GRADWELL GROUP LTD
AUGUST 2024

ENERGY STATEMENT
118A & 118B HIGH STREET

Contents

The content of this report, including any calculations, is based on information provided by the client, their agents, and the design team. Any changes to the technical specifications on which this report is founded may render the results invalid.

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Introduction

The report outlines the design strategy focusing on energy efficiency, carbon dioxide emissions, and sustainability, ensuring compliance with:

- National Planning Policy
- The Richmond Upon Thames Local Plan Policy LP 22 – Sustainable Design and Construction

As required by policy, the development aims to achieve a 35% reduction in CO2 emissions compared to Part L 2013.

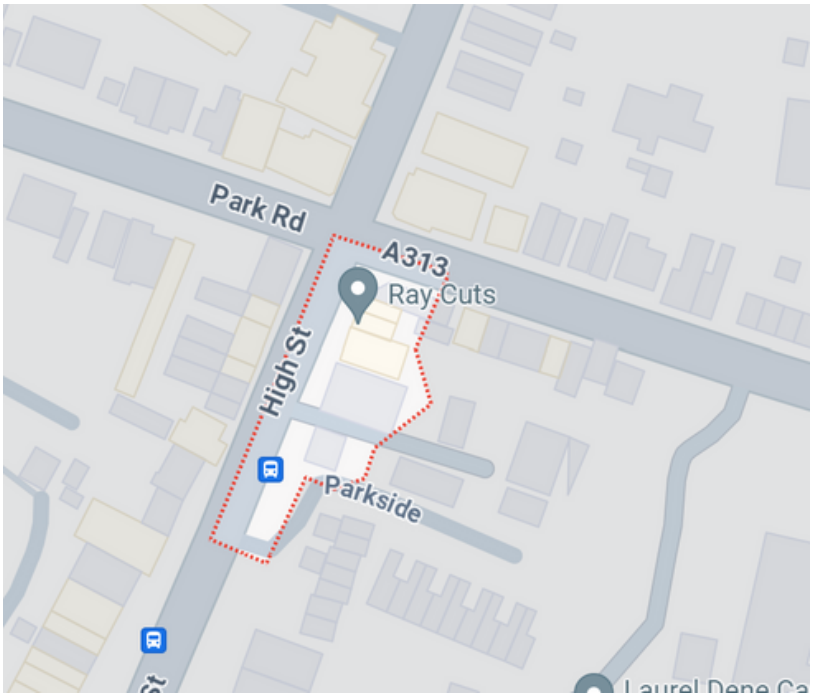
The design integrates energy-efficient building materials and services, as well as low-carbon technologies, including:

- Thermal specifications that meet and exceed the notional U-values of Part L 2013
- A design that minimizes air permeability, targeting a rate of 4
- A design that reduces thermal bridging by incorporating the notional psi values
- Energy-saving building services such as low-energy lighting, wastewater heat recovery, and heating controls
- Installation of low-carbon Solar PV Panels generating 1.8 kWp for the entire development, positioned horizontally with minimal shading

These measures collectively achieve a 58% reduction in CO2 emissions compared to Part L 2013."

Proposed Development

The proposed site for development is situated at 118A and 118B High Street, Hampton Hill, within the Hampton area. The project involves the extension of an existing structure to accommodate two new residential units.



Planning policy

The NPPF was revised in July 2021, with a stronger focus on enhancing beauty, place-making, environmental protection, and sustainable development. The updated environmental goals seek to preserve and improve the natural, built, and historic environments. They also promote effective land use, increased biodiversity, the careful management of natural resources, waste and pollution reduction, and adaptation to climate change, all while transitioning to a low-carbon economy.

Local Planning Policy

According to the Richmond Upon Thames Local Planning Policy, the development must aim to achieve:

- A 35% reduction in CO2 emissions compared to Part L1A 2013.

A. Major developments should aim to achieve net-zero carbon emissions. This involves reducing greenhouse gas emissions during operation and minimizing both annual and peak energy demand, following this energy hierarchy:

1. Be lean: Reduce energy usage and manage demand during operation.
2. Be clean: Utilize local energy resources (like secondary heat) and supply energy efficiently and cleanly.
3. Be green: Maximize the use of renewable energy by producing, storing, and using it on-site.
4. Be seen: Monitor, verify, and report on energy performance.

B. Major development proposals must include a comprehensive energy strategy to show how the zero-carbon target will be achieved within the framework of this energy hierarchy.

C. Major developments must achieve an on-site reduction of at least 35% beyond Building Regulations. For residential developments, a 10% reduction, and for non-residential developments, a 15% reduction, should be achieved through energy efficiency measures. If achieving the zero-carbon target on-site is not entirely possible, any shortfall should be compensated, with the borough's agreement, either through:

1. A cash contribution to the borough's carbon offset fund, or
2. Off-site measures, provided that a viable alternative is identified, and its delivery is guaranteed.

Methodology

An energy assessment has been conducted to demonstrate how the development will meet the targets for reducing regulated CO2 emissions beyond the 2021 Building Regulations. The following criteria, based on current planning policy, apply to this assessment:

- Residential developments must achieve an energy efficiency improvement of at least 35% above Part L of the Building Regulations.

- Developments should aim for net-zero carbon emissions, utilizing carbon offsetting if on-site reductions are not fully achievable.

For this energy assessment, the current SAP10 carbon factors have been applied, and energy demand has been calculated using the following approved methods:

- Residential (SAP): Calculations were performed using Elmhurst SAP 10 software.

The energy consumption and carbon emissions for the residential dwelling have been calculated using the Standard Assessment Procedure (SAP). The Elmhurst SAP 10 software was utilized to determine the Target Emissions Rate (TER) based on a notional building and the Dwelling Emissions Rate (DER) for the "lean" and "green" stages of the energy hierarchy, as outlined below:

- Lean: Energy efficiency measures, compared against a notional building equipped with individual gas boilers for hot water and heating.

- Clean: Not reported, as a heat network is not available.

- Green: Utilization of heat pumps only.

Energy Hierachy

Following best practices, the proposed energy strategy for this development will adhere to the principles of the energy hierarchy. The energy hierarchy prioritizes three key areas, aiming to reduce energy consumption first before meeting any remaining demand through the cleanest methods available:

1. **Be lean** – reduce energy consumption: Optimize the building's fabric, glazing, and structure to minimize energy use from the start by incorporating low U-values and ensuring good airtightness. Additionally, ensure that active systems operate with maximum energy efficiency.
2. **Be clean** – supply energy efficiently: Further reduce carbon emissions by utilizing decentralized energy sources where feasible, such as combined heat and power (CHP) systems.
3. **Be green** – utilize renewable energy: Once the above design strategies have been fully explored, supply energy through renewable sources wherever practicable.

Table 1.1 Baseline U-values

Element	Baseline specification
Groundfloor U-value	Party Floor
External wall U-value	0.18
Roof U-value	0.11
Windows U-value	1.2
Doors U-value	1
% Low energy lighting	100%
Heating - Gas	89.5%
Waste water heat recovery	Yes
Air tightness test result	5.0 m2/h.m3

Be Lean

1. Energy-Efficient Design Measures ("Be Lean")
2. Improving the thermal efficiency of the building envelope not only strengthens the structure for the future but also has the potential to achieve significant CO2 reductions. By first optimizing the building's thermal performance, the integration of renewable or low-carbon technologies can then maximize carbon savings while minimizing long-term costs for the developer.

The proposed energy-efficient design measures are outlined in Table 1.2:

Table 1.2 Be Lean - U-values

Element	Baseline specification
Groundfloor U-value	Party Floor
External wall U-value	0.15
Roof U-value	0.11
Windows U-value	1.2
Doors U-value	1
% Low energy lighting	100%
Heating - Gas	89.5%
Waste water heat recovery	Yes
PV Panels	Output equal to 40% of the ground floor area.
Air tightness test result	4.0 m2/h.m3

Be Clean

District Heating Networks

District heating networks deliver heat from one or more central energy centers to multiple buildings within the network. By supplying heat to multiple buildings, these networks ensure a high and consistent year-round local heat demand, which facilitates the use of low-carbon technologies, such as CHP systems, within the energy center. The centralized approach, coupled with aggregated demand, allows for more efficient operation of the systems.

Heat is distributed through the network via highly insulated pipes, and individual boilers in buildings are replaced with separately metered heat exchangers that connect to the network. According to London Plan Policy 5.6, new developments are required to connect to an existing district heating network if one is available. In cases where no network currently exists but there is potential for a future one, major developments should include the necessary infrastructure to enable future connection. This could involve installing a centralized heating plant connected to individual heat exchangers in each dwelling.

Upon reviewing the London Heat Map (see Fig. 2), it is clear that this proposed development is neither located within the coverage area of an existing district heating network nor within an area designated as having potential for a future network. Moreover, as this is a minor development consisting of a single dwelling, connecting to a district heating network would be neither practical nor cost-effective.

Combined Heat and Power (CHP)

Combined Heat and Power (CHP) systems utilize relatively affordable and clean fuels, such as natural gas, to produce both heat and electricity on-site. A typical CHP system works by burning natural gas to drive a turbine that generates electricity, while the resulting heat is captured to produce hot water. Since energy losses are minimized, the carbon footprint of the energy produced is significantly reduced. However, the efficiency of CHP systems depends on the presence of a consistent year-round local heat demand to fully utilize the heat generated. This is usually feasible in larger developments, such as those with at least 500 dwellings, universities, or hospitals. Given the smaller scale of this development, it is not considered suitable for a combined heat and power system.

Be Green

Be Green options:

Low and Zero Carbon Energy Sources ("Be Green")

Photovoltaics
Solar photovoltaic (PV) panels convert sunlight into electricity, which can be used on-site or fed into the National Grid. PV cells, typically made of silicon, generate electricity when exposed to sunlight, with higher output in stronger sunlight. The effectiveness of PV systems depends on available roof space and orientation, ideally facing south, southeast, or southwest. PV panels are easy to install, offer significant CO2 savings, and are suitable for most buildings, though overshadowing can reduce efficiency.

Heat Pumps
Heat pumps extract low-temperature heat from renewable sources (air or ground) and elevate it to a usable temperature. They provide heat for central heating and domestic hot water, often with a coefficient of performance (COP) of 3, meaning they generate over 3 kWh of heat per 1 kWh of electricity used. Ground source heat pumps require space for ground loops or boreholes, while air source heat pumps, though slightly less efficient, require less space and are easier to install. Heat pumps are ideal for sites without gas connections or for replacing electric or oil-fired systems but may not always be cost-effective compared to gas heating.

Solar Thermal
Solar thermal systems use solar energy to heat domestic hot water, with a boiler or immersion heater as a backup. These systems are best suited for buildings with high, year-round hot water demand. However, due to the anticipated low hot water demand in this development, solar thermal may not be as effective, especially when considering the relatively low CO2 and cost savings in homes with gas boilers.

Be Green

THIS PROJECT WILL UTILIZE AIR SOURCE HEAT PUMPS (ASHPS) TO ACHIEVE THE REQUIRED 35% REDUCTION IN CO2 EMISSIONS

Element	Baseline specification
Groundfloor U-value	Party Floor
External wall U-value	0.15
Roof U-value	0.11
Windows U-value	1.2
Doors U-value	1
% Low energy lighting	100%
Heating - ASHP	ASHP
Waste water heat recovery	Yes
PV Panels	Output equal to 40% of the ground floor area.
Air tightness test result	5.0 m2/h.m3

Summary

Baseline	
Space Heating Demand	2966.37
Water Heating Demand	6530.65
Pumps & Fans	172
Lighting	249.7
Total	9918.73

Be Green	
Space Heating Demand	904.28
Water Heating Demand	2845.62
Pumps & Fans	0
Lighting	211.27
Total	3961.17

THE DIFFERENCE IN ENERGY DEMAND FOR THE DWELLINGS WITH ASHP INSTALLED IS 5957.56 KWH/YEAR

THIS REPRESENTS A REDUCTION IN ENERGY DEMAND OF 60.06%

Summary

Summary

The energy demand assessment demonstrates that the carbon-saving measures detailed in the Environmental Design Strategy result in an overall reduction of over 60% compared to Building Regulations Part L (2021). This achievement is due to the implementation of lean and green carbon reduction strategies, including the use of an air source heat pump for heating and hot water.

Conclusion

The development consists of two new dwellings, each designed to achieve a minimum of 35% reduction in CO2 emissions compared to the baseline set by Part L1 (2021) of the Building Regulations. The proposed building fabric and mechanical services contribute to a carbon reduction of over 60% for both dwellings.

Full SAP Calculation Printout

Property Reference	Annie Khatnani	**Issued on Date**	30/08/2024
Assessment Reference	Be lean - Flat 1	**Prop Type Ref**	Annie Khatnani
Property			

SAP Rating	77 C	**DER**	7.18	**TER**	16.59
Environmental	95 A	**% DER < TER**			56.72
CO_2 Emissions (t/year)	0.28	**DFEE**	38.14	**TFEE**	41.64
Compliance Check	See BREL	**% DFEE < TFEE**			8.40
% DPER < TPER	13.82	**DPER**	76.10	**TPER**	88.30

Assessor Details	Mr. James Gradwell	**Assessor ID**	BJ35-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.4200	(1b)	x 2.2000	(2b) =	91.1240	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	41.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		91.1240	(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	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2195 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.4195 (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) =	0.4195 (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	0.5348	0.5244	0.5139	0.4614	0.4509	0.3985	0.3985	0.3880	0.4195	0.4509	0.4719	0.4929	(22b)
Effective ac	0.6430	0.6375	0.6320	0.6065	0.6017	0.5794	0.5794	0.5753	0.5880	0.6017	0.6114	0.6215	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			5.8000	0.9615	5.5769			(27)
External Wall 1	59.3000	7.9000	51.4000	0.1500	7.7100	9.0000	462.6000	(29a)
External Roof 1	41.4200		41.4200	0.1100	4.5562	9.0000	372.7800	(30)
Total net area of external elements Aum(A, m2)			100.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.9431			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			41.4200			30.0000	1242.6000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	2954.9800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		71.3419 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3 Sill	3.1000	0.0340	0.1054
E4 Jamb	13.0000	0.0430	0.5590
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14 Flat roof	27.9000	0.0460	1.2834
E16 Corner (normal)	8.9000	0.0300	0.2670

E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675
E18 Party wall between dwellings	8.9000	0.0300	0.2670
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1958 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.1389 (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	19.3364	19.1694	19.0057	18.2368	18.0929	17.4232	17.4232	17.2992	17.6812	18.0929	18.3839	18.6882	(38)
Heat transfer coeff	48.4753	48.3083	48.1446	47.3757	47.2318	46.5621	46.5621	46.4381	46.8201	47.2318	47.5229	47.8271	(39)

Average = Sum(39)m / 12 = 47.3750

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1703	1.1663	1.1624	1.1438	1.1403	1.1241	1.1241	1.1212	1.1304	1.1403	1.1473	1.1547	(40)
HLP (average)												1.1438	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.4446 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	62.1441	61.2102	59.8493	57.2455	55.3240	53.1811	51.9631	53.3136	54.7941	57.0949	59.7547	61.9060	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	29.4238	28.3539	27.2839	26.2140	25.1440	24.0740	24.0740	25.1440	26.2140	27.2839	28.3539	29.4238	(42c)

Average daily hot water use (litres/day) 84.0437 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5679	89.5641	87.1332	83.4595	80.4680	77.2551	76.0371	78.4576	81.0081	84.3788	88.1085	91.3298	(44)
Energy conte	145.0212	127.5380	133.9205	114.2518	108.3253	94.9942	91.9603	97.1469	99.8911	114.5013	125.5268	143.0004	(45)

Energy content (annual) Total = Sum(45)m = 1396.0778

Distribution loss (46)m = 0.15 x (45)m	21.7532	19.1307	20.0881	17.1378	16.2488	14.2491	13.7940	14.5720	14.9837	17.1752	18.8290	21.4501	(46)

Water storage loss:
Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0000 (48)
Temperature factor from Table 2b 0.7800 (49)
Enter (49) or (54) in (55) 1.5600 (55)

Total storage loss	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(56)
If cylinder contains dedicated solar storage	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(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	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(64)

Total per year (kWh/year) = Sum(64)m = 2487.0394 (64)
12Total per year (kWh/year) 2487 (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	92.1056	82.0454	88.4146	80.4591	79.9043	49.5952	49.1867	50.9113	51.2234	81.9578	84.2080	91.4337	(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	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.7013	74.9550	67.7013	69.9580	67.7013	69.9580	67.7013	67.7013	69.9580	67.7013	69.9580	67.7013	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	125.1206	126.4190	123.1472	116.1818	107.3893	99.1257	93.6050	92.3066	95.5785	102.5438	111.3363	119.6000	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	(71)
Water heating gains (Table 5)	123.7979	122.0914	118.8369	111.7488	107.3982	68.8822	66.1112	68.4291	71.1436	110.1583	116.9556	122.8948	(72)
Total internal gains	361.2883	368.1339	354.3539	342.5571	327.1573	282.6343	272.0860	273.1056	281.3486	325.0719	342.9184	354.8646	(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	
Southeast	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340	(77)
Southwest	0.6000	36.7938	0.6300	0.7000	0.7700	6.7468	(79)
Northwest	2.2000	11.2829	0.6300	0.7000	0.7700	7.5861	(81)

Solar gains	48.0669	84.3955	122.1666	162.5888	192.3528	195.4659	186.5756	163.6817	136.0566	95.0796	58.0319	40.8383	(83)
Total gains	409.3552	452.5294	476.5204	505.1460	519.5101	478.1002	458.6615	436.7873	417.4052	420.1515	400.9504	395.7029	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.9329	16.9914	17.0492	17.3259	17.3787	17.6287	17.6287	17.6757	17.5315	17.3787	17.2723	17.1624	
alpha	2.1289	2.1328	2.1366	2.1551	2.1586	2.1752	2.1752	2.1784	2.1688	2.1586	2.1515	2.1442	
util living area	0.8687	0.8387	0.7989	0.7251	0.6245	0.5152	0.4003	0.4304	0.5935	0.7350	0.8306	0.8754	(86)
Living	18.3224	18.6471	19.1216	19.7655	20.3142	20.6893	20.8720	20.8458	20.5481	19.9104	19.0495	18.2862	
Non living	17.5354	17.8511	18.3120	18.9344	19.4415	19.7793	19.9183	19.9041	19.6654	19.0841	18.2589	17.5087	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.6302	18.6471	19.1216	19.7655	20.3142	20.6893	20.8720	20.8458	20.5481	19.9104	19.0495	18.6658	(87)
Th 2	19.9438	19.9471	19.9502	19.9652	19.9680	19.9812	19.9812	19.9836	19.9761	19.9680	19.9624	19.9564	(88)
util rest of house	0.8551	0.8224	0.7780	0.6956	0.5820	0.4539	0.3205	0.3508	0.5350	0.7009	0.8111	0.8625	(89)
MIT 2	18.7118	17.8511	18.3120	18.9344	19.4415	19.7793	19.9183	19.9041	19.6654	19.0841	18.2589	17.8511	(90)
Living area fraction										fLA = Living area / (4) =		0.5777	(91)
MIT	19.2424	18.3110	18.7797	19.4146	19.9457	20.3051	20.4693	20.4481	20.1754	19.5615	18.7156	18.3218	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2424	18.3110	18.7797	19.4146	19.9457	20.3051	20.4693	20.4481	20.1754	19.5615	18.7156	18.3218	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8450	0.7922	0.7511	0.6783	0.5810	0.4743	0.3599	0.3884	0.5471	0.6859	0.7834	0.8383	(94)
Useful gains	345.8881	358.5056	357.8995	342.6217	301.8536	226.7464	165.0560	169.6655	228.3749	288.1921	314.0877	331.7129	(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	724.3379	647.8604	591.2031	498.1346	389.4594	265.6407	180.1624	187.9875	284.4490	423.2689	552.0077	675.4036	(97)
Space heating kWh	281.5667	194.4464	173.5778	111.9693	65.1787	0.0000	0.0000	0.0000	0.0000	100.4971	171.3024	255.7060	(98a)
Space heating requirement - total per year (kWh/year)												1354.2443	
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	281.5667	194.4464	173.5778	111.9693	65.1787	0.0000	0.0000	0.0000	0.0000	100.4971	171.3024	255.7060	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1354.2443	
Space heating per m2											(98c) / (4) =	32.6954	(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 %)	252.6170	(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	281.5667	194.4464	173.5778	111.9693	65.1787	0.0000	0.0000	0.0000	0.0000	100.4971	171.3024	255.7060	(98)
Space heating efficiency (main heating system 1)	252.6170	252.6170	252.6170	252.6170	252.6170	0.0000	0.0000	0.0000	0.0000	252.6170	252.6170	252.6170	(210)
Space heating fuel (main heating system)	111.4599	76.9728	68.7119	44.3237	25.8014	0.0000	0.0000	0.0000	0.0000	39.7824	67.8111	101.2228	(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	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(64)
Efficiency of water heater												176.8663	(216)
(217)m	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	(217)
Fuel for water heating, kWh/month	140.3539	124.8213	134.0776	121.0744	119.6061	92.8985	92.4894	95.4220	95.6672	123.0980	127.4492	139.2114	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
(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	(231)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(232)
Lighting	13.5239	10.8494	9.7687	7.1569	5.5282	4.5166	5.0430	6.5551	8.5145	11.1714	12.6181	13.8998	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
(233a)m													
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(234a)m													
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
(235a)m													
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(235c)m													
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
(233b)m													
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(234b)m													
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(235b)m													
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
(235d)m													

