	59.3936	67.1972	72.6344	81.9123	(65)

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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	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.3599	32.2946	26.2637	19.8833	14.8630	12.5480	13.5585	17.6239	23.6548	30.0352	35.0555	37.3705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	380.2728	384.2188	374.2749	353.1055	326.3830	301.2676	284.4889	280.5429	290.4868	311.6562	338.3787	363.4941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	(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)	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	(71)
Water heating gains (Table 5)	111.5059	108.8961	103.8687	92.8504	86.1013	79.0468	74.7140	78.2939	82.4911	90.3188	100.8812	110.0972	(72)
Total internal gains	639.8636	637.1345	616.1324	577.5642	539.0723	501.5874	481.4865	485.1857	505.3576	543.7351	586.0403	622.6868	(73)

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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	
South	1.2300	46.7521	0.7200	0.7000	0.7700	20.0849	(78)
West	7.2400	19.6403	0.7200	0.7000	0.7700	49.6649	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	69.7498	130.0490	201.9016	280.7086	335.3300	340.2441	325.1145	284.4727	229.8579	150.7619	85.7338	58.1972	(83)
Total gains	709.6135	767.1835	818.0340	858.2728	874.4023	841.8315	806.6010	769.6585	735.2155	694.4969	671.7741	680.8840	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9822	80.3116	80.6371	82.2021	82.5017	83.9255	83.9255	84.1946	83.3713	82.5017	81.8979	81.2760	
alpha	6.3321	6.3541	6.3758	6.4801	6.5001	6.5950	6.5950	6.6130	6.5581	6.5001	6.4599	6.4184	
util living area	0.9953	0.9912	0.9790	0.9375	0.8296	0.6350	0.4638	0.5055	0.7588	0.9512	0.9902	0.9963	(86)
MIT	20.3026	20.3959	20.5507	20.7461	20.8846	20.9434	20.9518	20.9512	20.9238	20.7522	20.4980	20.2909	(87)
Th 2	20.1642	20.1673	20.1704	20.1850	20.1877	20.2004	20.2004	20.2028	20.1955	20.1877	20.1822	20.1764	(88)
util rest of house	0.9938	0.9884	0.9722	0.9174	0.7823	0.5617	0.3805	0.4194	0.6881	0.9312	0.9865	0.9951	(89)
MIT 2	19.3471	19.4683	19.6657	19.9162	20.0706	20.1346	20.1396	20.1418	20.1160	19.9298	19.6111	19.3424	(90)
Living area fraction									fLA = Living area / (4) =			0.4959	(91)
MIT	19.8209	19.9283	20.1046	20.3278	20.4743	20.5357	20.5424	20.5432	20.5166	20.3377	20.0509	19.8127	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.6709	19.7783	19.9546	20.1778	20.3243	20.3857	20.3924	20.3932	20.3666	20.1877	19.9009	19.6627	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9868	0.9700	0.9172	0.7909	0.5791	0.4006	0.4402	0.7041	0.9312	0.9849	0.9941	(94)
Useful gains	704.3879	757.0342	793.4892	787.2186	691.5469	487.5092	323.1122	338.7766	517.6420	646.7306	661.6208	676.8897	(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	1376.1698	1326.6008	1194.8155	982.4381	748.5570	493.6594	323.5817	339.6267	538.2483	832.1754	1119.2637	1362.3513	(97)
Space heating kWh	499.8058	382.7488	298.5868	140.5580	42.4156	0.0000	0.0000	0.0000	0.0000	137.9709	329.5029	509.9834	(98a)
Space heating requirement - total per year (kWh/year)												2341.5723	
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	499.8058	382.7488	298.5868	140.5580	42.4156	0.0000	0.0000	0.0000	0.0000	137.9709	329.5029	509.9834	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2341.5723	
Space heating per m2										(98c) / (4) =		23.6403	(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	499.8058	382.7488	298.5868	140.5580	42.4156	0.0000	0.0000	0.0000	0.0000	137.9709	329.5029	509.9834	(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)	563.4789	431.5093	336.6255	158.4645	47.8191	0.0000	0.0000	0.0000	0.0000	155.5478	371.4802	574.9531	(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	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5295	88.5132	88.4764	88.4007	88.2870	88.2000	88.2000	88.2000	88.2000	88.3977	88.4960	88.5331	(217)
Fuel for water heating, kWh/month	290.5214	256.4944	271.3771	235.8527	226.9198	202.4933	198.2488	207.3326	210.9510	237.3132	255.2533	286.9483	(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	31.8256	25.5317	22.9885	16.8423	13.0095	10.6289	11.8677	15.4261	20.0370	26.2896	29.6940	32.7102	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-22.8890	-37.4397	-62.6995	-79.1729	-90.7492	-86.4079	-84.8445	-77.0647	-63.4160	-46.1065	-26.5587	-18.9810	(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	-8.0614	-20.6211	-51.5789	-93.6271	-137.8076	-143.9921	-140.1411	-109.8281	-69.0640	-32.4599	-11.4573	-6.0174	(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	2639.8785 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	88.2000
Water heating fuel used	2879.7059 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	256.8512 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1520.9856 (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	4341.4500 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2639.8785	3.6400	96.0916	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2879.7059	3.6400	104.8213	(247)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	86.0000	18.5800	15.9788	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	256.8512	18.5800	47.7230	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-696.3295	18.5800	-129.3780	
PV Unit electricity exported	-824.6561	5.5900	-46.0983	
Total			-175.4763	(252)
Total energy cost			181.1383	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4527 (257)
SAP value		92.6619
SAP rating (Section 12)		93 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2639.8785	0.2100	554.3745	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2879.7059	0.2100	604.7382	(264)
Space and water heating			1159.1127	(265)
Pumps, fans and electric keep-hot	86.0000	0.1432	12.3154	(267)
Energy for lighting	256.8512	0.1490	38.2759	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-696.3295	0.1366	-95.1166	
PV Unit electricity exported	-824.6561	0.1215	-100.1949	
Total			-195.3115	(269)
Total CO2, kg/year			1014.3926	(272)
CO2 emissions per m2			10.2400	(273)
EI value			90.5638	
EI rating			91	(274)
EI band			B	

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		99.0500 (1b)	x	2.7200 (2b)	=	269.4160	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.0500						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	269.4160	(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	5 * 10 =	50.0000 (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) =	50.0000 / (5) =	0.1856	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.8000	(17)
Infiltration rate		0.4256	(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) =	0.3617	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.7000	3.4000	3.4000	3.2000	3.1000	2.9000	3.0000	2.8000	2.7000	2.8000	2.9000	3.2000	(22)
Wind factor	0.9250	0.8500	0.8500	0.8000	0.7750	0.7250	0.7500	0.7000	0.6750	0.7000	0.7250	0.8000	(22a)
Adj infilt rate	0.3346	0.3075	0.3075	0.2894	0.2804	0.2623	0.2713	0.2532	0.2442	0.2532	0.2623	0.2894	(22b)
Effective ac	0.5560	0.5473	0.5473	0.5419	0.5393	0.5344	0.5368	0.5321	0.5298	0.5321	0.5344	0.5419	(25)

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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	
Entrance door			1.9100	1.0000	1.9100			(26)
WINDOWS AND GL DOORS (Uw = 1.30)			8.4700	1.2357	10.4667			(27)
External Wall 1	63.0500	10.3800	52.6700	0.1800	9.4806	70.0000	3686.9000	(29a)
External Roof 1	40.3500		40.3500	0.1400	5.6490	9.0000	363.1500	(30)
External Roof 2	25.0600		25.0600	0.1400	3.5084	9.0000	225.5400	(30)
Total net area of external elements Aum(A, m2)			128.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.0147			(33)
Party Wall 1			49.2000	0.0000	0.0000	45.0000	2214.0000	(32)
Party Floor 1			99.0500			135.0000	13371.7500	(32d)
Party Ceiling 1			33.6400			135.0000	4541.4000	(32b)
Internal Wall 1			152.9300			9.0000	1376.3700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25779.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		260.2636 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	4.7900	0.0300	0.1437
E3 Sill	4.7900	0.0300	0.1437
E4 Jamb	17.6800	0.0300	0.5304
E7 Party floor between dwellings (in blocks of flats)	23.1800	0.0600	1.3908
E16 Corner (normal)	2.7200	0.0600	0.1632
E14 Flat roof	12.1400	0.0600	0.7284
E17 Corner (inverted – internal area greater than external area)	2.7200	-0.0900	-0.2448
E10 Eaves (insulation at ceiling level)	12.9500	0.0600	0.7770
E18 Party wall between dwellings	10.8800	0.0600	0.6528
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	26.2200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.3400	0.0600	0.3204

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.6056 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	35.6203 (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	49.4311	48.6566	48.6566	48.1767	47.9477	47.5114	47.7259	47.3041	47.1041	47.3041	47.5114	48.1767	(38)
Heat transfer coeff	85.0514	84.2770	84.2770	83.7970	83.5680	83.1317	83.3462	82.9244	82.7245	82.9244	83.1317	83.7970	(39)
Average = Sum(39)m / 12 =												83.5792	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8587	0.8509	0.8509	0.8460	0.8437	0.8393	0.8415	0.8372	0.8352	0.8372	0.8393	0.8460	(40)
HLP (average)												0.8438	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7306 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
70.0022	68.9502	67.4173	64.4842	62.3197	59.9058	58.5338	60.0552	61.7229	64.3146	67.3107	69.7340	(42a)

Hot water usage for baths

30.2265	29.7776	29.1454	27.9798	27.1071	26.1393	25.6166	26.2443	26.9278	27.9633	29.1529	30.1243	(42b)

Hot water usage for other uses

42.5936	41.0448	39.4959	37.9470	36.3982	34.8493	34.8493	36.3982	37.9470	39.4959	41.0448	42.5936	(42c)

Average daily hot water use (litres/day)		131.2859 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8223	139.7726	136.0586	130.4111	125.8249	120.8945	118.9997	122.6976	126.5977	131.7738	137.5083	142.4519	(44)
Energy conte	226.1956	199.0343	209.1170	178.5263	169.3846	148.6538	143.9198	151.9253	156.1076	178.8158	195.9058	223.0453	(45)
Energy content (annual)										Total = Sum(45)m =		2180.6312	
Distribution loss (46)m = 0.15 x (45)m	33.9293	29.8551	31.3675	26.7789	25.4077	22.2981	21.5880	22.7888	23.4161	26.8224	29.3859	33.4568	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	31.0015	27.9971	30.9878	29.9691	30.9560	29.9452	30.9356	30.9421	29.9512	30.9636	29.9830	30.9989	(61)
Total heat required for water heating calculated for each month	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(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	257.1971	227.0314	240.1048	208.4954	200.3406	178.5991	174.8555	182.8674	186.0588	209.7794	225.8888	254.0442	(64)
								Total per year (kWh/year) = Sum(64)m =				2545.2624	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month	82.9604	73.1782	77.2783	66.8523	64.0594	56.9137	55.5872	58.2507	59.3936	67.1972	72.6344	81.9123	(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	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	163.8333	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.3599	32.2946	26.2637	19.8833	14.8630	12.5480	13.5585	17.6239	23.6548	30.0352	35.0555	37.3705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	380.2728	384.2188	374.2749	353.1055	326.3830	301.2676	284.4889	280.5429	290.4868	311.6562	338.3787	363.4941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	54.1139	(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)	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	-109.2222	(71)
Water heating gains (Table 5)	111.5059	108.8961	103.8687	92.8504	86.1013	79.0468	74.7140	78.2939	82.4911	90.3188	100.8812	110.0972	(72)
Total internal gains	639.8636	637.1345	616.1324	577.5642	539.0723	501.5874	481.4865	485.1857	505.3576	543.7351	586.0403	622.6868	(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	
South	1.2300	52.2144	0.7200	0.7000	0.7700	22.4315	(78)
West	7.2400	23.0226	0.7200	0.7000	0.7700	58.2178	(80)

