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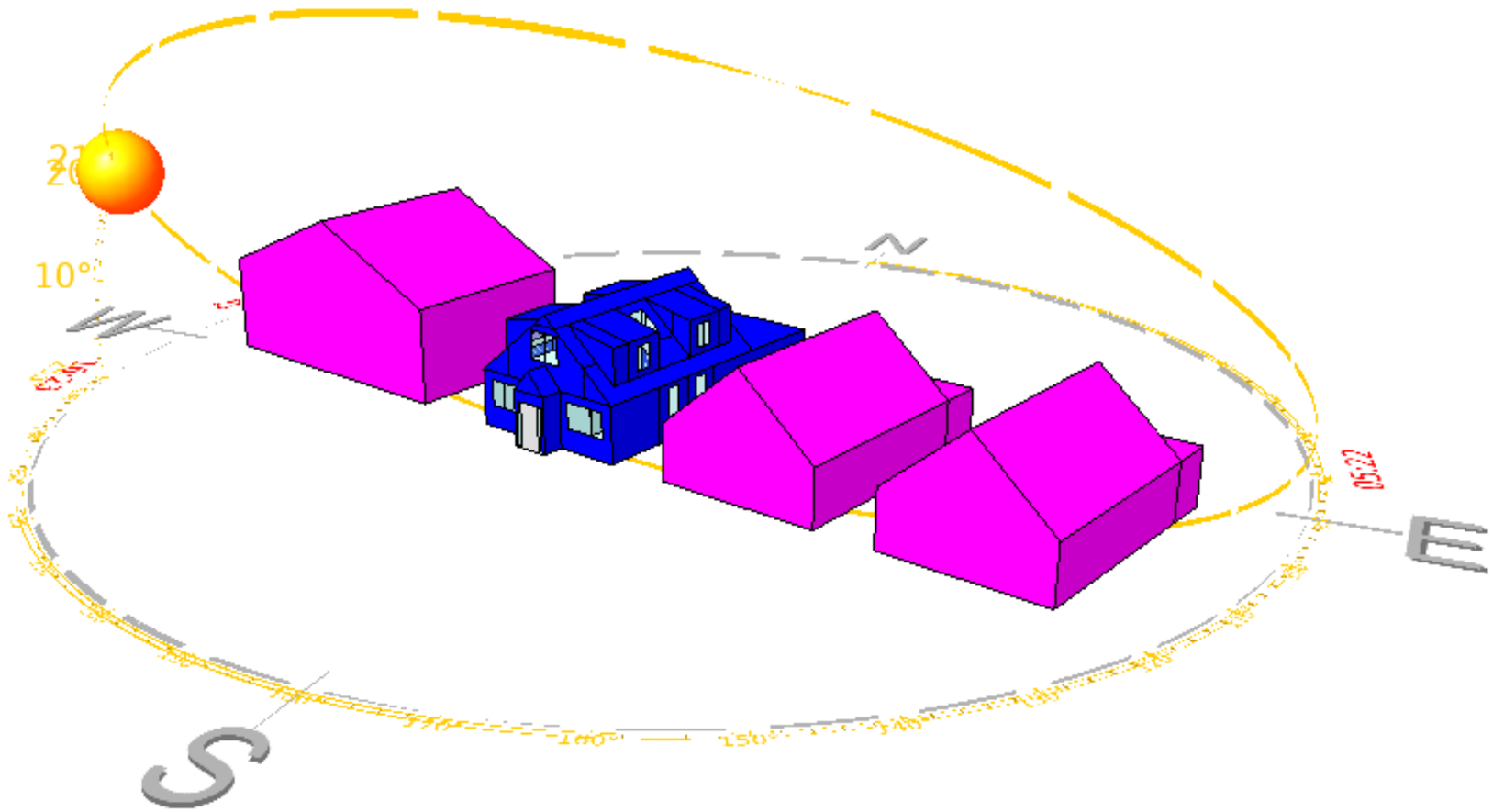
CIBSE TM59 Overheating Analysis in Accordance with Part O



OVERHEATING REPORT OF 42 WHITE HEART AVE, UXBRIDGE

Contents

Appendix A – 42 White Heart Ave - Approved Doc O 2021 Compliance Report - Cooling Hierarchy Passive Measures Only

Prepared by:	Signature	Date
-	-	03.09.25

Revision Record			
Rev	Date	By	Summary of Changes
-	03.09.25		-

1 Executive Summary

This report presents an analytical study of the overheating outcomes for the proposed 4-bed dwelling at the 42 White Heart Ave site in Uxbridge, assessing the development for risks of overheating. The modelling exercise uses design information and relevant industry standards. The results are based on the dynamic modelling outputs from the IES VE software.

The overheating assessment has been carried out with the guidance set out in CIBSE TM59: *Design Methodology for the Assessment of Overheating in Homes* in accordance with Approved Document Part O. The methodology aims to produce a test that encourages good design that is comfortable within sensible limits while prioritising passive measures to achieving compliance against the overheating assessment criteria.

The dwelling has been assessed against the DSY1 weather file to determine the likelihood of overheating to occur, with the proposed buildings created in the IES VE software modelled to a high level of detail and accuracy to stress-test the proposed overheating strategy.

The proposed natural ventilation strategy includes openable windows as per the architectural drawings/elevations. Opening schedules are detailed within this report, with unrestricted openings (up to AD K limit) on all windows have been assumed (as sill heights appear to be above the 1100mm FFL threshold as outlined in *Approved Document K*), whereas patio/bi-fold and rooflights doors have assumed as entirely openable also.

No acoustical limitations have been assumed which would prevent the use of opening windows during the day or night-time for overheating mitigation.

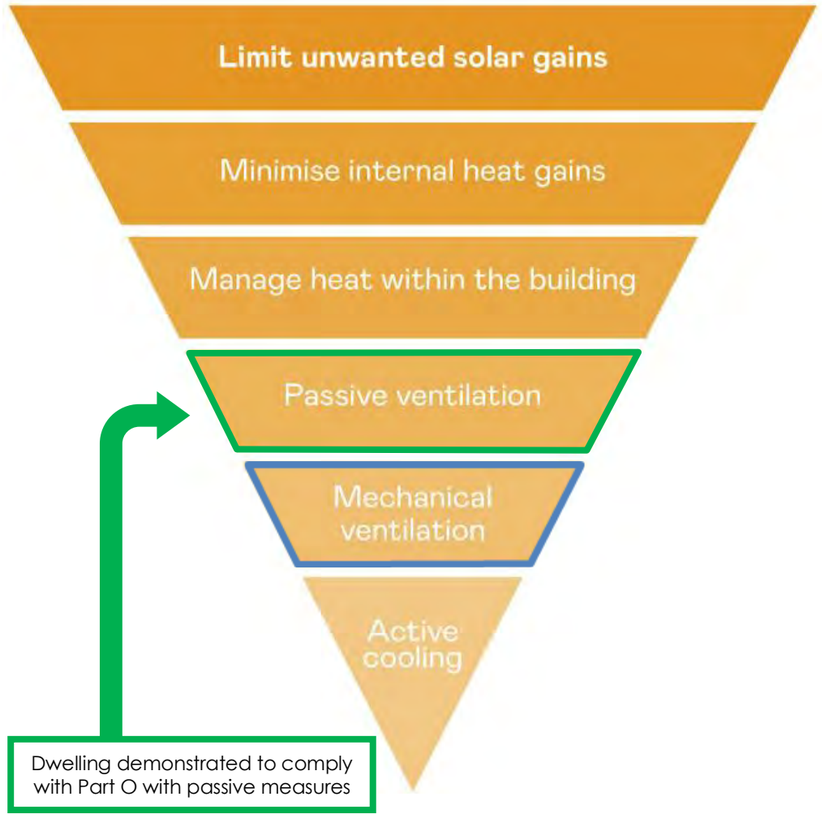


Figure 1: Cooling hierarchy (adopted from GLA London Plan) – showing the priority for actions to mitigate overheating

Mechanical ventilation by dMEV (decentralised mechanical extract ventilation) also forms the overheating strategy, which has been modelled to meet the *Approved Document F* minimum requirements for a continuous extract system (known as system 3).

However, analysis has found that a device/mechanism of secure openings is required to be installed to the ground floor bedroom windows to ensure they satisfy the ADO stipulations to secure accessible windows and doors, measures could include the following; a) Fixed or lockable louvred shutters, or b) Fixed or lockable window grilles or railings. This is to ensure these openings can be made openable during overnight hours.

Note, failure to demonstrate adherence to ADO on the secure methods may invalidate the results and other forms of overheating mitigation my need to be explored. See page 4 for details.

A glazing g value of 0.55 (BS EN 410) has been proposed for the glazing, rooflights and patio doors.

The results show that the Cooling Hierarchy has been followed and can be concluded that the dwelling requires the use securely opening windows to ground floor bedrooms to ensure Part O compliance is achieved,

Assessment findings

The assessment found that the assessed dwelling is able to meet the TM59 overheating criteria and therefore achieve Part O compliance with the building design described in this report. A summary of measures that form the overheating mitigating strategy include:

- Natural ventilation via window openings as per the architectural drawings.
- Window openings to be opened to maximal permissible opening angles in accordance with Approved Document K (safeguarding measures required).
- Glazing solar performance (g value) of 0.50 (BS EN 410) for all windows, rooflights and glazed doors.
- Internal doors to be left open when possible.
- dMEV (system 3) providing whole house continuous extract ventilation meeting minimum Approved Document F requirements
- Window trickle ventilators meeting minimum Approved Document F requirements.
- A device/mechanism of secure openings is required to be installed to the ground floor bedroom windows to ensure they satisfy the ADO stipulations to secure affected windows and doors

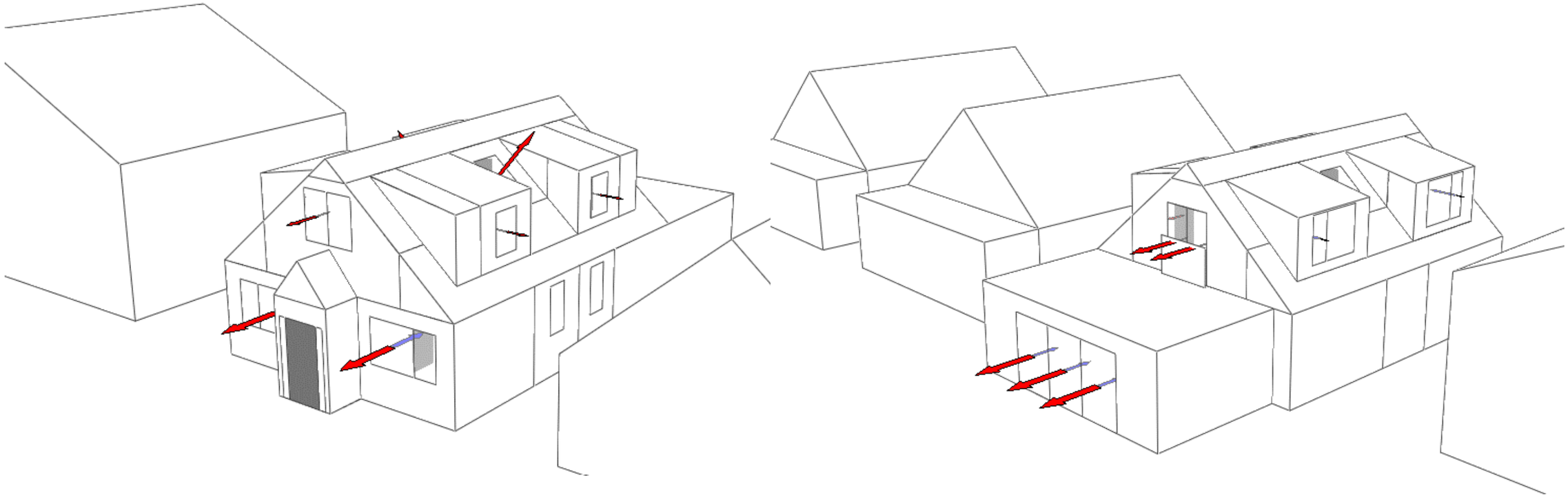


Figure 2: Ventilation depiction of the proposed dwellings in Macroflo

2 INTRODUCTION

2.1 PROJECT SCOPE

This report reviews the overheating risk assessment carried out for the proposed residential building, using dynamic simulation modelling following the guidance detailed in CIBSE TM59 Design methodology for the assessment of overheating risk in homes (2017).

An analytical study is presented within this report of the potential overheating risks of the residential spaces. The scope of this study is to report upon the likely overheating risk and to assess the periods of the year that the building has the potential to overheat using current CIBSE weather file data, and to present a working solution to any and all spaces within the assessed dwelling.

The intention is that this study helps inform and verify the design proposals, thereby providing the basis for mitigating overheating risk and producing a building that provides comfortable environmental conditions for occupants.

It is important to note that with any modelling exercise there are assumptions and approximations that have to be made. As far as possible, details of all assumptions and approximations are supplied within the report. These were predominantly informed by information provided by the design team and should be reviewed carefully.

All results are based on the output from computer modelling software and should be taken as an indication of the likely final situation, but these conditions cannot be guaranteed.

Moreover, this Overheating Assessment supports the Planning Application and demonstrate that the proposed development complies with the relevant current guidance CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes (2017) and the requirements of the Dynamic Simulation of the building regulation in England setting standards for overheating in new residential buildings: Overheating: Approved Part O.