Annual totals kWh/year

Space heating fuel - main system 1	536.0860	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.8663	
Water heating fuel used	1406.1690	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	109.1455	(232)

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

PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2051.4006	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	536.0860	0.1546	82.8898	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1406.1690	0.1415	198.9150	(264)
Space and water heating			281.8048	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	109.1455	0.1443	15.7531	(268)
Total CO2, kg/year			297.5579	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.1800	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	536.0860	1.5724	842.9424	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1406.1690	1.5231	2141.7493	(278)
Space and water heating			2984.6917	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	109.1455	1.5338	167.4111	(282)
Total Primary energy kWh/year			3152.1028	(286)
Dwelling Primary energy Rate (DPER)			76.1000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.4200	(1b)	x 2.2000	(2b) =	91.1240	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	41.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		91.1240	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2195	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4695	(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) =	0.4695	(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	0.5986	0.5869	0.5751	0.5164	0.5047	0.4460	0.4460	0.4343	0.4695	0.5047	0.5282	0.5516	(22b)
Effective ac	0.6792	0.6722	0.6654	0.6333	0.6274	0.5995	0.5995	0.5943	0.6102	0.6274	0.6395	0.6522	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.20)			5.8000	1.1450	6.6412			(27)

External Wall 1	59.3000	7.9000	51.4000	0.1800	9.2520	(29a)
External Roof 1	41.4200		41.4200	0.1100	4.5562	(30)
Total net area of external elements Aum(A, m2)			100.7200			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.5494	(33)
Party Wall 1			16.4000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 71.3419 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0500	2.1500
E3 Sill	3.1000	0.0500	0.1550
E4 Jamb	13.0000	0.0500	0.6500
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0700	1.9530
E14 Flat roof	27.9000	0.0800	2.2320
E16 Corner (normal)	8.9000	0.0900	0.8010
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0900	-0.4050
E18 Party wall between dwellings	8.9000	0.0600	0.5340
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.1200	0.9000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9700 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 31.5194 (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	20.4228	20.2136	20.0085	19.0454	18.8652	18.0263	18.0263	17.8710	18.3495	18.8652	19.2297	19.6109	(38)
Heat transfer coeff	51.9422	51.7330	51.5280	50.5648	50.3846	49.5458	49.5458	49.3904	49.8689	50.3846	50.7492	51.1303	(39)

Average = Sum(39)m / 12 = 50.5640

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2540	1.2490	1.2440	1.2208	1.2164	1.1962	1.1962	1.1924	1.2040	1.2164	1.2252	1.2344	(40)
HLP (average)												1.2208	
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 1.4446 (42)

Hot water usage for mixer showers

62.1441	61.2102	59.8493	57.2455	55.3240	53.1811	51.9631	53.3136	54.7941	57.0949	59.7547	61.9060	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

29.4238	28.3539	27.2839	26.2140	25.1440	24.0740	24.0740	25.1440	26.2140	27.2839	28.3539	29.4238	(42c)

Average daily hot water use (litres/day) 84.0437 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5679	89.5641	87.1332	83.4595	80.4680	77.2551	76.0371	78.4576	81.0081	84.3788	88.1085	91.3298	(44)
Energy conte	145.0212	127.5380	133.9205	114.2518	108.3253	94.9942	91.9603	97.1469	99.8911	114.5013	125.5268	143.0004	(45)

Energy content (annual) Total = Sum(45)m = 1396.0778

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

21.7532	19.1307	20.0881	17.1378	16.2488	14.2491	13.7940	14.5720	14.9837	17.1752	18.8290	21.4501	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss

Combi loss

Total heat required for water heating calculated for each month

191.6161	169.6237	180.5154	159.3437	154.9202	140.0860	138.5552	143.7418	144.9829	161.0962	170.6186	189.5953	(62)
-28.4097	-25.1258	-26.3102	-21.7859	-20.3037	-17.3740	-16.2854	-17.3179	-17.9758	-21.1915	-24.0074	-27.8836	(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)

WWHRS

PV diverter

Solar input

FGHRS

Output from w/h

163.2064	144.4980	154.2052	137.5577	134.6165	122.7120	122.2698	126.4240	127.0071	139.9047	146.6112	161.7117	(64)

Total per year (kWh/year) = Sum(64)m = 1680.7243 (64)

12Total per year (kWh/year) 1681 (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

85.4955	76.0750	81.8045	74.0622	73.2941	67.6590	67.8527	69.5773	69.2873	75.3476	77.8111	84.8236	(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	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.7013	74.9550	67.7013	69.9580	67.7013	69.9580	67.7013	67.7013	69.9580	67.7013	69.9580	67.7013	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	125.1206	126.4190	123.1472	116.1818	107.3893	99.1257	93.6050	92.3066	95.5785	102.5438	111.3363	119.6000	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	(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)	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	(71)
Water heating gains (Table 5)	114.9133	113.2068	109.9523	102.8642	98.5136	93.9709	91.1999	93.5178	96.2323	101.2737	108.0710	114.0102	(72)
Total internal gains	355.4037	362.2493	348.4692	336.6725	321.2727	307.7231	297.1747	298.1943	306.4373	319.1873	337.0338	348.9799	(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	
Southeast	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340	(77)
Southwest	0.6000	36.7938	0.6300	0.7000	0.7700	6.7468	(79)
Northwest	2.2000	11.2829	0.6300	0.7000	0.7700	7.5861	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	48.0669	84.3955	122.1666	162.5888	192.3528	195.4659	186.5756	163.6817	136.0566	95.0796	58.0319	40.8383	(83)
Total gains	403.4706	446.6448	470.6358	499.2613	513.6255	503.1889	483.7502	461.8760	442.4939	414.2669	395.0657	389.8183	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	15.8027	15.8666	15.9298	16.2332	16.2912	16.5671	16.5671	16.6192	16.4597	16.2912	16.1742	16.0537	
alpha	2.0535	2.0578	2.0620	2.0822	2.0861	2.1045	2.1045	2.1079	2.0973	2.0861	2.0783	2.0702	
util living area	0.8771	0.8489	0.8115	0.7413	0.6445	0.5144	0.4001	0.4289	0.5891	0.7513	0.8415	0.8833	(86)
MIT	18.0725	18.4081	18.9097	19.6033	20.2038	20.6599	20.8574	20.8300	20.5146	19.7686	18.8491	18.0428	(87)
Th 2	19.8770	19.8810	19.8849	19.9034	19.9069	19.9231	19.9231	19.9261	19.9168	19.9069	19.8999	19.8926	(88)
util rest of house	0.8636	0.8327	0.7906	0.7114	0.6004	0.4501	0.3163	0.3455	0.5279	0.7168	0.8221	0.8705	(89)
MIT 2	16.5330	16.9482	17.5689	18.4207	19.1309	19.6456	19.8362	19.8172	19.4975	18.6372	17.5115	16.5017	(90)
Living area fraction									fLA = Living area / (4) =			0.5777	(91)
MIT	17.4224	17.7916	18.3435	19.1039	19.7508	20.2316	20.4262	20.4024	20.0851	19.2908	18.2843	17.3921	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4224	17.7916	18.3435	19.1039	19.7508	20.2316	20.4262	20.4024	20.0851	19.2908	18.2843	17.3921	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8259	0.7951	0.7559	0.6866	0.5936	0.4695	0.3568	0.3839	0.5381	0.6945	0.7871	0.8334	(94)
Useful gains	333.2079	355.1374	355.7744	342.7936	304.8835	236.2248	172.5923	177.3228	238.1034	287.7111	310.9413	324.8803	(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	681.6059	666.9239	610.2720	515.9585	405.6354	279.0230	189.5723	197.6781	298.4710	437.8852	567.5929	674.5156	(97)
Space heating kWh	259.2081	209.5205	189.3462	124.6788	74.9594	0.0000	0.0000	0.0000	0.0000	111.7296	184.7892	260.1287	(98a)
Space heating requirement - total per year (kWh/year)												1414.3604	
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	259.2081	209.5205	189.3462	124.6788	74.9594	0.0000	0.0000	0.0000	0.0000	111.7296	184.7892	260.1287	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1414.3604	
Space heating per m2											(98c) / (4) =	34.1468	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	259.2081	209.5205	189.3462	124.6788	74.9594	0.0000	0.0000	0.0000	0.0000	111.7296	184.7892	260.1287	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	280.8322	226.9994	205.1422	135.0799	81.2128	0.0000	0.0000	0.0000	0.0000	121.0505	200.2050	281.8295	(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	163.2064	144.4980	154.2052	137.5577	134.6165	122.7120	122.2698	126.4240	127.0071	139.9047	146.6112	161.7117	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.0921	84.8921	84.5213	83.8400	82.8016	79.8000	79.8000	79.8000	79.8000	83.5603	84.5799	85.1199	(217)
Fuel for water heating, kWh/month	191.7997	170.2137	182.4453	164.0718	162.5772	153.7744	153.2203	158.4260	159.1567	167.4295	173.3404	189.9812	(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	14.0670	11.2851	10.1609	7.4443	5.7502	4.6980	5.2455	6.8184	8.8564	11.6200	13.1248	14.4580	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3822	-21.0856	-31.5164	-36.9181	-41.1376	-38.9271	-38.4971	-35.7109	-30.9800	-24.8101	-16.1128	-12.3449	(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	-5.8334	-12.4791	-25.1792	-38.3562	-51.2200	-51.6078	-50.9548	-42.8736	-31.1028	-17.9723	-7.8328	-4.5942	(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												1532.3515	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2026.4364	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	113.5287	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-682.4291	(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	3075.8874	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1532.3515	0.2100	321.7938	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2026.4364	0.2100	425.5516	(264)
Space and water heating			747.3455	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	113.5287	0.1443	16.3857	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-342.4229	0.1337	-45.7925	
PV Unit electricity exported	-340.0062	0.1255	-42.6724	
Total			-88.4649	(269)
Total CO2, kg/year			687.1955	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.5900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1532.3515	1.1300	1731.5572	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2026.4364	1.1300	2289.8731	(278)
Space and water heating			4021.4303	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	113.5287	1.5338	174.1340	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-342.4229	1.4942	-511.6476	
PV Unit electricity exported	-340.0062	0.4607	-156.6314	
Total			-668.2790	(283)
Total Primary energy kWh/year			3657.3861	(286)
Target Primary Energy Rate (TPER)			88.3000	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		41.4200	(1b)	x 2.2000	(2b) =	91.1240	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	41.4200						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		91.1240	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2195	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.4195	(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) = 0.4195 (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	0.5348	0.5244	0.5139	0.4614	0.4509	0.3985	0.3985	0.3880	0.4195	0.4509	0.4719	0.4929	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

Effective ac	0.6430	0.6375	0.6320	0.6065	0.6017	0.5794	0.5794	0.5753	0.5880	0.6017	0.6114	0.6215	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			5.8000	0.9615	5.5769			(27)
External Wall 1	59.3000	7.9000	51.4000	0.1500	7.7100	9.0000	462.6000	(29a)
External Roof 1	41.4200		41.4200	0.1100	4.5562	9.0000	372.7800	(30)
Total net area of external elements Aum(A, m2)			100.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.9431			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			41.4200			30.0000	1242.6000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 2954.9800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 71.3419 (35)
List of Thermal Bridges

		Length	Psi-value	Total
K1	Element			
E2	Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3	Sill	3.1000	0.0340	0.1054
E4	Jamb	13.0000	0.0430	0.5590
E7	Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14	Flat roof	27.9000	0.0460	1.2834
E16	Corner (normal)	8.9000	0.0300	0.2670
E17	Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675
E18	Party wall between dwellings	8.9000	0.0300	0.2670
P2	Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925
P4	Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1958 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.1389 (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	19.3364	19.1694	19.0057	18.2368	18.0929	17.4232	17.4232	17.2992	17.6812	18.0929	18.3839	18.6882	(38)
Heat transfer coeff	48.4753	48.3083	48.1446	47.3757	47.2318	46.5621	46.5621	46.4381	46.8201	47.2318	47.5229	47.8271	(39)

Average = Sum(39)m / 12 = 47.3750

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1703	1.1663	1.1624	1.1438	1.1403	1.1241	1.1241	1.1212	1.1304	1.1403	1.1473	1.1547	(40)
HLP (average)												1.1438	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.4446 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

20.9541	20.6429	20.2046	19.3966	18.7916	18.1207	17.7583	18.1935	18.6673	19.3852	20.2098	20.8832	(42b)

Hot water usage for other uses

29.4238	28.3539	27.2839	26.2140	25.1440	24.0740	24.0740	25.1440	26.2140	27.2839	28.3539	29.4238	(42c)

Average daily hot water use (litres/day) 46.1766 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	50.3779	48.9967	47.4885	45.6106	43.9356	42.1947	41.8323	43.3375	44.8812	46.6691	48.5637	50.3070	(44)
Energy conte	79.7862	69.7707	72.9881	62.4386	59.1457	51.8833	50.5926	53.6608	55.3431	63.3295	69.1879	78.7687	(45)

Energy content (annual) Total = Sum(45)m = 766.8952
Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:
Total storage loss

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

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

67.8183	59.3051	62.0399	53.0728	50.2739	44.1008	43.0037	45.6117	47.0416	53.8301	58.8097	66.9534	(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

67.8183	59.3051	62.0399	53.0728	50.2739	44.1008	43.0037	45.6117	47.0416	53.8301	58.8097	66.9534	(64)

Total per year (kWh/year) = Sum(64)m = 651.8609 (64)
12Total per year (kWh/year) 652 (64)
Electric shower(s)

38.7924	34.5644	37.7430	36.0177	36.6935	35.0021	36.1688	36.6935	36.0177	37.7430	37.0333	38.7924	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 441.2617 (64a)
Heat gains from water heating, kWh/month

26.6527	23.4674	24.9457	22.2726	21.7418	19.7757	19.7931	20.5763	20.7648	22.8933	23.9607	26.4365	(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	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.7013	74.9550	67.7013	69.9580	67.7013	69.9580	67.7013	67.7013	69.9580	67.7013	69.9580	67.7013	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	125.1206	126.4190	123.1472	116.1818	107.3893	99.1257	93.6050	92.3066	95.5785	102.5438	111.3363	119.6000	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	(71)
Water heating gains (Table 5)													
	35.8235	34.9217	33.5292	30.9342	29.2229	27.4663	26.6037	27.6563	28.8400	30.7705	33.2788	35.5329	(72)
Total internal gains													
	273.3139	280.9642	269.0462	261.7425	248.9821	241.2185	232.5785	232.3328	239.0450	245.6841	259.2416	267.5026	(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	
Southeast	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340	(77)
Southwest	0.6000	36.7938	0.6300	0.7000	0.7700	6.7468	(79)
Northwest	2.2000	11.2829	0.6300	0.7000	0.7700	7.5861	(81)

Solar gains	48.0669	84.3955	122.1666	162.5888	192.3528	195.4659	186.5756	163.6817	136.0566	95.0796	58.0319	40.8383	(83)
Total gains	321.3808	365.3597	391.2127	424.3314	441.3348	436.6843	419.1540	396.0145	375.1016	340.7637	317.2735	308.3410	(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	16.9329	16.9914	17.0492	17.3259	17.3787	17.6287	17.6287	17.6757	17.5315	17.3787	17.2723	17.1624	
alpha	2.1289	2.1328	2.1366	2.1551	2.1586	2.1752	2.1752	2.1784	2.1688	2.1586	2.1515	2.1442	
util living area													
	0.9107	0.8832	0.8477	0.7783	0.6818	0.5481	0.4301	0.4641	0.6320	0.7969	0.8809	0.9169	(86)
MIT	17.9512	18.3112	18.8311	19.5508	20.1736	20.6473	20.8520	20.8203	20.4843	19.6881	18.7305	17.9080	(87)
Th 2	19.9438	19.9471	19.9502	19.9652	19.9680	19.9812	19.9812	19.9836	19.9761	19.9680	19.9624	19.9564	(88)
util rest of house													
	0.9006	0.8703	0.8302	0.7518	0.6407	0.4856	0.3464	0.3809	0.5739	0.7672	0.8657	0.9075	(89)
MIT 2	17.1779	17.5309	18.0400	18.7412	19.3245	19.7497	19.9076	19.8897	19.6171	18.8866	17.9578	17.1436	(90)
Living area fraction										fLA = Living area / (4) =		0.5777	(91)
MIT	17.6247	17.9817	18.4971	19.2090	19.8151	20.2683	20.4532	20.4274	20.1181	19.3496	18.4042	17.5852	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6247	17.9817	18.4971	19.2090	19.8151	20.2683	20.4532	20.4274	20.1181	19.3496	18.4042	17.5852	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8719	0.8402	0.8010	0.7296	0.6341	0.5042	0.3866	0.4187	0.5826	0.7464	0.8372	0.8797	(94)
Useful gains	280.2092	306.9638	313.3677	309.5955	279.8432	220.1614	162.0369	165.8136	218.5321	254.3617	265.6143	271.2377	(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													
	645.9182	631.9551	577.5933	488.3948	383.2888	263.9263	179.4152	187.0239	281.7685	413.2616	537.2083	640.1757	(97)
Space heating kWh													
	272.0875	218.3942	196.5839	128.7354	76.9635	0.0000	0.0000	0.0000	0.0000	118.2216	195.5476	274.4899	(98a)
Space heating requirement - total per year (kWh/year)												1481.0236	
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													
	272.0875	218.3942	196.5839	128.7354	76.9635	0.0000	0.0000	0.0000	0.0000	118.2216	195.5476	274.4899	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1481.0236	
Space heating per m2											(98c) / (4) =	35.7562	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	437.6840	344.5598	352.9297	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7186	0.7801	0.7564	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	314.5410	268.7895	266.9572	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	483.8086	464.7919	439.0669	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	121.8726	145.8258	128.0497	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	30.4682	36.4565	32.0124	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												98.9370	(107)
Energy for space heating												35.7562	(99)
Energy for space cooling												2.3886	(108)
Total												38.1449	(109)
Fabric Energy Efficiency (DFEE)												38.1	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.4200 (1b)	x	2.2000 (2b)	=	91.1240	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	41.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	91.1240	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2195	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4695	(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) =	0.4695	(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	0.5986	0.5869	0.5751	0.5164	0.5047	0.4460	0.4460	0.4343	0.4695	0.5047	0.5282	0.5516	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.6792	0.6722	0.6654	0.6333	0.6274	0.5995	0.5995	0.5943	0.6102	0.6274	0.6395	0.6522	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.20)			5.8000	1.1450	6.6412			(27)
External Wall 1	59.3000	7.9000	51.4000	0.1800	9.2520			(29a)
External Roof 1	41.4200		41.4200	0.1100	4.5562			(30)
Total net area of external elements Aum(A, m2)			100.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.5494			(33)
Party Wall 1			16.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		71.3419	(35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	43.0000	0.0500	2.1500
E3 Sill	3.1000	0.0500	0.1550
E4 Jamb	13.0000	0.0500	0.6500
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0700	1.9530
E14 Flat roof	27.9000	0.0800	2.2320
E16 Corner (normal)	8.9000	0.0900	0.8010
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0900	-0.4050
E18 Party wall between dwellings	8.9000	0.0600	0.5340
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.1200	0.9000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.9700 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	31.5194 (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	20.4228	20.2136	20.0085	19.0454	18.8652	18.0263	18.0263	17.8710	18.3495	18.8652	19.2297	19.6109	(38)
Heat transfer coeff	51.9422	51.7330	51.5280	50.5648	50.3846	49.5458	49.5458	49.3904	49.8689	50.3846	50.7492	51.1303	(39)
Average = Sum(39)m / 12 =												50.5640	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2540	1.2490	1.2440	1.2208	1.2164	1.1962	1.1962	1.1924	1.2040	1.2164	1.2252	1.2344	(40)
HLP (average)												1.2208	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.4446	(42)
Hot water usage for mixer showers			
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000			(42a)
Hot water usage for baths			
20.9541 20.6429 20.2046 19.3966 18.7916 18.1207 17.7583 18.1935 18.6673 19.3852 20.2098 20.8832			(42b)
Hot water usage for other uses			