Solar gains	80.6494	128.7114	203.1905	290.2136	339.2879	368.1903	349.8648	308.2974	248.2752	166.7106	98.3064	64.4750	(83)
Total gains	720.5130	765.8458	819.3228	867.7779	878.3602	869.7777	831.3513	793.4831	753.6328	710.4457	684.3468	687.1617	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	84.1946	84.9682	84.9682	85.4549	85.6891	86.1388	85.9171	86.3541	86.5628	86.3541	86.1388	85.4549	
alpha	6.6130	6.6645	6.6645	6.6970	6.7126	6.7426	6.7278	6.7569	6.7709	6.7569	6.7426	6.6970	
util living area	0.9932	0.9884	0.9703	0.9109	0.7625	0.5315	0.3607	0.3863	0.6729	0.9217	0.9852	0.9946	(86)
MIT	20.4112	20.4905	20.6409	20.8097	20.9200	20.9512	20.9536	20.9537	20.9424	20.8226	20.5881	20.4006	(87)
Th 2	20.2028	20.2095	20.2095	20.2136	20.2156	20.2194	20.2175	20.2212	20.2229	20.2212	20.2194	20.2136	(88)
util rest of house	0.9910	0.9847	0.9608	0.8844	0.7071	0.4593	0.2824	0.3052	0.5980	0.8924	0.9798	0.9929	(89)
MIT 2	19.5177	19.6236	19.8114	20.0152	20.1309	20.1590	20.1582	20.1621	20.1574	20.0404	19.7562	19.5135	(90)
Living area fraction									fLA = Living area / (4) =			0.4959	(91)
MIT	19.9608	20.0535	20.2228	20.4092	20.5222	20.5519	20.5527	20.5547	20.5467	20.4283	20.1688	19.9534	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.8108	19.9035	20.0728	20.2592	20.3722	20.4019	20.4027	20.4047	20.3967	20.2783	20.0188	19.8034	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9896	0.9830	0.9588	0.8861	0.7187	0.4763	0.3010	0.3244	0.6153	0.8949	0.9780	0.9917	(94)
Useful gains	713.0117	752.8011	785.6046	768.9306	631.2817	414.3119	250.2077	257.3687	463.7099	635.7560	669.3004	681.4486	(95)
Ext temp.	4.9000	5.4000	7.1000	9.5000	12.5000	15.4000	17.4000	17.3000	14.7000	11.2000	7.6000	4.9000	(96)
Heat loss rate W	1268.1828	1222.3089	1093.3051	901.5885	657.8666	415.8147	250.2620	257.4553	471.2571	752.8148	1032.3932	1248.8608	(97)
Space heating kWh	413.0473	315.5093	228.9292	95.5137	19.7791	0.0000	0.0000	0.0000	0.0000	87.0918	261.4269	422.1547	(98a)
Space heating requirement - total per year (kWh/year)												1843.4519	
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	413.0473	315.5093	228.9292	95.5137	19.7791	0.0000	0.0000	0.0000	0.0000	87.0918	261.4269	422.1547	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1843.4519	
Space heating per m2											(98c) / (4) =	18.6113	(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	413.0473	315.5093	228.9292	95.5137	19.7791	0.0000	0.0000	0.0000	0.0000	87.0918	261.4269	422.1547	(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)
             465.6677   355.7038   258.0938   107.6817    22.2989     0.0000     0.0000     0.0000     0.0000    98.1869   294.7315   475.9354 (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
             257.1971   227.0314   240.1048   208.4954   200.3406   178.5991   174.8555   182.8674   186.0588   209.7794   225.8888   254.0442 (64)
Efficiency of water heater                                                                                                                 88.2000 (216)
(217)m        88.5075    88.4901    88.4433    88.3565    88.2447    88.2000    88.2000    88.2000    88.2000    88.3461    88.4675    88.5115 (217)
Fuel for water heating, kWh/month
             290.5937   256.5614   271.4786   235.9707   227.0285   202.4933   198.2488   207.3326   210.9510   237.4518   255.3353   287.0184 (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      31.8256    25.5317    22.9885    16.8423    13.0095    10.6289    11.8677    15.4261    20.0370    26.2896    29.6940    32.7102 (232)
Electricity generated by PVs (Appendix M) (negative quantity)
(233a)m      -26.5272   -37.9757   -64.0467   -81.6623   -91.9820   -90.3128   -88.5059   -81.1786   -67.3998   -50.5422   -30.4002   -21.2749 (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      -10.3752   -21.1603   -53.8029  -100.3537  -142.5268  -161.9752  -156.7165  -124.7606   -78.9042   -38.7378   -14.5278    -7.2947 (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                                                                                                      2078.2997 (211)
Space heating fuel - main system 2                                                                                                         0.0000 (213)
Space heating fuel - secondary                                                                                                             0.0000 (215)
Efficiency of water heater                                                                                                                88.2000
Water heating fuel used                                                                                                                 2880.4641 (219)
Space cooling fuel                                                                                                                         0.0000 (221)

Electricity for pumps and fans:
   central heating pump                                                                                                                   41.0000 (230c)
   main heating flue fan                                                                                                                  45.0000 (230e)
Total electricity for the above, kWh/year                                                                                                 86.0000 (231)
Electricity for lighting (calculated in Appendix L)                                                                                      256.8512 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation                                                                                                                          -1642.9440 (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                                                                                                     3658.6710 (238)


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10a. Fuel costs - using BEDF prices (535)
-------------------------------------------------------------------------------------------------------
                                                                          Fuel          Fuel price          Fuel cost
                                                                       kWh/year             p/kWh            £/year
Space heating - main system 1                                        2078.2997             6.1900          128.6468 (240)
Total CO2 associated with community systems                                                                    0.0000 (473)
Water heating (other fuel)                                           2880.4641             6.1900          178.3007 (247)
Energy for instantaneous electric shower(s)                             0.0000            28.2800            0.0000 (247a)
Pumps, fans and electric keep-hot (0.90*29.80 + 0.10*14.60)            86.0000            28.2800           24.3208 (249)
Energy for lighting (0.90*29.80 + 0.10*14.60)                         256.8512            28.2800           72.6375 (250)
Additional standing charges                                                                                  102.0000 (251)

 Energy saving/generation technologies
PV Unit electricity used in dwelling                                 -731.8084            28.2800         -206.9554
PV Unit electricity exported                                         -911.1356             5.8100          -52.9370
Total                                                                                                      -259.8924 (252)
Total energy cost                                                                                           246.0134 (255)


-------------------------------------------------------------------------------------------------------
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP
-------------------------------------------------------------------------------------------------------
                                                                        Energy    Emission factor       Emissions
                                                                     kWh/year       kg CO2/kWh     kg CO2/year
Space heating - main system 1                                        2078.2997           0.2100        436.4429 (261)
Total CO2 associated with community systems                                                              0.0000 (373)
Water heating (other fuel)                                           2880.4641           0.2100        604.8975 (264)
Space and water heating                                                                               1041.3404 (265)
Pumps, fans and electric keep-hot                                      86.0000           0.1432         12.3154 (267)
Energy for lighting                                                   256.8512           0.1490         38.2759 (268)

 Energy saving/generation technologies
PV Unit electricity used in dwelling                                 -731.8084           0.1367        -100.0538
PV Unit electricity exported                                         -911.1356           0.1211        -110.3171
Total                                                                                                 -210.3710 (269)
Total CO2, kg/year                                                                                     881.5608 (272)