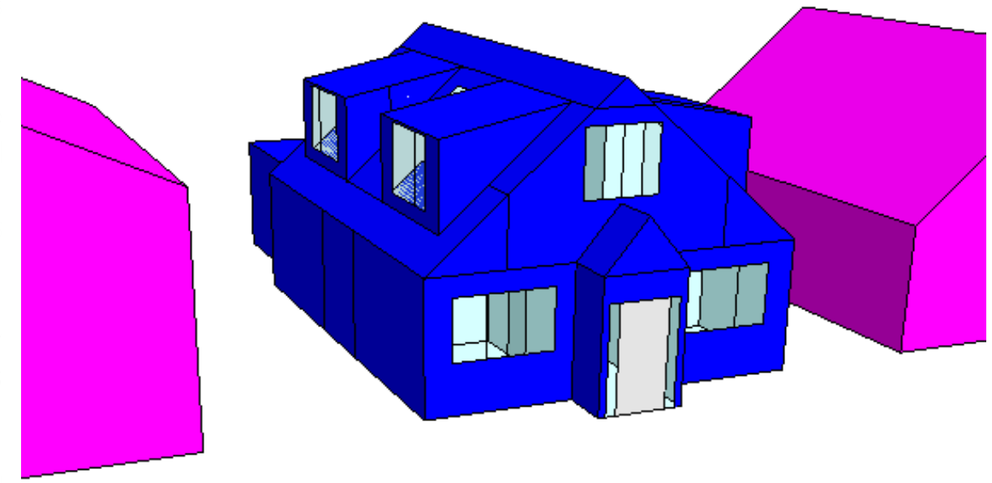


Figure 3: 3D view of the proposed development

2.2 Vulnerable to Intrusion / Easily Accessible Windows

Part Part O stipulates in section 3.6 *Security* that openings which may be vulnerable to intrusion by a casual or opportunistic burglar includes the following:

a) Ground Floor Bedrooms
b) Easily accessible bedrooms

With 'Easily Accessible' being defined as one of either of the following definitions:

- A window or doorway, any part of which is within 2m vertically of an accessible level surface, such as the ground or basement level, or an access boundary
- A window within 2m vertically of a flat or sloping roof (with a pitch of less than 30 degrees) that is within 3.5m of ground level.

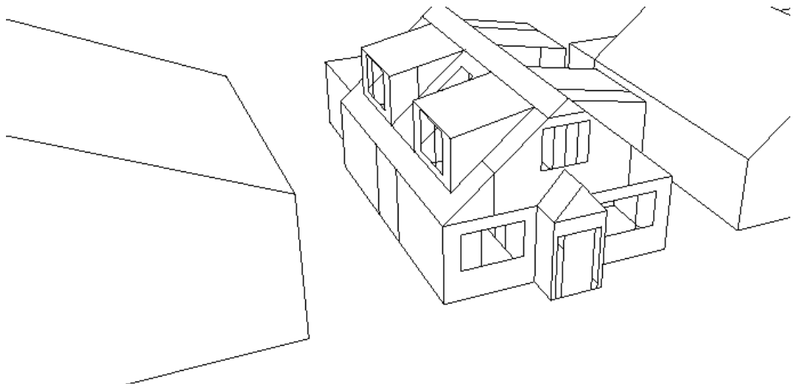


Figure 4: IES model Images of proposed site

Any windows which can be attributed with any of the above two criteria therefore are required to be closed overnight to ensure compliance with Part O stipulations is adhered to, which has been taken into account during the modelling process, and extended to non-bedroom windows (such as bathrooms and landings which are often used as additional window openings to can aid the removal of excess heat in dwellings) which may act as access points into the dwelling for opportunistic burglars etc.

It has been assumed that measures in line with ADO stipulations to secure affected windows and doors have been considered, which may include:

a) Fixed or lockable louvred shutters.
b) Fixed or lockable window grilles or railings.

Analysis has found that all bedroom windows on the ground floor require a device/mechanism of secure openings is required to be installed to the windows to ensure they satisfy the ADO stipulations to secure affected windows and doors – this is to ensure they can be opened at night.

2.3 Noise / Acoustical Impact Assessment

Part O stipulates in section 3.2 *Noise* In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).
Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits:
a) 40dB $L_{Aeq,T,}$ averaged over 8 hours (between 11pm and 7am).
b) 55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am).

On the propsoed development, it is assumed there are no acoustical limitations that would prevent the use of opening windows for the purpose of controlling internal temepratures.

2.4 PROTECTION FROM FALLING

- **3.8)** Openings which are intended to be open for long periods to reduce overheating risk might pose a higher risk of falls from height. Only the proportion of openings which can be opened with a very low risk of occupants falling from height should be considered to form part of the overheating mitigation strategy.

- **3.9)** Openings that can be opened wider than 100mm may form part of the overheating mitigation strategy where they meet all of the following conditions:
  a) Window handles on windows that open outwards are not more than 650mm from the inside face of the wall when the window is at its maximum openable angle.
  b) Guarding meets the minimum standards in Table 3.1
  c) Guarding does not allow children to easily climb it. For example, horizontal bars should generally be avoided.

  For more information, please refer to *Approved Document K*.

Analysis has found that all windows meet the requirments to be opened beyond 100mm restrictors across the site as the sill heights are above the minimum threshold of 1100mm above FFL.

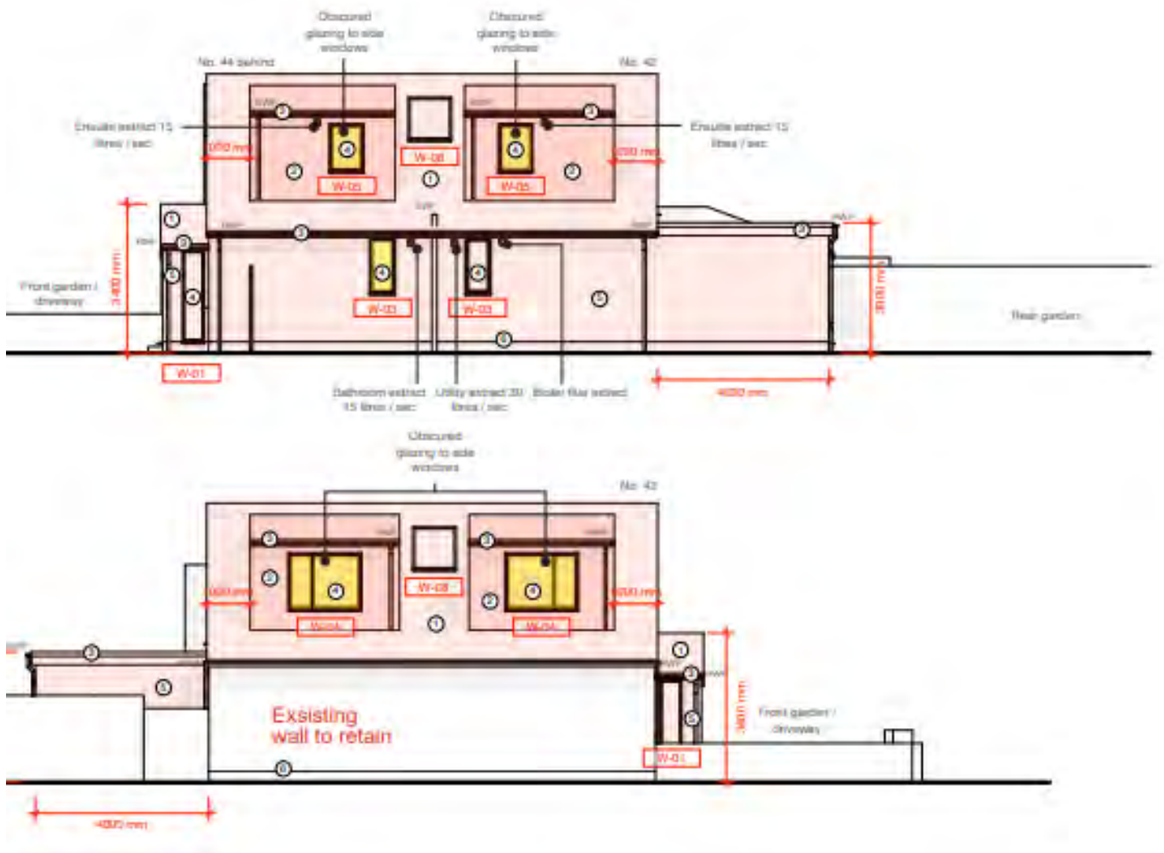


Figure 5: Elevations and sections detailing sill heights from FFL

3 Overheating Assessment Criteria

TM59 sets different overheating compliance criteria for homes that are predominantly naturally ventilated and for homes that are predominantly mechanically ventilated.

For homes that are predominantly naturally ventilated, the method with two criteria should be used to assess overheating. The first overheating criteria, which applies to both living rooms/kitchens and bedrooms, is an adaptive criteria. The second overheating criterion is a fixed temperature criteria which applies only to bedrooms. Both criteria must be met for all spaces within a home to demonstrate compliance.

For mechanically ventilated homes, the fixed temperature method with a single criterion should be used to assess overheating. This single criterion must be met for all spaces (living rooms/kitchens and bedrooms) within a mechanically ventilated home to demonstrate compliance.

The TM59 criteria for naturally and mechanically ventilated homes are summarised in the following table. The dwelling in this assessment is assessed against 'predominantly naturally ventilated' criteria.

All criteria must be met for all spaces within a home to demonstrate full compliance.

Assessment Type	Assessment Criteria	Applicable Rooms	Occupied Hours	Naturally Ventilated Homes (open windows)	Mechanically Ventilated Homes (closed windows)
Predominantly Natural Ventilation	Criterion 1	Living rooms, kitchens and bedrooms	Living / Kitchen / Dining rooms – 9am to 10pm (13 hours/day) Bedrooms – 24-hour occupancy	The number of hours during which external and internal temperature difference is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours.	Not Applicable
	Criterion 2	Bedrooms only	Bedrooms – 24-hour occupancy	The operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. 33 or more hours above 26˚C will be a fail	Not Applicable
Predominantly Mechanical Ventilation	Criterion 3	Living rooms, kitchens and bedrooms	Living / Kitchen / Dining rooms – 9am to 10pm (13 hours/day) Bedrooms – 24-hour occupancy	Not applicable	The operative temperature in occupied all occupied rooms should not exceed 26˚C for more than 3% of the annual occupied annual hours. 143 or more hours above 26˚C for living rooms and kitchens will be a fail. 263 or more hours above 26 ˚C for bedrooms will be a fail

4 Design Criteria

The following general criteria have been used throughout the simulation: -

4.1 Air permeability

An air infiltration rate of 0.15ACH has been applied to the dwelling based on Table 4.24 of CIBSE Guide A.

4.2 External Envelope

The following U-values have been used: -

Element	Proposed U-value (W/m²K)	Part L1A U-value (W/m²K)
External Walls	**0.18**	0.18
Ground floor	**0.13**	0.15
Roof	**0.11**	0.15
Glazing	**1.20**	1.40
Rooflights	**1.20**	1.40

Building envelope U-values

4.3 Glazing Specification

The glazing is based on a G-value of 0.55 (BS EN 410) for windows, rooflights and doors.

4.4 Internal window blinds

Internal blinds have been not included in the calculations

4.5 Weather

Weather file used in the calculation: - **London_LHR _DSY1_2020High50.epw**

4.6 Site & Orientation

The dwelling has been modelled in the orientation as depicted in figure 7.