	29.4238	28.3539	27.2839	26.2140	25.1440	24.0740	24.0740	25.1440	26.2140	27.2839	28.3539	29.4238	(42c)
Average daily hot water use (litres/day)												46.1766	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	50.3779	48.9967	47.4885	45.6106	43.9356	42.1947	41.8323	43.3375	44.8812	46.6691	48.5637	50.3070	(44)
Energy conte	79.7862	69.7707	72.9881	62.4386	59.1457	51.8833	50.5926	53.6608	55.3431	63.3295	69.1879	78.7687	(45)
Energy content (annual)											Total = Sum(45)m =	766.8952	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	67.8183	59.3051	62.0399	53.0728	50.2739	44.1008	43.0037	45.6117	47.0416	53.8301	58.8097	66.9534	(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													
	67.8183	59.3051	62.0399	53.0728	50.2739	44.1008	43.0037	45.6117	47.0416	53.8301	58.8097	66.9534	(64)
										Total per year (kWh/year) = Sum(64)m =		651.8609	(64)
12Total per year (kWh/year)												652	(64)
Electric shower(s)													
	38.7924	34.5644	37.7430	36.0177	36.6935	35.0021	36.1688	36.6935	36.0177	37.7430	37.0333	38.7924	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												441.2617	(64a)
Heat gains from water heating, kWh/month													
	26.6527	23.4674	24.9457	22.2726	21.7418	19.7757	19.7931	20.5763	20.7648	22.8933	23.9607	26.4365	(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	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	72.2284	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.7013	74.9550	67.7013	69.9580	67.7013	69.9580	67.7013	67.7013	69.9580	67.7013	69.9580	67.7013	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	125.1206	126.4190	123.1472	116.1818	107.3893	99.1257	93.6050	92.3066	95.5785	102.5438	111.3363	119.6000	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	30.2228	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	(71)
Water heating gains (Table 5)													
	35.8235	34.9217	33.5292	30.9342	29.2229	27.4663	26.6037	27.6563	28.8400	30.7705	33.2788	35.5329	(72)
Total internal gains													
	273.3139	280.9642	269.0462	261.7425	248.9821	241.2185	232.5785	232.3328	239.0450	245.6841	259.2416	267.5026	(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	
Southeast	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340	(77)
Southwest	0.6000	36.7938	0.6300	0.7000	0.7700	6.7468	(79)
Northwest	2.2000	11.2829	0.6300	0.7000	0.7700	7.5861	(81)

Solar gains	48.0669	84.3955	122.1666	162.5888	192.3528	195.4659	186.5756	163.6817	136.0566	95.0796	58.0319	40.8383	(83)
Total gains	321.3808	365.3597	391.2127	424.3314	441.3348	436.6843	419.1540	396.0145	375.1016	340.7637	317.2735	308.3410	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	15.8027	15.8666	15.9298	16.2332	16.2912	16.5671	16.5671	16.6192	16.4597	16.2912	16.1742	16.0537	
alpha	2.0535	2.0578	2.0620	2.0822	2.0861	2.1045	2.1045	2.1079	2.0973	2.0861	2.0783	2.0702	
util living area													
	0.9139	0.8880	0.8545	0.7885	0.6960	0.5651	0.4475	0.4815	0.6475	0.8061	0.8857	0.9197	(86)
MIT	17.7296	18.0956	18.6369	19.3982	20.0657	20.5896	20.8224	20.7866	20.4112	19.5571	18.5523	17.6939	(87)
Th 2	19.8770	19.8810	19.8849	19.9034	19.9069	19.9231	19.9231	19.9261	19.9168	19.9069	19.8999	19.8926	(88)
util rest of house													
	0.9037	0.8750	0.8368	0.7615	0.6537	0.4993	0.3575	0.3925	0.5871	0.7759	0.8703	0.9102	(89)
MIT 2	16.9205	17.2802	17.8112	18.5559	19.1834	19.6564	19.8367	19.8166	19.5104	18.7232	17.7461	16.8950	(90)
Living area fraction										fLA = Living area / (4) =		0.5777	(91)
MIT	17.3879	17.7513	18.2882	19.0425	19.6932	20.1955	20.4062	20.3770	20.0308	19.2049	18.2119	17.3565	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3879	17.7513	18.2882	19.0425	19.6932	20.1955	20.4062	20.3770	20.0308	19.2049	18.2119	17.3565	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8740	0.8435	0.8059	0.7370	0.6446	0.5170	0.3996	0.4317	0.5940	0.7531	0.8405	0.8815	(94)
Useful gains	280.8889	308.1792	315.2593	312.7306	284.4678	225.7669	167.4965	170.9649	222.8187	256.6144	266.6649	271.7916	(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													
	679.8152	664.8364	607.4232	512.8534	402.7328	277.2355	188.5796	196.4254	295.7639	433.5566	563.9204	672.6968	(97)
Space heating kWh													
	296.8012	239.6736	217.3700	144.0884	87.9891	0.0000	0.0000	0.0000	0.0000	131.6450	214.0240	298.2735	(98a)
Space heating requirement - total per year (kWh/year)												1629.8647	
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	(98b)
Solar heating contribution - total per year (kWh/year)											0.0000	
Space heating kWh												
	296.8012	239.6736	217.3700	144.0884	87.9891	0.0000	0.0000	0.0000	131.6450	214.0240	298.2735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)											1629.8647	
Space heating per m2										(98c) / (4) =	39.3497	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	465.7302	366.6387	375.3672	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6907	0.7540	0.7296	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	321.6789	276.4614	273.8843	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	483.8086	464.7919	439.0669	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	116.7333	140.1179	122.8959	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	29.1833	35.0295	30.7240	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												94.9368	(107)
Energy for space heating												39.3497	(99)
Energy for space cooling												2.2921	(108)
Total												41.6418	(109)
Fabric Energy Efficiency (TFEE)												41.6	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.4200	(1b)	x 2.2000	(2b) =	91.1240	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	41.4200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	91.1240	(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	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2195 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.4195 (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) =	0.4195 (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													
	0.5348	0.5244	0.5139	0.4614	0.4509	0.3985	0.3985	0.3880	0.4195	0.4509	0.4719	0.4929	(22b)
Effective ac	0.6430	0.6375	0.6320	0.6065	0.6017	0.5794	0.5794	0.5753	0.5880	0.6017	0.6114	0.6215	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			5.8000	0.9615	5.5769			(27)
External Wall 1	59.3000	7.9000	51.4000	0.1500	7.7100	9.0000	462.6000	(29a)
External Roof 1	41.4200		41.4200	0.1100	4.5562	9.0000	372.7800	(30)
Total net area of external elements Aum(A, m2)			100.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.9431			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			41.4200			30.0000	1242.6000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		2954.9800	(34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 71.3419 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3 Sill	3.1000	0.0340	0.1054
E4 Jamb	13.0000	0.0430	0.5590
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14 Flat roof	27.9000	0.0460	1.2834
E16 Corner (normal)	8.9000	0.0300	0.2670
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675
E18 Party wall between dwellings	8.9000	0.0300	0.2670
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1958 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.1389 (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	19.3364	19.1694	19.0057	18.2368	18.0929	17.4232	17.4232	17.2992	17.6812	18.0929	18.3839	18.6882	(38)
Heat transfer coeff	48.4753	48.3083	48.1446	47.3757	47.2318	46.5621	46.5621	46.4381	46.8201	47.2318	47.5229	47.8271	(39)

Average = Sum(39)m / 12 = 47.3750

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1703	1.1663	1.1624	1.1438	1.1403	1.1241	1.1241	1.1212	1.1304	1.1403	1.1473	1.1547	(40)
HLP (average)												1.1438	
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 1.4446 (42)
Hot water usage for mixer showers

62.1441	61.2102	59.8493	57.2455	55.3240	53.1811	51.9631	53.3136	54.7941	57.0949	59.7547	61.9060	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

29.4238	28.3539	27.2839	26.2140	25.1440	24.0740	24.0740	25.1440	26.2140	27.2839	28.3539	29.4238	(42c)

Average daily hot water use (litres/day) 84.0437 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5679	89.5641	87.1332	83.4595	80.4680	77.2551	76.0371	78.4576	81.0081	84.3788	88.1085	91.3298	(44)
Energy conte	145.0212	127.5380	133.9205	114.2518	108.3253	94.9942	91.9603	97.1469	99.8911	114.5013	125.5268	143.0004	(45)
Energy content (annual)										Total = Sum(45)m =		1396.0778	
Distribution loss (46)m = 0.15 x (45)m	21.7532	19.1307	20.0881	17.1378	16.2488	14.2491	13.7940	14.5720	14.9837	17.1752	18.8290	21.4501	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.5600	(55)
Total storage loss	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(56)
If cylinder contains dedicated solar storage	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(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	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(64)
										Total per year (kWh/year) = Sum(64)m =		2487.0394	(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	92.1056	82.0454	88.4146	80.4591	79.9043	49.5952	49.1867	50.9113	51.2234	81.9578	84.2080	91.4337	(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	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.4507	13.7232	11.1604	8.4492	6.3158	5.3321	5.7615	7.4890	10.0518	12.7630	14.8964	15.8801	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	186.7472	188.6850	183.8017	173.4057	160.2826	147.9487	139.7090	137.7711	142.6544	153.0504	166.1735	178.5074	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	(71)
Water heating gains (Table 5)	123.7979	122.0914	118.8369	111.7488	107.3982	68.8822	66.1112	68.4291	71.1436	110.1583	116.9556	122.8948	(72)
Total internal gains	399.9991	398.5030	387.8024	367.6070	348.0000	296.1664	285.5850	287.6926	297.8531	349.9751	372.0289	391.2857	(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	
Southeast	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340	(77)
Southwest	0.6000	36.7938	0.6300	0.7000	0.7700	6.7468	(79)
Northwest	2.2000	11.2829	0.6300	0.7000	0.7700	7.5861	(81)

Solar gains	48.0669	84.3955	122.1666	162.5888	192.3528	195.4659	186.5756	163.6817	136.0566	95.0796	58.0319	40.8383	(83)
Total gains	448.0660	482.8985	509.9690	530.1958	540.3527	491.6322	472.1606	451.3744	433.9098	445.0547	430.0608	432.1240	(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	16.9329	16.9914	17.0492	17.3259	17.3787	17.6287	17.6287	17.6757	17.5315	17.3787	17.2723	17.1624	
alpha	2.1289	2.1328	2.1366	2.1551	2.1586	2.1752	2.1752	2.1784	2.1688	2.1586	2.1515	2.1442	
util living area													
	0.8496	0.8231	0.7801	0.7093	0.6104	0.5052	0.3909	0.4194	0.5794	0.7164	0.8131	0.8575	(86)
Living	18.4704	18.7530	19.2230	19.8239	20.3463	20.7016	20.8779	20.8536	20.5701	19.9705	19.1485	18.4295	
Non living	17.6767	17.9511	18.4059	18.9863	19.4678	19.7879	19.9215	19.9085	19.6818	19.1366	18.3513	17.6458	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7060	18.7530	19.2230	19.8239	20.3463	20.7016	20.8779	20.8536	20.5701	19.9705	19.1485	18.7890	(87)
Th 2	19.9438	19.9471	19.9502	19.9652	19.9680	19.9812	19.9812	19.9836	19.9761	19.9680	19.9624	19.9564	(88)
util rest of house													
	0.8347	0.8057	0.7581	0.6792	0.5677	0.4443	0.3124	0.3410	0.5210	0.6814	0.7923	0.8433	(89)
MIT 2	18.7840	17.9511	18.4059	18.9863	19.4678	19.7879	19.9215	19.9085	19.6818	19.1366	18.3513	17.9690	(90)
Living area fraction									fLA = Living area / (4) =			0.5777	(91)
MIT	19.3167	18.4144	18.8779	19.4702	19.9754	20.3158	20.4741	20.4545	20.1950	19.6183	18.8118	18.4428	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3167	18.4144	18.8779	19.4702	19.9754	20.3158	20.4741	20.4545	20.1950	19.6183	18.8118	18.4428	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8248	0.7761	0.7325	0.6633	0.5680	0.4651	0.3515	0.3785	0.5342	0.6683	0.7654	0.8189	(94)
Useful gains	369.5544	374.7834	373.5305	351.7037	306.9445	228.6777	165.9599	170.8648	231.8038	297.4258	329.1705	353.8719	(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													
	727.9372	652.8569	595.9309	500.7720	390.8603	266.1382	180.3844	188.2847	285.3702	425.9529	556.5798	681.1898	(97)
Space heating kWh													
	266.6368	186.8654	165.4659	107.3292	62.4333	0.0000	0.0000	0.0000	0.0000	95.6241	163.7347	243.5245	(98a)
Space heating requirement - total per year (kWh/year)												1291.6139	
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													
	266.6368	186.8654	165.4659	107.3292	62.4333	0.0000	0.0000	0.0000	0.0000	95.6241	163.7347	243.5245	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1291.6139	
Space heating per m2											(98c) / (4) =	31.1833	(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 %)												252.6170	(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													
	266.6368	186.8654	165.4659	107.3292	62.4333	0.0000	0.0000	0.0000	0.0000	95.6241	163.7347	243.5245	(98)
Space heating efficiency (main heating system 1)													
	252.6170	252.6170	252.6170	252.6170	252.6170	0.0000	0.0000	0.0000	0.0000	252.6170	252.6170	252.6170	(210)
Space heating fuel (main heating system)													
	105.5498	73.9718	65.5007	42.4869	24.7146	0.0000	0.0000	0.0000	0.0000	37.8534	64.8154	96.4007	(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													
	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(64)
Efficiency of water heater												176.8663	(216)
(217)m	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	(217)
Fuel for water heating, kWh/month													
	140.3539	124.8213	134.0776	121.0744	119.6061	92.8985	92.4894	95.4220	95.6672	123.0980	127.4492	139.2114	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	13.5239	10.8494	9.7687	7.1569	5.5282	4.5166	5.0430	6.5551	8.5145	11.1714	12.6181	13.8998	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												511.2934	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	176.8663	
Water heating fuel used	1406.1690	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	109.1455	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2026.6079	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	511.2934	16.4900	84.3123	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1406.1690	16.4900	231.8773	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	109.1455	16.4900	17.9981	(250)
Additional standing charges			0.0000	(251)
Total energy cost			334.1876	(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] =	1.3921	(257)
SAP value		77.4336	
SAP rating (Section 12)		77	(258)
SAP band		C	

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	511.2934	0.1546	79.0482	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1406.1690	0.1415	198.9150	(264)
Space and water heating			277.9632	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	109.1455	0.1443	15.7531	(268)
Total CO2, kg/year			293.7163	(272)
CO2 emissions per m2			7.0900	(273)
EI value			95.4457	
EI rating			95	(274)
EI band			A	

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		41.4200 (1b)	x	2.2000 (2b)	=	91.1240	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	41.4200						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	91.1240	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2195	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.4195	(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) = 0.4195 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.5348	0.4929	0.4824	0.4509	0.4509	0.4195	0.4195	0.4090	0.4195	0.4719	0.4614	0.4929	(22b)
Effective ac	0.6430	0.6215	0.6164	0.6017	0.6017	0.5880	0.5880	0.5836	0.5880	0.6114	0.6065	0.6215	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			5.8000	0.9615	5.5769			(27)
External Wall 1	59.3000	7.9000	51.4000	0.1500	7.7100	9.0000	462.6000	(29a)
External Roof 1	41.4200		41.4200	0.1100	4.5562	9.0000	372.7800	(30)
Total net area of external elements Aum(A, m2)			100.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.9431			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			41.4200			30.0000	1242.6000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 2954.9800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 71.3419 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3 Sill	3.1000	0.0340	0.1054
E4 Jamb	13.0000	0.0430	0.5590
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14 Flat roof	27.9000	0.0460	1.2834
E16 Corner (normal)	8.9000	0.0300	0.2670
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675
E18 Party wall between dwellings	8.9000	0.0300	0.2670
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1958 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.1389 (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	19.3364	18.6882	18.5344	18.0929	18.0929	17.6812	17.6812	17.5505	17.6812	18.3839	18.2368	18.6882	(38)
Heat transfer coeff	48.4753	47.8271	47.6733	47.2318	47.2318	46.8201	46.8201	46.6895	46.8201	47.5229	47.3757	47.8271	(39)
Average = Sum(39)m / 12 =												47.3596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1703	1.1547	1.1510	1.1403	1.1403	1.1304	1.1304	1.1272	1.1304	1.1473	1.1438	1.1547	(40)
HLP (average)												1.1434	
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 1.4446 (42)
Hot water usage for mixer showers

62.1441	61.2102	59.8493	57.2455	55.3240	53.1811	51.9631	53.3136	54.7941	57.0949	59.7547	61.9060	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

29.4238	28.3539	27.2839	26.2140	25.1440	24.0740	24.0740	25.1440	26.2140	27.2839	28.3539	29.4238	(42c)

Average daily hot water use (litres/day) 84.0437 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5679	89.5641	87.1332	83.4595	80.4680	77.2551	76.0371	78.4576	81.0081	84.3788	88.1085	91.3298	(44)
Energy conte	145.0212	127.5380	133.9205	114.2518	108.3253	94.9942	91.9603	97.1469	99.8911	114.5013	125.5268	143.0004	(45)
Energy content (annual)										Total = Sum(45)m =		1396.0778	
Distribution loss (46)m = 0.15 x (45)m	21.7532	19.1307	20.0881	17.1378	16.2488	14.2491	13.7940	14.5720	14.9837	17.1752	18.8290	21.4501	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.5600	(55)
Total storage loss	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(56)
If cylinder contains dedicated solar storage	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(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	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(64)
									Total per year (kWh/year) = Sum(64)m =			2487.0394	(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	92.1056	82.0454	88.4146	80.4591	79.9043	49.5952	49.1867	50.9113	51.2234	81.9578	84.2080	91.4337	(65)