-------------------------------------------------------------------------------------------------------
13a. Primary energy - Individual heating systems including micro-CHP
-------------------------------------------------------------------------------------------------------
                                                                        Energy Primary energy factor       Primary energy
                                                                     kWh/year       kg CO2/kWh             kWh/year
Space heating - main system 1                                        2078.2997           1.1300        2348.4787 (275)
Total CO2 associated with community systems                                                              0.0000 (473)
Water heating (other fuel)                                           2880.4641           1.1300        3254.9244 (278)
```

Space and water heating			5603.4031 (279)
Pumps, fans and electric keep-hot	86.0000	1.5335	131.8797 (281)
Energy for lighting	256.8512	1.5547	399.3380 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-731.8084	1.5098	-1104.8920
PV Unit electricity exported	-911.1356	0.4441	-404.6597
Total			-1509.5517 (283)
Total Primary energy kWh/year			4625.0692 (286)

Full SAP Calculation Printout

Property Reference	5847-SUST-WHD-HEATH BDGS 9	**Issued on Date**	10/01/2024
Assessment Reference	00001_gas boiler	**Prop Type Ref**	
Property	Heath Buildings, UNIT 9, High St, Oxshott, Leatherhead, KT22 0JP		

SAP Rating	92 A	**DER**	11.94	**TER**	11.97
Environmental	88 B	**% DER < TER**			0.25
CO_2 Emissions (t/year)	1.7	**DFEE**	44.07	**TFEE**	45.36
Compliance Check	See BREL	**% DFEE < TFEE**			2.84
% DPER < TPER	0.20	**DPER**	63.17	**TPER**	63.30

Assessor Details	Mr. Michael Andrews	**Assessor ID**	N388-0001
Client	WOLSEY HOUSE DESIGNS, WOLSEY HOUSE DESIGNS		

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	167.6700 (1b)	x	2.4700 (2b)	=	414.1449	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	414.1449	(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	5 * 10 =	50.0000	(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) =	50.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.8000	(17)
Infiltration rate		0.3607	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3607	(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	0.4599	0.4509	0.4419	0.3968	0.3878	0.3427	0.3427	0.3337	0.3607	0.3878	0.4058	0.4239	(22b)
Effective ac	0.6058	0.6017	0.5976	0.5787	0.5752	0.5587	0.5587	0.5557	0.5651	0.5752	0.5823	0.5898	(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	
Entrance door			1.9100	1.0000	1.9100			(26)
WINDOWS AND GL DOORS (Uw = 1.30)			32.8900	1.2357	40.6435			(27)
RL1			1.0800	1.2357	1.3346			(27a)
RL2			2.1600	1.2357	2.6692			(27a)
RL3-4			1.4400	1.2357	1.7795			(27a)
RL5-6			1.2800	1.2357	1.5817			(27a)
External Wall 1	148.0400	3.0500	144.9900	0.1800	26.0982	9.0000	1304.9100	(29a)
External Wall dormer	59.3200	31.7500	27.5700	0.1800	4.9626	9.0000	248.1300	(29a)
External loft wall	26.9800		26.9800	0.1800	4.8564	9.0000	242.8200	(29a)
External Roof 1	158.6400	5.9600	152.6800	0.1400	21.3752	9.0000	1374.1200	(30)
External Roof 2	16.7800		16.7800	0.1400	2.3492	9.0000	151.0200	(30)
Total net area of external elements Aum(A, m2)			409.7600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.5602			(33)
Party Floor 1			166.9400			135.0000	22536.9000	(32d)
Internal Wall 1			224.2400			9.0000	2018.1600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	27876.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		166.2555 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E1 Steel lintel with perforated steel base plate	18.5700	0.0300	0.5571	
E3 Sill	4.1000	0.0300	0.1230	
E4 Jamb	27.3000	0.0300	0.8190	
E7 Party floor between dwellings (in blocks of flats)	76.1900	0.0600	4.5714	
E16 Corner (normal)	15.6200	0.0600	0.9372	
R11 Upstands or kerbs of rooflights	24.4000	0.0600	1.4640	
E14 Flat roof	48.0800	0.0600	2.8848	
E17 Corner (inverted – internal area greater than external area)	10.0000	-0.0900	-0.9000	
R6 Flat ceiling	12.7900	0.0600	0.7674	
R7 Flat ceiling (inverted)	1.7700	0.0600	0.1062	
R8 Roof to wall (rafter)	12.6400	0.0600	0.7584	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				12.0885 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	121.6487 (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	82.7891	82.2278	81.6776	79.0933	78.6098	76.3590	76.3590	75.9422	77.2260	78.6098	79.5879	80.6105	(38)
Heat transfer coeff	204.4377	203.8764	203.3262	200.7420	200.2585	198.0076	198.0076	197.5908	198.8746	200.2585	201.2366	202.2592	(39)
Average = Sum(39)m / 12 =												200.7396	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2193	1.2159	1.2127	1.1972	1.1944	1.1809	1.1809	1.1785	1.1861	1.1944	1.2002	1.2063	(40)
HLP (average)												1.1972	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9594	(42)
Hot water usage for mixer showers													
	73.8400	72.7303	71.1133	68.0194	65.7362	63.1901	61.7428	63.3476	65.1067	67.8405	71.0008	73.5571	(42a)
Hot water usage for baths													
	31.8768	31.4034	30.7367	29.5075	28.5871	27.5665	27.0152	27.6772	28.3980	29.4901	30.7446	31.7691	(42b)
Hot water usage for other uses													
	44.9376	43.3036	41.6695	40.0354	38.4013	36.7672	36.7672	38.4013	40.0354	41.6695	43.3036	44.9376	(42c)
Average daily hot water use (litres/day)												138.4852	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	150.6544	147.4373	143.5195	137.5623	132.7246	127.5237	125.5252	129.4261	133.5401	139.0001	145.0490	150.2638	(44)
Energy conte	238.5998	209.9487	220.5841	188.3159	178.6728	156.8053	151.8118	160.2565	164.6683	188.6218	206.6489	235.2767	(45)
Energy content (annual)										Total = Sum(45)m =		2300.2107	
Distribution loss (46)m = 0.15 x (45)m													
	35.7900	31.4923	33.0876	28.2474	26.8009	23.5208	22.7718	24.0385	24.7002	28.2933	30.9973	35.2915	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	28.4834	25.7247	28.4762	27.5475	28.4594	27.5349	28.4487	28.4520	27.5381	28.4634	27.5549	28.4821	(61)
Total heat required for water heating calculated for each month													
	267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(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													
	267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(64)
										Total per year (kWh/year) = Sum(64)m =		2635.3759	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month													
	86.4553	76.2391	80.4633	69.5019	66.5236	59.0215	57.5896	60.3983	61.6367	69.8326	75.5995	85.3500	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.0149	40.8700	33.2377	25.1631	18.8097	15.8799	17.1588	22.3037	29.9360	38.0106	44.3640	47.2938	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	506.2176	511.4706	498.2333	470.0527	434.4798	401.0462	378.7106	373.4576	386.6949	414.8755	450.4484	483.8820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	(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)													
	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	(71)
Water heating gains (Table 5)													
	116.2033	113.4511	108.1495	96.5305	89.4134	81.9743	77.4054	81.1805	85.6066	93.8610	104.9993	114.7178	(72)
Total internal gains													
	786.3408	783.6966	757.5255	709.6512	660.6078	613.8054	588.1797	591.8468	617.1424	664.6521	717.7166	763.7984	(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	
North	0.5700	10.6334	0.7200	0.7000	0.7700	2.1169	(74)
East	3.2800	19.6403	0.7200	0.7000	0.7700	22.5001	(76)
South	0.5700	46.7521	0.7200	0.7000	0.7700	9.3076	(78)
West	28.4700	19.6403	0.7200	0.7000	0.7700	195.2983	(80)
South	5.9600	26.0000	0.7200	0.7000	1.0000	70.2899	(82)

Solar gains	299.5129	591.3357	987.4839	1461.8360	1810.9361	1862.4474	1769.5764	1507.0176	1155.5064	705.2415	374.4274	245.6869	(83)
Total gains	1085.8537	1375.0323	1745.0094	2171.4872	2471.5439	2476.2528	2357.7561	2098.8643	1772.6488	1369.8936	1092.1440	1009.4853	(84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.8763	37.9806	38.0834	38.5736	38.6668	39.1063	39.1063	39.1888	38.9358	38.6668	38.4788	38.2843	
alpha	3.5251	3.5320	3.5389	3.5716	3.5778	3.6071	3.6071	3.6126	3.5957	3.5778	3.5653	3.5523	
util living area	0.9879	0.9726	0.9297	0.8228	0.6606	0.4884	0.3630	0.4209	0.6734	0.9104	0.9784	0.9905	(86)
MIT	19.4113	19.6646	20.0614	20.4996	20.7657	20.8771	20.9047	20.8981	20.7989	20.3748	19.8000	19.3707	(87)
Th 2	19.9046	19.9073	19.9099	19.9222	19.9245	19.9353	19.9353	19.9373	19.9311	19.9245	19.9198	19.9150	(88)
util rest of house	0.9851	0.9665	0.9145	0.7885	0.6047	0.4151	0.2780	0.3288	0.5969	0.8840	0.9725	0.9883	(89)
MIT 2	18.0478	18.3702	18.8663	19.3976	19.6879	19.8019	19.8216	19.8205	19.7368	19.2706	18.5544	18.0036	(90)
Living area fraction									fLA = Living area / (4) =			0.4287	(91)
MIT	18.6323	18.9251	19.3787	19.8700	20.1499	20.2628	20.2859	20.2824	20.1921	19.7440	19.0884	18.5897	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6323	18.9251	19.3787	19.8700	20.1499	20.2628	20.2859	20.2824	20.1921	19.7440	19.0884	18.5897	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9594	0.9057	0.7867	0.6171	0.4382	0.3064	0.3593	0.6168	0.8787	0.9667	0.9847	(94)
Useful gains	1064.9650	1319.2423	1580.5079	1708.3108	1525.0819	1085.1297	722.4726	754.1823	1093.4131	1203.7056	1055.7356	994.0301	(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	2930.0632	2859.3803	2618.5678	2202.1479	1692.1703	1121.2841	729.8404	767.1362	1211.5735	1831.1626	2412.4987	2910.4531	(97)
Space heating kWh	1387.6330	1034.9727	772.3165	355.5627	124.3138	0.0000	0.0000	0.0000	0.0000	466.8280	976.8694	1425.8187	(98a)
Space heating requirement - total per year (kWh/year)												6544.3149	
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	1387.6330	1034.9727	772.3165	355.5627	124.3138	0.0000	0.0000	0.0000	0.0000	466.8280	976.8694	1425.8187	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6544.3149	
Space heating per m2											(98c) / (4) =	39.0309	(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	1387.6330	1034.9727	772.3165	355.5627	124.3138	0.0000	0.0000	0.0000	0.0000	466.8280	976.8694	1425.8187	(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)	1564.4115	1166.8238	870.7064	400.8599	140.1508	0.0000	0.0000	0.0000	0.0000	526.2999	1101.3183	1607.4619	(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	267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(64)