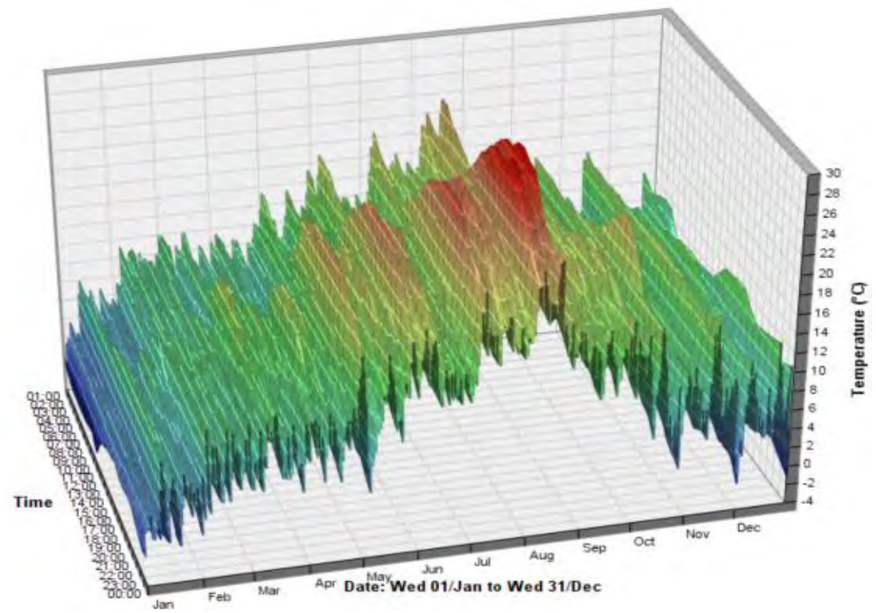


Figure 6: Annual dry-bulb temperature graph of modelled weather file

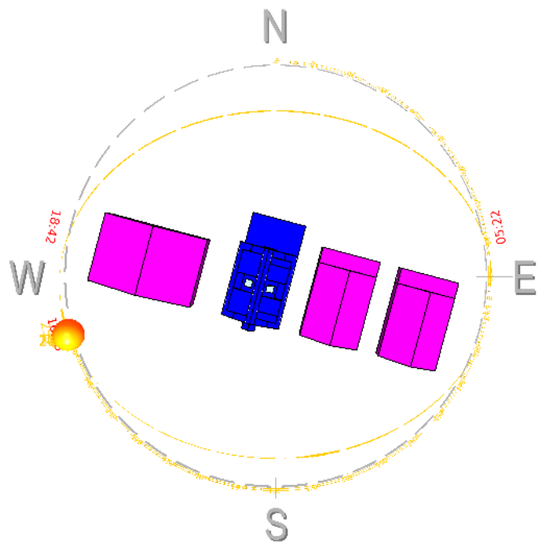


Figure 7: Site orientation depiction

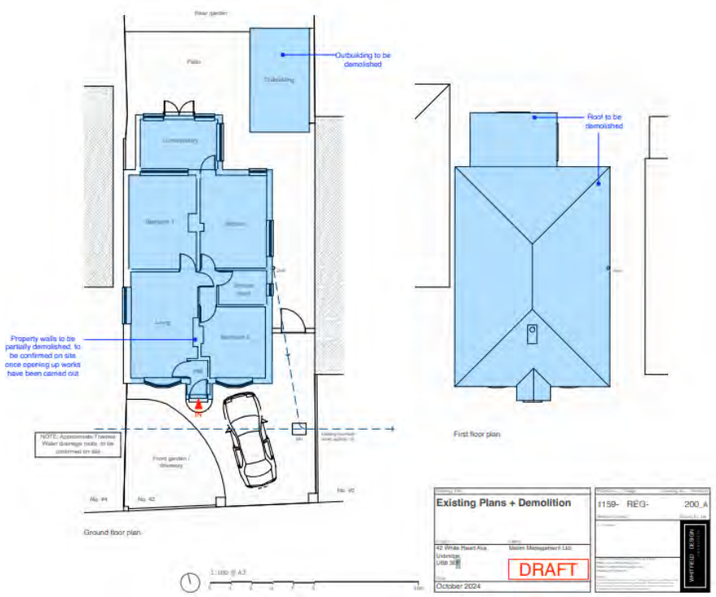
5 REFERENCE DATA

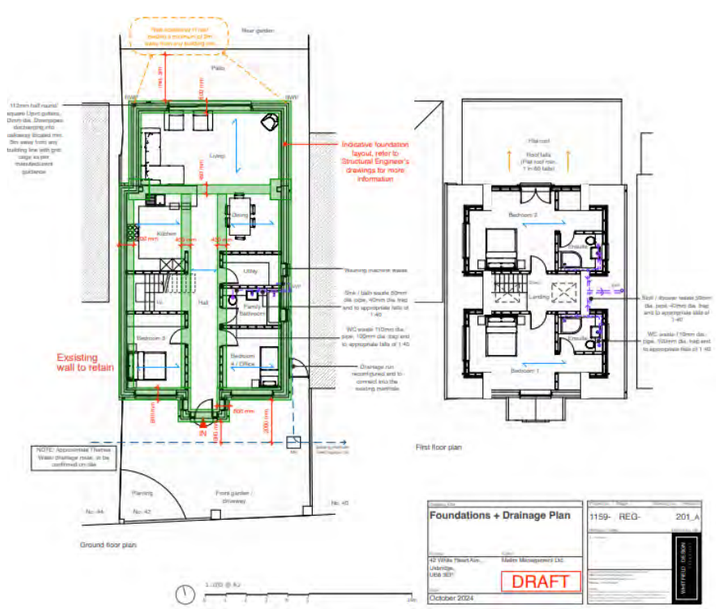
Architectural Drawings

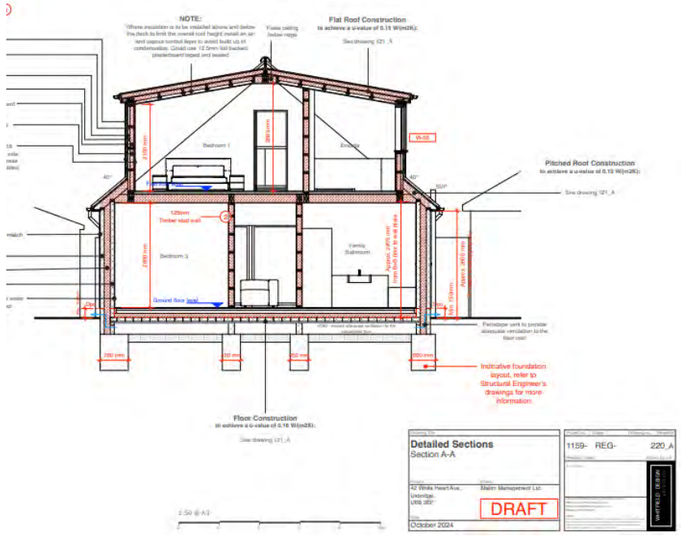
Floor Plans
Proposed Floor Plans

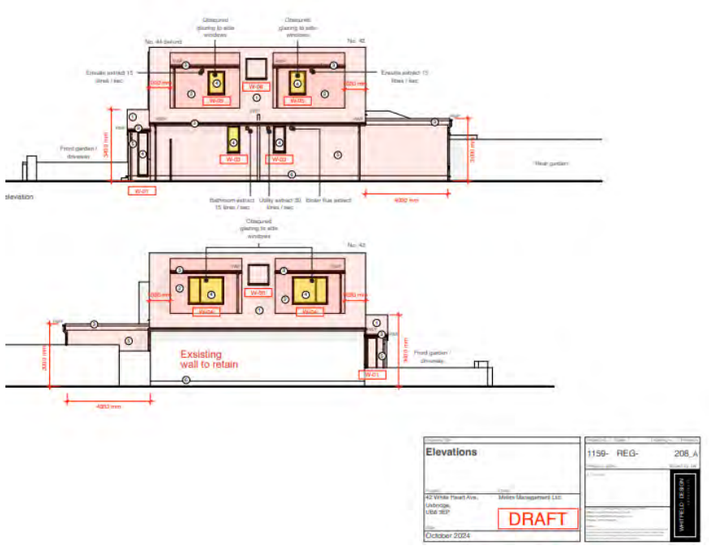
Elevations
Proposed Elevations

Sections
Proposed Sections









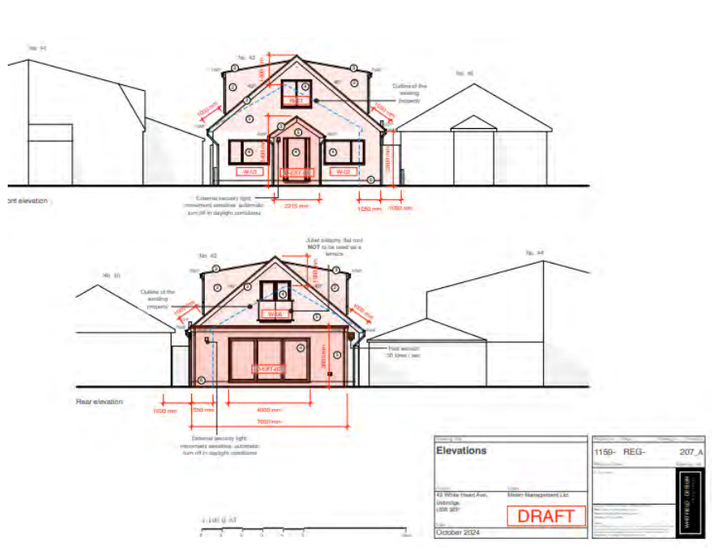


Figure 8: Architectural drawings

6 Internal Gains

The internal gains used throughout the simulations are detailed below. No differences between weekdays and weekends are considered. Bedrooms are set with a 24 hour occupancy profile which means that one person is always considered in each bedroom during the daytime and two people in each double bedroom at night. Kitchen/living rooms are unoccupied during sleeping hours and occupied during the rest of the day. Occupied periods are totalled as 3672 hours per year for bedrooms (24/7 May to September) and 1989 hours for living areas (13 hours per day May to September).
See Appendix B for a detailed CIBSE TM59 internal gain schedule.

6.1 Occupancy

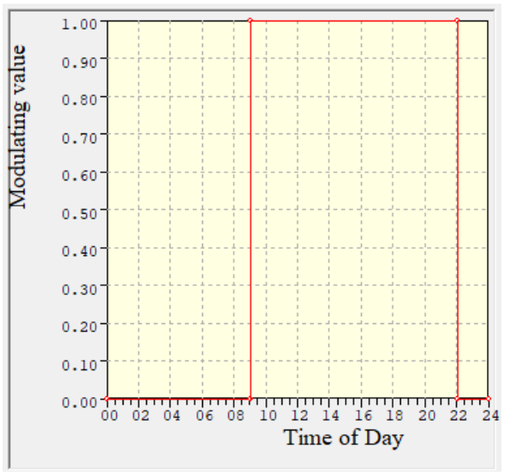
Based on CIBSE Guide A (2015a), a maximum sensible heat gain of 75W/person is assumed in the living spaces. An allowance for 30% reduced gain during sleeping is based on Addendum g to ANSI/ASHRAE Standard 55-2010.

Activity	Sensible heat gain per person (W)
Standard	75
Sleeping	52.5

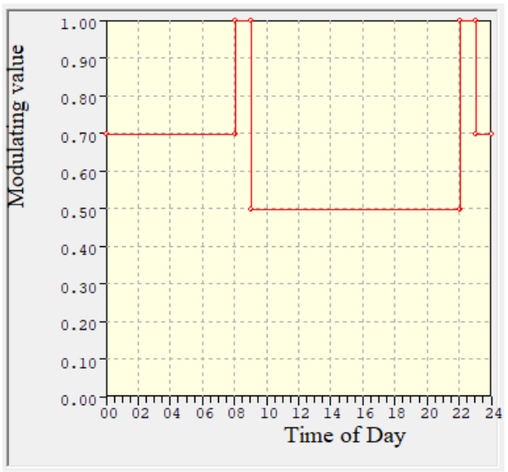
Occupant Gains

Unit/room type	Occupancy
1 bed living/kitchen	1 person from 9am to 10pm room is unoccupied for the rest of the day
2 bed living/kitchen	2 people from 9am to 10pm room is unoccupied for the rest of the day
3 bed living/kitchen	3 people from 9am to 10pm room is unoccupied for the rest of the day
Double bedroom	2 people at 70% gain from 11pm to 8am 2 people at full gain from 8am to 9am and from 10pm to 11pm 1 person at full gain from 9am to 10pm
Single bedroom	1 person at 70% gain from 11pm to 8am 1 person at full gain from 8am to 11pm

Occupancy



Typical living/kitchen occupancy profile



Typical double bedroom occupancy profile

6.2 LIGHTING

Lighting energy is assumed to be proportional to floor area. A default value of 2W/m² is applied to all occupied areas from 6pm to 11 pm.

Zone Type	Gain (W/m²)
living/kitchen/dining areas, bedrooms	2
	0

Lighting gains

6.3 EQUIPMENT

Equipment gains per room type are listed in the table below.

Unit/room type	Load
1 bed living/kitchen	Peak load of 450W from 6pm to 8pm 200W from 8pm to 10pm 110W from 9am to 6pm and 10pm to 12pm Base load of 85W for the rest of the day
2 bed living/kitchen	Peak load of 450W from 6pm to 8pm 200W from 8pm to 10pm 110W from 9am to 6pm and 10pm to 12pm Base load of 85W for the rest of the day
3 bed living/kitchen	Peak load of 450W from 6pm to 8pm 200W from 8pm to 10pm 110W from 9am to 6pm and 10pm to 12pm Base load of 85W for the rest of the day
Double bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during sleeping hours
Single bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during sleeping hours
Communal corridors	Assumed to be zero

Equipment gains

Typical living/kitchen equipment profile

Typical double bedroom equipment profile

7 Cooling Hierarchy – Passive Measures Only

7.1 Natural Ventilation

The windows have been modelled using an opening profile that simulates the occupants within the rooms opening the windows when the internal air temperature reaches 22°C, as stipulated by *AD Part O*. The same procedure operates in reverse as the air temperature cools.

The free area is a way of measuring what the equivalent completely open area is for a glazing assembly. Sufficient free area to the opening windows in a dwelling is vital to the overheating mitigation strategy and can be calculated using the combined areas of A+B (in m^2).

Opening angle is the degree of opening of area **B**. Windows have been modelled to be either top or side hung as shown on the architectural drawings.
Dimension **c** refers to the opening length that windows reach when opened. As referenced in AD Part O section 3.9, if the maximum opening angle (**B**) exceeds 100mm of dimension length **c** then the following three criteria must be met:

a) *Window handles on windows that open outwards are not more than 650mm from the inside face of the wall when the window is at its maximum openable angle.*
b) *Guarding meets the minimum standards in Table 3.1*
c) *Guarding does not allow children to easily climb it. For example, horizontal bars should generally be avoided.*
See section 8 of this report for more information.