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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	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.4507	13.7232	11.1604	8.4492	6.3158	5.3321	5.7615	7.4890	10.0518	12.7630	14.8964	15.8801	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	186.7472	188.6850	183.8017	173.4057	160.2826	147.9487	139.7090	137.7711	142.6544	153.0504	166.1735	178.5074	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	(71)
Water heating gains (Table 5)													
	123.7979	122.0914	118.8369	111.7488	107.3982	68.8822	66.1112	68.4291	71.1436	110.1583	116.9556	122.8948	(72)
Total internal gains													
	399.9991	398.5030	387.8024	367.6070	348.0000	296.1664	285.5850	287.6926	297.8531	349.9751	372.0289	391.2857	(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	
Southeast	3.0000	46.3896	0.6300	0.7000	0.7700	42.5318	(77)
Southwest	0.6000	46.3896	0.6300	0.7000	0.7700	8.5064	(79)
Northwest	2.2000	15.0428	0.6300	0.7000	0.7700	10.1140	(81)

Solar gains	61.1522	91.9663	133.0587	181.5088	206.0877	227.0360	211.3721	188.7109	157.5282	109.7511	73.1946	49.5892	(83)
Total gains	461.1513	490.4693	520.8611	549.1158	554.0877	523.2024	496.9571	476.4036	455.3813	459.7263	445.2235	440.8748	(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	16.9329	17.1624	17.2178	17.3787	17.3787	17.5315	17.5315	17.5806	17.5315	17.2723	17.3259	17.1624	
alpha	2.1289	2.1442	2.1479	2.1586	2.1586	2.1688	2.1688	2.1720	2.1688	2.1515	2.1551	2.1442	
util living area													
	0.8271	0.8046	0.7555	0.6767	0.5644	0.4382	0.3246	0.3360	0.5111	0.6654	0.7762	0.8348	(86)
Living	18.7891	18.9986	19.4563	20.0033	20.4980	20.8025	20.9286	20.9239	20.7110	20.2180	19.5007	18.7837	
Non living	17.9868	18.1950	18.6347	19.1537	19.6001	19.8598	19.9474	19.9479	19.7949	19.3583	18.6905	17.9915	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.8690	18.9986	19.4563	20.0033	20.4980	20.8025	20.9286	20.9239	20.7110	20.2180	19.5007	19.0937	(87)
Th 2	19.9438	19.9564	19.9594	19.9680	19.9680	19.9761	19.9761	19.9787	19.9761	19.9624	19.9652	19.9564	(88)
util rest of house													
	0.8094	0.7853	0.7310	0.6435	0.5169	0.3724	0.2425	0.2518	0.4453	0.6231	0.7506	0.8176	(89)
MIT 2	18.9427	18.1950	18.6347	19.1537	19.6001	19.8598	19.9474	19.9479	19.7949	19.3583	18.6905	18.2664	(90)
Living area fraction										fLA = Living area / (4) =		0.5777	(91)
MIT	19.4779	18.6593	19.1094	19.6445	20.1188	20.4045	20.5143	20.5118	20.3242	19.8550	19.1586	18.7444	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4779	18.6593	19.1094	19.6445	20.1188	20.4045	20.5143	20.5118	20.3242	19.8550	19.1586	18.7444	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8008	0.7575	0.7084	0.6322	0.5242	0.4008	0.2866	0.2968	0.4687	0.6184	0.7279	0.7945	(94)
Useful gains	369.2814	371.5165	368.9969	347.1670	290.4437	209.7230	142.4462	141.3927	213.4285	284.2828	324.0731	350.2588	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W													
	682.4288	619.8036	562.9923	474.4207	355.1285	234.3089	150.4939	149.9565	249.2793	382.7948	509.6961	633.4393	(97)
Space heating kWh													
	232.9817	166.8489	144.3325	91.6227	48.1255	0.0000	0.0000	0.0000	0.0000	73.2930	133.6485	210.6863	(98a)
Space heating requirement - total per year (kWh/year)												1101.5391	
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													
	232.9817	166.8489	144.3325	91.6227	48.1255	0.0000	0.0000	0.0000	0.0000	73.2930	133.6485	210.6863	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1101.5391	
Space heating per m2											(98c) / (4) =	26.5944	(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 %)	252.6019	(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													
	232.9817	166.8489	144.3325	91.6227	48.1255	0.0000	0.0000	0.0000	0.0000	73.2930	133.6485	210.6863	(98)
Space heating efficiency (main heating system 1)													
	252.6019	252.6019	252.6019	252.6019	252.6019	0.0000	0.0000	0.0000	0.0000	252.6019	252.6019	252.6019	(210)
Space heating fuel (main heating system)													
	92.2327	66.0521	57.1383	36.2716	19.0519	0.0000	0.0000	0.0000	0.0000	29.0152	52.9088	83.4064	(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

	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180 (64)
Efficiency of water heater												176.8566 (216)
(217)m	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566 (217)
Fuel for water heating, kWh/month												
	140.3616	124.8281	134.0849	121.0810	119.6127	92.9036	92.4945	95.4272	95.6724	123.1047	127.4562	139.2190 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	13.5239	10.8494	9.7687	7.1569	5.5282	4.5166	5.0430	6.5551	8.5145	11.1714	12.6181	13.8998 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	436.0771 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	176.8566
Water heating fuel used	1406.2459 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	109.1455 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1951.4686 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	436.0771	26.0600	113.6417	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1406.2459	26.0600	366.4677	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	109.1455	26.0600	28.4433	(250)
Additional standing charges			0.0000	(251)
Total energy cost			508.5527	(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	436.0771	0.1550	67.5767	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1406.2459	0.1415	198.9259	(264)
Space and water heating			266.5026	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	109.1455	0.1443	15.7531	(268)
Total CO2, kg/year			282.2557	(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	436.0771	1.5737	686.2512	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1406.2459	1.5231	2141.8664	(278)
Space and water heating			2828.1176	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	109.1455	1.5338	167.4111	(282)
Total Primary energy kWh/year			2995.5287	(286)

SAP 10 EPC IMPROVEMENTS

Be lean - Flat 1

Current energy efficiency rating:	C 77
Current environmental impact rating:	A 95

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: C 77
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£509	£509	£0
Space heating	£114	£114	£0
Water heating	£366	£366	£0
Lighting	£28	£28	£0
Total cost of fuels	£509	£509	£0
Total cost of uses	£508	£508	£0
Delivered energy	47 kWh/m²	47 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	72 kWh/m²	72 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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.4200 (1b)	x	2.2000 (2b)	=	91.1240	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	41.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	91.1240	(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	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2195 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.4195 (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) =	0.4195 (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	0.5348	0.5244	0.5139	0.4614	0.4509	0.3985	0.3985	0.3880	0.4195	0.4509	0.4719	0.4929	(22b)
Effective ac	0.6430	0.6375	0.6320	0.6065	0.6017	0.5794	0.5794	0.5753	0.5880	0.6017	0.6114	0.6215	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			5.8000	0.9615	5.5769			(27)
External Wall 1	59.3000	7.9000	51.4000	0.1500	7.7100	9.0000	462.6000	(29a)
External Roof 1	41.4200		41.4200	0.1100	4.5562	9.0000	372.7800	(30)
Total net area of external elements Aum(A, m2)			100.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.9431			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			41.4200			30.0000	1242.6000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	2954.9800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		71.3419	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3 Sill	3.1000	0.0340	0.1054
E4 Jamb	13.0000	0.0430	0.5590
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14 Flat roof	27.9000	0.0460	1.2834
E16 Corner (normal)	8.9000	0.0300	0.2670
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675
E18 Party wall between dwellings	8.9000	0.0300	0.2670
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.1958	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	29.1389	(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	19.3364	19.1694	19.0057	18.2368	18.0929	17.4232	17.4232	17.2992	17.6812	18.0929	18.3839	18.6882	(38)
Heat transfer coeff	48.4753	48.3083	48.1446	47.3757	47.2318	46.5621	46.5621	46.4381	46.8201	47.2318	47.5229	47.8271	(39)
Average = Sum(39)m / 12 =												47.3750	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1703	1.1663	1.1624	1.1438	1.1403	1.1241	1.1241	1.1212	1.1304	1.1403	1.1473	1.1547	(40)
HLP (average)												1.1438	
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		1.4446	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
62.1441	61.2102	59.8493	57.2455	55.3240	53.1811	51.9631	53.3136	54.7941	57.0949	59.7547	61.9060	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

29.4238	28.3539	27.2839	26.2140	25.1440	24.0740	24.0740	25.1440	26.2140	27.2839	28.3539	29.4238	(42c)

Average daily hot water use (litres/day)		84.0437	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5679	89.5641	87.1332	83.4595	80.4680	77.2551	76.0371	78.4576	81.0081	84.3788	88.1085	91.3298	(44)
Energy conte	145.0212	127.5380	133.9205	114.2518	108.3253	94.9942	91.9603	97.1469	99.8911	114.5013	125.5268	143.0004	(45)
Energy content (annual)										Total = Sum(45)m =		1396.0778	

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

21.7532	19.1307	20.0881	17.1378	16.2488	14.2491	13.7940	14.5720	14.9837	17.1752	18.8290	21.4501	(46)

Water storage loss:		
Store volume	150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	2.0000	(48)
Temperature factor from Table 2b	0.7800	(49)
Enter (49) or (54) in (55)	1.5600	(55)

Total storage loss

48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(56)

If cylinder contains dedicated solar storage

48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(57)
Primary loss 54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(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

248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(64)
									Total per year (kWh/year) = Sum(64)m =		2487.0394	(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

92.1056	82.0454	88.4146	80.4591	79.9043	49.5952	49.1867	50.9113	51.2234	81.9578	84.2080	91.4337	(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	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.4507	13.7232	11.1604	8.4492	6.3158	5.3321	5.7615	7.4890	10.0518	12.7630	14.8964	15.8801	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	186.7472	188.6850	183.8017	173.4057	160.2826	147.9487	139.7090	137.7711	142.6544	153.0504	166.1735	178.5074	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	(71)
Water heating gains (Table 5)	123.7979	122.0914	118.8369	111.7488	107.3982	68.8822	66.1112	68.4291	71.1436	110.1583	116.9556	122.8948	(72)
Total internal gains	399.9991	398.5030	387.8024	367.6070	348.0000	296.1664	285.5850	287.6926	297.8531	349.9751	372.0289	391.2857	(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	
Southeast	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340	(77)

Southwest			0.6000		36.7938		0.6300		0.7000		0.7700		6.7468 (79)
Northwest			2.2000		11.2829		0.6300		0.7000		0.7700		7.5861 (81)
Solar gains	48.0669	84.3955	122.1666	162.5888	192.3528	195.4659	186.5756	163.6817	136.0566	95.0796	58.0319	40.8383	(83)
Total gains	448.0660	482.8985	509.9690	530.1958	540.3527	491.6322	472.1606	451.3744	433.9098	445.0547	430.0608	432.1240	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.9329	16.9914	17.0492	17.3259	17.3787	17.6287	17.6287	17.6757	17.5315	17.3787	17.2723	17.1624	
alpha	2.1289	2.1328	2.1366	2.1551	2.1586	2.1752	2.1752	2.1784	2.1688	2.1586	2.1515	2.1442	
util living area	0.8496	0.8231	0.7801	0.7093	0.6104	0.5052	0.3909	0.4194	0.5794	0.7164	0.8131	0.8575	(86)
Living	18.4704	18.7530	19.2230	19.8239	20.3463	20.7016	20.8779	20.8536	20.5701	19.9705	19.1485	18.4295	
Non living	17.6767	17.9511	18.4059	18.9863	19.4678	19.7879	19.9215	19.9085	19.6818	19.1366	18.3513	17.6458	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7060	18.7530	19.2230	19.8239	20.3463	20.7016	20.8779	20.8536	20.5701	19.9705	19.1485	18.7890	(87)
Th 2	19.9438	19.9471	19.9502	19.9652	19.9680	19.9812	19.9812	19.9836	19.9761	19.9680	19.9624	19.9564	(88)
util rest of house	0.8347	0.8057	0.7581	0.6792	0.5677	0.4443	0.3124	0.3410	0.5210	0.6814	0.7923	0.8433	(89)
MIT 2	18.7840	17.9511	18.4059	18.9863	19.4678	19.7879	19.9215	19.9085	19.6818	19.1366	18.3513	17.9690	(90)
Living area fraction										fLA = Living area / (4) =		0.5777	(91)
MIT	19.3167	18.4144	18.8779	19.4702	19.9754	20.3158	20.4741	20.4545	20.1950	19.6183	18.8118	18.4428	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3167	18.4144	18.8779	19.4702	19.9754	20.3158	20.4741	20.4545	20.1950	19.6183	18.8118	18.4428	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8248	0.7761	0.7325	0.6633	0.5680	0.4651	0.3515	0.3785	0.5342	0.6683	0.7654	0.8189	(94)
Useful gains	369.5544	374.7834	373.5305	351.7037	306.9445	228.6777	165.9599	170.8648	231.8038	297.4258	329.1705	353.8719	(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	727.9372	652.8569	595.9309	500.7720	390.8603	266.1382	180.3844	188.2847	285.3702	425.9529	556.5798	681.1898	(97)
Space heating kWh	266.6368	186.8654	165.4659	107.3292	62.4333	0.0000	0.0000	0.0000	0.0000	95.6241	163.7347	243.5245	(98a)
Space heating requirement - total per year (kWh/year)												1291.6139	
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	266.6368	186.8654	165.4659	107.3292	62.4333	0.0000	0.0000	0.0000	0.0000	95.6241	163.7347	243.5245	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1291.6139	
Space heating per m2											(98c) / (4) =	31.1833	(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 %)	252.6170 (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	266.6368	186.8654	165.4659	107.3292	62.4333	0.0000	0.0000	0.0000	0.0000	95.6241	163.7347	243.5245	(98)
Space heating efficiency (main heating system 1)	252.6170	252.6170	252.6170	252.6170	252.6170	0.0000	0.0000	0.0000	0.0000	252.6170	252.6170	252.6170	(210)
Space heating fuel (main heating system)	105.5498	73.9718	65.5007	42.4869	24.7146	0.0000	0.0000	0.0000	0.0000	37.8534	64.8154	96.4007	(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	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(64)
Efficiency of water heater												176.8663	(216)
(217)m	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	176.8663	(217)
Fuel for water heating, kWh/month	140.3539	124.8213	134.0776	121.0744	119.6061	92.8985	92.4894	95.4220	95.6672	123.0980	127.4492	139.2114	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	13.5239	10.8494	9.7687	7.1569	5.5282	4.5166	5.0430	6.5551	8.5145	11.1714	12.6181	13.8998	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												511.2934	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.8663	
Water heating fuel used	1406.1690	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	109.1455	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2026.6079	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	511.2934	16.4900	84.3123	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1406.1690	16.4900	231.8773	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	109.1455	16.4900	17.9981	(250)
Additional standing charges			0.0000	(251)
Total energy cost			334.1876	(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] =	1.3921	(257)
SAP value		77.4336	
SAP rating (Section 12)		77	(258)
SAP band		C	

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	511.2934	0.1546	79.0482	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1406.1690	0.1415	198.9150	(264)
Space and water heating			277.9632	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	109.1455	0.1443	15.7531	(268)
Total CO2, kg/year			293.7163	(272)
CO2 emissions per m2			7.0900	(273)
EI value			95.4457	
EI rating			95	(274)
EI band			A	

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		41.4200	(1b)	x 2.2000	(2b) =	91.1240	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	41.4200						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		91.1240	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2195	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	