Efficiency of water heater												87.6000	(216)
(217)m	88.5206	88.4939	88.4292	88.2812	88.0094	87.6000	87.6000	87.6000	87.6000	88.3479	88.4851	88.5265	(217)
Fuel for water heating, kWh/month	301.7187	266.3160	281.6493	244.5180	235.3525	210.4340	205.7768	215.4207	219.4136	245.7164	264.6815	297.9434	(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	40.2766	32.3113	29.0928	21.3146	16.4640	13.4513	15.0190	19.5223	25.3576	33.2705	37.5789	41.3960	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.5642	-54.3456	-89.9169	-111.9900	-126.9142	-120.2230	-118.0111	-107.8996	-89.8374	-66.3777	-38.7627	-27.8849	(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	-12.8614	-32.7456	-81.5007	-147.2100	-215.9210	-225.3770	-219.4673	-172.4396	-108.8826	-51.4719	-18.2613	-9.6127	(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 7378.0325 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 87.6000
Water heating fuel used 2988.9410 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 86.0000 (231)
Electricity for lighting (calculated in Appendix L) 325.0548 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-2281.4784	(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	8496.5500	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7378.0325	3.6400	268.5604	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2988.9410	3.6400	108.7975	(247)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	86.0000	18.5800	15.9788	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	325.0548	18.5800	60.3952	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-985.7274	18.5800	-183.1481	
PV Unit electricity exported	-1295.7510	5.5900	-72.4325	
Total			-255.5806	(252)
Total energy cost			290.1512	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4912	(257)
SAP value		92.0383	
SAP rating (Section 12)		92	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7378.0325	0.2100	1549.3868	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2988.9410	0.2100	627.6776	(264)
Space and water heating			2177.0645	(265)
Pumps, fans and electric keep-hot	86.0000	0.1432	12.3154	(267)
Energy for lighting	325.0548	0.1490	48.4396	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-985.7274	0.1369	-134.9045	
PV Unit electricity exported	-1295.7510	0.1216	-157.5600	
Total			-292.4644	(269)
Total CO2, kg/year			1945.3550	(272)
CO2 emissions per m2			11.6000	(273)
EI value			87.7426	
EI rating			88	(274)
EI band			B	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	167.6700 (1b)	x	2.4700 (2b)	=	414.1449	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 167.6700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	414.1449	(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	5 * 10 =	50.0000	(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) =	50.0000 / (5) =	0.1207	(8)
Pressure test		Yes	

Pressure Test Method												Blower Door	
Measured/design AP50												4.8000	(17)
Infiltration rate												0.3607	(18)
Number of sides sheltered												0	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				1.0000	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.3607	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.7000	3.4000	3.4000	3.2000	3.1000	2.9000	3.0000	2.8000	2.7000	2.8000	2.9000	3.2000	(22)
Wind factor	0.9250	0.8500	0.8500	0.8000	0.7750	0.7250	0.7500	0.7000	0.6750	0.7000	0.7250	0.8000	(22a)
Adj infilt rate	0.3337	0.3066	0.3066	0.2886	0.2796	0.2615	0.2705	0.2525	0.2435	0.2525	0.2615	0.2886	(22b)
Effective ac	0.5557	0.5470	0.5470	0.5416	0.5391	0.5342	0.5366	0.5319	0.5296	0.5319	0.5342	0.5416	(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	
Entrance door			1.9100	1.0000	1.9100			(26)
WINDOWS AND GL DOORS (Uw = 1.30)			32.8900	1.2357	40.6435			(27)
RL1			1.0800	1.2357	1.3346			(27a)
RL2			2.1600	1.2357	2.6692			(27a)
RL3-4			1.4400	1.2357	1.7795			(27a)
RL5-6			1.2800	1.2357	1.5817			(27a)
External Wall 1	148.0400	3.0500	144.9900	0.1800	26.0982	9.0000	1304.9100	(29a)
External Wall dormer	59.3200	31.7500	27.5700	0.1800	4.9626	9.0000	248.1300	(29a)
External loft wall	26.9800		26.9800	0.1800	4.8564	9.0000	242.8200	(29a)
External Roof 1	158.6400	5.9600	152.6800	0.1400	21.3752	9.0000	1374.1200	(30)
External Roof 2	16.7800		16.7800	0.1400	2.3492	9.0000	151.0200	(30)
Total net area of external elements Aum(A, m2)			409.7600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.5602			(33)
Party Floor 1			166.9400			135.0000	22536.9000	(32d)
Internal Wall 1			224.2400			9.0000	2018.1600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	27876.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		166.2555 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	18.5700	0.0300	0.5571
E3	Sill	4.1000	0.0300	0.1230
E4	Jamb	27.3000	0.0300	0.8190
E7	Party floor between dwellings (in blocks of flats)	76.1900	0.0600	4.5714
E16	Corner (normal)	15.6200	0.0600	0.9372
R11	Upstands or kerbs of rooflights	24.4000	0.0600	1.4640
E14	Flat roof	48.0800	0.0600	2.8848
E17	Corner (inverted – internal area greater than external area)	10.0000	-0.0900	-0.9000
R6	Flat ceiling	12.7900	0.0600	0.7674
R7	Flat ceiling (inverted)	1.7700	0.0600	0.1062
R8	Roof to wall (rafter)	12.6400	0.0600	0.7584

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.0885 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	121.6487 (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	75.9422	74.7584	74.7584	74.0248	73.6747	73.0078	73.3357	72.6910	72.3854	72.6910	73.0078	74.0248	(38)
Heat transfer coeff	197.5908	196.4071	196.4071	195.6735	195.3234	194.6565	194.9843	194.3397	194.0340	194.3397	194.6565	195.6735	(39)
Average = Sum(39)m / 12 =												195.3405	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1785	1.1714	1.1714	1.1670	1.1649	1.1609	1.1629	1.1591	1.1572	1.1591	1.1609	1.1670	(40)
HLP (average)												1.1650	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9594 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.8400	72.7303	71.1133	68.0194	65.7362	63.1901	61.7428	63.3476	65.1067	67.8405	71.0008	73.5571	(42a)

Hot water usage for baths

31.8768	31.4034	30.7367	29.5075	28.5871	27.5665	27.0152	27.6772	28.3980	29.4901	30.7446	31.7691	(42b)

Hot water usage for other uses

44.9376	43.3036	41.6695	40.0354	38.4013	36.7672	36.7672	38.4013	40.0354	41.6695	43.3036	44.9376	(42c)

Average daily hot water use (litres/day)		138.4852 (43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
150.6544	147.4373	143.5195	137.5623	132.7246	127.5237	125.5252	129.4261	133.5401	139.0001	145.0490	150.2638	(44)
238.5998	209.9487	220.5841	188.3159	178.6728	156.8053	151.8118	160.2565	164.6683	188.6218	206.6489	235.2767	(45)

Energy content (annual)	Total = Sum(45)m =	2300.2107

Distribution loss (46)m = 0.15 x (45)m

35.7900	31.4923	33.0876	28.2474	26.8009	23.5208	22.7718	24.0385	24.7002	28.2933	30.9973	35.2915	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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)
28.4834	25.7247	28.4762	27.5475	28.4594	27.5349	28.4487	28.4520	27.5381	28.4634	27.5549	28.4821	(61)

Total heat required for water heating calculated for each month

267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(62)
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)
-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)
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)
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

267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(64)

	Total per year (kWh/year) = Sum(64)m =	2635.3759 (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
86.4553 76.2391 80.4633 69.5019 66.5236 59.0215 57.5896 60.3983 61.6367 69.8326 75.5995 85.3500 (65)

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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	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	(66)

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

	46.0149	40.8700	33.2377	25.1631	18.8097	15.8799	17.1588	22.3037	29.9360	38.0106	44.3640	47.2938	(67)

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

	506.2176	511.4706	498.2333	470.0527	434.4798	401.0462	378.7106	373.4576	386.6949	414.8755	450.4484	483.8820	(68)

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

	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	(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)

	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	(71)

Water heating gains (Table 5)

	116.2033	113.4511	108.1495	96.5305	89.4134	81.9743	77.4054	81.1805	85.6066	93.8610	104.9993	114.7178	(72)

Total internal gains

	786.3408	783.6966	757.5255	709.6512	660.6078	613.8054	588.1797	591.8468	617.1424	664.6521	717.7166	763.7984	(73)

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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	
North	0.5700	12.3370	0.7200	0.7000	0.7700	2.4561	(74)
East	3.2800	23.0226	0.7200	0.7000	0.7700	26.3749	(76)
South	0.5700	52.2144	0.7200	0.7000	0.7700	10.3951	(78)
West	28.4700	23.0226	0.7200	0.7000	0.7700	228.9312	(80)
South	5.9600	31.0000	0.7200	0.7000	1.0000	83.8071	(82)

Solar gains	351.9645	594.3176	1006.9641	1526.3929	1845.5698	2027.5192	1916.7423	1647.5567	1263.0692	791.3843	436.2660	276.6578	(83)
Total gains	1138.3053	1378.0142	1764.4896	2236.0441	2506.1776	2641.3246	2504.9220	2239.4035	1880.2116	1456.0363	1153.9826	1040.4563	(84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.1888	39.4250	39.4250	39.5728	39.6437	39.7796	39.7127	39.8444	39.9072	39.8444	39.7796	39.5728	
alpha	3.6126	3.6283	3.6283	3.6382	3.6429	3.6520	3.6475	3.6563	3.6605	3.6563	3.6520	3.6382	
util living area													
	0.9842	0.9689	0.9163	0.7869	0.6039	0.4030	0.2783	0.3177	0.5958	0.8764	0.9710	0.9880	(86)
MIT	19.5799	19.7935	20.1928	20.5965	20.8201	20.8989	20.9123	20.9107	20.8493	20.5067	19.9478	19.5369	(87)
Th 2	19.9373	19.9430	19.9430	19.9465	19.9482	19.9514	19.9498	19.9529	19.9544	19.9529	19.9514	19.9465	(88)
util rest of house													
	0.9805	0.9619	0.8984	0.7479	0.5440	0.3313	0.1980	0.2294	0.5142	0.8417	0.9632	0.9852	(89)
MIT 2	18.2861	18.5596	19.0537	19.5279	19.7633	19.8339	19.8404	19.8432	19.8023	19.4477	18.7640	18.2383	(90)
Living area fraction									fLA = Living area / (4) =			0.4287	(91)
MIT	18.8408	19.0885	19.5420	19.9860	20.2163	20.2905	20.2999	20.3008	20.2511	19.9017	19.2715	18.7950	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8408	19.0885	19.5420	19.9860	20.2163	20.2905	20.2999	20.3008	20.2511	19.9017	19.2715	18.7950	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9755	0.9548	0.8905	0.7495	0.5599	0.3548	0.2250	0.2590	0.5385	0.8397	0.9567	0.9810	(94)