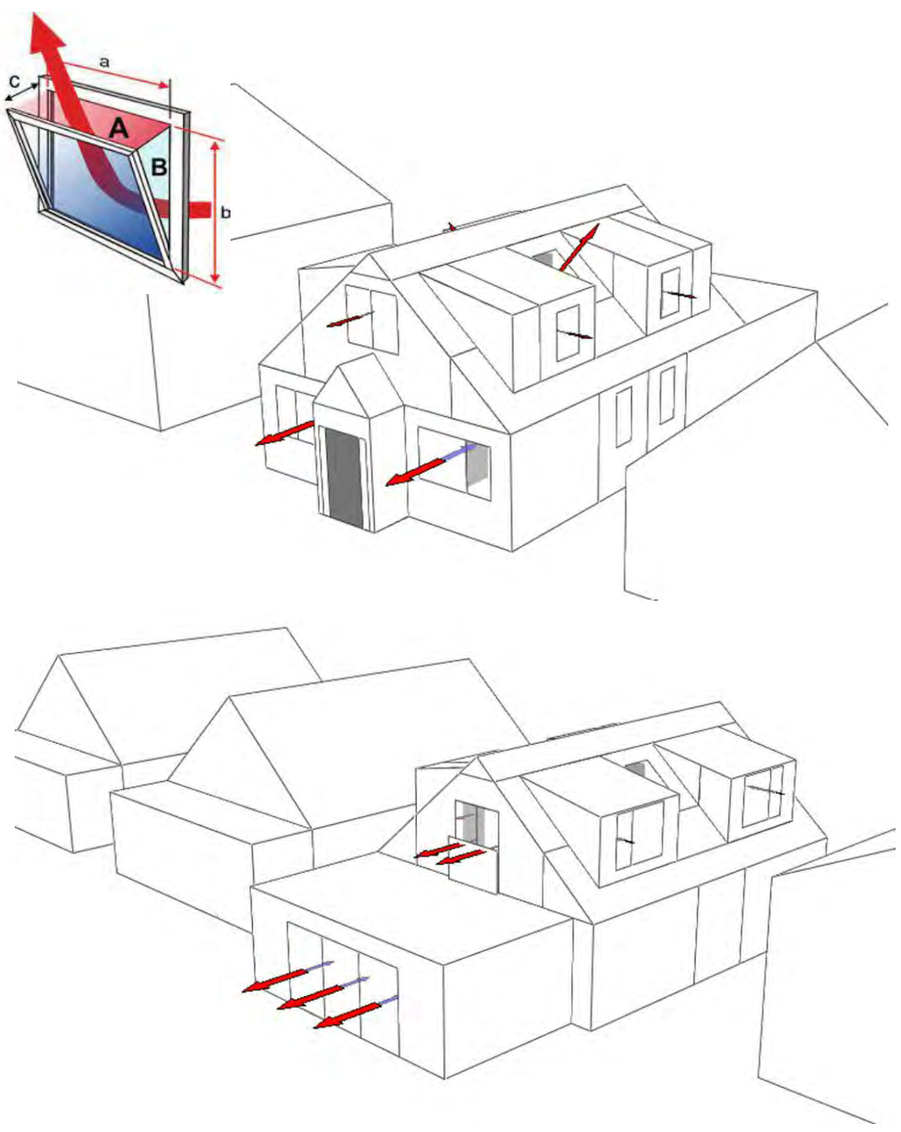


Figure 9: Airflow depiction of the development

7.2 Internal Doors

It is recommended for dwelling occupants to keep internal doors open at all times where possible so to allow air movement between rooms. Openable windows in non-habitable spaces such as landing/halls and bathrooms have been modelled and can contribute to the overall natural ventilation strategy for the dwelling.

Approved Document Part O stipulates bedroom doors must be modelled to be closed during sleeping hours, however there are no constraints during the day and are therefore modelled as open. All non-bedroom doors are considered open on a 24/7 basis.

7.3 WINDOW OPENING SCHEDULE

Opening Schedule Description:

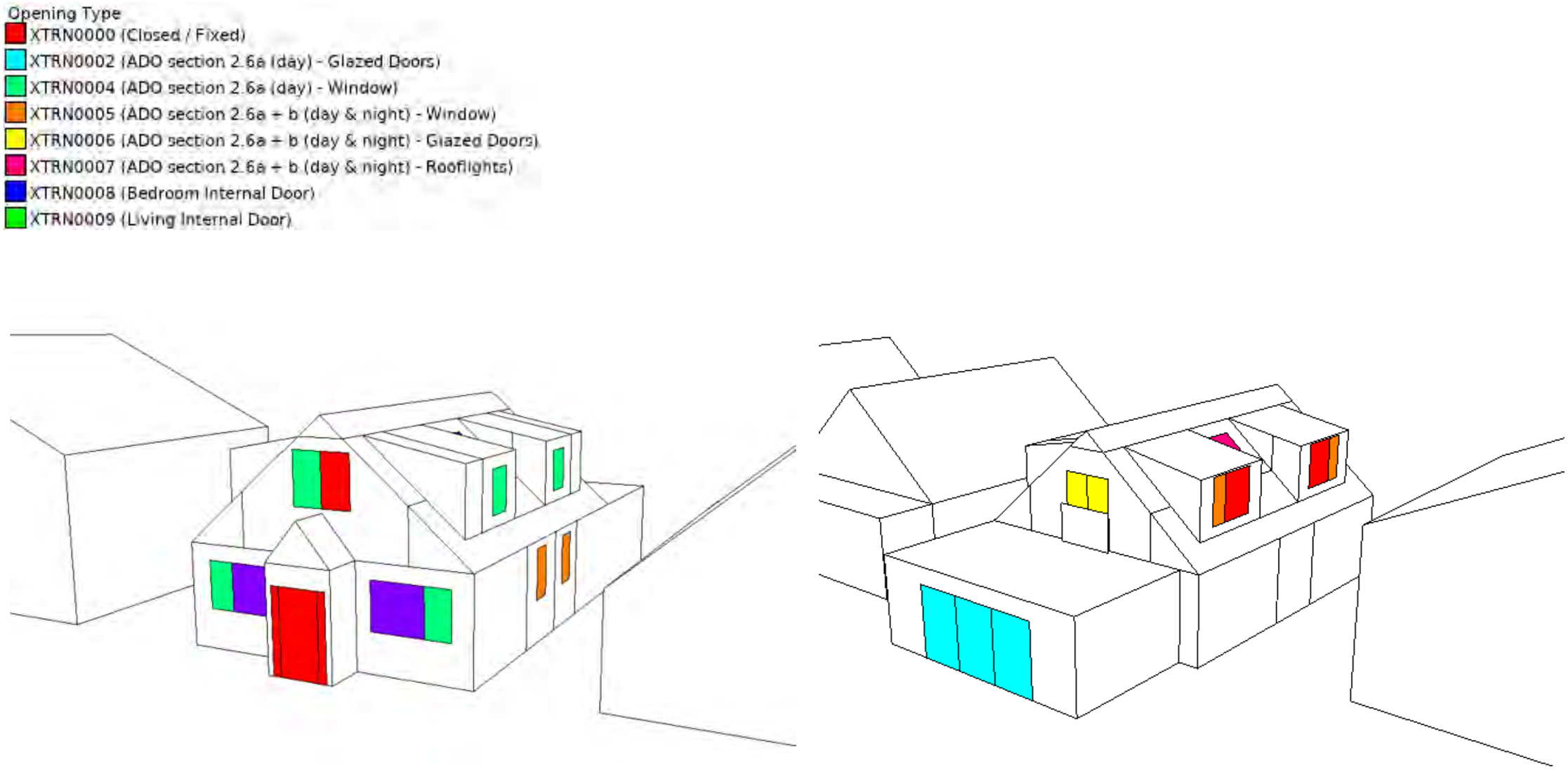


Figure 10: Window opening schedule key of the development

7.4 SHADING

Shading devices such as railings and balconies (providing shading to below windows) have been modelled as this would provide shading to the glazing, limiting any unwanted solar gains.

Additionally, local buildings may provide useful shading, and have been included in the modelling as such.

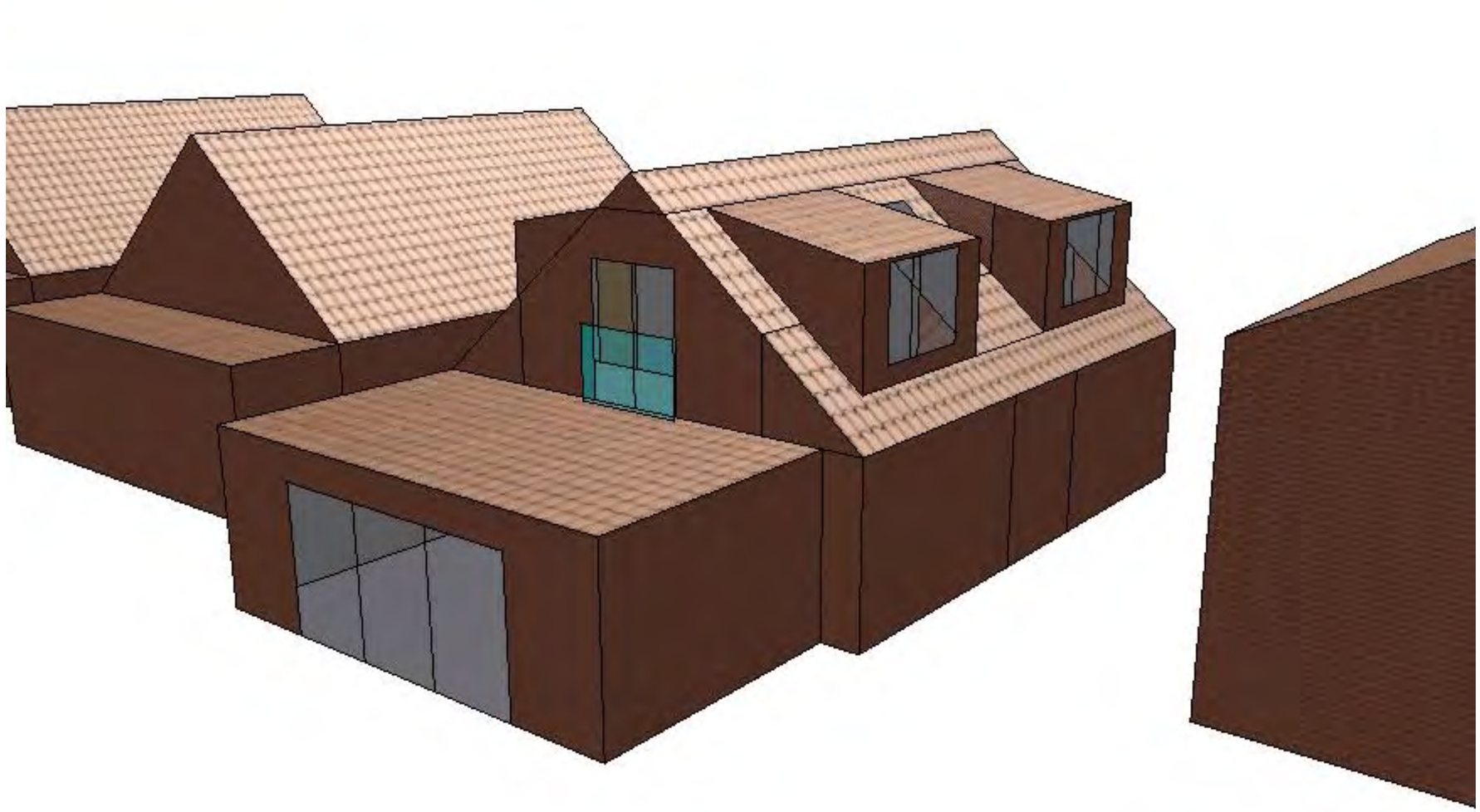


Figure 11: Depiction of the modelled shading devices and surrounding buildings across the scheme

7.5 MECHANICAL VENTILATION

Mechanical ventilation in the form of centralised and/or decentralised mechanical extract ventilation (cMEV / dMEV, respectively) is proposed for the dwelling, known as system 3.

This is a low energy, continuous mechanical extract ventilation system designed to replace conventional bathroom fans (such as intermittent systems) and draw moisture laden air out of the kitchen and wet rooms (bathrooms and utility), providing a quiet and efficient ventilation system.

An additional benefit is an air pathway is also formed drawing warm air out of habitable spaces and evacuated from the dwelling, with the makeup air being provided by the windows (when opened) or by the trickle ventilators (see section 7.4 below) which are intended always be open.

The minimum extract ventilation rates (high rate and continuous rates) can be seen in tables 1.2 and 1.3 – these have been taken from *Approved Document F.*

For more information, please refer to *Approved Document F, Volume 1: Dwellings.*

7.6 TRICKLE VENTILATORS

As per section 1.64 of *Approved Document F*, where continuous mechanical extract ventilation is present, trickle/background ventilators must be installed and meet the following conditions:

a) Not be in wet rooms
b) Provide a minimum equivalent area of 4000mm2 for each habitable room in the dwelling
c) Provide a minimum total number of ventilators that is the same as the number of bedrooms plus two ventilators (i.e. a one-bedroom dwelling should have three background ventilators, a two bedroom dwelling should have four background ventilators, etc.)

Table 1.2 Minimum extract ventilation rates for continuous extract systems[1]

Room	High rate (l/s)	Continuous rate
Kitchen	13	The sum of all extract ventilation in the dwelling on its continuous rate should be at least the whole dwelling ventilation rate given in Table 1.3
Utility room	8	
Bathroom	8	
Sanitary accommodation	6	

NOTE:
1. If the continuous rate of ventilation provided in a room is equal to or higher than the minimum high rate specified in the table, no extra ventilation is needed.

▲ *Minimum High (Boost) extract rates for continuous mechanical extract for each wet room.*

Figure 12: Depiction of dMEV and cMEV systems

8 COOLING HIERARCHY – MECHANICAL VENTILATION

Not required for Part O compliance.

9 Cooling Hierarchy – Active Cooling

Not required for Part O compliance.

10 Ensuring the Overheating Strategy is Usable

Approved Document O lists a number of measures to ensure the overheating mitigation strategy can be feasibly implemented in reality, as well as complying with overlapping building codes. The full literature can be found in *Section 3: Ensuring the overheating mitigation strategy is usable* of Approved Document O. A summary of these standards has been compiled below:

10.1 Noise

- **3.2)** In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

- **3.3)** Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits: A) 40dB LAeq,T, averaged over 8 hours (between 11pm and 7am). & b) 55dB LAFmax, more than 10 times a night (between 11pm and 7am).

10.2 Pollution

- **3.5)** Buildings located near to significant local pollution sources should be designed to minimise the intake of external air pollutants. Guidance is given in Section 2 of Approved Document F, Volume 1: Dwellings.

10.3 Security

- **3.6)** When determining the free area available for ventilation during sleeping hours, only the proportion of openings that can be opened securely should be considered to provide useful ventilation. This particularly applies in the following locations, where openings may be vulnerable to intrusion by a casual or opportunistic burglar.
  a) Ground floor bedrooms
  b) Easily accessible bedrooms

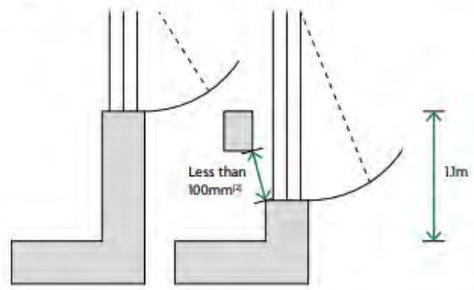
10.4 Protection from Falling

- **3.8)** Openings which are intended to be open for long periods to reduce overheating risk might pose a higher risk of falls from height. Only the proportion of openings which can be opened with a very low risk of occupants falling from height should be considered to form part of the overheating mitigation strategy.
- **3.9)** Openings that can be opened wider than 100mm may form part of the overheating mitigation strategy where they meet all of the following conditions:
  d) Window handles on windows that open outwards are not more than 650mm from the inside face of the wall when the window is at its maximum openable angle.
  e) Guarding meets the minimum standards in Table 3.1
  f) Guarding does not allow children to easily climb it. For example, horizontal bars should generally be avoided.