Measured/design AP50	4.0000	(17)
Infiltration rate	0.4195	(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) =	0.4195	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.5348	0.4929	0.4824	0.4509	0.4509	0.4195	0.4195	0.4090	0.4195	0.4719	0.4614	0.4929	(22b)
Effective ac	0.6430	0.6215	0.6164	0.6017	0.6017	0.5880	0.5880	0.5836	0.5880	0.6114	0.6065	0.6215	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			5.8000	0.9615	5.5769			(27)
External Wall 1	59.3000	7.9000	51.4000	0.1500	7.7100	9.0000	462.6000	(29a)
External Roof 1	41.4200		41.4200	0.1100	4.5562	9.0000	372.7800	(30)
Total net area of external elements Aum(A, m2)			100.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.9431			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			41.4200			30.0000	1242.6000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	2954.9800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	71.3419	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3 Sill	3.1000	0.0340	0.1054
E4 Jamb	13.0000	0.0430	0.5590
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14 Flat roof	27.9000	0.0460	1.2834
E16 Corner (normal)	8.9000	0.0300	0.2670
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675
E18 Party wall between dwellings	8.9000	0.0300	0.2670
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1958	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	29.1389	(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	19.3364	18.6882	18.5344	18.0929	18.0929	17.6812	17.6812	17.5505	17.6812	18.3839	18.2368	18.6882	(38)
Heat transfer coeff	48.4753	47.8271	47.6733	47.2318	47.2318	46.8201	46.8201	46.6895	46.8201	47.5229	47.3757	47.8271	(39)
Average = Sum(39)m / 12 =												47.3596	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1703	1.1547	1.1510	1.1403	1.1403	1.1304	1.1304	1.1272	1.1304	1.1473	1.1438	1.1547	(40)
HLP (average)												1.1434	
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	1.4446	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	62.1441	61.2102	59.8493	57.2455	55.3240	53.1811	51.9631	53.3136	54.7941	57.0949	59.7547	61.9060	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	29.4238	28.3539	27.2839	26.2140	25.1440	24.0740	24.0740	25.1440	26.2140	27.2839	28.3539	29.4238	(42c)
Average daily hot water use (litres/day)												84.0437	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5679	89.5641	87.1332	83.4595	80.4680	77.2551	76.0371	78.4576	81.0081	84.3788	88.1085	91.3298	(44)
Energy conte	145.0212	127.5380	133.9205	114.2518	108.3253	94.9942	91.9603	97.1469	99.8911	114.5013	125.5268	143.0004	(45)
Energy content (annual)										Total = Sum(45)m =		1396.0778	
Distribution loss (46)m = 0.15 x (45)m	21.7532	19.1307	20.0881	17.1378	16.2488	14.2491	13.7940	14.5720	14.9837	17.1752	18.8290	21.4501	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.5600	(55)
Total storage loss	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(56)
If cylinder contains dedicated solar storage	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(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	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180	(64)
									Total per year (kWh/year) = Sum(64)m =			2487.0394	(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	92.1056	82.0454	88.4146	80.4591	79.9043	49.5952	49.1867	50.9113	51.2234	81.9578	84.2080	91.4337	(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	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	86.6741	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.4507	13.7232	11.1604	8.4492	6.3158	5.3321	5.7615	7.4890	10.0518	12.7630	14.8964	15.8801	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	186.7472	188.6850	183.8017	173.4057	160.2826	147.9487	139.7090	137.7711	142.6544	153.0504	166.1735	178.5074	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	45.1120	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	-57.7827	(71)
Water heating gains (Table 5)													
	123.7979	122.0914	118.8369	111.7488	107.3982	68.8822	66.1112	68.4291	71.1436	110.1583	116.9556	122.8948	(72)
Total internal gains													
	399.9991	398.5030	387.8024	367.6070	348.0000	296.1664	285.5850	287.6926	297.8531	349.9751	372.0289	391.2857	(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	
Southeast	3.0000	46.3896	0.6300	0.7000	0.7700	42.5318	(77)
Southwest	0.6000	46.3896	0.6300	0.7000	0.7700	8.5064	(79)
Northwest	2.2000	15.0428	0.6300	0.7000	0.7700	10.1140	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	61.1522	91.9663	133.0587	181.5088	206.0877	227.0360	211.3721	188.7109	157.5282	109.7511	73.1946	49.5892	(83)
Total gains	461.1513	490.4693	520.8611	549.1158	554.0877	523.2024	496.9571	476.4036	455.3813	459.7263	445.2235	440.8748	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.9329	17.1624	17.2178	17.3787	17.3787	17.5315	17.5315	17.5806	17.5315	17.2723	17.3259	17.1624	
alpha	2.1289	2.1442	2.1479	2.1586	2.1586	2.1688	2.1688	2.1720	2.1688	2.1515	2.1551	2.1442	
util living area													
	0.8271	0.8046	0.7555	0.6767	0.5644	0.4382	0.3246	0.3360	0.5111	0.6654	0.7762	0.8348	(86)
Living	18.7891	18.9986	19.4563	20.0033	20.4980	20.8025	20.9286	20.9239	20.7110	20.2180	19.5007	18.7837	
Non living	17.9868	18.1950	18.6347	19.1537	19.6001	19.8598	19.9474	19.9479	19.7949	19.3583	18.6905	17.9915	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.8690	18.9986	19.4563	20.0033	20.4980	20.8025	20.9286	20.9239	20.7110	20.2180	19.5007	19.0937	(87)
Th 2	19.9438	19.9564	19.9594	19.9680	19.9680	19.9761	19.9761	19.9787	19.9761	19.9624	19.9652	19.9564	(88)
util rest of house													
	0.8094	0.7853	0.7310	0.6435	0.5169	0.3724	0.2425	0.2518	0.4453	0.6231	0.7506	0.8176	(89)
MIT 2	18.9427	18.1950	18.6347	19.1537	19.6001	19.8598	19.9474	19.9479	19.7949	19.3583	18.6905	18.2664	(90)
Living area fraction										fLA = Living area / (4) =		0.5777	(91)
MIT	19.4779	18.6593	19.1094	19.6445	20.1188	20.4045	20.5143	20.5118	20.3242	19.8550	19.1586	18.7444	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4779	18.6593	19.1094	19.6445	20.1188	20.4045	20.5143	20.5118	20.3242	19.8550	19.1586	18.7444	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8008	0.7575	0.7084	0.6322	0.5242	0.4008	0.2866	0.2968	0.4687	0.6184	0.7279	0.7945	(94)
Useful gains	369.2814	371.5165	368.9969	347.1670	290.4437	209.7230	142.4462	141.3927	213.4285	284.2828	324.0731	350.2588	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W													
	682.4288	619.8036	562.9923	474.4207	355.1285	234.3089	150.4939	149.9565	249.2793	382.7948	509.6961	633.4393	(97)
Space heating kWh													
	232.9817	166.8489	144.3325	91.6227	48.1255	0.0000	0.0000	0.0000	0.0000	73.2930	133.6485	210.6863	(98a)
Space heating requirement - total per year (kWh/year)												1101.5391	
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													
	232.9817	166.8489	144.3325	91.6227	48.1255	0.0000	0.0000	0.0000	0.0000	73.2930	133.6485	210.6863	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1101.5391	
Space heating per m2											(98c) / (4) =	26.5944	(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 %)	252.6019	(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													
	232.9817	166.8489	144.3325	91.6227	48.1255	0.0000	0.0000	0.0000	0.0000	73.2930	133.6485	210.6863	(98)
Space heating efficiency (main heating system 1)													
	252.6019	252.6019	252.6019	252.6019	252.6019	0.0000	0.0000	0.0000	0.0000	252.6019	252.6019	252.6019	(210)
Space heating fuel (main heating system)													
	92.2327	66.0521	57.1383	36.2716	19.0519	0.0000	0.0000	0.0000	0.0000	29.0152	52.9088	83.4064	(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

	248.2388	220.7668	237.1381	214.1398	211.5429	164.3062	163.5827	168.7693	169.2031	217.7189	225.4148	246.2180 (64)
Efficiency of water heater												176.8566 (216)
(217)m	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566	176.8566 (217)
Fuel for water heating, kWh/month												
	140.3616	124.8281	134.0849	121.0810	119.6127	92.9036	92.4945	95.4272	95.6724	123.1047	127.4562	139.2190 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	13.5239	10.8494	9.7687	7.1569	5.5282	4.5166	5.0430	6.5551	8.5145	11.1714	12.6181	13.8998 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	436.0771 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	176.8566
Water heating fuel used	1406.2459 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	109.1455 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1951.4686 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	436.0771	26.0600	113.6417	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1406.2459	26.0600	366.4677	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	109.1455	26.0600	28.4433	(250)
Additional standing charges			0.0000	(251)
Total energy cost			508.5527	(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	436.0771	0.1550	67.5767	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1406.2459	0.1415	198.9259	(264)
Space and water heating			266.5026	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	109.1455	0.1443	15.7531	(268)
Total CO2, kg/year			282.2557	(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	436.0771	1.5737	686.2512	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1406.2459	1.5231	2141.8664	(278)
Space and water heating			2828.1176	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	109.1455	1.5338	167.4111	(282)
Total Primary energy kWh/year			2995.5287	(286)

Full SAP Calculation Printout

Property Reference	Annie Khatnani	**Issued on Date**	30/08/2024
Assessment Reference	Be Lean - Flat 2	**Prop Type Ref**	Annie Khatnani
Property			

SAP Rating	78 C	**DER**	6.58	**TER**	15.13
Environmental	96 A	**% DER < TER**			56.51
CO_2 Emissions (t/year)	0.29	**DFEE**	35.44	**TFEE**	38.60
Compliance Check	See BREL	**% DFEE < TFEE**			8.18
% DPER < TPER	13.38	**DPER**	69.68	**TPER**	80.44

Assessor Details	Mr. James Gradwell	**Assessor ID**	BJ35-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.1900	(1b)	x 2.2000	(2b) =	103.8180	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	47.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		103.8180	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1926	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3926	(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) =	0.3926	(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	0.5006	0.4908	0.4810	0.4319	0.4221	0.3730	0.3730	0.3632	0.3926	0.4221	0.4417	0.4614	(22b)
Effective ac	0.6253	0.6204	0.6157	0.5933	0.5891	0.5696	0.5696	0.5660	0.5771	0.5891	0.5976	0.6064	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			4.8000	0.9615	4.6154			(27)
External Wall 1	64.2000	6.9000	57.3000	0.1500	8.5950	9.0000	515.7000	(29a)
External Roof 1	47.1900		47.1900	0.1100	5.1909	9.0000	424.7100	(30)
Total net area of external elements Aum(A, m2)			111.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.5013			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			47.1900			30.0000	1415.7000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	3233.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		68.5126 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3 Sill	3.1000	0.0340	0.1054
E4 Jamb	13.0000	0.0430	0.5590
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14 Flat roof	27.9000	0.0460	1.2834
E16 Corner (normal)	8.9000	0.0300	0.2670

E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675	
E18 Party wall between dwellings	8.9000	0.0300	0.2670	
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925	
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1958 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.6971 (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	21.4231	21.2564	21.0930	20.3255	20.1819	19.5134	19.5134	19.3896	19.7709	20.1819	20.4724	20.7761	(38)
Heat transfer coeff	51.1202	50.9535	50.7901	50.0226	49.8790	49.2105	49.2105	49.0867	49.4680	49.8790	50.1695	50.4732	(39)
Average = Sum(39)m / 12 =												50.0219	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0833	1.0798	1.0763	1.0600	1.0570	1.0428	1.0428	1.0402	1.0483	1.0570	1.0631	1.0696	(40)
HLP (average)												1.0600	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6078 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	65.6717	64.6848	63.2466	60.4950	58.4644	56.1999	54.9127	56.3400	57.9045	60.3359	63.1466	65.4201	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	31.0955	29.9648	28.8340	27.7033	26.5725	25.4418	25.4418	26.5725	27.7033	28.8340	29.9648	31.0955	(42c)
Average daily hot water use (litres/day)												88.8157	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7672	94.6495	92.0806	88.1983	85.0369	81.6417	80.3545	82.9125	85.6078	89.1699	93.1114	96.5156	(44)
Energy conte	153.2556	134.7797	141.5245	120.7391	114.4761	100.3879	97.1818	102.6630	105.5629	121.0028	132.6542	151.1201	(45)
Energy content (annual)										Total = Sum(45)m =		1475.3476	
Distribution loss (46)m = 0.15 x (45)m	22.9883	20.2169	21.2287	18.1109	17.1714	15.0582	14.5773	15.3994	15.8344	18.1504	19.8981	22.6680	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.5600	(55)
Total storage loss	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(56)
If cylinder contains dedicated solar storage	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(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	256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(64)
										Total per year (kWh/year) = Sum(64)m =		2566.3092	(64)
12Total per year (kWh/year)												2566	(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	94.8436	84.4533	90.9430	82.6161	81.9494	51.3886	50.9229	52.7454	53.1093	84.1195	86.5779	94.1335	(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	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.2133	89.9147	81.2133	83.9204	81.2133	83.9204	81.2133	81.2133	83.9204	81.2133	83.9204	81.2133	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	139.9415	141.3936	137.7342	129.9438	120.1099	110.8673	104.6927	103.2406	106.9000	114.6904	124.5243	133.7669	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	(71)
Water heating gains (Table 5)	127.4779	125.6745	122.2352	114.7446	110.1470	71.3730	68.4447	70.8943	73.7629	113.0638	120.2471	126.5235	(72)
Total internal gains	395.7497	404.0999	388.2998	375.7259	358.5872	313.2778	301.4678	302.4652	311.7003	356.0845	375.8089	388.6207	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.6000	11.2829	0.6300	0.7000	0.7700	2.0689	(75)
Southeast	2.0000	36.7938	0.6300	0.7000	0.7700	22.4893	(77)
Northwest	2.2000	11.2829	0.6300	0.7000	0.7700	7.5861	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	32.1443	57.9607	87.8227	123.0947	150.9087	155.5499	147.5811	125.9542	99.8993	66.3557	39.0855	27.1310	(83)
Total gains	427.8940	462.0606	476.1225	498.8206	509.4959	468.8277	449.0489	428.4195	411.5996	422.4402	414.8944	415.7517	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	17.5681	17.6256	17.6823	17.9536	18.0053	18.2499	18.2499	18.2959	18.1549	18.0053	17.9010	17.7933	
alpha	2.1712	2.1750	2.1788	2.1969	2.2004	2.2167	2.2167	2.2197	2.2103	2.2004	2.1934	2.1862	
util living area	0.8746	0.8505	0.8178	0.7507	0.6547	0.5453	0.4274	0.4581	0.6221	0.7547	0.8398	0.8804	(86)
Living	18.3690	18.6512	19.0895	19.7203	20.2767	20.6688	20.8625	20.8348	20.5247	19.8901	19.0682	18.3393	
Non living	17.6309	17.9068	18.3350	18.9485	19.4684	19.8251	19.9765	19.9604	19.7063	19.1207	18.3277	17.6094	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.6541	18.6512	19.0895	19.7203	20.2767	20.6688	20.8625	20.8348	20.5247	19.8901	19.0682	18.7115	(87)
Th 2	20.0145	20.0174	20.0202	20.0336	20.0361	20.0478	20.0478	20.0500	20.0433	20.0361	20.0311	20.0258	(88)
util rest of house	0.8623	0.8360	0.7993	0.7241	0.6154	0.4868	0.3494	0.3808	0.5674	0.7238	0.8221	0.8686	(89)
MIT 2	18.7951	17.9068	18.3350	18.9485	19.4684	19.8251	19.9765	19.9604	19.7063	19.1207	18.3277	17.9474	(90)
Living area fraction										fLA = Living area / (4) =		0.5071	(91)
MIT	19.2307	18.2843	18.7176	19.3399	19.8783	20.2529	20.4258	20.4038	20.1213	19.5108	18.7032	18.3349	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2307	18.2843	18.7176	19.3399	19.8783	20.2529	20.4258	20.4038	20.1213	19.5108	18.7032	18.3349	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8512	0.8051	0.7704	0.7028	0.6084	0.5001	0.3815	0.4108	0.5722	0.7048	0.7932	0.8439	(94)
Useful gains	364.2176	372.0034	366.8195	350.5737	309.9935	234.4571	171.3138	176.0004	235.5186	297.7440	329.0931	350.8642	(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	763.2611	681.9768	620.5338	522.2292	407.9235	278.1837	188.2686	196.5340	297.8621	444.4637	582.1246	713.4319	(97)
Space heating kWh	296.8883	208.3021	188.7634	123.5920	72.8599	0.0000	0.0000	0.0000	0.0000	109.1595	182.1827	269.7504	(98a)
Space heating requirement - total per year (kWh/year)												1451.4984	
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	296.8883	208.3021	188.7634	123.5920	72.8599	0.0000	0.0000	0.0000	0.0000	109.1595	182.1827	269.7504	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1451.4984	
Space heating per m2											(98c) / (4) =	30.7586	(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 %)	254.9702	(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	296.8883	208.3021	188.7634	123.5920	72.8599	0.0000	0.0000	0.0000	0.0000	109.1595	182.1827	269.7504	(98)
Space heating efficiency (main heating system 1)	254.9702	254.9702	254.9702	254.9702	254.9702	0.0000	0.0000	0.0000	0.0000	254.9702	254.9702	254.9702	(210)
Space heating fuel (main heating system)	116.4404	81.6966	74.0335	48.4731	28.5758	0.0000	0.0000	0.0000	0.0000	42.8126	71.4525	105.7968	(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	256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(64)
Efficiency of water heater												178.2901	(216)
(217)m	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	(217)
Fuel for water heating, kWh/month	143.8516	127.8862	137.2718	123.7461	122.1008	95.1819	94.6795	97.7538	98.0845	125.7615	130.4291	142.6538	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	16.2230	13.0147	11.7183	8.5853	6.6316	5.4180	6.0495	7.8634	10.2138	13.4010	15.1365	16.6739	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	569.2815	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	178.2901	
Water heating fuel used	1439.4006	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	130.9291	(232)

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

PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2139.6112	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	569.2815	0.1545	87.9388	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1439.4006	0.1415	203.6221	(264)
Space and water heating			291.5609	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	130.9291	0.1443	18.8971	(268)
Total CO2, kg/year			310.4580	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.5800	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	569.2815	1.5719	894.8323	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1439.4006	1.5231	2192.3869	(278)
Space and water heating			3087.2192	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	130.9291	1.5338	200.8235	(282)
Total Primary energy kWh/year			3288.0427	(286)
Dwelling Primary energy Rate (DPER)			69.6800	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.1900	(1b)	x 2.2000	(2b) =	103.8180	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	47.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	103.8180	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1926	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4426	(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) =	0.4426	(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	0.5644	0.5533	0.5422	0.4869	0.4758	0.4205	0.4205	0.4094	0.4426	0.4758	0.4980	0.5201	(22b)
Effective ac	0.6593	0.6531	0.6470	0.6185	0.6132	0.5884	0.5884	0.5838	0.5980	0.6132	0.6240	0.6353	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.20)			4.8000	1.1450	5.4962			(27)

External Wall 1	64.2000	6.9000	57.3000	0.1800	10.3140	(29a)
External Roof 1	47.1900		47.1900	0.1100	5.1909	(30)
Total net area of external elements Aum(A, m2)			111.3900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.1011	(33)
Party Wall 1			16.4000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 68.5126 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0500	2.1500
E3 Sill	3.1000	0.0500	0.1550
E4 Jamb	13.0000	0.0500	0.6500
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0700	1.9530
E14 Flat roof	27.9000	0.0800	2.2320
E16 Corner (normal)	8.9000	0.0900	0.8010
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0900	-0.4050
E18 Party wall between dwellings	8.9000	0.0600	0.5340
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.1200	0.9000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9700 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 32.0711 (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	22.5861	22.3743	22.1666	21.1912	21.0087	20.1591	20.1591	20.0017	20.4863	21.0087	21.3779	21.7638	(38)
Heat transfer coeff	54.6572	54.4454	54.2377	53.2622	53.0797	52.2302	52.2302	52.0728	52.5574	53.0797	53.4489	53.8349	(39)

Average = Sum(39)m / 12 = 53.2614

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1582	1.1537	1.1493	1.1287	1.1248	1.1068	1.1068	1.1035	1.1137	1.1248	1.1326	1.1408	(40)
HLP (average)												1.1287	
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 1.6078 (42)

Hot water usage for mixer showers

65.6717	64.6848	63.2466	60.4950	58.4644	56.1999	54.9127	56.3400	57.9045	60.3359	63.1466	65.4201	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

31.0955	29.9648	28.8340	27.7033	26.5725	25.4418	25.4418	26.5725	27.7033	28.8340	29.9648	31.0955	(42c)

Average daily hot water use (litres/day) 88.8157 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7672	94.6495	92.0806	88.1983	85.0369	81.6417	80.3545	82.9125	85.6078	89.1699	93.1114	96.5156	(44)
Energy conte	153.2556	134.7797	141.5245	120.7391	114.4761	100.3879	97.1818	102.6630	105.5629	121.0028	132.6542	151.1201	(45)

Energy content (annual) Total = Sum(45)m = 1475.3476

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

22.9883	20.2169	21.2287	18.1109	17.1714	15.0582	14.5773	15.3994	15.8344	18.1504	19.8981	22.6680	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

199.8505	176.8654	188.1194	165.8309	161.0710	145.4798	143.7767	149.2579	150.6548	167.5977	177.7461	197.7150	(62)
-30.0224	-26.5520	-27.8037	-23.0226	-21.4562	-18.3602	-17.2098	-18.3009	-18.9962	-22.3945	-25.3702	-29.4664	(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)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

169.8281	150.3134	160.3157	142.8083	139.6147	127.1195	126.5669	130.9570	131.6586	145.2032	152.3759	168.2486	(64)

Total per year (kWh/year) = Sum(64)m = 1745.0099 (64)

12Total per year (kWh/year) 1745 (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

88.2334	78.4828	84.3328	76.2192	75.3392	69.4525	69.5889	71.4114	71.1732	77.5093	80.1810	87.5233	(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	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.2133	89.9147	81.2133	83.9204	81.2133	83.9204	81.2133	81.2133	83.9204	81.2133	83.9204	81.2133	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	139.9415	141.3936	137.7342	129.9438	120.1099	110.8673	104.6927	103.2406	106.9000	114.6904	124.5243	133.7669	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	(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)	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	(71)
Water heating gains (Table 5)	118.5933	116.7899	113.3506	105.8600	101.2624	96.4618	93.5334	95.9830	98.8516	104.1792	111.3625	117.6389	(72)
Total internal gains	389.8651	398.2153	382.4151	369.8413	352.7026	338.3665	326.5565	327.5539	336.7890	350.1999	369.9243	382.7361	(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	
Northeast	0.6000	11.2829	0.6300	0.7000	0.7700	2.0689	(75)
Southeast	2.0000	36.7938	0.6300	0.7000	0.7700	22.4893	(77)
Northwest	2.2000	11.2829	0.6300	0.7000	0.7700	7.5861	(81)