Useful gains	1110.4017	1315.7593	1571.2137	1675.8852	1403.1357	937.1767	563.5213	580.0190	1012.4172	1222.7053	1103.9991	1020.7285	(95)
Ext temp.	4.9000	5.4000	7.1000	9.5000	12.5000	15.4000	17.4000	17.3000	14.7000	11.2000	7.6000	4.9000	(96)
Heat loss rate W													
	2754.5670	2688.5275	2443.7043	2051.8412	1507.1803	951.9588	565.4441	583.1749	1077.1045	1691.0776	2271.9314	2718.8864	(97)
Space heating kWh													
	1223.2590	922.5002	649.1330	270.6883	77.4092	0.0000	0.0000	0.0000	0.0000	348.4690	840.9113	1263.4294	(98a)
Space heating requirement - total per year (kWh/year)												5595.7992	
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													
	1223.2590	922.5002	649.1330	270.6883	77.4092	0.0000	0.0000	0.0000	0.0000	348.4690	840.9113	1263.4294	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5595.7992	
Space heating per m2											(98c) / (4) =	33.3739	(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													
	1223.2590	922.5002	649.1330	270.6883	77.4092	0.0000	0.0000	0.0000	0.0000	348.4690	840.9113	1263.4294	(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)													
	1379.0969	1040.0227	731.8297	305.1728	87.2708	0.0000	0.0000	0.0000	0.0000	392.8624	948.0397	1424.3849	(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												
	267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588 (64)
Efficiency of water heater												87.6000 (216)
(217)m	88.5008	88.4739	88.3922	88.2086	87.8965	87.6000	87.6000	87.6000	87.6000	88.2745	88.4580	88.5081 (217)
Fuel for water heating, kWh/month												
	301.7860	266.3761	281.7672	244.7193	235.6546	210.4340	205.7768	215.4207	219.4136	245.9206	264.7626	298.0054 (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	40.2766	32.3113	29.0928	21.3146	16.4640	13.4513	15.0190	19.5223	25.3576	33.2705	37.5789	41.3960 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-38.8165	-55.1066	-91.7835	-115.3291	-128.5193	-125.2085	-122.6863	-113.2620	-95.1974	-72.5622	-44.2614	-31.2088 (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	-16.5371	-33.5974	-84.9909	-157.6949	-223.2439	-253.2235	-245.1473	-195.6468	-124.2586	-61.3578	-23.1306	-11.6456 (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	6308.6801 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	87.6000
Water heating fuel used	2990.0370 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	325.0548 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2464.4160 (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	7245.3559 (238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6308.6801	6.1900	390.5073	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2990.0370	6.1900	185.0833	(247)
Energy for instantaneous electric shower(s)	0.0000	28.2800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*29.80 + 0.10*14.60)	86.0000	28.2800	24.3208	(249)
Energy for lighting (0.90*29.80 + 0.10*14.60)	325.0548	28.2800	91.9255	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1033.9415	28.2800	-292.3987	
PV Unit electricity exported	-1430.4745	5.8100	-83.1106	
Total			-375.5092	(252)
Total energy cost			418.3277	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6308.6801	0.2100	1324.8228	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2990.0370	0.2100	627.9078	(264)
Space and water heating			1952.7306	(265)
Pumps, fans and electric keep-hot	86.0000	0.1432	12.3154	(267)
Energy for lighting	325.0548	0.1490	48.4396	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1033.9415	0.1370	-141.6535	
PV Unit electricity exported	-1430.4745	0.1212	-173.3535	
Total			-315.0070	(269)
Total CO2, kg/year			1698.4786	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	6308.6801	1.1300	7128.8085	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2990.0370	1.1300	3378.7418	(278)
Space and water heating			10507.5503	(279)
Pumps, fans and electric keep-hot	86.0000	1.5335	131.8797	(281)
Energy for lighting	325.0548	1.5547	505.3772	(282)
Energy saving/generation technologies				

PV Unit electricity used in dwelling	-1033.9415	1.5108	-1562.1230
PV Unit electricity exported	-1430.4745	0.4445	-635.8973
Total			-2198.0202 (283)
Total Primary energy kWh/year			8946.7871 (286)

SAP 10 EPC IMPROVEMENTS

00001_gas boiler

Current energy efficiency rating: A 92
Current environmental impact rating: B 88

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£116	£116	£0
Mains gas	£678	£678	£0
Space heating	£517	£517	£0
Water heating	£185	£185	£0
Lighting	£92	£92	£0
Generated (PV)	-£376	-£376	£0
Total cost of fuels	£418	£418	£0
Total cost of uses	£418	£418	£0
Delivered energy	43 kWh/m²	43 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.7 tonnes	1.7 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	53 kWh/m²	53 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	167.6700 (1b)	x	2.4700 (2b)	=	414.1449 (1b) - (3b)	(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6700					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	414.1449 (5)	

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2. Ventilation rate

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	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	5 * 10 =	50.0000 (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) =	50.0000 / (5) =	0.1207 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.8000 (17)
Infiltration rate		0.3607 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3607 (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												
	0.4599	0.4509	0.4419	0.3968	0.3878	0.3427	0.3427	0.3337	0.3607	0.3878	0.4058	0.4239 (22b)
Effective ac	0.6058	0.6017	0.5976	0.5787	0.5752	0.5587	0.5587	0.5557	0.5651	0.5752	0.5823	0.5898 (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	
Entrance door			1.9100	1.0000	1.9100			(26)
WINDOWS AND GL DOORS (Uw = 1.30)			32.8900	1.2357	40.6435			(27)
RL1			1.0800	1.2357	1.3346			(27a)
RL2			2.1600	1.2357	2.6692			(27a)
RL3-4			1.4400	1.2357	1.7795			(27a)
RL5-6			1.2800	1.2357	1.5817			(27a)
External Wall 1	148.0400	3.0500	144.9900	0.1800	26.0982	9.0000	1304.9100	(29a)
External Wall dormer	59.3200	31.7500	27.5700	0.1800	4.9626	9.0000	248.1300	(29a)
External loft wall	26.9800		26.9800	0.1800	4.8564	9.0000	242.8200	(29a)
External Roof 1	158.6400	5.9600	152.6800	0.1400	21.3752	9.0000	1374.1200	(30)
External Roof 2	16.7800		16.7800	0.1400	2.3492	9.0000	151.0200	(30)
Total net area of external elements Aum(A, m2)			409.7600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.5602			(33)
Party Floor 1			166.9400			135.0000	22536.9000	(32d)
Internal Wall 1			224.2400			9.0000	2018.1600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	27876.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		166.2555 (35)

List of Thermal Bridges

K1	Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	18.5700	0.0300	0.5571
E3	Sill	4.1000	0.0300	0.1230
E4	Jamb	27.3000	0.0300	0.8190
E7	Party floor between dwellings (in blocks of flats)	76.1900	0.0600	4.5714
E16	Corner (normal)	15.6200	0.0600	0.9372
R11	Upstands or kerbs of rooflights	24.4000	0.0600	1.4640
E14	Flat roof	48.0800	0.0600	2.8848
E17	Corner (inverted – internal area greater than external area)	10.0000	-0.0900	-0.9000
R6	Flat ceiling	12.7900	0.0600	0.7674
R7	Flat ceiling (inverted)	1.7700	0.0600	0.1062
R8	Roof to wall (rafter)	12.6400	0.0600	0.7584

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.0885 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	121.6487 (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	82.7891	82.2278	81.6776	79.0933	78.6098	76.3590	76.3590	75.9422	77.2260	78.6098	79.5879	80.6105	(38)
Heat transfer coeff	204.4377	203.8764	203.3262	200.7420	200.2585	198.0076	198.0076	197.5908	198.8746	200.2585	201.2366	202.2592	(39)
Average = Sum(39)m / 12 =												200.7396	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2193	1.2159	1.2127	1.1972	1.1944	1.1809	1.1809	1.1785	1.1861	1.1944	1.2002	1.2063	(40)
HLP (average)												1.1972	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9594 (42)
Hot water usage for mixer showers												
	73.8400	72.7303	71.1133	68.0194	65.7362	63.1901	61.7428	63.3476	65.1067	67.8405	71.0008	73.5571 (42a)
Hot water usage for baths												
	31.8768	31.4034	30.7367	29.5075	28.5871	27.5665	27.0152	27.6772	28.3980	29.4901	30.7446	31.7691 (42b)
Hot water usage for other uses												
	44.9376	43.3036	41.6695	40.0354	38.4013	36.7672	36.7672	38.4013	40.0354	41.6695	43.3036	44.9376 (42c)
Average daily hot water use (litres/day)												138.4852 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	150.6544	147.4373	143.5195	137.5623	132.7246	127.5237	125.5252	129.4261	133.5401	139.0001	145.0490	150.2638	(44)
Energy conte	238.5998	209.9487	220.5841	188.3159	178.6728	156.8053	151.8118	160.2565	164.6683	188.6218	206.6489	235.2767	(45)
Energy content (annual)										Total = Sum(45)m =		2300.2107	
Distribution loss (46)m = 0.15 x (45)m													
	35.7900	31.4923	33.0876	28.2474	26.8009	23.5208	22.7718	24.0385	24.7002	28.2933	30.9973	35.2915	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	28.4834	25.7247	28.4762	27.5475	28.4594	27.5349	28.4487	28.4520	27.5381	28.4634	27.5549	28.4821	(61)
Total heat required for water heating calculated for each month													
	267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(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													
	267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(64)
										Total per year (kWh/year) = Sum(64)m =		2635.3759	(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													
	86.4553	76.2391	80.4633	69.5019	66.5236	59.0215	57.5896	60.3983	61.6367	69.8326	75.5995	85.3500	(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	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
46.0149 40.8700 33.2377 25.1631 18.8097 15.8799 17.1588 22.3037 29.9360 38.0106 44.3640 47.2938 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
506.2176 511.4706 498.2333 470.0527 434.4798 401.0462 378.7106 373.4576 386.6949 414.8755 450.4484 483.8820 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
55.7161 55.7161 55.7161 55.7161 55.7161 55.7161 55.7161 55.7161 55.7161 55.7161 55.7161 55.7161 (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)