  For more information, please refer to *Approved Document K*.

Table 3.1 Guarding heights

Change in floor level between inside and outside	Guarding height[1]
Less than 600mm	See Approved Document K
More than 600mm	1.1m



NOTES:

1. This approved document has increased levels of protection from falling compared to Approved Document K. Where applicable, the higher standard applies.
2. Guarding should be sized to prevent the passage of a 100mm sphere.

Figure 14: Guarding heights (from Approved Document K)

11 Results Summary

See Appendix A for full detailed results.

Results Summary

Summary

CIBSE TM59 overheating methodology for predominantly naturally ventilated rooms assesses against two criteria, (a) and (b) (for Category I occupancy, Tmax is reduced by 1K):

- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours
- Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail). Approved document O applies limits to CIBSE TM59 section 3.3 (openings); these requirements are applied by appropriate assignment of MacroFlo types / scripted profiles in the model (see Modelled Openings Section).

CIBSE TM59 overheating methodology for predominantly mechanically ventilated rooms states the operative temperature of all rooms shall not exceed 26°C for more than 3% of annual occupied hours.

CIBSE TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them. While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	Naturally ventilated Criterion a check	Naturally ventilated Criterion b check	Mechanically ventilated check	Corridor overheating risk check
00-Bedroom 3	Pass	Pass	-	-
00-Kitchen/Dining/Living	Pass	N/A	-	-
00-Bedroom 4	Pass	Pass	-	-
01-Bedroom 1	Pass	Pass	-	-
01-Bedroom 2	Pass	Pass	-	-

Naturally ventilated rooms – criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours.

Room name	Occupied hours	No. hours ΔT ≥ 1°K	% Occupied hours ΔT ≥ 1°K	Criterion a check
00-Bedroom 3	3672	22	0.6	Pass
00-Kitchen/Dining/Living	1989	13	0.7	Pass
00-Bedroom 4	3672	28	0.8	Pass
01-Bedroom 1	3672	16	0.4	Pass
01-Bedroom 2	3672	24	0.7	Pass

Naturally ventilated rooms – criterion (b)

Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail). Any rooms that are not bedrooms are therefore not assessed, hence the corresponding N/A values.

Room name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Criterion b check
00-Bedroom 3	9	11	20	Pass
00-Kitchen/Dining/Living	N/A	N/A	N/A	N/A
00-Bedroom 4	9	10	19	Pass
01-Bedroom 1	9	6	15	Pass
01-Bedroom 2	6	0	6	Pass

12 Assessment Summary

The assessment has shown that the assessed residential dwelling presents a low to medium chance of overheating – with the detailed dynamic thermal modelling showing where the risks are likely to occur.

Following the cooling hierarchy (as adopted in the GLA London Plan), the modelling has found that the use of passive measures alone to be the best solution to ensuring the proposed dwelling maintains a comfortable internal environment for occupants during the summer months, and to minimise the risk of overheating.

Natural ventilation via openable windows forms the primary overheating mitigation strategy for the site, with it being demonstrated that there are no limits to the use of opening windows (day and/or night) for overheating purposes from the noise impact assessment findings. A select number of ground floor windows and doors have been made secure to satisfy the AD O criteria to be opened day and night, as detailed in the report.

A solar controlled window glazing g value of 0.55 (BS EN 410) has been considered to prevent excessive solar gains during summer months.

Passive solutions such as shading devices, reduced glazing g values and unrestricted opening windows/doors were found to be a sufficient solution, with the modelling finding that internal temperatures are kept to a comfortable level and Part O compliance is achieved. A key component of the overheating mitigation strategy is to keep rooflights as openable during the day and night.

The assessed spaces in the houses however were able to sufficiently mitigate the warm temperature build up by:

- Natural ventilation via window openings as per the architectural drawings.
- Window openings to be opened beyond 100mm restrictors
- Glazing solar performance (g value) of 0.55 (BS EN 410) for windows, rooflights and glazed doors
- Internal doors to be left open when possible.
- dMEV (system 3) providing whole house continuous extract ventilation meeting minimum Approved Document F requirements
- Window trickle ventilators meeting minimum Approved Document F requirements.
- A device/mechanism of secure openings is required to be installed to the ground floor bedroom windows to ensure they satisfy the ADO stipulations to secure affected windows and doors

With the above measures implemented, the modelling found all spaces in the dwelling to pass the overheating criteria and comply with Part O building regulations.

Though the regulations do not permit the use of blinds and curtains in the calculations, if the sun shines directly into a living space, the occupant should consider closing the curtains or blinds to limit solar gains and try and keep rooms as cool as possible.

Mitigating overheating will rely on the end user operation and understanding of overheating. Heat comes into the house in two ways: solar radiation from the sun, and hot air. We need to limit both to prevent overheating, which may require closing both the windows and curtains on the warmest days.

If it's cooler inside than outside, it is advised that occupants should keep their windows closed, to prevent bringing warm air in. If it reaches a point where the temperature inside the house is equal to that outside, then you should open the windows, keeping the curtains closed.

13 Modelling Disclaimer

The calculations produced by have been carried out with the information provided by others to determine whether the thermal model of the proposed building can achieve compliance, at design stage, with the stated criteria within this report.

It should be noted that the data generated by this work is obtained using computer simulations. These simulations are the best means of predicting the performance of the building at this stage. Full certainty can only be achieved by measuring the performance of the building and associated systems after a period of use.

The actual operative temperatures within the building once occupied may vary from the calculated values within this report. These differences will occur due to a number of variable parameters between the modelled building and the actual building. Such differences will include the hours, levels of occupancy, equipment, how the windows are used etc.

Whilst the simulations have been undertaken in good faith using reasonable skill and care, we can take no responsibility for differences between the computer simulations and the actual performance of the completed development due to the inherent complexity and variability of the physics in a building and its environment.

On the Approved Document O detailed report appendices, although the assessor is listed in the Approved Document O detailed report appendices under designer details, including organisation and address, we hold no responsibility for the design of the buildings, houses, or dwellings referenced. The term "designer" in this context refers solely to our role as a consultant interpreting drawings and details provided by the architect, client, or contractor. Our responsibility is limited to constructing and simulating the Part O overheating model within the IES software based on this information.

14 Appendix B - Detailed Occupancy Schedules – CIBSE TM59 Heat gain Profile

Number of People	Description /Occupancy	Period																						
		00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
		Hour ending																							
		1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00
1	Single Bedroom	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
2	Double Bedroom	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.7
2	Studio	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
1	1-bedroom /living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1	1 - bedroom /living	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
1	1 - bedroom Kitchen	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
2	2-bedroom /living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
2	2 - bedroom /living	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
2	2 - bedroom Kitchen	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
3	3 - bedroom/living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
3	3 - bedroom /living	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
3	3 - bedroom Kitchen	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0

15 Appendix C – Compliance Checklist (Approved Document O – Appendix B – Part 2B)

2b.1 Modelling details			
Dynamic software name and version	IES Virtual Environment 2024 (Version 2024.1.0.0)		
Weather file location used, including any additional, more extreme weather files	London_LHR_DSY1_2020High50.epw		
Number of sample units modelled, including an explanation of why the size/selection has been chosen	The dwelling has been assessed in its correct orientation.		
2b.2 Modelled occupancy			
Has the project passed the assessment described in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6?[1]		**Yes**	~~No~~
Details of the occupancy profiles used	As per imported ADO dataset profiles		
Details of the equipment profiles used	As per imported ADO dataset profiles		
Details of the opening profiles used	As per imported ADO dataset profiles		
2b.3 Modelled overheating mitigation strategy			
Free areas	Fully openable but handles within 650mm limit of inside wall face as per section 3.9 of ADO		
Infiltration and mechanical flow rates	Based on Table 4.24 of CIBSE Guide A for an air permeability target of 3m²/(h.m²). dMEV to kitchen + wet rooms as per Approved Document F minimum requirements.		
Window g-value	Windows, Rooflights & Glazed Doors (0.55) (BS EN 410)		
Shading strategy	N/A		
Mechanical cooling	N/A		
2b.4 Modelling results			
Has the project passed the assessment described in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6?[1]		**Yes**	~~No~~
What is the overall overheating strategy (i.e. what design features are key to the project passing)?	- Unrestricted openable windows (beyond 100mm restrictors) - Glazing g value of 0.55 (BS EN 410) to all glazing throughout the dwelling - dMEV to all kitchen + wet rooms - A device/mechanism of secure openings is required to be installed to the ground floor bedroom windows to ensure they satisfy the ADO stipulations to secure affected windows and doors		
2b.5 Designer's declaration			
Has the building construction proposal been modelled accurately?		**Yes**	~~No~~
Designer's name			
Designer's organisation	-		
Designer's signature			
Registration number (if applicable)	N/A		
Date of design	03/09/25		

Note:
[1] All references to paragraphs are to Approved Document O

Appendix A - 42 White Heart Ave - Passive Measures Only

Building details

Project name: Appendix A - 42 White Heart Ave - Passive Measures Only - Part O Compliance Document	Date: 03-09-2025 11:57:10
Location: London Heathrow, United Kingdom	
Address: 42 White Heart Ave, Uxbridge, London, UB8 3EP	
Building use: Dwelling	
Are there any security, noise, or pollution issues: Ground floor windows required to close overnight for security / accessability limitations as per AD O stipulat	

Designer's details

Designer's name: -
Designer's organisation: -
Designer's address: -

Dynamic thermal model

Software: IESVE version 2024.1.0.0	
Weather file: London_LHR_DSY1_2020High50_.epw	
Results file: 01OH - 42 White Heart Ave - Passive Measures Only.aps	
Number of rooms analysed: 5	
TM59: summer elevated air speed: 0.1	
TM59: occupant category: Category II (normal)	
Overheating mitigation strategy: - Unrestricted window openings per architectural drawings - Glazing g value of 0.55 (BS EN 410) - dMEV ventilation system to kitchen + wet rooms (Part F min rates) - A device/mechanism of secure openings is required to be installed to the ground floor bedroom windows to ensure they satisfy the ADO stipulations to secure affected windows and doors	
Has the building construction proposal been modelled accurately?	YES
Have the analysed rooms passed the assessment for Approved Doc O Dynamic Thermal Modelling Method (CIBSE TM 59)?	YES
Designer's signature:	

Appendix A - 42 White Heart Ave - Passive Measures Only

Summary

CIBSE TM59 overheating methodology for predominantly naturally ventilated rooms assesses against two criteria, (a) and (b) (for Category I occupancy, Tmax is reduced by 1K):

- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours
- Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail). Approved document O applies limits to CIBSE TM59 section 3.3 (openings); these requirements are applied by appropriate assignment of MacroFlo types / scripted profiles in the model (see Modelled Openings Section).

CIBSE TM59 overheating methodology for predominantly mechanically ventilated rooms states the operative temperature of all rooms shall not exceed 26°C for more than 3% of annual occupied hours.

CIBSE TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them. While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	Naturally ventilated Criterion a check	Naturally ventilated Criterion b check	Mechanically ventilated check	Corridor overheating risk check
00-Bedroom 3	Pass	Pass	-	-
00-Kitchen/Dining/Living	Pass	N/A	-	-
00-Bedroom 4	Pass	Pass	-	-
01-Bedroom 1	Pass	Pass	-	-
01-Bedroom 2	Pass	Pass	-	-

Naturally ventilated rooms – criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours.

Room name	Occupied hours	No. hours ΔT ≥ 1°K	% Occupied hours ΔT ≥ 1°K	Criterion a check
00-Bedroom 3	3672	37	1.0	Pass
00-Kitchen/Dining/Living	1989	13	0.7	Pass
00-Bedroom 4	3672	57	1.6	Pass
01-Bedroom 1	3672	16	0.4	Pass
01-Bedroom 2	3672	9	0.2	Pass

Naturally ventilated rooms – criterion (b)

Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail). Any rooms that are not bedrooms are therefore not assessed, hence the corresponding N/A values.