Solar gains	32.1443	57.9607	87.8227	123.0947	150.9087	155.5499	147.5811	125.9542	99.8993	66.3557	39.0855	27.1310	(83)
Total gains	422.0094	456.1760	470.2379	492.9360	503.6113	493.9164	474.1376	453.5082	436.6884	416.5556	409.0098	409.8671	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.4312	16.4952	16.5583	16.8616	16.9196	17.1948	17.1948	17.2467	17.0877	16.9196	16.8027	16.6822	
alpha	2.0954	2.0997	2.1039	2.1241	2.1280	2.1463	2.1463	2.1498	2.1392	2.1280	2.1202	2.1121	
util living area	0.8824	0.8598	0.8291	0.7654	0.6735	0.5430	0.4259	0.4552	0.6163	0.7698	0.8499	0.8877	(86)
MIT	18.1293	18.4220	18.8853	19.5626	20.1675	20.6410	20.8486	20.8200	20.4937	19.7532	18.8767	18.1067	(87)
Th 2	19.9536	19.9572	19.9607	19.9775	19.9806	19.9953	19.9953	19.9980	19.9896	19.9806	19.9743	19.9676	(88)
util rest of house	0.8702	0.8453	0.8106	0.7386	0.6330	0.4819	0.3443	0.3745	0.5592	0.7386	0.8323	0.8760	(89)
MIT 2	16.6429	17.0075	17.5855	18.4245	19.1490	19.6912	19.8974	19.8761	19.5372	18.6705	17.5885	16.6198	(90)
Living area fraction									fLA = Living area / (4) =			0.5071	(91)
MIT	17.3966	17.7248	18.2446	19.0016	19.6655	20.1729	20.3798	20.3548	20.0222	19.2195	18.2418	17.3738	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3966	17.7248	18.2446	19.0016	19.6655	20.1729	20.3798	20.3548	20.0222	19.2195	18.2418	17.3738	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8315	0.8064	0.7735	0.7091	0.6192	0.4933	0.3768	0.4046	0.5612	0.7116	0.7954	0.8380	(94)
Useful gains	350.9153	367.8814	363.7100	349.5613	311.8338	243.6687	178.6547	183.4710	245.0600	296.4209	325.3428	343.4846	(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	715.8263	698.2508	637.0001	538.0338	422.8067	291.0720	197.4176	205.9364	311.2557	457.5207	595.5164	709.2105	(97)
Space heating kWh	271.4938	222.0083	203.3278	135.7002	82.5639	0.0000	0.0000	0.0000	0.0000	119.8582	194.5250	272.1001	(98a)
Space heating requirement - total per year (kWh/year)												1501.5773	
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	271.4938	222.0083	203.3278	135.7002	82.5639	0.0000	0.0000	0.0000	0.0000	119.8582	194.5250	272.1001	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1501.5773	
Space heating per m2											(98c) / (4) =	31.8198	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	271.4938	222.0083	203.3278	135.7002	82.5639	0.0000	0.0000	0.0000	0.0000	119.8582	194.5250	272.1001	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	294.1428	240.5290	220.2902	147.0208	89.4517	0.0000	0.0000	0.0000	0.0000	129.8572	210.7530	294.7996	(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	169.8281	150.3134	160.3157	142.8083	139.6147	127.1195	126.5669	130.9570	131.6586	145.2032	152.3759	168.2486	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1064	84.9328	84.5939	83.9454	82.9232	79.8000	79.8000	79.8000	79.8000	83.6329	84.6085	85.1315	(217)
Fuel for water heating, kWh/month	199.5481	176.9791	189.5121	170.1204	168.3664	159.2977	158.6051	164.1065	164.9857	173.6197	180.0951	197.6337	(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	16.8745	13.5374	12.1889	8.9301	6.8979	5.6356	6.2925	8.1792	10.6240	13.9392	15.7443	17.3435	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.3163	-23.8802	-35.6243	-41.6349	-46.2964	-43.7605	-43.2717	-40.1895	-34.9382	-28.0568	-18.2639	-14.0092	(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	-6.7155	-14.3601	-28.9692	-44.1256	-58.9270	-59.3864	-58.6413	-49.3422	-35.7931	-20.6854	-9.0175	-5.2896	(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												1626.8443	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2102.8697	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	136.1870	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-777.4947	(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	3174.4064	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1626.8443	0.2100	341.6373	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2102.8697	0.2100	441.6026	(264)
Space and water heating			783.2399	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	136.1870	0.1443	19.6560	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-386.2420	0.1338	-51.6710	
PV Unit electricity exported	-391.2527	0.1255	-49.1037	
Total			-100.7747	(269)
Total CO2, kg/year			714.0505	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.1300	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1626.8443	1.1300	1838.3341	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2102.8697	1.1300	2376.2427	(278)
Space and water heating			4214.5768	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	136.1870	1.5338	208.8882	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-386.2420	1.4944	-577.1916	
PV Unit electricity exported	-391.2527	0.4607	-180.2375	
Total			-757.4291	(283)
Total Primary energy kWh/year			3796.1367	(286)
Target Primary Energy Rate (TPER)			80.4400	(287)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		47.1900	(1b)	x 2.2000	(2b) =	103.8180	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	47.1900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		103.8180	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1926	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3926	(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) = 0.3926 (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	0.5006	0.4908	0.4810	0.4319	0.4221	0.3730	0.3730	0.3632	0.3926	0.4221	0.4417	0.4614	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.6253 0.6204 0.6157 0.5933 0.5891 0.5696 0.5696 0.5660 0.5771 0.5891 0.5976 0.6064 (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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			4.8000	0.9615	4.6154			(27)
External Wall 1	64.2000	6.9000	57.3000	0.1500	8.5950	9.0000	515.7000	(29a)
External Roof 1	47.1900		47.1900	0.1100	5.1909	9.0000	424.7100	(30)
Total net area of external elements Aum(A, m2)			111.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.5013			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			47.1900			30.0000	1415.7000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3233.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 68.5126 (35)
List of Thermal Bridges

		Length	Psi-value	Total
K1 Element				
E2 Other lintels (including other steel lintels)		43.0000	0.0840	3.6120
E3 Sill		3.1000	0.0340	0.1054
E4 Jamb		13.0000	0.0430	0.5590
E7 Party floor between dwellings (in blocks of flats)		27.9000	0.0800	2.2320
E14 Flat roof		27.9000	0.0460	1.2834
E16 Corner (normal)		8.9000	0.0300	0.2670
E17 Corner (inverted - internal area greater than external area)		4.5000	-0.0150	-0.0675
E18 Party wall between dwellings		8.9000	0.0300	0.2670
P2 Party wall - Intermediate floor within a dwelling		7.5000	0.0790	0.5925
P4 Party wall - Roof (insulation at ceiling level)		7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1958 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.6971 (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	21.4231	21.2564	21.0930	20.3255	20.1819	19.5134	19.5134	19.3896	19.7709	20.1819	20.4724	20.7761	(38)
Heat transfer coeff	51.1202	50.9535	50.7901	50.0226	49.8790	49.2105	49.2105	49.0867	49.4680	49.8790	50.1695	50.4732	(39)

Average = Sum(39)m / 12 = 50.0219

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0833	1.0798	1.0763	1.0600	1.0570	1.0428	1.0428	1.0402	1.0483	1.0570	1.0631	1.0696	(40)
HLP (average)												1.0600	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6078 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

22.1310	21.8023	21.3395	20.4861	19.8471	19.1385	18.7558	19.2154	19.7158	20.4740	21.3450	22.0562	(42b)

Hot water usage for other uses

31.0955	29.9648	28.8340	27.7033	26.5725	25.4418	25.4418	26.5725	27.7033	28.8340	29.9648	31.0955	(42c)

Average daily hot water use (litres/day) 48.7876 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	53.2265	51.7671	50.1735	48.1894	46.4196	44.5803	44.1975	45.7879	47.4191	49.3080	51.3097	53.1517	(44)
Energy conte	84.2978	73.7157	77.1148	65.9688	62.4897	54.8167	53.4531	56.6950	58.4725	66.9105	73.1001	83.2227	(45)

Energy content (annual) Total = Sum(45)m = 810.2573
Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:
Total storage loss

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

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

71.6531	62.6583	65.5476	56.0735	53.1162	46.5942	45.4351	48.1907	49.7016	56.8739	62.1351	70.7393	(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

71.6531	62.6583	65.5476	56.0735	53.1162	46.5942	45.4351	48.1907	49.7016	56.8739	62.1351	70.7393	(64)

Total per year (kWh/year) = Sum(64)m = 688.7187 (64)
12Total per year (kWh/year) 689 (64)
Electric shower(s)

40.9843	36.5173	39.8755	38.0527	38.7668	36.9797	38.2124	38.7668	38.0527	39.8755	39.1257	40.9843	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 466.1936 (64a)
Heat gains from water heating, kWh/month

28.1593	24.7939	26.3558	23.5316	22.9707	20.8935	20.9119	21.7394	21.9386	24.1874	25.3152	27.9309	(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	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.2133	89.9147	81.2133	83.9204	81.2133	83.9204	81.2133	81.2133	83.9204	81.2133	83.9204	81.2133	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	139.9415	141.3936	137.7342	129.9438	120.1099	110.8673	104.6927	103.2406	106.9000	114.6904	124.5243	133.7669	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	(71)
Water heating gains (Table 5)													
	37.8486	36.8957	35.4244	32.6827	30.8747	29.0187	28.1074	29.2196	30.4702	32.5099	35.1600	37.5415	(72)
Total internal gains													
	306.1204	315.3211	301.4890	293.6640	279.3149	270.9235	261.1304	260.7905	268.4076	275.5306	290.7218	299.6387	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.6000	11.2829	0.6300	0.7000	0.7700	2.0689	(75)
Southeast	2.0000	36.7938	0.6300	0.7000	0.7700	22.4893	(77)
Northwest	2.2000	11.2829	0.6300	0.7000	0.7700	7.5861	(81)

Solar gains	32.1443	57.9607	87.8227	123.0947	150.9087	155.5499	147.5811	125.9542	99.8993	66.3557	39.0855	27.1310	(83)
Total gains	338.2647	373.2818	389.3117	416.7587	430.2236	426.4734	408.7115	386.7447	368.3070	341.8863	329.8073	326.7697	(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	17.5681	17.6256	17.6823	17.9536	18.0053	18.2499	18.2499	18.2959	18.1549	18.0053	17.9010	17.7933	
alpha	2.1712	2.1750	2.1788	2.1969	2.2004	2.2167	2.2167	2.2197	2.2103	2.2004	2.1934	2.1862	
util living area													
	0.9146	0.8929	0.8646	0.8031	0.7130	0.5801	0.4598	0.4945	0.6619	0.8151	0.8877	0.9197	(86)
MIT	18.0129	18.3231	18.7990	19.4998	20.1277	20.6227	20.8402	20.8066	20.4564	19.6671	18.7600	17.9778	(87)
Th 2	20.0145	20.0174	20.0202	20.0336	20.0361	20.0478	20.0478	20.0500	20.0433	20.0361	20.0311	20.0258	(88)
util rest of house													
	0.9054	0.8815	0.8495	0.7797	0.6757	0.5210	0.3784	0.4141	0.6082	0.7886	0.8740	0.9111	(89)
MIT 2	17.2868	17.5923	18.0607	18.7474	19.3417	19.7914	19.9639	19.9436	19.6531	18.9199	18.0351	17.2595	(90)
Living area fraction										fLA = Living area / (4) =		0.5071	(91)
MIT	17.6550	17.9629	18.4351	19.1289	19.7403	20.2130	20.4082	20.3812	20.0605	19.2988	18.4027	17.6238	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6550	17.9629	18.4351	19.1289	19.7403	20.2130	20.4082	20.3812	20.0605	19.2988	18.4027	17.6238	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8769	0.8515	0.8195	0.7543	0.6631	0.5319	0.4105	0.4435	0.6092	0.7648	0.8451	0.8835	(94)
Useful gains	296.6228	317.8483	319.0381	314.3652	285.2685	226.8531	167.7896	171.5238	224.3838	261.4649	278.7240	288.6868	(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													
	682.7116	665.6018	606.1853	511.6777	401.0406	276.2170	187.4053	195.4246	294.8527	433.8883	567.0518	677.5412	(97)
Space heating kWh													
	287.2500	233.6904	213.6375	142.0650	86.1344	0.0000	0.0000	0.0000	0.0000	128.2830	207.5961	289.3077	(98a)
Space heating requirement - total per year (kWh/year)												1587.9640	
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													
	287.2500	233.6904	213.6375	142.0650	86.1344	0.0000	0.0000	0.0000	0.0000	128.2830	207.5961	289.3077	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1587.9640	
Space heating per m2											(98c) / (4) =	33.6504	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	462.5786	364.1576	373.0589	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6886	0.7535	0.7283	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	318.5099	274.3865	271.7152	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	461.8204	442.9514	418.9202	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	103.1836	125.4122	109.5205	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	25.7959	31.3531	27.3801	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												84.5291	(107)
Energy for space heating												33.6504	(99)
Energy for space cooling												1.7912	(108)
Total												35.4417	(109)
Fabric Energy Efficiency (DFEE)												35.4	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.1900 (1b)	x	2.2000 (2b)	=	103.8180	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 47.1900						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	103.8180	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1926	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4426	(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) =	0.4426	(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	0.5644	0.5533	0.5422	0.4869	0.4758	0.4205	0.4205	0.4094	0.4426	0.4758	0.4980	0.5201	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.6593	0.6531	0.6470	0.6185	0.6132	0.5884	0.5884	0.5838	0.5980	0.6132	0.6240	0.6353	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.20)			4.8000	1.1450	5.4962			(27)
External Wall 1	64.2000	6.9000	57.3000	0.1800	10.3140			(29a)
External Roof 1	47.1900		47.1900	0.1100	5.1909			(30)
Total net area of external elements Aum(A, m2)			111.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.1011			(33)
Party Wall 1			16.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 68.5126 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0500	2.1500
E3 Sill	3.1000	0.0500	0.1550
E4 Jamb	13.0000	0.0500	0.6500
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0700	1.9530
E14 Flat roof	27.9000	0.0800	2.2320
E16 Corner (normal)	8.9000	0.0900	0.8010
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0900	-0.4050
E18 Party wall between dwellings	8.9000	0.0600	0.5340
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.1200	0.9000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.9700	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	32.0711	(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	22.5861	22.3743	22.1666	21.1912	21.0087	20.1591	20.1591	20.0017	20.4863	21.0087	21.3779	21.7638	(38)
Heat transfer coeff	54.6572	54.4454	54.2377	53.2622	53.0797	52.2302	52.2302	52.0728	52.5574	53.0797	53.4489	53.8349	(39)
Average = Sum(39)m / 12 =												53.2614	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1582	1.1537	1.1493	1.1287	1.1248	1.1068	1.1068	1.1035	1.1137	1.1248	1.1326	1.1408	(40)
HLP (average)												1.1287	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6078 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	22.1310	21.8023	21.3395	20.4861	19.8471	19.1385	18.7558	19.2154	19.7158	20.4740	21.3450	22.0562	(42b)
Hot water usage for other uses													

	31.0955	29.9648	28.8340	27.7033	26.5725	25.4418	25.4418	26.5725	27.7033	28.8340	29.9648	31.0955 (42c)
Average daily hot water use (litres/day)												48.7876 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	53.2265	51.7671	50.1735	48.1894	46.4196	44.5803	44.1975	45.7879	47.4191	49.3080	51.3097	53.1517	(44)
Energy conte	84.2978	73.7157	77.1148	65.9688	62.4897	54.8167	53.4531	56.6950	58.4725	66.9105	73.1001	83.2227	(45)
Energy content (annual)											Total = Sum(45)m =	810.2573	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	71.6531	62.6583	65.5476	56.0735	53.1162	46.5942	45.4351	48.1907	49.7016	56.8739	62.1351	70.7393	(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													
	71.6531	62.6583	65.5476	56.0735	53.1162	46.5942	45.4351	48.1907	49.7016	56.8739	62.1351	70.7393	(64)
										Total per year (kWh/year) = Sum(64)m =		688.7187	(64)
12Total per year (kWh/year)												689	(64)
Electric shower(s)													
	40.9843	36.5173	39.8755	38.0527	38.7668	36.9797	38.2124	38.7668	38.0527	39.8755	39.1257	40.9843	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												466.1936	(64a)
Heat gains from water heating, kWh/month													
	28.1593	24.7939	26.3558	23.5316	22.9707	20.8935	20.9119	21.7394	21.9386	24.1874	25.3152	27.9309	(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	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	80.3901	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.2133	89.9147	81.2133	83.9204	81.2133	83.9204	81.2133	81.2133	83.9204	81.2133	83.9204	81.2133	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	139.9415	141.3936	137.7342	129.9438	120.1099	110.8673	104.6927	103.2406	106.9000	114.6904	124.5243	133.7669	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	31.0390	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	(71)
Water heating gains (Table 5)													
	37.8486	36.8957	35.4244	32.6827	30.8747	29.0187	28.1074	29.2196	30.4702	32.5099	35.1600	37.5415	(72)
Total internal gains													
	306.1204	315.3211	301.4890	293.6640	279.3149	270.9235	261.1304	260.7905	268.4076	275.5306	290.7218	299.6387	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.6000	11.2829	0.6300	0.7000	0.7700	2.0689	(75)
Southeast	2.0000	36.7938	0.6300	0.7000	0.7700	22.4893	(77)
Northwest	2.2000	11.2829	0.6300	0.7000	0.7700	7.5861	(81)

Solar gains	32.1443	57.9607	87.8227	123.0947	150.9087	155.5499	147.5811	125.9542	99.8993	66.3557	39.0855	27.1310	(83)
Total gains	338.2647	373.2818	389.3117	416.7587	430.2236	426.4734	408.7115	386.7447	368.3070	341.8863	329.8073	326.7697	(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	16.4312	16.4952	16.5583	16.8616	16.9196	17.1948	17.1948	17.2467	17.0877	16.9196	16.8027	16.6822	
alpha	2.0954	2.0997	2.1039	2.1241	2.1280	2.1463	2.1463	2.1498	2.1392	2.1280	2.1202	2.1121	
util living area													
	0.9176	0.8971	0.8704	0.8118	0.7257	0.5961	0.4768	0.5113	0.6762	0.8232	0.8920	0.9224	(86)
MIT	17.7998	18.1167	18.6131	19.3529	20.0223	20.5653	20.8102	20.7727	20.3848	19.5417	18.5899	17.7725	(87)
Th 2	19.9536	19.9572	19.9607	19.9775	19.9806	19.9953	19.9953	19.9980	19.9896	19.9806	19.9743	19.9676	(88)
util rest of house													
	0.9083	0.8856	0.8551	0.7882	0.6876	0.5343	0.3898	0.4259	0.6206	0.7964	0.8782	0.9137	(89)
MIT 2	17.0406	17.3533	17.8427	18.5704	19.2060	19.7024	19.8974	19.8748	19.5512	18.7646	17.8341	17.0225	(90)
Living area fraction										fLA = Living area / (4) =		0.5071	(91)
MIT	17.4256	17.7405	18.2334	18.9672	19.6200	20.1400	20.3603	20.3301	19.9739	19.1587	18.2174	17.4028	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4256	17.7405	18.2334	18.9672	19.6200	20.1400	20.3603	20.3301	19.9739	19.1587	18.2174	17.4028	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8544	0.8235	0.7607	0.6724	0.5439	0.4230	0.4559	0.6196	0.7706	0.8481	0.8851	(94)
Useful gains	297.2722	318.9167	320.6171	317.0088	289.2847	231.9515	172.8932	176.3053	228.2190	263.4504	279.7046	289.2267	(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													
	717.4105	699.1033	636.3922	536.2031	420.3901	289.3544	196.3989	204.6519	308.7165	454.2914	594.2108	710.7737	(97)
Space heating kWh													
	312.5829	255.4854	234.9367	157.8199	97.5424	0.0000	0.0000	0.0000	0.0000	141.9857	226.4444	313.6309	(98a)
Space heating requirement - total per year (kWh/year)												1740.4285	
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	(98b)
Solar heating contribution - total per year (kWh/year)											0.0000	
Space heating kWh												
	312.5829	255.4854	234.9367	157.8199	97.5424	0.0000	0.0000	0.0000	141.9857	226.4444	313.6309	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)											1740.4285	
Space heating per m2										(98c) / (4) =	36.8813	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	490.9635	386.5032	395.7535	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6611	0.7273	0.7017	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	324.5594	281.1061	277.7037	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	461.8204	442.9514	418.9202	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	98.8279	120.4129	105.0650	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	24.7070	30.1032	26.2663	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												81.0765	(107)
Energy for space heating												36.8813	(99)
Energy for space cooling												1.7181	(108)
Total												38.5994	(109)
Fabric Energy Efficiency (TFEE)												38.6	(109)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		47.1900	(1b)	x 2.2000	(2b) =	103.8180	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	47.1900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		103.8180	(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		2 * 10 =	20.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.1926	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3926	(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) =	0.3926	(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													
	0.5006	0.4908	0.4810	0.4319	0.4221	0.3730	0.3730	0.3632	0.3926	0.4221	0.4417	0.4614	(22b)
Effective ac	0.6253	0.6204	0.6157	0.5933	0.5891	0.5696	0.5696	0.5660	0.5771	0.5891	0.5976	0.6064	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			4.8000	0.9615	4.6154			(27)
External Wall 1	64.2000	6.9000	57.3000	0.1500	8.5950	9.0000	515.7000	(29a)
External Roof 1	47.1900		47.1900	0.1100	5.1909	9.0000	424.7100	(30)
Total net area of external elements Aum(A, m2)			111.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.5013			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			47.1900			30.0000	1415.7000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		3233.1100	(34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 68.5126 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3	Sill	3.1000	0.0340	0.1054
E4	Jamb	13.0000	0.0430	0.5590
E7	Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14	Flat roof	27.9000	0.0460	1.2834
E16	Corner (normal)	8.9000	0.0300	0.2670
E17	Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675
E18	Party wall between dwellings	8.9000	0.0300	0.2670
P2	Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925
P4	Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1958 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.6971 (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	21.4231	21.2564	21.0930	20.3255	20.1819	19.5134	19.5134	19.3896	19.7709	20.1819	20.4724	20.7761	(38)
Heat transfer coeff	51.1202	50.9535	50.7901	50.0226	49.8790	49.2105	49.2105	49.0867	49.4680	49.8790	50.1695	50.4732	(39)