-118.3777 -118.3777 -118.3777 -118.3777 -118.3777 -118.3777 -118.3777 -118.3777 -118.3777 -118.3777 -118.3777 -118.3777 (71)
Water heating gains (Table 5)
116.2033 113.4511 108.1495 96.5305 89.4134 81.9743 77.4054 81.1805 85.6066 93.8610 104.9993 114.7178 (72)
Total internal gains
786.3408 783.6966 757.5255 709.6512 660.6078 613.8054 588.1797 591.8468 617.1424 664.6521 717.7166 763.7984 (73)

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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	
North	0.5700	10.6334	0.7200	0.7000	0.7700	2.1169	(74)
East	3.2800	19.6403	0.7200	0.7000	0.7700	22.5001	(76)
South	0.5700	46.7521	0.7200	0.7000	0.7700	9.3076	(78)
West	28.4700	19.6403	0.7200	0.7000	0.7700	195.2983	(80)
South	5.9600	26.0000	0.7200	0.7000	1.0000	70.2899	(82)

Solar gains 299.5129 591.3357 987.4839 1461.8360 1810.9361 1862.4474 1769.5764 1507.0176 1155.5064 705.2415 374.4274 245.6869 (83)
Total gains 1085.8537 1375.0323 1745.0094 2171.4872 2471.5439 2476.2528 2357.7561 2098.8643 1772.6488 1369.8936 1092.1440 1009.4853 (84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.8763	37.9806	38.0834	38.5736	38.6668	39.1063	39.1063	39.1888	38.9358	38.6668	38.4788	38.2843	
alpha	3.5251	3.5320	3.5389	3.5716	3.5778	3.6071	3.6071	3.6126	3.5957	3.5778	3.5653	3.5523	
util living area	0.9879	0.9726	0.9297	0.8228	0.6606	0.4884	0.3630	0.4209	0.6734	0.9104	0.9784	0.9905	(86)
MIT	19.4113	19.6646	20.0614	20.4996	20.7657	20.8771	20.9047	20.8981	20.7989	20.3748	19.8000	19.3707	(87)
Th 2	19.9046	19.9073	19.9099	19.9222	19.9245	19.9353	19.9353	19.9373	19.9311	19.9245	19.9198	19.9150	(88)
util rest of house	0.9851	0.9665	0.9145	0.7885	0.6047	0.4151	0.2780	0.3288	0.5969	0.8840	0.9725	0.9883	(89)
MIT 2	18.0478	18.3702	18.8663	19.3976	19.6879	19.8019	19.8216	19.8205	19.7368	19.2706	18.5544	18.0036	(90)
Living area fraction										fLA = Living area / (4) =		0.4287	(91)
MIT	18.6323	18.9251	19.3787	19.8700	20.1499	20.2628	20.2859	20.2824	20.1921	19.7440	19.0884	18.5897	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6323	18.9251	19.3787	19.8700	20.1499	20.2628	20.2859	20.2824	20.1921	19.7440	19.0884	18.5897	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9594	0.9057	0.7867	0.6171	0.4382	0.3064	0.3593	0.6168	0.8787	0.9667	0.9847	(94)
Useful gains	1064.9650	1319.2423	1580.5079	1708.3108	1525.0819	1085.1297	722.4726	754.1823	1093.4131	1203.7056	1055.7356	994.0301	(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	2930.0632	2859.3803	2618.5678	2202.1479	1692.1703	1121.2841	729.8404	767.1362	1211.5735	1831.1626	2412.4987	2910.4531	(97)
Space heating kWh	1387.6330	1034.9727	772.3165	355.5627	124.3138	0.0000	0.0000	0.0000	0.0000	466.8280	976.8694	1425.8187	(98a)
Space heating requirement - total per year (kWh/year)												6544.3149	
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	1387.6330	1034.9727	772.3165	355.5627	124.3138	0.0000	0.0000	0.0000	0.0000	466.8280	976.8694	1425.8187	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6544.3149	
Space heating per m2											(98c) / (4) =	39.0309	(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	1387.6330	1034.9727	772.3165	355.5627	124.3138	0.0000	0.0000	0.0000	0.0000	466.8280	976.8694	1425.8187	(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)	1564.4115	1166.8238	870.7064	400.8599	140.1508	0.0000	0.0000	0.0000	0.0000	526.2999	1101.3183	1607.4619	(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	267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(64)
Efficiency of water heater												87.6000	(216)
(217)m	88.5206	88.4939	88.4292	88.2812	88.0094	87.6000	87.6000	87.6000	87.6000	88.3479	88.4851	88.5265	(217)
Fuel for water heating, kWh/month	301.7187	266.3160	281.6493	244.5180	235.3525	210.4340	205.7768	215.4207	219.4136	245.7164	264.6815	297.9434	(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	40.2766	32.3113	29.0928	21.3146	16.4640	13.4513	15.0190	19.5223	25.3576	33.2705	37.5789	41.3960 (232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	-33.5642	-54.3456	-89.9169	-111.9900	-126.9142	-120.2230	-118.0111	-107.8996	-89.8374	-66.3777	-38.7627	-27.8849 (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	-12.8614	-32.7456	-81.5007	-147.2100	-215.9210	-225.3770	-219.4673	-172.4396	-108.8826	-51.4719	-18.2613	-9.6127 (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	7378.0325 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	87.6000
Water heating fuel used	2988.9410 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	325.0548 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2281.4784 (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	8496.5500 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7378.0325	3.6400	268.5604	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2988.9410	3.6400	108.7975	(247)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	86.0000	18.5800	15.9788	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	325.0548	18.5800	60.3952	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-985.7274	18.5800	-183.1481	
PV Unit electricity exported	-1295.7510	5.5900	-72.4325	
Total			-255.5806	(252)
Total energy cost			290.1512	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4912 (257)
SAP value		92.0383
SAP rating (Section 12)		92 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7378.0325	0.2100	1549.3868	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2988.9410	0.2100	627.6776	(264)
Space and water heating			2177.0645	(265)
Pumps, fans and electric keep-hot	86.0000	0.1432	12.3154	(267)
Energy for lighting	325.0548	0.1490	48.4396	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-985.7274	0.1369	-134.9045	
PV Unit electricity exported	-1295.7510	0.1216	-157.5600	
Total			-292.4644	(269)
Total CO2, kg/year			1945.3550	(272)
CO2 emissions per m2			11.6000	(273)
EI value			87.7426	
EI rating			88	(274)
EI band			B	

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	167.6700 (1b)	x	2.4700 (2b)	=	414.1449	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	414.1449	(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	5 * 10 =	50.0000	(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) =	50.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.8000	(17)
Infiltration rate		0.3607	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3607	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.7000	3.4000	3.4000	3.2000	3.1000	2.9000	3.0000	2.8000	2.7000	2.8000	2.9000	3.2000	(22)
Wind factor	0.9250	0.8500	0.8500	0.8000	0.7750	0.7250	0.7500	0.7000	0.6750	0.7000	0.7250	0.8000	(22a)
Adj infilt rate	0.3337	0.3066	0.3066	0.2886	0.2796	0.2615	0.2705	0.2525	0.2435	0.2525	0.2615	0.2886	(22b)
Effective ac	0.5557	0.5470	0.5470	0.5416	0.5391	0.5342	0.5366	0.5319	0.5296	0.5319	0.5342	0.5416	(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	
Entrance door			1.9100	1.0000	1.9100			(26)
WINDOWS AND GL DOORS (Uw = 1.30)			32.8900	1.2357	40.6435			(27)
RL1			1.0800	1.2357	1.3346			(27a)
RL2			2.1600	1.2357	2.6692			(27a)
RL3-4			1.4400	1.2357	1.7795			(27a)
RL5-6			1.2800	1.2357	1.5817			(27a)
External Wall 1	148.0400	3.0500	144.9900	0.1800	26.0982	9.0000	1304.9100	(29a)
External Wall dormer	59.3200	31.7500	27.5700	0.1800	4.9626	9.0000	248.1300	(29a)
External loft wall	26.9800		26.9800	0.1800	4.8564	9.0000	242.8200	(29a)
External Roof 1	158.6400	5.9600	152.6800	0.1400	21.3752	9.0000	1374.1200	(30)
External Roof 2	16.7800		16.7800	0.1400	2.3492	9.0000	151.0200	(30)
Total net area of external elements Aum(A, m2)			409.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		109.5602			(33)
Party Floor 1			166.9400			135.0000	22536.9000	(32d)
Internal Wall 1			224.2400			9.0000	2018.1600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	27876.0600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		166.2555	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	18.5700	0.0300	0.5571
E3	Sill	4.1000	0.0300	0.1230
E4	Jamb	27.3000	0.0300	0.8190
E7	Party floor between dwellings (in blocks of flats)	76.1900	0.0600	4.5714
E16	Corner (normal)	15.6200	0.0600	0.9372
R11	Upstands or kerbs of rooflights	24.4000	0.0600	1.4640
E14	Flat roof	48.0800	0.0600	2.8848
E17	Corner (inverted – internal area greater than external area)	10.0000	-0.0900	-0.9000
R6	Flat ceiling	12.7900	0.0600	0.7674
R7	Flat ceiling (inverted)	1.7700	0.0600	0.1062
R8	Roof to wall (rafter)	12.6400	0.0600	0.7584

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.0885	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	121.6487	(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	75.9422	74.7584	74.7584	74.0248	73.6747	73.0078	73.3357	72.6910	72.3854	72.6910	73.0078	74.0248	(38)
Heat transfer coeff	197.5908	196.4071	196.4071	195.6735	195.3234	194.6565	194.9843	194.3397	194.0340	194.3397	194.6565	195.6735	(39)
Average = Sum(39)m / 12 =												195.3405	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1785	1.1714	1.1714	1.1670	1.1649	1.1609	1.1629	1.1591	1.1572	1.1591	1.1609	1.1670	(40)
HLP (average)												1.1650	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9594	(42)
Hot water usage for mixer showers		

	73.8400	72.7303	71.1133	68.0194	65.7362	63.1901	61.7428	63.3476	65.1067	67.8405	71.0008	73.5571 (42a)
Hot water usage for baths												
	31.8768	31.4034	30.7367	29.5075	28.5871	27.5665	27.0152	27.6772	28.3980	29.4901	30.7446	31.7691 (42b)
Hot water usage for other uses												
	44.9376	43.3036	41.6695	40.0354	38.4013	36.7672	36.7672	38.4013	40.0354	41.6695	43.3036	44.9376 (42c)
Average daily hot water use (litres/day)												138.4852 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	150.6544	147.4373	143.5195	137.5623	132.7246	127.5237	125.5252	129.4261	133.5401	139.0001	145.0490	150.2638	(44)
Energy conte	238.5998	209.9487	220.5841	188.3159	178.6728	156.8053	151.8118	160.2565	164.6683	188.6218	206.6489	235.2767	(45)
Energy content (annual)										Total = Sum(45)m =		2300.2107	
Distribution loss (46)m = 0.15 x (45)m													
	35.7900	31.4923	33.0876	28.2474	26.8009	23.5208	22.7718	24.0385	24.7002	28.2933	30.9973	35.2915	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	28.4834	25.7247	28.4762	27.5475	28.4594	27.5349	28.4487	28.4520	27.5381	28.4634	27.5549	28.4821	(61)
Total heat required for water heating calculated for each month													
	267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(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													