Room name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Criterion b check
00-Bedroom 3	19	9	28	Pass
00-Kitchen/Dining/Living	N/A	N/A	N/A	N/A
00-Bedroom 4	17	6	23	Pass
01-Bedroom 1	4	1	5	Pass
01-Bedroom 2	0	0	0	Pass

Appendix A - 42 White Heart Ave - Passive Measures Only

Modelled openings

Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
00-Bedroom 3	13.75	0.55	0.78, 1.62, 1.68	40.0, 100.0, 0.0	17.5	Bedrooms Doors Weekly, off continuously, ADO.Section_26ab
00-Kitchen/Dining/Living	14.48	0.55	2.79, 2.79, 2.79, 1.68	100.0, 100.0, 100.0, 100.0	19.27	ADO.Section_26a, on continuously
00-Bedroom 4	15.37	0.55	0.78, 1.62, 1.68	40.0, 100.0, 0.0	21.49	Bedrooms Doors Weekly, off continuously, ADO.Section_26ab
01-Bedroom 1	14.84	0.55, 0.55	0.74, 1.56, 1.68, 1.68, 0.98, 0.97	40.0, 0.0, 100.0, 100.0, 40.0, 0.0	23.9	off continuously, Bedrooms Doors Weekly, ADO.Section_26ab
01-Bedroom 2	18.59	0.55, 0.55	0.74, 1.56, 1.68, 1.68, 1.5, 1.5	40.0, 0.0, 100.0, 100.0, 100.0, 100.0	39.69	off continuously, Bedrooms Doors Weekly, ADO.Section_26ab

Modelled ventilation

Room name	Infiltration rate ACH	Mech vent flow rate ACH
00-Bedroom 3	0.15	0
00-Kitchen/Dining/Living	0.15	0.35
00-Bedroom 4	0.15	0
01-Bedroom 1	0.15	0
01-Bedroom 2	0.15	0

Full SAP Calculation Printout

Property Reference	42 White Heart Avenue	**Issued on Date**	16/04/2025
Assessment Reference	Heat Pump	**Prop Type Ref**	New Build
Property	42, White Heart Avenue, Uxbridge, UB8 3EP		

SAP Rating	81 B	**DER**	3.87	**TER**	9.41
Environmental	96 A	**% DER < TER**			58.87
CO_2 Emissions (t/year)	0.54	**DFEE**	45.05	**TFEE**	45.17
Compliance Check	See BREL	**% DFEE < TFEE**			0.27
% DPER < TPER	19.22	**DPER**	40.28	**TPER**	49.87

Assessor Details	Mr. Alexander Cotterill	**Assessor ID**	AV67-0001
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)	
Main dwelling						
Ground floor	100.8600 (1b)	x	2.6000 (2b)	=	262.2360	(1b) - (3b)
First floor	53.1100 (1c)	x	2.4700 (2c)	=	131.1817	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	393.4177	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1017	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3517	(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) =	0.3517	(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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132	(22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854	(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	
Main dwelling								
Windows			26.8800	1.3258	35.6364			(27)
Door			1.9000	1.0000	1.9000			(26)
Rooflight			1.8000	1.2357	2.2243			(27a)
Ground Floor			100.8600	0.1400	14.1204	110.0000	11094.6000	(28a)
New Facade	134.3200	23.7400	110.5800	0.1700	18.7986	60.0000	6634.8000	(29a)
Dormer Wall	32.8600	5.0400	27.8200	0.2000	5.5640	9.0000	250.3800	(29a)
Flat Roof	27.7200		27.7200	0.1500	4.1580	9.0000	249.4800	(30)
Semi Exposed Ceiling	47.7500		47.7500	0.1395	6.6628	9.0000	429.7500	(30)
Sloped Roof	56.2000	1.8000	54.4000	0.1500	8.1600	9.0000	489.6000	(30)
Total net area of external elements Aum(A, m2)			399.7100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.2245			(33)
Main dwelling								
Internal Wall 1			229.5200			9.0000	2065.6800	(32c)
Internal Ceiling 1			53.1100			9.0000	477.9900	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		21692.2800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							140.8864	(35)
Thermal bridges (User defined value 0.030 * total exposed area)							11.9913	(36)
Point Thermal bridges						(36a) =	0.0000	

Total fabric heat loss (33) + (36) + (36a) = 109.2158 (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	77.9647	77.4579	76.9612	74.6280	74.1915	72.1593	72.1593	71.7830	72.9421	74.1915	75.0746	75.9978	(38)
Heat transfer coeff	187.1805	186.6737	186.1770	183.8438	183.4073	181.3751	181.3751	180.9988	182.1579	183.4073	184.2904	185.2136	(39)
Average = Sum(39)m / 12 =												183.8417	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2157	1.2124	1.2092	1.1940	1.1912	1.1780	1.1780	1.1755	1.1831	1.1912	1.1969	1.2029	(40)
HLP (average)												1.1940	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9402 (42)

Hot water usage for mixer showers	73.5177	72.4129	70.8029	67.7226	65.4493	62.9143	61.4733	63.0711	64.8225	67.5444	70.6910	73.2360 (42a)
Hot water usage for baths	31.7382	31.2669	30.6031	29.3792	28.4628	27.4466	26.8978	27.5569	28.2746	29.3619	30.6110	31.6309 (42b)
Hot water usage for other uses	44.7408	43.1139	41.4869	39.8600	38.2331	36.6061	36.6061	38.2331	39.8600	41.4869	43.1139	44.7408 (42c)
Average daily hot water use (litres/day)												137.8806 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.9967	146.7936	142.8929	136.9618	132.1452	126.9670	124.9772	128.8610	132.9571	138.3933	144.4158	149.6078	(44)
Energy conte	237.5581	209.0321	219.6211	187.4938	177.8928	156.1208	151.1491	159.5569	163.9494	187.7983	205.7468	234.2496	(45)
Energy content (annual)										Total = Sum(45)m =		2290.1689	
Distribution loss (46)m = 0.15 x (45)m	35.6337	31.3548	32.9432	28.1241	26.6839	23.4181	22.6724	23.9335	24.5924	28.1698	30.8620	35.1374	(46)

Water storage loss:

Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5400 (55)
Total storage loss	16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400 (56)
If cylinder contains dedicated solar storage	16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	277.5605	245.1633	259.6235	226.2058	217.8952	194.8328	191.1515	199.5593	202.6614	227.8007	244.4588	274.2520 (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	277.5605	245.1633	259.6235	226.2058	217.8952	194.8328	191.1515	199.5593	202.6614	227.8007	244.4588	274.2520 (64)
										Total per year (kWh/year) = Sum(64)m =		2761.1649 (64)
12Total per year (kWh/year)												2761 (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	110.9900	98.4081	105.0259	93.3113	91.1513	82.8798	82.2590	85.0546	85.4828	94.4449	99.3804	109.8899 (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	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	166.1583	183.9610	166.1583	171.6970	166.1583	171.6970	166.1583	166.1583	171.6970	166.1583	171.6970	166.1583	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.8084	328.1788	319.6853	301.6036	278.7786	257.3264	242.9950	239.6245	248.1180	266.1998	289.0247	310.4769	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	(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)	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	(71)
Water heating gains (Table 5)	149.1801	146.4407	141.1639	129.5990	122.5152	115.1108	110.5632	114.3207	118.7261	126.9420	138.0283	147.7015	(72)
Total internal gains	707.2501	725.6839	694.1109	670.0029	634.5555	611.2374	586.8198	587.2068	605.6444	626.4035	665.8533	691.4401	(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	11.4300	11.2829	0.7600	0.7000	0.7700	47.5459	(75)
Southeast	4.3400	36.7938	0.7600	0.7000	0.7700	58.8721	(77)
Southwest	7.7100	36.7938	0.7600	0.7000	0.7700	104.5862	(79)
Northwest	3.4000	11.2829	0.7600	0.7000	0.7700	14.1431	(81)
Southeast	0.9000	39.2172	0.7600	0.7000	1.0000	16.8995	(82)
Northwest	0.9000	16.8560	0.7600	0.7000	1.0000	7.2636	(82)

Solar gains	249.3104	450.4429	683.6912	958.2818	1173.5270	1208.7594	1147.2046	980.1653	777.8844	516.1066	303.3367	210.2891	(83)
Total gains	956.5605	1176.1267	1377.8021	1628.2847	1808.0825	1819.9968	1734.0244	1567.3722	1383.5288	1142.5101	969.1900	901.7292	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.1916	32.2790	32.3651	32.7758	32.8538	33.2219	33.2219	33.2910	33.0792	32.8538	32.6964	32.5334	
alpha	3.1461	3.1519	3.1577	3.1851	3.1903	3.2148	3.2148	3.2194	3.2053	3.1903	3.1798	3.1689	
util living area	0.9831	0.9677	0.9377	0.8639	0.7387	0.5738	0.4389	0.4963	0.7244	0.9115	0.9712	0.9859	(86)
Living	19.1912	19.4392	19.7986	20.2594	20.6120	20.8121	20.8751	20.8612	20.7029	20.2210	19.6282	19.1568	
Non living	17.7886	18.1043	18.5574	19.1296	19.5365	19.7499	19.8012	19.7949	19.6505	19.0990	18.3561	17.7519	
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	20.0747	19.4392	19.7986	20.2594	20.6120	20.8121	20.8751	20.8612	20.7029	20.2210	19.6282	19.4146	(87)
Th 2	19.9075	19.9101	19.9127	19.9248	19.9271	19.9376	19.9376	19.9396	19.9336	19.9271	19.9225	19.9177	(88)
util rest of house	0.9797	0.9613	0.9251	0.8368	0.6886	0.4968	0.3413	0.3949	0.6540	0.8877	0.9645	0.9830	(89)
MIT 2	19.0628	18.1043	18.5574	19.1296	19.5365	19.7499	19.8012	19.7949	19.6505	19.0990	18.3561	18.1422	(90)
Living area fraction										fLA = Living area / (4) =		0.4473	(91)
MIT	19.5154	18.7014	19.1126	19.6349	20.0176	20.2250	20.2815	20.2719	20.1212	19.6008	18.9251	18.7113	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5154	18.7014	19.1126	19.6349	20.0176	20.2250	20.2815	20.2719	20.1212	19.6008	18.9251	18.7113	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9783	0.9523	0.9139	0.8285	0.6932	0.5186	0.3739	0.4280	0.6676	0.8789	0.9563	0.9789	(94)
Useful gains	935.8123	1119.9799	1259.1247	1349.0080	1253.3389	943.8373	648.2900	670.7688	923.6121	1004.1893	926.8354	882.7119	(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	2848.0249	2576.3592	2348.1680	1973.5517	1525.5002	1020.2422	667.7396	700.8015	1096.8166	1650.8192	2179.2448	2687.6975	(97)
Space heating kWh	1422.6862	978.6869	810.2482	449.6714	202.4880	0.0000	0.0000	0.0000	0.0000	481.0927	901.7348	1342.9093	(98a)
Space heating requirement - total per year (kWh/year)												6589.5174	
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	1422.6862	978.6869	810.2482	449.6714	202.4880	0.0000	0.0000	0.0000	0.0000	481.0927	901.7348	1342.9093	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6589.5174	
Space heating per m2											(98c) / (4) =	42.7974	(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 %)	304.1402	(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	1422.6862	978.6869	810.2482	449.6714	202.4880	0.0000	0.0000	0.0000	0.0000	481.0927	901.7348	1342.9093	(98)
Space heating efficiency (main heating system 1)	304.1402	304.1402	304.1402	304.1402	304.1402	0.0000	0.0000	0.0000	0.0000	304.1402	304.1402	304.1402	(210)
Space heating fuel (main heating system)	467.7732	321.7881	266.4062	147.8501	66.5772	0.0000	0.0000	0.0000	0.0000	158.1812	296.4866	441.5429	(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	277.5605	245.1633	259.6235	226.2058	217.8952	194.8328	191.1515	199.5593	202.6614	227.8007	244.4588	274.2520	(64)
Efficiency of water heater												176.1368	(216)
(217)m	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	(217)
Fuel for water heating, kWh/month	157.5823	139.1891	147.3988	128.4262	123.7079	110.6144	108.5244	113.2979	115.0591	129.3317	138.7891	155.7039	(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	32.6303	26.1772	23.5697	17.2682	13.3384	10.8976	12.1678	15.8161	20.5436	26.9543	30.4448	33.5372	(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	2166.6055	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.1368	
Water heating fuel used	1567.6248	(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)	263.3450	(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	3997.5753	(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	2166.6055	0.1554	336.6776	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1567.6248	0.1411	221.1751	(264)
Space and water heating			557.8527	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	263.3450	0.1443	38.0088	(268)
Total CO2, kg/year			595.8616	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8700	(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	2166.6055	1.5753	3412.9824	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1567.6248	1.5217	2385.4648	(278)
Space and water heating			5798.4472	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	263.3450	1.5338	403.9274	(282)
Total Primary energy kWh/year			6202.3746	(286)
Dwelling Primary energy Rate (DPER)			40.2800	(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)	
Main dwelling						
Ground floor	100.8600	(1b) x	2.6000	(2b) =	262.2360	(1b) - (3b)
First floor	53.1100	(1c) x	2.4700	(2c) =	131.1817	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		393.4177	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1017 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3517 (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) =	0.3517 (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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132	(22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854	(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	
Main dwelling								
TER Opaque door			1.9000	1.0000	1.9000			(26)
TER Opening Type			26.8800	1.1450	30.7786			(27)
TER Roof Light			1.8000	1.5918	3.4871			(27a)
Ground Floor			100.8600	0.1300	13.1118			(28a)

New Facade	134.3200	23.7400	110.5800	0.1800	19.9044	(29a)
Dormer Wall	32.8600	5.0400	27.8200	0.1800	5.0076	(29a)
Flat Roof	27.7200		27.7200	0.1100	3.0492	(30)
Semi Exposed Ceiling	47.7500		47.7500	0.1100	5.2525	(30)
Sloped Roof	56.2000	1.8000	54.4000	0.1100	5.9840	(30)

Total net area of external elements Aum(A, m2) 399.7100 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 88.4752 (33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 140.8864 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	18.9000	0.0500	0.9450
E3 Sill	18.9000	0.0500	0.9450
E4 Jamb	33.5000	0.0500	1.6750
E5 Ground floor (normal)	44.2500	0.1600	7.0800
E6 Intermediate floor within a dwelling	36.4600	0.0000	0.0000
E13 Gable (insulation at rafter level)	18.0000	0.0800	1.4400
E10 Eaves (insulation at ceiling level)	20.7600	0.0600	1.2456
E14 Flat roof	14.8200	0.0800	1.1856
E14 Flat roof	21.6000	0.0800	1.7280
E16 Corner (normal)	22.5000	0.0900	2.0250
E17 Corner (inverted - internal area greater than external area)	15.4000	-0.0900	-1.3860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.8832 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 105.3584 (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	77.9647	77.4579	76.9612	74.6280	74.1915	72.1593	72.1593	71.7830	72.9421	74.1915	75.0746	75.9978	(38)
Heat transfer coeff	183.3231	182.8163	182.3196	179.9864	179.5499	177.5177	177.5177	177.1414	178.3005	179.5499	180.4330	181.3562	(39)