Average = Sum(39)m / 12 = 50.0219

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0833	1.0798	1.0763	1.0600	1.0570	1.0428	1.0428	1.0402	1.0483	1.0570	1.0631	1.0696	(40)
HLP (average)												1.0600	
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 1.6078 (42)
Hot water usage for mixer showers

65.6717	64.6848	63.2466	60.4950	58.4644	56.1999	54.9127	56.3400	57.9045	60.3359	63.1466	65.4201	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

31.0955	29.9648	28.8340	27.7033	26.5725	25.4418	25.4418	26.5725	27.7033	28.8340	29.9648	31.0955	(42c)

Average daily hot water use (litres/day) 88.8157 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7672	94.6495	92.0806	88.1983	85.0369	81.6417	80.3545	82.9125	85.6078	89.1699	93.1114	96.5156	(44)
Energy conte	153.2556	134.7797	141.5245	120.7391	114.4761	100.3879	97.1818	102.6630	105.5629	121.0028	132.6542	151.1201	(45)
Energy content (annual)										Total = Sum(45)m =		1475.3476	
Distribution loss (46)m = 0.15 x (45)m	22.9883	20.2169	21.2287	18.1109	17.1714	15.0582	14.5773	15.3994	15.8344	18.1504	19.8981	22.6680	(46)

Water storage loss:
Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0000 (48)
Temperature factor from Table 2b 0.7800 (49)
Enter (49) or (54) in (55) 1.5600 (55)
Total storage loss

48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(56)

If cylinder contains dedicated solar storage

48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(57)
Primary loss 54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(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

256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(64)

Total per year (kWh/year) = Sum(64)m = 2566.3092 (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

94.8436	84.4533	90.9430	82.6161	81.9494	51.3886	50.9229	52.7454	53.1093	84.1195	86.5779	94.1335	(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	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5344	16.4621	13.3879	10.1355	7.5764	6.3963	6.9114	8.9837	12.0579	15.3103	17.8694	19.0495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	208.8678	211.0352	205.5735	193.9460	179.2685	165.4736	156.2578	154.0904	159.5522	171.1796	185.8572	199.6520	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	(71)
Water heating gains (Table 5)	127.4779	125.6745	122.2352	114.7446	110.1470	71.3730	68.4447	70.8943	73.7629	113.0638	120.2471	126.5235	(72)
Total internal gains	433.2908	431.5825	419.6072	397.2368	375.4025	321.6536	310.0246	312.3791	323.7837	377.9645	402.3844	423.6357	(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	
Northeast	0.6000	11.2829	0.6300	0.7000	0.7700	2.0689	(75)
Southeast	2.0000	36.7938	0.6300	0.7000	0.7700	22.4893	(77)
Northwest	2.2000	11.2829	0.6300	0.7000	0.7700	7.5861	(81)

Solar gains	32.1443	57.9607	87.8227	123.0947	150.9087	155.5499	147.5811	125.9542	99.8993	66.3557	39.0855	27.1310	(83)
Total gains	465.4351	489.5432	507.4299	520.3315	526.3112	477.2035	457.6057	438.3333	423.6830	444.3202	441.4699	450.7667	(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	17.5681	17.6256	17.6823	17.9536	18.0053	18.2499	18.2499	18.2959	18.1549	18.0053	17.9010	17.7933	
alpha	2.1712	2.1750	2.1788	2.1969	2.2004	2.2167	2.2167	2.2197	2.2103	2.2004	2.1934	2.1862	
util living area	0.8573	0.8372	0.8010	0.7374	0.6432	0.5388	0.4210	0.4502	0.6115	0.7389	0.8247	0.8642	(86)
Living	18.5049	18.7438	19.1834	19.7714	20.3040	20.6770	20.8667	20.8407	20.5417	19.9428	19.1547	18.4692	
Non living	17.7611	17.9948	18.4229	18.9947	19.4913	19.8311	19.9788	19.9638	19.7195	19.1673	18.4090	17.7343	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7236	18.7438	19.1834	19.7714	20.3040	20.6770	20.8667	20.8407	20.5417	19.9428	19.1547	18.8232	(87)
Th 2	20.0145	20.0174	20.0202	20.0336	20.0361	20.0478	20.0478	20.0500	20.0433	20.0361	20.0311	20.0258	(88)
util rest of house	0.8437	0.8218	0.7814	0.7102	0.6036	0.4805	0.3438	0.3736	0.5568	0.7071	0.8059	0.8512	(89)
MIT 2	18.8618	17.9948	18.4229	18.9947	19.4913	19.8311	19.9788	19.9638	19.7195	19.1673	18.4090	18.0548	(90)
Living area fraction										fLA = Living area / (4) =		0.5071	(91)
MIT	19.2988	18.3747	18.8086	19.3886	19.9034	20.2600	20.4290	20.4085	20.1364	19.5605	18.7871	18.4445	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2988	18.3747	18.8086	19.3886	19.9034	20.2600	20.4290	20.4085	20.1364	19.5605	18.7871	18.4445	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8327	0.7911	0.7535	0.6900	0.5977	0.4942	0.3758	0.4037	0.5625	0.6896	0.7775	0.8263	(94)
Useful gains	387.5685	387.2896	382.3305	359.0514	314.5766	235.8189	171.9746	176.9350	238.3170	306.3834	343.2548	372.4865	(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	766.7420	686.5807	625.1527	524.6662	409.1769	278.5323	188.4292	196.7634	298.6086	446.9430	586.3371	718.9638	(97)
Space heating kWh	282.1051	201.1236	180.6597	119.2427	70.3826	0.0000	0.0000	0.0000	0.0000	104.5763	175.0193	257.7791	(98a)
Space heating requirement - total per year (kWh/year)												1390.8884	
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	282.1051	201.1236	180.6597	119.2427	70.3826	0.0000	0.0000	0.0000	0.0000	104.5763	175.0193	257.7791	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1390.8884	
Space heating per m2											(98c) / (4) =	29.4742	(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 %)	254.9702	(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	282.1051	201.1236	180.6597	119.2427	70.3826	0.0000	0.0000	0.0000	0.0000	104.5763	175.0193	257.7791	(98)
Space heating efficiency (main heating system 1)	254.9702	254.9702	254.9702	254.9702	254.9702	0.0000	0.0000	0.0000	0.0000	254.9702	254.9702	254.9702	(210)
Space heating fuel (main heating system)	110.6424	78.8812	70.8552	46.7673	27.6042	0.0000	0.0000	0.0000	0.0000	41.0151	68.6430	101.1016	(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	256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(64)
Efficiency of water heater												178.2901	(216)
(217)m	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	(217)
Fuel for water heating, kWh/month	143.8516	127.8862	137.2718	123.7461	122.1008	95.1819	94.6795	97.7538	98.0845	125.7615	130.4291	142.6538	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	16.2230	13.0147	11.7183	8.5853	6.6316	5.4180	6.0495	7.8634	10.2138	13.4010	15.1365	16.6739	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												545.5101	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	178.2901	
Water heating fuel used	1439.4006	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	130.9291	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2115.8398	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	545.5101	16.4900	89.9546	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1439.4006	16.4900	237.3572	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	130.9291	16.4900	21.5902	(250)
Additional standing charges			0.0000	(251)
Total energy cost			348.9020	(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] =	1.3625	(257)
SAP value		77.9146	
SAP rating (Section 12)		78	(258)
SAP band		C	

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	545.5101	0.1544	84.2508	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1439.4006	0.1415	203.6221	(264)
Space and water heating			287.8728	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	130.9291	0.1443	18.8971	(268)
Total CO2, kg/year			306.7700	(272)
CO2 emissions per m2			6.5000	(273)
EI value			95.5410	
EI rating			96	(274)
EI band			A	

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	47.1900 (1b)	x	2.2000 (2b)	=	103.8180	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 47.1900						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	103.8180	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1926	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3926	(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) = 0.3926 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.5006	0.4614	0.4515	0.4221	0.4221	0.3926	0.3926	0.3828	0.3926	0.4417	0.4319	0.4614	(22b)
Effective ac	0.6253	0.6064	0.6019	0.5891	0.5891	0.5771	0.5771	0.5733	0.5771	0.5976	0.5933	0.6064	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			4.8000	0.9615	4.6154			(27)
External Wall 1	64.2000	6.9000	57.3000	0.1500	8.5950	9.0000	515.7000	(29a)
External Roof 1	47.1900		47.1900	0.1100	5.1909	9.0000	424.7100	(30)
Total net area of external elements Aum(A, m2)			111.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.5013			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			47.1900			30.0000	1415.7000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3233.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 68.5126 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3 Sill	3.1000	0.0340	0.1054
E4 Jamb	13.0000	0.0430	0.5590
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14 Flat roof	27.9000	0.0460	1.2834
E16 Corner (normal)	8.9000	0.0300	0.2670
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675
E18 Party wall between dwellings	8.9000	0.0300	0.2670
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1958 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.6971 (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	21.4231	20.7761	20.6226	20.1819	20.1819	19.7709	19.7709	19.6405	19.7709	20.4724	20.3255	20.7761	(38)
Heat transfer coeff	51.1202	50.4732	50.3197	49.8790	49.8790	49.4680	49.4680	49.3376	49.4680	50.1695	50.0226	50.4732	(39)
Average = Sum(39)m / 12 =												50.0065	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0833	1.0696	1.0663	1.0570	1.0570	1.0483	1.0483	1.0455	1.0483	1.0631	1.0600	1.0696	(40)
HLP (average)												1.0597	
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 1.6078 (42)
Hot water usage for mixer showers

65.6717	64.6848	63.2466	60.4950	58.4644	56.1999	54.9127	56.3400	57.9045	60.3359	63.1466	65.4201	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

31.0955	29.9648	28.8340	27.7033	26.5725	25.4418	25.4418	26.5725	27.7033	28.8340	29.9648	31.0955	(42c)

Average daily hot water use (litres/day) 88.8157 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7672	94.6495	92.0806	88.1983	85.0369	81.6417	80.3545	82.9125	85.6078	89.1699	93.1114	96.5156	(44)
Energy conte	153.2556	134.7797	141.5245	120.7391	114.4761	100.3879	97.1818	102.6630	105.5629	121.0028	132.6542	151.1201	(45)
Energy content (annual)										Total = Sum(45)m =		1475.3476	
Distribution loss (46)m = 0.15 x (45)m	22.9883	20.2169	21.2287	18.1109	17.1714	15.0582	14.5773	15.3994	15.8344	18.1504	19.8981	22.6680	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.5600	(55)
Total storage loss	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(56)
If cylinder contains dedicated solar storage	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(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	256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(64)
										Total per year (kWh/year) = Sum(64)m =		2566.3092	(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	94.8436	84.4533	90.9430	82.6161	81.9494	51.3886	50.9229	52.7454	53.1093	84.1195	86.5779	94.1335	(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	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	(66)

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

	18.5344	16.4621	13.3879	10.1355	7.5764	6.3963	6.9114	8.9837	12.0579	15.3103	17.8694	19.0495	(67)

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

	208.8678	211.0352	205.5735	193.9460	179.2685	165.4736	156.2578	154.0904	159.5522	171.1796	185.8572	199.6520	(68)

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

	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	(71)

Water heating gains (Table 5)

	127.4779	125.6745	122.2352	114.7446	110.1470	71.3730	68.4447	70.8943	73.7629	113.0638	120.2471	126.5235	(72)

Total internal gains

	433.2908	431.5825	419.6072	397.2368	375.4025	321.6536	310.0246	312.3791	323.7837	377.9645	402.3844	423.6357	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.6000	15.0428	0.6300	0.7000	0.7700	2.7584	(75)
Southeast	2.0000	46.3896	0.6300	0.7000	0.7700	28.3545	(77)
Northwest	2.2000	15.0428	0.6300	0.7000	0.7700	10.1140	(81)

Solar gains	41.2269	63.7967	96.7754	138.9340	163.1220	182.0509	168.5652	146.6991	117.0273	77.4302	49.7274	33.1922	(83)
Total gains	474.5177	495.3792	516.3826	536.1708	538.5245	503.7045	478.5898	459.0782	440.8110	455.3947	452.1118	456.8279	(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	17.5681	17.7933	17.8476	18.0053	18.0053	18.1549	18.1549	18.2029	18.1549	17.9010	17.9536	17.7933	
alpha	2.1712	2.1862	2.1898	2.2004	2.2004	2.2103	2.2103	2.2135	2.2103	2.1934	2.1969	2.1862	
util living area	0.8375	0.8206	0.7787	0.7075	0.5980	0.4726	0.3529	0.3648	0.5457	0.6915	0.7918	0.8435	(86)
Living	18.8046	18.9808	19.4116	19.9491	20.4617	20.7828	20.9211	20.9160	20.6865	20.1879	19.4902	18.8081	
Non living	18.0539	18.2308	18.6476	19.1623	19.6312	19.9098	20.0093	20.0091	19.8389	19.3903	18.7339	18.0661	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.8769	18.9808	19.4116	19.9491	20.4617	20.7828	20.9211	20.9160	20.6865	20.1879	19.4902	19.1147	(87)
Th 2	20.0145	20.0258	20.0284	20.0361	20.0361	20.0433	20.0433	20.0456	20.0433	20.0311	20.0336	20.0258	(88)
util rest of house	0.8215	0.8033	0.7567	0.6773	0.5533	0.4085	0.2708	0.2808	0.4828	0.6527	0.7686	0.8279	(89)
MIT 2	19.0115	18.2308	18.6476	19.1623	19.6312	19.9098	20.0093	20.0091	19.8389	19.3903	18.7339	18.3402	(90)
Living area fraction										fLA = Living area / (4) =		0.5071	(91)
MIT	19.4504	18.6111	19.0350	19.5613	20.0523	20.3525	20.4717	20.4690	20.2687	19.7948	19.1174	18.7330	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4504	18.6111	19.0350	19.5613	20.0523	20.3525	20.4717	20.4690	20.2687	19.7948	19.1174	18.7330	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8114	0.7740	0.7312	0.6610	0.5541	0.4300	0.3086	0.3192	0.4984	0.6423	0.7435	0.8037	(94)
Useful gains	385.0098	383.4041	377.5662	354.4024	298.3997	216.6036	147.6750	146.5403	219.7158	292.4916	336.1308	367.1738	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	718.2579	651.6640	590.5035	496.8595	371.7151	244.9905	156.8963	156.3499	260.6336	401.0938	536.1125	667.9092	(97)
Space heating kWh	247.9366	180.2707	158.4253	102.5691	54.5467	0.0000	0.0000	0.0000	0.0000	80.8000	143.9868	223.7471	(98a)
Space heating requirement - total per year (kWh/year)												1192.2824	
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	247.9366	180.2707	158.4253	102.5691	54.5467	0.0000	0.0000	0.0000	0.0000	80.8000	143.9868	223.7471	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1192.2824	
Space heating per m2											(98c) / (4) =	25.2656	(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 %)	254.9645	(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	247.9366	180.2707	158.4253	102.5691	54.5467	0.0000	0.0000	0.0000	0.0000	80.8000	143.9868	223.7471	(98)
Space heating efficiency (main heating system 1)	254.9645	254.9645	254.9645	254.9645	254.9645	0.0000	0.0000	0.0000	0.0000	254.9645	254.9645	254.9645	(210)
Space heating fuel (main heating system)	97.2436	70.7042	62.1362	40.2288	21.3938	0.0000	0.0000	0.0000	0.0000	31.6907	56.4733	87.7562	(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													
	256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(64)
Efficiency of water heater												178.2921	(216)
(217)m	178.2921	178.2921	178.2921	178.2921	178.2921	178.2921	178.2921	178.2921	178.2921	178.2921	178.2921	178.2921	(217)
Fuel for water heating, kWh/month													
	143.8500	127.8848	137.2703	123.7447	122.0994	95.1808	94.6784	97.7527	98.0834	125.7601	130.4276	142.6522	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	16.2230	13.0147	11.7183	8.5853	6.6316	5.4180	6.0495	7.8634	10.2138	13.4010	15.1365	16.6739	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	467.6268	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	178.2921	
Water heating fuel used	1439.3844	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	130.9291	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2037.9403	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	467.6268	26.0600	121.8635	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1439.3844	26.0600	375.1036	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	130.9291	26.0600	34.1201	(250)
Additional standing charges			0.0000	(251)
Total energy cost			531.0872	(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	467.6268	0.1548	72.3886	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1439.3844	0.1415	203.6198	(264)
Space and water heating			276.0084	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	130.9291	0.1443	18.8971	(268)
Total CO2, kg/year			294.9055	(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	467.6268	1.5731	735.6174	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1439.3844	1.5231	2192.3622	(278)
Space and water heating			2927.9796	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	130.9291	1.5338	200.8235	(282)
Total Primary energy kWh/year			3128.8031	(286)