	267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(64)
										Total per year (kWh/year) = Sum(64)m =		2635.3759	(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													
	86.4553	76.2391	80.4633	69.5019	66.5236	59.0215	57.5896	60.3983	61.6367	69.8326	75.5995	85.3500	(65)

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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	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	177.5665	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.0149	40.8700	33.2377	25.1631	18.8097	15.8799	17.1588	22.3037	29.9360	38.0106	44.3640	47.2938	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	506.2176	511.4706	498.2333	470.0527	434.4798	401.0462	378.7106	373.4576	386.6949	414.8755	450.4484	483.8820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	55.7161	(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)													
	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	-118.3777	(71)
Water heating gains (Table 5)													
	116.2033	113.4511	108.1495	96.5305	89.4134	81.9743	77.4054	81.1805	85.6066	93.8610	104.9993	114.7178	(72)
Total internal gains													
	786.3408	783.6966	757.5255	709.6512	660.6078	613.8054	588.1797	591.8468	617.1424	664.6521	717.7166	763.7984	(73)

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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	
North	0.5700	12.3370	0.7200	0.7000	0.7700	2.4561	(74)
East	3.2800	23.0226	0.7200	0.7000	0.7700	26.3749	(76)
South	0.5700	52.2144	0.7200	0.7000	0.7700	10.3951	(78)
West	28.4700	23.0226	0.7200	0.7000	0.7700	228.9312	(80)
South	5.9600	31.0000	0.7200	0.7000	1.0000	83.8071	(82)

Solar gains	351.9645	594.3176	1006.9641	1526.3929	1845.5698	2027.5192	1916.7423	1647.5567	1263.0692	791.3843	436.2660	276.6578	(83)
Total gains	1138.3053	1378.0142	1764.4896	2236.0441	2506.1776	2641.3246	2504.9220	2239.4035	1880.2116	1456.0363	1153.9826	1040.4563	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.1888	39.4250	39.4250	39.5728	39.6437	39.7796	39.7127	39.8444	39.9072	39.8444	39.7796	39.5728	
alpha	3.6126	3.6283	3.6283	3.6382	3.6429	3.6520	3.6475	3.6563	3.6605	3.6563	3.6520	3.6382	
util living area													
	0.9842	0.9689	0.9163	0.7869	0.6039	0.4030	0.2783	0.3177	0.5958	0.8764	0.9710	0.9880	(86)
MIT	19.5799	19.7935	20.1928	20.5965	20.8201	20.8989	20.9123	20.9107	20.8493	20.5067	19.9478	19.5369	(87)
Th 2	19.9373	19.9430	19.9430	19.9465	19.9482	19.9514	19.9498	19.9529	19.9544	19.9529	19.9514	19.9465	(88)
util rest of house													
	0.9805	0.9619	0.8984	0.7479	0.5440	0.3313	0.1980	0.2294	0.5142	0.8417	0.9632	0.9852	(89)
MIT 2	18.2861	18.5596	19.0537	19.5279	19.7633	19.8339	19.8404	19.8432	19.8023	19.4477	18.7640	18.2383	(90)
Living area fraction										fLA = Living area / (4) =		0.4287	(91)
MIT	18.8408	19.0885	19.5420	19.9860	20.2163	20.2905	20.2999	20.3008	20.2511	19.9017	19.2715	18.7950	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8408	19.0885	19.5420	19.9860	20.2163	20.2905	20.2999	20.3008	20.2511	19.9017	19.2715	18.7950	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9755	0.9548	0.8905	0.7495	0.5599	0.3548	0.2250	0.2590	0.5385	0.8397	0.9567	0.9810	(94)
Useful gains	1110.4017	1315.7593	1571.2137	1675.8852	1403.1357	937.1767	563.5213	580.0190	1012.4172	1222.7053	1103.9991	1020.7285	(95)
Ext temp.	4.9000	5.4000	7.1000	9.5000	12.5000	15.4000	17.4000	17.3000	14.7000	11.2000	7.6000	4.9000	(96)
Heat loss rate W													

	2754.5670	2688.5275	2443.7043	2051.8412	1507.1803	951.9588	565.4441	583.1749	1077.1045	1691.0776	2271.9314	2718.8864 (97)
Space heating kWh												
	1223.2590	922.5002	649.1330	270.6883	77.4092	0.0000	0.0000	0.0000	0.0000	348.4690	840.9113	1263.4294 (98a)
Space heating requirement - total per year (kWh/year)												5595.7992
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												
	1223.2590	922.5002	649.1330	270.6883	77.4092	0.0000	0.0000	0.0000	0.0000	348.4690	840.9113	1263.4294 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5595.7992
Space heating per m2											(98c) / (4) =	33.3739 (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													
	1223.2590	922.5002	649.1330	270.6883	77.4092	0.0000	0.0000	0.0000	0.0000	348.4690	840.9113	1263.4294	(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)													
	1379.0969	1040.0227	731.8297	305.1728	87.2708	0.0000	0.0000	0.0000	0.0000	392.8624	948.0397	1424.3849	(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													
	267.0832	235.6734	249.0603	215.8635	207.1322	184.3402	180.2605	188.7085	192.2063	217.0852	234.2038	263.7588	(64)
Efficiency of water heater												87.6000	(216)
(217)m	88.5008	88.4739	88.3922	88.2086	87.8965	87.6000	87.6000	87.6000	87.6000	88.2745	88.4580	88.5081	(217)
Fuel for water heating, kWh/month													
	301.7860	266.3761	281.7672	244.7193	235.6546	210.4340	205.7768	215.4207	219.4136	245.9206	264.7626	298.0054	(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	40.2766	32.3113	29.0928	21.3146	16.4640	13.4513	15.0190	19.5223	25.3576	33.2705	37.5789	41.3960	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.8165	-55.1066	-91.7835	-115.3291	-128.5193	-125.2085	-122.6863	-113.2620	-95.1974	-72.5622	-44.2614	-31.2088	(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	-16.5371	-33.5974	-84.9909	-157.6949	-223.2439	-253.2235	-245.1473	-195.6468	-124.2586	-61.3578	-23.1306	-11.6456	(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	6308.6801 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	87.6000
Water heating fuel used	2990.0370 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	325.0548 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2464.4160 (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	7245.3559 (238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6308.6801	6.1900	390.5073	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2990.0370	6.1900	185.0833	(247)
Energy for instantaneous electric shower(s)	0.0000	28.2800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*29.80 + 0.10*14.60)	86.0000	28.2800	24.3208	(249)
Energy for lighting (0.90*29.80 + 0.10*14.60)	325.0548	28.2800	91.9255	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1033.9415	28.2800	-292.3987	
PV Unit electricity exported	-1430.4745	5.8100	-83.1106	
Total			-375.5092	(252)
Total energy cost			418.3277	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6308.6801	0.2100	1324.8228	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2990.0370	0.2100	627.9078	(264)
Space and water heating			1952.7306	(265)
Pumps, fans and electric keep-hot	86.0000	0.1432	12.3154	(267)
Energy for lighting	325.0548	0.1490	48.4396	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1033.9415	0.1370	-141.6535	
PV Unit electricity exported	-1430.4745	0.1212	-173.3535	
Total			-315.0070	(269)
Total CO2, kg/year			1698.4786	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	6308.6801	1.1300	7128.8085	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2990.0370	1.1300	3378.7418	(278)
Space and water heating			10507.5503	(279)
Pumps, fans and electric keep-hot	86.0000	1.5335	131.8797	(281)
Energy for lighting	325.0548	1.5547	505.3772	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1033.9415	1.5108	-1562.1230	
PV Unit electricity exported	-1430.4745	0.4445	-635.8973	
Total			-2198.0202	(283)
Total Primary energy kWh/year			8946.7871	(286)

Overview Report

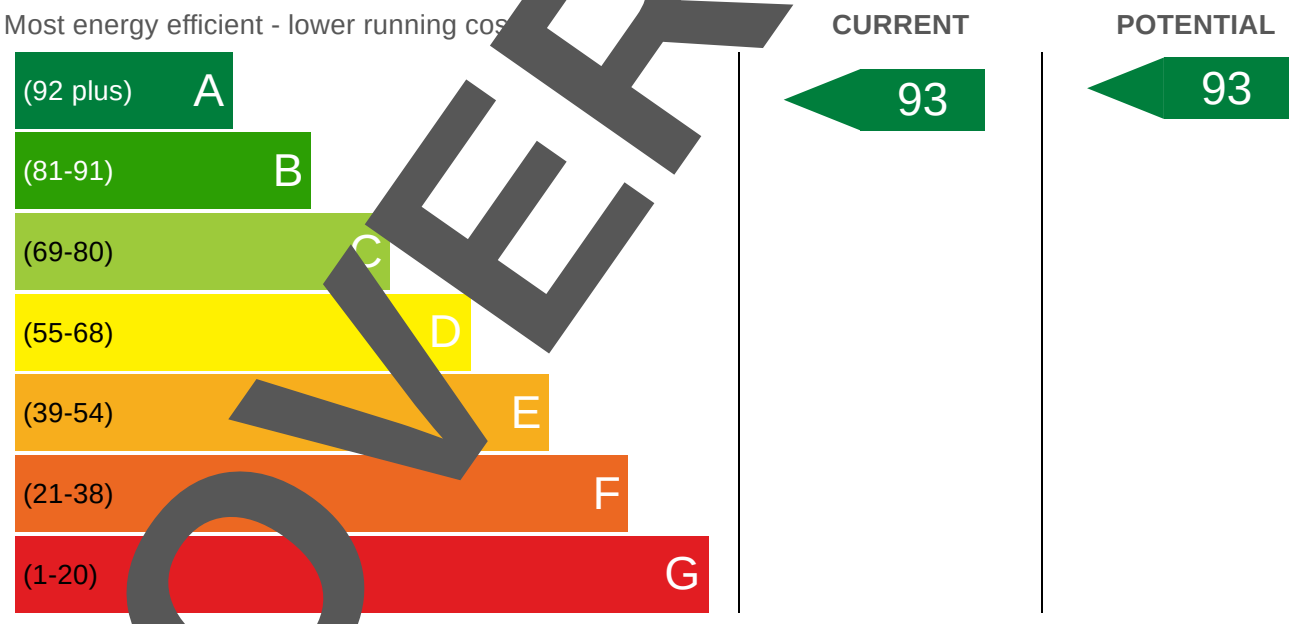
Dwelling Address	Heath Buildings, UNIT 6, High St, Oxshott, Leatherhead, KT22 0JP
Report Date	10/01/2024
Property Type	Flat, Semi-Detached
Floor Area [m^2]	99

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

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after we recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



Least energy efficient - higher running costs

Overview Report

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor | Poor | Average | Good | Very Good

Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m²K	Very Good
Roof	Average thermal transmittance 0.14 W/m²K	Very Good
Windows	High performance glazing	Good
Main heating	Boiler and underfloor heating, mains gas	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Very Good
Lighting	Good lighting efficiency	Good
Air tightness	Air permeability [AP50 4.8 m³/h.m² (assumed)	Good

Primary Energy

The primary energy for this property per year is 47 kilowatt hour (kWh) per square metre

Estimated emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions, the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.9** per year

With the recommended measures the potential CO emissions could be: **1** per year

Overview Report

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 measure	Typical Yearly Saving	Potential Rating after measure installed	...lative ... (per ye...	Cumulative Potential Rating

Estimated energy use and potential savi...

Estimated energy cost for this property over a year

£246

Over a year you could save

£0

The estimated cost and savings show... how much the average household... would spend in this property... heating, lighting and hot water. It... not based on how energy is used by... the people living at the proper...

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Michael Andrews
Assessor accreditation number	EES/019603
Email Address	[redacted]

Overview Report

Accreditation scheme contact details	
Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	01225 862266
Email Address	[redacted]

Assessment details	
Related party disclosure	No related pa
Date of assessment	10/01/202
Date of certificate	10/01/20
Type of assessment	SA dwelli

Overview Report

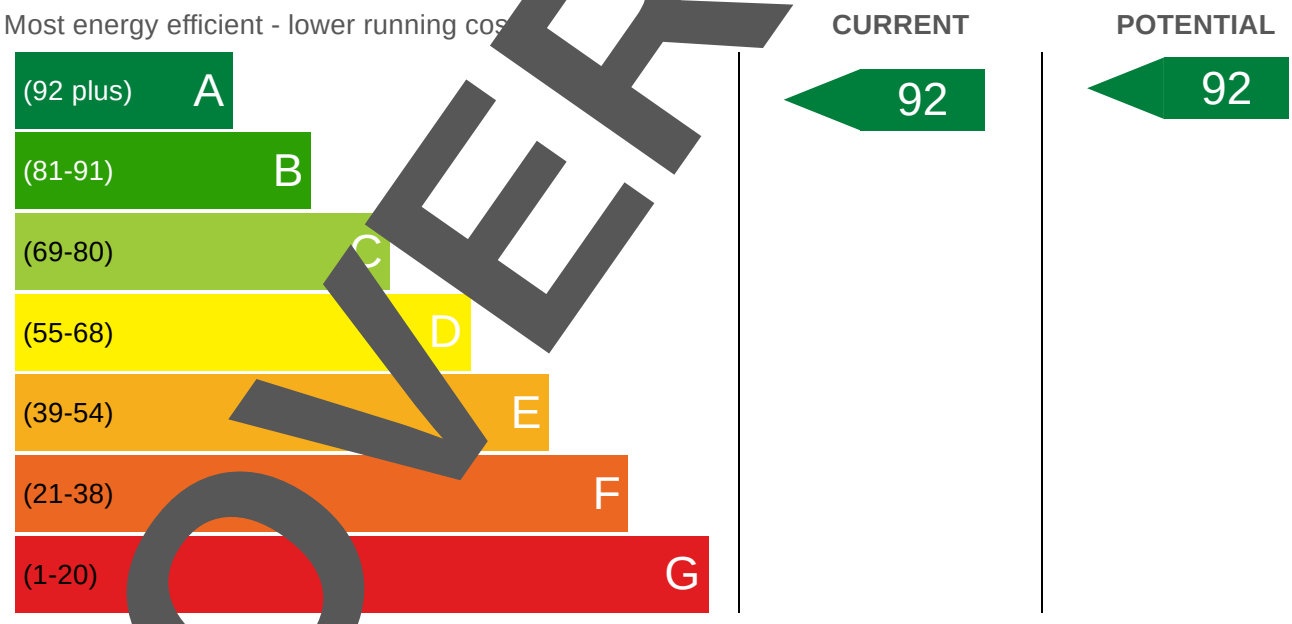
Dwelling Address	Heath Buildings, UNIT 9, High St, Oxshott, Leatherhead, KT22 0JP
Report Date	10/01/2024
Property Type	Flat, Detached
Floor Area [m^2]	168

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

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after we recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



Least energy efficient - higher running costs

Overview Report

elmhurst energy

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor | Poor | Average | Good | Very Good

Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m²K	Very Good
Roof	Average thermal transmittance 0.14 W/m²K	Very Good
Windows	High performance glazing	Good