Average = Sum(39)m / 12 = 179.9843

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1906	1.1874	1.1841	1.1690	1.1661	1.1529	1.1529	1.1505	1.1580	1.1661	1.1719	1.1779	(40)
HLP (average)												1.1690	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9402 (42)
Hot water usage for mixer showers

73.5177	72.4129	70.8029	67.7226	65.4493	62.9143	61.4733	63.0711	64.8225	67.5444	70.6910	73.2360	(42a)

Hot water usage for baths

31.7382	31.2669	30.6031	29.3792	28.4628	27.4466	26.8978	27.5569	28.2746	29.3619	30.6110	31.6309	(42b)

Hot water usage for other uses

44.7408	43.1139	41.4869	39.8600	38.2331	36.6061	36.6061	38.2331	39.8600	41.4869	43.1139	44.7408	(42c)

Average daily hot water use (litres/day) 137.8806 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.9967	146.7936	142.8929	136.9618	132.1452	126.9670	124.9772	128.8610	132.9571	138.3933	144.4158	149.6078	(44)
Energy conte	237.5581	209.0321	219.6211	187.4938	177.8928	156.1208	151.1491	159.5569	163.9494	187.7983	205.7468	234.2496	(45)

Energy content (annual) Total = Sum(45)m = 2290.1689

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

35.6337	31.3548	32.9432	28.1241	26.6839	23.4181	22.6724	23.9335	24.5924	28.1698	30.8620	35.1374	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.7016 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.9188 (55)
Total storage loss

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)

If cylinder contains dedicated solar storage

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(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

289.3047	255.7710	271.3677	237.5712	229.6394	206.1981	202.8957	211.3035	214.0267	239.5449	255.8241	285.9962	(62)
-33.6092	-29.7243	-31.1255	-25.7732	-24.0197	-20.5538	-19.2659	-20.4874	-21.2658	-25.0700	-28.4013	-32.9868	(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

255.6955	226.0467	240.2422	211.7980	205.6198	185.6443	183.6298	190.8161	192.7610	214.4750	227.4229	253.0094	(64)

Total per year (kWh/year) = Sum(64)m = 2587.1605 (64)
12Total per year (kWh/year) 2587 (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

120.3854	106.8943	114.4213	102.4036	100.5466	91.9720	91.6543	94.4499	94.5750	103.8402	108.4727	119.2853	(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	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	166.1583	183.9610	166.1583	171.6970	166.1583	171.6970	166.1583	166.1583	171.6970	166.1583	171.6970	166.1583	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.8084	328.1788	319.6853	301.6036	278.7786	257.3264	242.9950	239.6245	248.1180	266.1998	289.0247	310.4769	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	(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)	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	(71)
Water heating gains (Table 5)	161.8083	159.0689	153.7921	142.2272	135.1433	127.7389	123.1913	126.9488	131.3542	139.5702	150.6565	160.3297	(72)
Total internal gains	722.8783	741.3120	709.7390	685.6310	650.1836	623.8656	599.4480	599.8350	618.2725	642.0316	681.4815	707.0683	(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	11.4300	11.2829	0.6300	0.7000	0.7700	39.4131	(75)
Southeast	4.3400	36.7938	0.6300	0.7000	0.7700	48.8019	(77)
Southwest	7.7100	36.7938	0.6300	0.7000	0.7700	86.6964	(79)
Northwest	3.4000	11.2829	0.6300	0.7000	0.7700	11.7239	(81)
Southeast	0.9000	39.2172	0.6300	0.7000	1.0000	14.0088	(82)
Northwest	0.9000	16.8560	0.6300	0.7000	1.0000	6.0211	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	206.6652	373.3934	566.7440	794.3652	972.7921	1001.9979	950.9722	812.5055	644.8252	427.8252	251.4501	174.3186	(83)
Total gains	929.5435	1114.7055	1276.4831	1479.9962	1622.9757	1625.8635	1550.4202	1412.3405	1263.0977	1069.8568	932.9316	881.3869	(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	32.8689	32.9600	33.0498	33.4783	33.5597	33.9438	33.9438	34.0159	33.7948	33.5597	33.3954	33.2254	
alpha	3.1913	3.1973	3.2033	3.2319	3.2373	3.2629	3.2629	3.2677	3.2530	3.2373	3.2264	3.2150	
util living area	0.9844	0.9717	0.9473	0.8858	0.7748	0.6153	0.4756	0.5322	0.7547	0.9223	0.9738	0.9868	(86)
MIT	18.7438	19.0429	19.4896	20.0833	20.5636	20.8559	20.9535	20.9328	20.7062	20.0681	19.3100	18.7036	(87)
Th 2	19.9275	19.9301	19.9327	19.9449	19.9472	19.9578	19.9578	19.9598	19.9537	19.9472	19.9426	19.9377	(88)
util rest of house	0.9812	0.9660	0.9365	0.8619	0.7279	0.5380	0.3738	0.4282	0.6875	0.9009	0.9676	0.9841	(89)
MIT 2	17.2936	17.6744	18.2389	18.9784	19.5405	19.8537	19.9354	19.9245	19.7151	18.9770	18.0248	17.2486	(90)
Living area fraction										fLA = Living area / (4) =		0.4473	(91)
MIT	17.9423	18.2865	18.7983	19.4727	19.9981	20.3020	20.3908	20.3755	20.1584	19.4651	18.5996	17.8994	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9423	18.2865	18.7983	19.4727	19.9981	20.3020	20.3908	20.3755	20.1584	19.4651	18.5996	17.8994	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9729	0.9543	0.9218	0.8494	0.7304	0.5649	0.4174	0.4715	0.7020	0.8887	0.9568	0.9767	(94)
Useful gains	904.3290	1063.7122	1176.6733	1257.0590	1185.3450	918.3709	647.1935	665.9369	886.6624	950.8204	892.6091	860.8067	(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	2500.9487	2447.2774	2242.2228	1902.9346	1489.9272	1012.1998	672.9317	704.2345	1080.2144	1591.7203	2074.9136	2484.4724	(97)
Space heating kWh	1187.8851	929.7558	792.7689	465.0304	226.6092	0.0000	0.0000	0.0000	0.0000	476.8295	851.2592	1208.0073	(98a)
Space heating requirement - total per year (kWh/year)												6138.1454	
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	1187.8851	929.7558	792.7689	465.0304	226.6092	0.0000	0.0000	0.0000	0.0000	476.8295	851.2592	1208.0073	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6138.1454	
Space heating per m2											(98c) / (4) =	39.8659	(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	1187.8851	929.7558	792.7689	465.0304	226.6092	0.0000	0.0000	0.0000	0.0000	476.8295	851.2592	1208.0073	(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)	1286.9827	1007.3194	858.9045	503.8250	245.5137	0.0000	0.0000	0.0000	0.0000	516.6084	922.2744	1308.7836	(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	255.6955	226.0467	240.2422	211.7980	205.6198	185.6443	183.6298	190.8161	192.7610	214.4750	227.4229	253.0094	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.0608	86.8836	86.5304	85.7729	84.2783	79.8000	79.8000	79.8000	79.8000	85.7979	86.7375	87.0989	(217)
Fuel for water heating, kWh/month	293.6976	260.1720	277.6391	246.9289	243.9772	232.6370	230.1125	239.1179	241.5551	249.9769	262.1966	290.4852	(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	34.5244	27.6968	24.9379	18.2706	14.1127	11.5302	12.8741	16.7342	21.7361	28.5189	32.2121	35.4840	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-80.9479	-107.9104	-146.7183	-155.6726	-160.3136	-146.8522	-144.8189	-140.1530	-131.1911	-118.5650	-86.6544	-70.7165	(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	-66.7310	-137.2848	-267.4523	-394.2191	-514.3737	-514.5203	-508.6417	-433.9200	-322.3345	-193.9675	-88.2728	-53.0267	(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	(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	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	6650.2117	(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	3068.4960	(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)	278.6319	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-4985.2582	(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	5098.0814	(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	6650.2117	0.2100	1396.5445	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.4960	0.2100	644.3842	(264)
Space and water heating			2040.9286	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	278.6319	0.1443	40.2152	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1490.5138	0.1358	-202.4667	
PV Unit electricity exported	-3494.7443	0.1265	-441.9147	
Total			-644.3814	(269)
Total CO2, kg/year			1448.6917	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4100	(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	6650.2117	1.1300	7514.7392	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.4960	1.1300	3467.4005	(278)
Space and water heating			10982.1397	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	278.6319	1.5338	427.3748	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1490.5138	1.5021	-2238.8988	
PV Unit electricity exported	-3494.7443	0.4642	-1622.2149	
Total			-3861.1137	(283)
Total Primary energy kWh/year			7678.5017	(286)
Target Primary Energy Rate (TPER)			49.8700	(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)	
Main dwelling						
Ground floor	100.8600	(1b) x	2.6000	(2b) =	262.2360	(1b) - (3b)
First floor	53.1100	(1c) x	2.4700	(2c) =	131.1817	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		393.4177	(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	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1017	(8)

Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3517	(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) =	0.3517	(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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132	(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	0.5854	(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	
Main dwelling								
Windows			26.8800	1.3258	35.6364			(27)
Door			1.9000	1.0000	1.9000			(26)
Rooflight			1.8000	1.2357	2.2243			(27a)
Ground Floor			100.8600	0.1400	14.1204	110.0000	11094.6000	(28a)
New Facade	134.3200	23.7400	110.5800	0.1700	18.7986	60.0000	6634.8000	(29a)
Dormer Wall	32.8600	5.0400	27.8200	0.2000	5.5640	9.0000	250.3800	(29a)
Flat Roof	27.7200		27.7200	0.1500	4.1580	9.0000	249.4800	(30)
Semi Exposed Ceiling	47.7500		47.7500	0.1395	6.6628	9.0000	429.7500	(30)
Sloped Roof	56.2000	1.8000	54.4000	0.1500	8.1600	9.0000	489.6000	(30)
Total net area of external elements Aum(A, m2)			399.7100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.2245			(33)
Main dwelling								
Internal Wall 1			229.5200			9.0000	2065.6800	(32c)
Internal Ceiling 1			53.1100			9.0000	477.9900	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	21692.2800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	140.8864	(35)
Thermal bridges (User defined value 0.030 * total exposed area)	11.9913	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	109.2158	(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	77.9647	77.4579	76.9612	74.6280	74.1915	72.1593	72.1593	71.7830	72.9421	74.1915	75.0746	75.9978	(38)
Heat transfer coeff	187.1805	186.6737	186.1770	183.8438	183.4073	181.3751	181.3751	180.9988	182.1579	183.4073	184.2904	185.2136	(39)
Average = Sum(39)m / 12 =												183.8417	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2157	1.2124	1.2092	1.1940	1.1912	1.1780	1.1780	1.1755	1.1831	1.1912	1.1969	1.2029	(40)
HLP (average)												1.1940	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9402	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7382	31.2669	30.6031	29.3792	28.4628	27.4466	26.8978	27.5569	28.2746	29.3619	30.6110	31.6309	(42b)

Hot water usage for other uses

44.7408	43.1139	41.4869	39.8600	38.2331	36.6061	36.6061	38.2331	39.8600	41.4869	43.1139	44.7408	(42c)

Average daily hot water use (litres/day)	70.0998	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.4790	74.3807	72.0900	69.2392	66.6959	64.0528	63.5039	65.7899	68.1345	70.8488	73.7248	76.3717	(44)
Energy conte	121.1241	105.9172	110.7997	94.7850	89.7855	78.7603	76.8024	81.4617	84.0167	96.1412	105.0345	119.5797	(45)
Energy content (annual)										Total = Sum(45)m =		1164.2081	

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

	102.9555	90.0296	94.1797	80.5673	76.3176	66.9463	65.2821	69.2424	71.4142	81.7200	89.2794	101.6427	(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	102.9555	90.0296	94.1797	80.5673	76.3176	66.9463	65.2821	69.2424	71.4142	81.7200	89.2794	101.6427	(64)
									Total per year (kWh/year) = Sum(64)m =			989.5769	(64)
12Total per year (kWh/year)												990	(64)

Electric shower(s)

	58.8754	52.4585	57.2827	54.6641	55.6899	53.1227	54.8935	55.6899	54.6641	57.2827	56.2055	58.8754	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						669.7044	(64a)