SAP 10 EPC IMPROVEMENTS

Be Lean - Flat 2

Current energy efficiency rating:	C 78
Current environmental impact rating:	A 96

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: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£531	£531	£0
Space heating	£122	£122	£0
Water heating	£375	£375	£0
Lighting	£34	£34	£0
Total cost of fuels	£531	£531	£0
Total cost of uses	£531	£531	£0
Delivered energy	43 kWh/m²	43 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	66 kWh/m²	66 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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.1900 (1b)	x	2.2000 (2b)	=	103.8180 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	47.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	103.8180	(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	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1926 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3926 (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) =	0.3926 (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	0.5006	0.4908	0.4810	0.4319	0.4221	0.3730	0.3730	0.3632	0.3926	0.4221	0.4417	0.4614	(22b)
Effective ac	0.6253	0.6204	0.6157	0.5933	0.5891	0.5696	0.5696	0.5660	0.5771	0.5891	0.5976	0.6064	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			4.8000	0.9615	4.6154			(27)
External Wall 1	64.2000	6.9000	57.3000	0.1500	8.5950	9.0000	515.7000	(29a)
External Roof 1	47.1900		47.1900	0.1100	5.1909	9.0000	424.7100	(30)
Total net area of external elements Aum(A, m2)			111.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.5013			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			47.1900			30.0000	1415.7000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	3233.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		68.5126 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3 Sill	3.1000	0.0340	0.1054
E4 Jamb	13.0000	0.0430	0.5590
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14 Flat roof	27.9000	0.0460	1.2834
E16 Corner (normal)	8.9000	0.0300	0.2670
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675
E18 Party wall between dwellings	8.9000	0.0300	0.2670
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.1958 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	29.6971 (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	21.4231	21.2564	21.0930	20.3255	20.1819	19.5134	19.5134	19.3896	19.7709	20.1819	20.4724	20.7761	(38)
Heat transfer coeff	51.1202	50.9535	50.7901	50.0226	49.8790	49.2105	49.2105	49.0867	49.4680	49.8790	50.1695	50.4732	(39)
Average = Sum(39)m / 12 =												50.0219	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0833	1.0798	1.0763	1.0600	1.0570	1.0428	1.0428	1.0402	1.0483	1.0570	1.0631	1.0696	(40)
HLP (average)												1.0600	
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		1.6078 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.6717	64.6848	63.2466	60.4950	58.4644	56.1999	54.9127	56.3400	57.9045	60.3359	63.1466	65.4201	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

31.0955	29.9648	28.8340	27.7033	26.5725	25.4418	25.4418	26.5725	27.7033	28.8340	29.9648	31.0955	(42c)

Average daily hot water use (litres/day)		88.8157 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7672	94.6495	92.0806	88.1983	85.0369	81.6417	80.3545	82.9125	85.6078	89.1699	93.1114	96.5156	(44)
Energy conte	153.2556	134.7797	141.5245	120.7391	114.4761	100.3879	97.1818	102.6630	105.5629	121.0028	132.6542	151.1201	(45)
Energy content (annual)										Total = Sum(45)m =		1475.3476	

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
22.9883	20.2169	21.2287	18.1109	17.1714	15.0582	14.5773	15.3994	15.8344	18.1504	19.8981	22.6680	(46)

Water storage loss:		
Store volume		150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		2.0000 (48)
Temperature factor from Table 2b		0.7800 (49)
Enter (49) or (54) in (55)		1.5600 (55)

Total storage loss

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(56)

If cylinder contains dedicated solar storage

48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(57)
Primary loss 54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(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

256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(64)
							Total per year (kWh/year) = Sum(64)m =				2566.3092	(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

94.8436	84.4533	90.9430	82.6161	81.9494	51.3886	50.9229	52.7454	53.1093	84.1195	86.5779	94.1335	(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	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5344	16.4621	13.3879	10.1355	7.5764	6.3963	6.9114	8.9837	12.0579	15.3103	17.8694	19.0495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	208.8678	211.0352	205.5735	193.9460	179.2685	165.4736	156.2578	154.0904	159.5522	171.1796	185.8572	199.6520	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	(71)
Water heating gains (Table 5)	127.4779	125.6745	122.2352	114.7446	110.1470	71.3730	68.4447	70.8943	73.7629	113.0638	120.2471	126.5235	(72)
Total internal gains	433.2908	431.5825	419.6072	397.2368	375.4025	321.6536	310.0246	312.3791	323.7837	377.9645	402.3844	423.6357	(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	
Northeast	0.6000	11.2829	0.6300	0.7000	0.7700	2.0689	(75)

Southeast			2.0000		36.7938		0.6300		0.7000		0.7700		22.4893 (77)
Northwest			2.2000		11.2829		0.6300		0.7000		0.7700		7.5861 (81)
Solar gains	32.1443	57.9607	87.8227	123.0947	150.9087	155.5499	147.5811	125.9542	99.8993	66.3557	39.0855	27.1310 (83)	
Total gains	465.4351	489.5432	507.4299	520.3315	526.3112	477.2035	457.6057	438.3333	423.6830	444.3202	441.4699	450.7667 (84)	

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	17.5681	17.6256	17.6823	17.9536	18.0053	18.2499	18.2499	18.2959	18.1549	18.0053	17.9010	17.7933	
alpha	2.1712	2.1750	2.1788	2.1969	2.2004	2.2167	2.2167	2.2197	2.2103	2.2004	2.1934	2.1862	
util living area	0.8573	0.8372	0.8010	0.7374	0.6432	0.5388	0.4210	0.4502	0.6115	0.7389	0.8247	0.8642	(86)
Living	18.5049	18.7438	19.1834	19.7714	20.3040	20.6770	20.8667	20.8407	20.5417	19.9428	19.1547	18.4692	
Non living	17.7611	17.9948	18.4229	18.9947	19.4913	19.8311	19.9788	19.9638	19.7195	19.1673	18.4090	17.7343	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7236	18.7438	19.1834	19.7714	20.3040	20.6770	20.8667	20.8407	20.5417	19.9428	19.1547	18.8232	(87)
Th 2	20.0145	20.0174	20.0202	20.0336	20.0361	20.0478	20.0478	20.0500	20.0433	20.0361	20.0311	20.0258	(88)
util rest of house	0.8437	0.8218	0.7814	0.7102	0.6036	0.4805	0.3438	0.3736	0.5568	0.7071	0.8059	0.8512	(89)
MIT 2	18.8618	17.9948	18.4229	18.9947	19.4913	19.8311	19.9788	19.9638	19.7195	19.1673	18.4090	18.0548	(90)
Living area fraction										fLA = Living area / (4) =		0.5071	(91)
MIT	19.2988	18.3747	18.8086	19.3886	19.9034	20.2600	20.4290	20.4085	20.1364	19.5605	18.7871	18.4445	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2988	18.3747	18.8086	19.3886	19.9034	20.2600	20.4290	20.4085	20.1364	19.5605	18.7871	18.4445	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8327	0.7911	0.7535	0.6900	0.5977	0.4942	0.3758	0.4037	0.5625	0.6896	0.7775	0.8263	(94)
Useful gains	387.5685	387.2896	382.3305	359.0514	314.5766	235.8189	171.9746	176.9350	238.3170	306.3834	343.2548	372.4865	(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	766.7420	686.5807	625.1527	524.6662	409.1769	278.5323	188.4292	196.7634	298.6086	446.9430	586.3371	718.9638	(97)
Space heating kWh	282.1051	201.1236	180.6597	119.2427	70.3826	0.0000	0.0000	0.0000	0.0000	104.5763	175.0193	257.7791	(98a)
Space heating requirement - total per year (kWh/year)												1390.8884	
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	282.1051	201.1236	180.6597	119.2427	70.3826	0.0000	0.0000	0.0000	0.0000	104.5763	175.0193	257.7791	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1390.8884	
Space heating per m2											(98c) / (4) =	29.4742	(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 %)												254.9702	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement													
	282.1051	201.1236	180.6597	119.2427	70.3826	0.0000	0.0000	0.0000	0.0000	104.5763	175.0193	257.7791	(98)
Space heating efficiency (main heating system 1)													
	254.9702	254.9702	254.9702	254.9702	254.9702	0.0000	0.0000	0.0000	0.0000	254.9702	254.9702	254.9702	(210)
Space heating fuel (main heating system)													
	110.6424	78.8812	70.8552	46.7673	27.6042	0.0000	0.0000	0.0000	0.0000	41.0151	68.6430	101.1016	(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													
	256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(64)
Efficiency of water heater												178.2901	(216)
(217)m	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	178.2901	(217)
Fuel for water heating, kWh/month													
	143.8516	127.8862	137.2718	123.7461	122.1008	95.1819	94.6795	97.7538	98.0845	125.7615	130.4291	142.6538	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	16.2230	13.0147	11.7183	8.5853	6.6316	5.4180	6.0495	7.8634	10.2138	13.4010	15.1365	16.6739	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												545.5101	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	178.2901	
Water heating fuel used	1439.4006	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	130.9291	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2115.8398	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	545.5101	16.4900	89.9546	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1439.4006	16.4900	237.3572	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	130.9291	16.4900	21.5902	(250)
Additional standing charges			0.0000	(251)
Total energy cost			348.9020	(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] =	1.3625	(257)
SAP value		77.9146	
SAP rating (Section 12)		78	(258)
SAP band		C	

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	545.5101	0.1544	84.2508	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1439.4006	0.1415	203.6221	(264)
Space and water heating			287.8728	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	130.9291	0.1443	18.8971	(268)
Total CO2, kg/year			306.7700	(272)
CO2 emissions per m2			6.5000	(273)
EI value			95.5410	
EI rating			96	(274)
EI band			A	

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		47.1900	(1b)	x 2.2000	(2b) =	103.8180	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	47.1900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		103.8180	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1926	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	

Measured/design AP50	4.0000	(17)
Infiltration rate	0.3926	(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) =	0.3926	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.5006	0.4614	0.4515	0.4221	0.4221	0.3926	0.3926	0.3828	0.3926	0.4417	0.4319	0.4614	(22b)
Effective ac	0.6253	0.6064	0.6019	0.5891	0.5891	0.5771	0.5771	0.5733	0.5771	0.5976	0.5933	0.6064	(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	
Doors			2.1000	1.0000	2.1000			(26)
Glazing (Uw = 1.00)			4.8000	0.9615	4.6154			(27)
External Wall 1	64.2000	6.9000	57.3000	0.1500	8.5950	9.0000	515.7000	(29a)
External Roof 1	47.1900		47.1900	0.1100	5.1909	9.0000	424.7100	(30)
Total net area of external elements Aum(A, m2)			111.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.5013			(33)
Party Wall 1			16.4000	0.0000	0.0000	20.0000	328.0000	(32)
Party Floor 1			47.1900			30.0000	1415.7000	(32d)
Internal Wall 1			61.0000			9.0000	549.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	3233.1100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	68.5126	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	43.0000	0.0840	3.6120
E3 Sill	3.1000	0.0340	0.1054
E4 Jamb	13.0000	0.0430	0.5590
E7 Party floor between dwellings (in blocks of flats)	27.9000	0.0800	2.2320
E14 Flat roof	27.9000	0.0460	1.2834
E16 Corner (normal)	8.9000	0.0300	0.2670
E17 Corner (inverted - internal area greater than external area)	4.5000	-0.0150	-0.0675
E18 Party wall between dwellings	8.9000	0.0300	0.2670
P2 Party wall - Intermediate floor within a dwelling	7.5000	0.0790	0.5925
P4 Party wall - Roof (insulation at ceiling level)	7.5000	0.0460	0.3450

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1958	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	29.6971	(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	21.4231	20.7761	20.6226	20.1819	20.1819	19.7709	19.7709	19.6405	19.7709	20.4724	20.3255	20.7761	(38)
Heat transfer coeff	51.1202	50.4732	50.3197	49.8790	49.8790	49.4680	49.4680	49.3376	49.4680	50.1695	50.0226	50.4732	(39)
Average = Sum(39)m / 12 =												50.0065	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0833	1.0696	1.0663	1.0570	1.0570	1.0483	1.0483	1.0455	1.0483	1.0631	1.0600	1.0696	(40)
HLP (average)												1.0597	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6078	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	65.6717	64.6848	63.2466	60.4950	58.4644	56.1999	54.9127	56.3400	57.9045	60.3359	63.1466	65.4201	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	31.0955	29.9648	28.8340	27.7033	26.5725	25.4418	25.4418	26.5725	27.7033	28.8340	29.9648	31.0955	(42c)
Average daily hot water use (litres/day)												88.8157	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7672	94.6495	92.0806	88.1983	85.0369	81.6417	80.3545	82.9125	85.6078	89.1699	93.1114	96.5156	(44)
Energy conte	153.2556	134.7797	141.5245	120.7391	114.4761	100.3879	97.1818	102.6630	105.5629	121.0028	132.6542	151.1201	(45)
Energy content (annual)										Total = Sum(45)m =		1475.3476	
Distribution loss (46)m = 0.15 x (45)m	22.9883	20.2169	21.2287	18.1109	17.1714	15.0582	14.5773	15.3994	15.8344	18.1504	19.8981	22.6680	(46)

Water storage loss:		
Store volume	150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	2.0000	(48)
Temperature factor from Table 2b	0.7800	(49)
Enter (49) or (54) in (55)	1.5600	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(56)
If cylinder contains dedicated solar storage	48.3600	43.6800	48.3600	46.8000	48.3600	46.8000	48.3600	48.3600	46.8000	48.3600	46.8000	48.3600	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(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	256.4732	228.0085	244.7421	220.6271	217.6937	169.6999	168.8042	174.2854	174.8749	224.2204	232.5422	254.3377	(64)
Total per year (kWh/year) = Sum(64)m =												2566.3092	(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	94.8436	84.4533	90.9430	82.6161	81.9494	51.3886	50.9229	52.7454	53.1093	84.1195	86.5779	94.1335	(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	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	96.4681	(66)

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

	18.5344	16.4621	13.3879	10.1355	7.5764	6.3963	6.9114	8.9837	12.0579	15.3103	17.8694	19.0495	(67)

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

	208.8678	211.0352	205.5735	193.9460	179.2685	165.4736	156.2578	154.0904	159.5522	171.1796	185.8572	199.6520	(68)

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

	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	46.2546	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	-64.3121	(71)

Water heating gains (Table 5)

	127.4779	125.6745	122.2352	114.7446	110.1470	71.3730	68.4447	70.8943	73.7629	113.0638	120.2471	126.5235	(72)

Total internal gains

	433.2908	431.5825	419.6072	397.2368	375.4025	321.6536	310.0246	312.3791	323.7837	377.9645	402.3844	423.6357	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.6000	15.0428	0.6300	0.7000	0.7700	2.7584	(75)
Southeast	2.0000	46.3896	0.6300	0.7000	0.7700	28.3545	(77)
Northwest	2.2000	15.0428	0.6300	0.7000	0.7700	10.1140	(81)

Solar gains	41.2269	63.7967	96.7754	138.9340	163.1220	182.0509	168.5652	146.6991	117.0273	77.4302	49.7274	33.1922	(83)
Total gains	474.5177	495.3792	516.3826	536.1708	538.5245	503.7045	478.5898	459.0782	440.8110	455.3947	452.1118	456.8279	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	17.5681	17.7933	17.8476	18.0053	18.0053	18.1549	18.1549	18.2029	18.1549	17.9010	17.9536	17.7933	
alpha	2.1712	2.1862	2.1898	2.2004	2.2004	2.2103	2.2103	2.2135	2.2103	2.1934	2.1969	2.1862	
util living area	0.8375	0.8206	0.7787	0.7075	0.5980	0.4726	0.3529	0.3648	0.5457	0.6915	0.7918	0.8435	(86)
Living	18.8046	18.9808	19.4116	19.9491	20.4617	20.7828	20.9211	20.9160	20.6865	20.1879	19.4902	18.8081	
Non living	18.0539	18.2308	18.6476	19.1623	19.6312	19.9098	20.0093	20.0091	19.8389	19.3903	18.7339	18.0661	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.8769	18.9808	19.4116	19.9491	20.4617	20.7828	20.9211	20.9160	20.6865	20.1879	19.4902	19.1147	(87)
Th 2	20.0145	20.0258	20.0284	20.0361	20.0361	20.0433	20.0433	20.0456	20.0433	20.0311	20.0336	20.0258	(88)
util rest of house	0.8215	0.8033	0.7567	0.6773	0.5533	0.4085	0.2708	0.2808	0.4828	0.6527	0.7686	0.8279	(89)
MIT 2	19.0115	18.2308	18.6476	19.1623	19.6312	19.9098	20.0093	20.0091	19.8389	19.3903	18.7339	18.3402	(90)
Living area fraction									fLA = Living area / (4) =			0.5071	(91)
MIT	19.4504	18.6111	19.0350	19.5613	20.0523	20.3525	20.4717	20.4690	20.2687	19.7948	19.1174	18.7330	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4504	18.6111	19.0350	19.5613	20.0523	20.3525	20.4717	20.4690	20.2687	19.7948	19.1174	18.7330	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8114	0.7740	0.7312	0.6610	0.5541	0.4300	0.3086	0.3192	0.4984	0.6423	0.7435	0.8037	(94)
Useful gains	385.0098	383.4041	377.5662	354.4024	298.3997	216.6036	147.6750	146.5403	219.7158	292.4916	336.1308	367.1738	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	718.2579	651.6640	590.5035	496.8595	371.7151	244.9905	156.8963	156.3499	260.6336	401.0938	536.1125	667.9092	(97)
Space heating kWh	247.9366	180.2707	158.4253	102.5691	54.5467	0.0000	0.0000	0.0000	0.0000	80.8000	143.9868	223.7471	(98a)
Space heating requirement - total per year (kWh/year)												1192.2824	
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	247.9366	180.2707	158.4253	102.5691	54.5467	0.0000	0.0000	0.0000	0.0000	80.8000	143.9868	223.7471	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1192.2824	
Space heating per m2											(98c) / (4) =	25.2656	(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 %)	254.9645	(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	247.9366	180.2707	158.4253	102.5691	54.5467	0.0000	0.0000	0.0000	0.0000	80.8000	143.9868	223.7471	(98)
Space heating efficiency (main heating system 1)	254.9645	254.9645	254.9645	254.9645	254.9645	0.0000	0.0000	0.0000	0.0000	254.9645	254.9645	254.9645	(210)
Space heating fuel (main heating system)	97.2436	70.7042	62.1362	40.2288	21.3938	0.0000	0.0000	0.0000	0.0000	31.6907	56.4733	87.7562	(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
256.4732 228.0085 244.7421 220.6271 217.6937 169.6999 168.8042 174.2854 174.8749 224.2204 232.5422 254.3377 (64)
Efficiency of water heater 178.2921 (216)
(217)m 178.2921 178.2921 178.2921 178.2921 178.2921 178.2921 178.2921 178.2921 178.2921 178.2921 178.2921 178.2921 (217)
Fuel for water heating, kWh/month
143.8500 127.8848 137.2703 123.7447 122.0994 95.1808 94.6784 97.7527 98.0834 125.7601 130.4276 142.6522 (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 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (231)
Lighting 16.2230 13.0147 11.7183 8.5853 6.6316 5.4180 6.0495 7.8634 10.2138 13.4010 15.1365 16.6739 (232)
Electricity generated by PVs (Appendix M) (negative quantity)
(233a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)
(234a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)
(235a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)
(235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)
(233b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)
(234b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)
(235b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)
(235d)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235d)
Annual totals kWh/year
Space heating fuel - main system 1 467.6268 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 178.2921
Water heating fuel used 1439.3844 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
Total electricity for the above, kWh/year 0.0000 (231)
Electricity for lighting (calculated in Appendix L) 130.9291 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2037.9403 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	467.6268	26.0600	121.8635	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1439.3844	26.0600	375.1036	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	130.9291	26.0600	34.1201	(250)
Additional standing charges			0.0000	(251)
Total energy cost			531.0872	(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	467.6268	0.1548	72.3886	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1439.3844	0.1415	203.6198	(264)
Space and water heating			276.0084	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	130.9291	0.1443	18.8971	(268)
Total CO2, kg/year			294.9055	(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	467.6268	1.5731	735.6174	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1439.3844	1.5231	2192.3622	(278)
Space and water heating			2927.9796	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	130.9291	1.5338	200.8235	(282)
Total Primary energy kWh/year			3128.8031	(286)