Main heating	Boiler and underfloor heating, mains gas	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Very Good
Lighting	Good lighting efficiency	Good
Air tightness	Air permeability [AP50 4.8 m³/h.m² (assumed)	Good

Primary Energy

The primary energy for this property per year is 53 kilowatt hour (kWh) per square metre

Estimated emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions, the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **1.7** per year

With the recommended measures the potential CO emissions could be: **2** per year

Overview Report

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 measure	Typical Yearly Saving	Potential Rating after measure installed	...lative ... (per ye...	Cumulative Potential Rating

Estimated energy use and potential savi...

Estimated energy cost for this property over a year

£418

Over a year you could save

£0

The estimated cost and savings show... how much the average household... would spend in this property... heating, lighting and hot water. It... not based on how energy is used by... the people living at the proper...

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Michael Andrews
Assessor accreditation number	EES/019603
Email Address	[redacted]

Overview Report

Accreditation scheme contact details	
Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	01225 862266
Email Address	[redacted]

Assessment details	
Related party disclosure	No related pa
Date of assessment	08/01/202
Date of certificate	08/01/20
Type of assessment	SA dwelli

Summary for Input Data

Property Reference	5847-SUST-WHD-HEATH BDGS 6	**Issued on Date**	10/01/2024
Assessment Reference	00001	**Prop Type Ref**	
Property	Heath Buildings, UNIT 6, High St, Oxshott, Leatherhead, KT22 0JP		

SAP Rating	93 A	**DER**	10.61	**TER**	10.91
Environmental	91 B	**% DER < TER**			2.75
CO_2 Emissions (t/year)	0.88	**DFEE**	27.63	**TFEE**	27.64
Compliance Check	See BREL	**% DFEE < TFEE**			0.05
% DPER < TPER	3.57	**DPER**	56.00	**TPER**	58.07

Assessor Details	Mr. Michael Andrews	**Assessor ID**	N388-0001
Client	WOLSEY HOUSE DESIGNS, WOLSEY HOUSE DESIGNS		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenture	ND
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	Flat, Semi-Detached
Position of Flat	Mid-floor flat
Which Floor	4
2.0 Number of Storeys	1
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	7 Hour Off Peak
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	23.18 m	99.05 m²	2.72 m

8.0 Living Area 49.12 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	63.05	52.67	0.00	None	10.38	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	49.20		None

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	152.93

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.14	9.00	40.35	40.35	None	0.00	Enter Gross Area	0.00
External Roof 2	External Flat Roof	Plasterboard, insulated flat roof	0.14	9.00	25.06	25.06	None	0.00	Enter Gross Area	0.00

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Other	135.00	33.64

Summary for Input Data

elmhurst energy

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Other	135.00	99.05

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Entrance door	Manufacturer	Door to Corridor							1.00
WINDOWS AND GL DOORS	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
ED1	Entrance door	External Wall 1	North	1.91	
W1-4	WINDOWS AND GL DOORS	External Wall 1	West	7.24	
W5	WINDOWS AND GL DOORS	External Wall 1	South	1.23	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	Yes	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted	Reference:	Imported
E1 Steel lintel with perforated steel base plate	Independently assessed	4.79	0.03	0.03	REF	No
E3 Sill	Independently assessed	4.79	0.03	0.03	REF	No
E4 Jamb	Independently assessed	17.68	0.03	0.03	REF	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	23.18	0.06	0.06	REF	No
E16 Corner (normal)	Independently assessed	2.72	0.06	0.06	REF	No
E14 Flat roof	Independently assessed	12.14	0.06	0.06	REF	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.72	-0.09	-0.09	REF	No
E10 Eaves (insulation at ceiling level)	Independently assessed	12.95	0.06	0.06	REF	No
E18 Party wall between dwellings	Independently assessed	10.88	0.06	0.06	REF	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	26.22	0.00	0.00	REF	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	5.34	0.06	0.06	REF	No

Y-value	0.04	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.80	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No	

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No	

22.0 Lighting

No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
Lighting 1	80.00	8	640	20

24.0 Main Heating 1	Database	
Description	GAS BOILER	
Percentage of Heat	100.00	%
Database Ref. No.	18908	
Fuel Type	Mains gas	
In Winter	88.70	
In Summer	88.20	
Model Name	Greenstar 4000	
Manufacturer	Bosch Thermotechnology Ltd	
System Type	Combi boiler	
Controls SAP Code	2110	

Summary for Input Data

elmhurst energy

Delayed Start Stat	Yes
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heating Pump Age	2013 or later
Heat Emitter	Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	Enter value
Flow Temperature Value	35.00
Boiler Interlock	Yes
Combi boiler type	Standard Combi
Combi keep hot type	None

25.0 Main Heating 2 None

26.0 Heat Networks None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1										
Heat source 2										
Heat source 3										
Heat source 4										
Heat source 5										

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	1

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder None

In Airing Cupboard: No

32.0 Photovoltaic Unit One Dwelling

Export Capable Meter?	Yes
Connected To Dwelling	Yes
Diverter	Yes
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
2.00	Horizontal	Horizontal	None Or Little		No	1.00		

34.0 Small-scale Hydro None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

Summary for Input Data

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
			0	0
			0	0
			0	0

Summary for Input Data

elmhurst energy

Property Reference	5847-SUST-WHD-HEATH BDGS 9	**Issued on Date**	10/01/2024
Assessment Reference	00001_gas boiler	**Prop Type Ref**	
Property	Heath Buildings, UNIT 9, High St, Oxshott, Leatherhead, KT22 0JP		

SAP Rating	92 A	**DER**	11.94	**TER**	11.97
Environmental	88 B	**% DER < TER**			0.25
CO_2 Emissions (t/year)	1.7	**DFEE**	44.07	**TFEE**	45.36
Compliance Check	See BREL	**% DFEE < TFEE**			2.84
% DPER < TPER	0.20	**DPER**	63.17	**TPER**	63.30

Assessor Details	Mr. Michael Andrews	**Assessor ID**	N388-0001
Client	WOLSEY HOUSE DESIGNS, WOLSEY HOUSE DESIGNS		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenture	ND
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	Flat, Detached
Position of Flat	Top-floor flat
Which Floor	5
2.0 Number of Storeys	1
3.0 Date Built	2024
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	7 Hour Off Peak
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	76.19 m	167.67 m²	2.47 m

8.0 Living Area 71.88 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	148.04	145.00	0.00	None	3.04	Enter Gross Area
External Wall dormer	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	59.32	27.57	0.00	None	31.75	Enter Gross Area
External loft wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	26.98	26.98	0.00	None	0.00	Enter Gross Area

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	224.24

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
External Roof 1	External Flat Roof	Plasterboard, insulated flat roof	0.14	9.00	158.64	152.68	None	0.00	Enter Gross Area	5.96
External Roof 2	External Slope Roof	Plasterboard, insulated slope	0.14	9.00	16.78	16.78	None	0.00	Enter Gross Area	0.00

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Other	135.00	166.94

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)

Entrance door	Manufacturer	Door to Corridor				1.00
WINDOWS AND GL DOORS	Manufacturer	Window	Double Low-E Hard 0.2	0.72	0.70	1.30
ROOFLIGHT	Manufacturer	Roof Light	Double Low-E Hard 0.2	0.72	0.70	1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
ED1	Entrance door	External Wall 1	West	1.91	
ED2-3	WINDOWS AND GL DOORS	External Wall dormer	West	15.62	
ED4	WINDOWS AND GL DOORS	External Wall dormer	West	12.85	
W1-3	WINDOWS AND GL DOORS	External Wall dormer	East	3.28	
W4	WINDOWS AND GL DOORS	External Wall 1	North	0.57	
W5	WINDOWS AND GL DOORS	External Wall 1	South	0.57	
RL1	ROOFLIGHT	External Roof 1	South	1.08	0
RL2	ROOFLIGHT	External Roof 1	South	2.16	0
RL3-4	ROOFLIGHT	External Roof 1	South	1.44	0
RL5-6	ROOFLIGHT	External Roof 1	South	1.28	0

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	Yes	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted	Reference:	Imported
E1 Steel lintel with perforated steel base plate	Independently assessed	18.57	0.03	0.03	REF	Yes
E3 Sill	Independently assessed	4.10	0.03	0.03	REF	No
E4 Jamb	Independently assessed	27.30	0.03	0.03	REF	Yes
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	76.19	0.06	0.06	REF	Yes
E16 Corner (normal)	Independently assessed	15.62	0.06	0.06	REF	No
R11 Upstands or kerbs of rooflights	Independently assessed	24.40	0.06	0.06	REF	Yes
E14 Flat roof	Independently assessed	48.08	0.06	0.06	REF	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	10.00	-0.09	-0.09	REF	No
R6 Flat ceiling	Independently assessed	12.79	0.06	0.06	REF	No
R7 Flat ceiling (inverted)	Independently assessed	1.77	0.06	0.06	REF	No
R8 Roof to wall (rafter)	Independently assessed	12.64	0.06	0.06	REF	No

Y-value	0.03	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.80	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	

19.0 Mechanical Ventilation

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Mechanical Ventilation System Present	No

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Manufacturer	Bosch Thermotechnology Ltd	
System Type	Combi boiler	
Controls SAP Code	2110	
Delayed Start Stat	No	

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Combi keep hot type	None

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26.0 Heat Networks — None

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Recommendations

Lower cost measures

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Further measures to achieve even higher standards

Summary for Input Data

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			SAP rating	Environmental Impact
			0	0
			0	0
			0	0