Heat gains from water heating, kWh/month

	40.4577	35.6220	37.8656	33.8079	33.0019	30.0173	30.0439	31.2331	31.5196	34.7507	36.3712	40.1295	(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	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	166.1583	183.9610	166.1583	171.6970	166.1583	171.6970	166.1583	166.1583	171.6970	166.1583	171.6970	166.1583	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.8084	328.1788	319.6853	301.6036	278.7786	257.3264	242.9950	239.6245	248.1180	266.1998	289.0247	310.4769	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	(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)													
	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	(71)
Water heating gains (Table 5)													
	54.3787	53.0090	50.8946	46.9554	44.3574	41.6906	40.3816	41.9799	43.7772	46.7079	50.5156	53.9376	(72)
Total internal gains													
	612.4487	632.2521	603.8416	587.3592	556.3977	537.8173	516.6382	514.8661	530.6955	546.1693	578.3406	597.6762	(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	11.4300	11.2829	0.7600	0.7000	0.7700	47.5459	(75)
Southeast	4.3400	36.7938	0.7600	0.7000	0.7700	58.8721	(77)
Southwest	7.7100	36.7938	0.7600	0.7000	0.7700	104.5862	(79)
Northwest	3.4000	11.2829	0.7600	0.7000	0.7700	14.1431	(81)
Southeast	0.9000	39.2172	0.7600	0.7000	1.0000	16.8995	(82)
Northwest	0.9000	16.8560	0.7600	0.7000	1.0000	7.2636	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	249.3104	450.4429	683.6912	958.2818	1173.5270	1208.7594	1147.2046	980.1653	777.8844	516.1066	303.3367	210.2891	(83)
Total gains	861.7591	1082.6950	1287.5328	1545.6410	1729.9246	1746.5767	1663.8428	1495.0315	1308.5799	1062.2759	881.6772	807.9653	(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	32.1916	32.2790	32.3651	32.7758	32.8538	33.2219	33.2219	33.2910	33.0792	32.8538	32.6964	32.5334	
alpha	3.1461	3.1519	3.1577	3.1851	3.1903	3.2148	3.2148	3.2194	3.2053	3.1903	3.1798	3.1689	
util living area													
	0.9874	0.9740	0.9471	0.8776	0.7560	0.5916	0.4550	0.5160	0.7466	0.9251	0.9777	0.9896	(86)
MIT	18.6250	18.9616	19.4521	20.0885	20.5818	20.8655	20.9568	20.9354	20.7052	20.0281	19.2166	18.5780	(87)
Th 2	19.9075	19.9101	19.9127	19.9248	19.9271	19.9376	19.9376	19.9396	19.9336	19.9271	19.9225	19.9177	(88)
util rest of house													
	0.9848	0.9688	0.9361	0.8524	0.7070	0.5139	0.3547	0.4121	0.6778	0.9041	0.9723	0.9875	(89)
MIT 2	17.7437	18.0783	18.5617	19.1799	19.6266	19.8632	19.9217	19.9136	19.7485	19.1386	18.3424	17.7039	(90)
Living area fraction										fLA = Living area / (4) =		0.4473	(91)
MIT	18.1379	18.4734	18.9599	19.5863	20.0539	20.3115	20.3847	20.3707	20.1765	19.5365	18.7334	18.0949	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1379	18.4734	18.9599	19.5863	20.0539	20.3115	20.3847	20.3707	20.1765	19.5365	18.7334	18.0949	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9789	0.9595	0.9241	0.8432	0.7133	0.5425	0.3981	0.4560	0.6950	0.8947	0.9642	0.9824	(94)
Useful gains	843.5371	1038.8980	1189.8070	1303.2726	1233.9257	947.5380	662.4573	681.6993	909.4662	950.3924	850.1349	793.7470	(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													
	2590.1843	2533.8002	2319.7545	1964.6079	1532.1601	1035.9293	686.4448	718.6843	1106.8738	1639.0130	2143.9264	2573.5203	(97)
Space heating kWh													
	1299.5055	1004.5743	840.6809	476.1614	221.8864	0.0000	0.0000	0.0000	0.0000	512.3337	931.5298	1324.1514	(98a)
Space heating requirement - total per year (kWh/year)												6610.8233	
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													
	1299.5055	1004.5743	840.6809	476.1614	221.8864	0.0000	0.0000	0.0000	0.0000	512.3337	931.5298	1324.1514	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6610.8233	
Space heating per m2											(98c) / (4) =	42.9358	(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	1704.9262	1342.1759	1375.5909	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8098	0.8680	0.8291	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1380.6386	1165.0323	1140.5155	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1941.9543	1849.8904	1659.9364	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	404.1473	509.5344	386.4492	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	101.0368	127.3836	96.6123	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												325.0327	(107)
Energy for space heating												42.9358	(99)
Energy for space cooling												2.1110	(108)
Total												45.0468	(109)
Fabric Energy Efficiency (DFEE)												45.0	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	100.8600 (1b)	x	2.6000 (2b)	=	262.2360	(1b) - (3b)
First floor	53.1100 (1c)	x	2.4700 (2c)	=	131.1817	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	393.4177	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1017	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3517	(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) =	0.3517	(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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132	(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	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854	(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	
Main dwelling								
TER Opaque door			1.9000	1.0000	1.9000			(26)
TER Opening Type			26.8800	1.1450	30.7786			(27)
TER Roof Light			1.8000	1.5918	3.4871			(27a)
Ground Floor			100.8600	0.1300	13.1118			(28a)
New Facade	134.3200	23.7400	110.5800	0.1800	19.9044			(29a)
Dormer Wall	32.8600	5.0400	27.8200	0.1800	5.0076			(29a)
Flat Roof	27.7200		27.7200	0.1100	3.0492			(30)
Semi Exposed Ceiling	47.7500		47.7500	0.1100	5.2525			(30)
Sloped Roof	56.2000	1.8000	54.4000	0.1100	5.9840			(30)
Total net area of external elements Aum(A, m2)			399.7100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		88.4752			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	140.8864	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	18.9000	0.0500	0.9450	
E3 Sill	18.9000	0.0500	0.9450	
E4 Jamb	33.5000	0.0500	1.6750	
E5 Ground floor (normal)	44.2500	0.1600	7.0800	
E6 Intermediate floor within a dwelling	36.4600	0.0000	0.0000	
E13 Gable (insulation at rafter level)	18.0000	0.0800	1.4400	
E10 Eaves (insulation at ceiling level)	20.7600	0.0600	1.2456	
E14 Flat roof	14.8200	0.0800	1.1856	
E14 Flat roof	21.6000	0.0800	1.7280	
E16 Corner (normal)	22.5000	0.0900	2.0250	
E17 Corner (inverted - internal area greater than external area)	15.4000	-0.0900	-1.3860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.8832	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	105.3584	(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	77.9647	77.4579	76.9612	74.6280	74.1915	72.1593	72.1593	71.7830	72.9421	74.1915	75.0746	75.9978	(38)
Heat transfer coeff	183.3231	182.8163	182.3196	179.9864	179.5499	177.5177	177.5177	177.1414	178.3005	179.5499	180.4330	181.3562	(39)
Average = Sum(39)m / 12 =												179.9843	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1906	1.1874	1.1841	1.1690	1.1661	1.1529	1.1529	1.1505	1.1580	1.1661	1.1719	1.1779	(40)
HLP (average)												1.1690	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9402	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	31.7382	31.2669	30.6031	29.3792	28.4628	27.4466	26.8978	27.5569	28.2746	29.3619	30.6110	31.6309	(42b)
Hot water usage for other uses													
	44.7408	43.1139	41.4869	39.8600	38.2331	36.6061	36.6061	38.2331	39.8600	41.4869	43.1139	44.7408	(42c)
Average daily hot water use (litres/day)												70.0998	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.4790	74.3807	72.0900	69.2392	66.6959	64.0528	63.5039	65.7899	68.1345	70.8488	73.7248	76.3717	(44)
Energy conte	121.1241	105.9172	110.7997	94.7850	89.7855	78.7603	76.8024	81.4617	84.0167	96.1412	105.0345	119.5797	(45)
Energy content (annual)										Total = Sum(45)m =		1164.2081	
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													
	102.9555	90.0296	94.1797	80.5673	76.3176	66.9463	65.2821	69.2424	71.4142	81.7200	89.2794	101.6427	(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													
	102.9555	90.0296	94.1797	80.5673	76.3176	66.9463	65.2821	69.2424	71.4142	81.7200	89.2794	101.6427	(64)
										Total per year (kWh/year) = Sum(64)m =		989.5769	(64)
12Total per year (kWh/year)												990	(64)
Electric shower(s)													
	58.8754	52.4585	57.2827	54.6641	55.6899	53.1227	54.8935	55.6899	54.6641	57.2827	56.2055	58.8754	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												669.7044	(64a)
Heat gains from water heating, kWh/month													
	40.4577	35.6220	37.8656	33.8079	33.0019	30.0173	30.0439	31.2331	31.5196	34.7507	36.3712	40.1295	(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	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	147.0111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	166.1583	183.9610	166.1583	171.6970	166.1583	171.6970	166.1583	166.1583	171.6970	166.1583	171.6970	166.1583	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.8084	328.1788	319.6853	301.6036	278.7786	257.3264	242.9950	239.6245	248.1180	266.1998	289.0247	310.4769	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	37.7011	(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)													
	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	(71)
Water heating gains (Table 5)													
	54.3787	53.0090	50.8946	46.9554	44.3574	41.6906	40.3816	41.9799	43.7772	46.7079	50.5156	53.9376	(72)
Total internal gains													
	612.4487	632.2521	603.8416	587.3592	556.3977	537.8173	516.6382	514.8661	530.6955	546.1693	578.3406	597.6762	(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	11.4300	11.2829	0.6300	0.7000	0.7700	39.4131	(75)
Southeast	4.3400	36.7938	0.6300	0.7000	0.7700	48.8019	(77)
Southwest	7.7100	36.7938	0.6300	0.7000	0.7700	86.6964	(79)
Northwest	3.4000	11.2829	0.6300	0.7000	0.7700	11.7239	(81)
Southeast	0.9000	39.2172	0.6300	0.7000	1.0000	14.0088	(82)
Northwest	0.9000	16.8560	0.6300	0.7000	1.0000	6.0211	(82)

Solar gains	206.6652	373.3934	566.7440	794.3652	972.7921	1001.9979	950.9722	812.5055	644.8252	427.8252	251.4501	174.3186	(83)
Total gains	819.1139	1005.6456	1170.5856	1381.7244	1529.1898	1539.8152	1467.6105	1327.3716	1175.5207	973.9945	829.7907	771.9948	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.8689	32.9600	33.0498	33.4783	33.5597	33.9438	33.9438	34.0159	33.7948	33.5597	33.3954	33.2254	
alpha	3.1913	3.1973	3.2033	3.2319	3.2373	3.2629	3.2629	3.2677	3.2530	3.2373	3.2264	3.2150	
util living area													
	0.9891	0.9785	0.9576	0.9017	0.7964	0.6391	0.4981	0.5589	0.7820	0.9379	0.9810	0.9909	(86)
MIT	18.6336	18.9387	19.3967	20.0145	20.5218	20.8385	20.9468	20.9224	20.6701	19.9906	19.2102	18.5931	(87)
Th 2	19.9275	19.9301	19.9327	19.9449	19.9472	19.9578	19.9578	19.9598	19.9537	19.9472	19.9426	19.9377	(88)
util rest of house													
	0.9868	0.9741	0.9486	0.8802	0.7516	0.5614	0.3931	0.4522	0.7175	0.9199	0.9763	0.9891	(89)
MIT 2	17.7658	18.0700	18.5232	19.1288	19.5964	19.8659	19.9375	19.9276	19.7414	19.1193	18.3503	17.7326	(90)
Living area fraction										fLA = Living area / (4) =		0.4473	(91)
MIT	18.1540	18.4585	18.9139	19.5250	20.0103	20.3009	20.3890	20.3726	20.1568	19.5091	18.7349	18.1175	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1540	18.4585	18.9139	19.5250	20.0103	20.3009	20.3890	20.3726	20.1568	19.5091	18.7349	18.1175	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9815	0.9660	0.9377	0.8701	0.7545	0.5885	0.4381	0.4966	0.7315	0.9106	0.9691	0.9845	(94)
Useful gains	803.9885	971.4680	1097.6400	1202.2487	1153.8371	906.1332	642.9773	659.1697	859.8550	886.9103	804.1674	760.0287	(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	2539.7511	2478.7232	2263.2952	1912.3538	1492.1152	1012.0139	672.6108	703.7062	1079.9271	1599.6216	2099.3164	2524.0241	(97)
Space heating kWh	1291.4074	1012.8755	867.2475	511.2757	251.6790	0.0000	0.0000	0.0000	0.0000	530.2572	932.5072	1312.4126	(98a)
Space heating requirement - total per year (kWh/year)												6709.6621	
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	1291.4074	1012.8755	867.2475	511.2757	251.6790	0.0000	0.0000	0.0000	0.0000	530.2572	932.5072	1312.4126	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6709.6621	
Space heating per m2											(98c) / (4) =	43.5777	(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	1668.6668	1313.6313	1346.2749	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7735	0.8394	0.7975	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1290.7459	1102.6385	1073.6982	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1704.6581	1624.6595	1467.4162	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	298.0168	388.3836	292.9262	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	74.5042	97.0959	73.2315	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												244.8316	(107)
Energy for space heating												43.5777	(99)
Energy for space cooling												1.5901	(108)
Total												45.1678	(109)
Fabric Energy Efficiency (TFEE)												45.2	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	100.8600	(1b)	x 2.6000	(2b) =	262.2360	(1b) - (3b)
First floor	53.1100	(1c)	x 2.4700	(2c) =	131.1817	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		393.4177	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1017	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3517	(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) =	0.3517	(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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132	(22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Windows			26.8800	1.3258	35.6364			(27)
Door			1.9000	1.0000	1.9000			(26)
Rooflight			1.8000	1.2357	2.2243			(27a)
Ground Floor			100.8600	0.1400	14.1204	110.0000	11094.6000	(28a)
New Facade	134.3200	23.7400	110.5800	0.1700	18.7986	60.0000	6634.8000	(29a)
Dormer Wall	32.8600	5.0400	27.8200	0.2000	5.5640	9.0000	250.3800	(29a)
Flat Roof	27.7200		27.7200	0.1500	4.1580	9.0000	249.4800	(30)
Semi Exposed Ceiling	47.7500		47.7500	0.1395	6.6628	9.0000	429.7500	(30)
Sloped Roof	56.2000	1.8000	54.4000	0.1500	8.1600	9.0000	489.6000	(30)
Total net area of external elements Aum(A, m2)			399.7100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.2245			(33)
Main dwelling								
Internal Wall 1			229.5200			9.0000	2065.6800	(32c)
Internal Ceiling 1			53.1100			9.0000	477.9900	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	21692.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		140.8864 (35)
Thermal bridges (User defined value 0.030 * total exposed area)		11.9913 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	109.2158 (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	77.9647	77.4579	76.9612	74.6280	74.1915	72.1593	72.1593	71.7830	72.9421	74.1915	75.0746	75.9978	(38)
Heat transfer coeff	187.1805	186.6737	186.1770	183.8438	183.4073	181.3751	181.3751	180.9988	182.1579	183.4073	184.2904	185.2136	(39)
Average = Sum(39)m / 12 =												183.8417	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2157	1.2124	1.2092	1.1940	1.1912	1.1780	1.1780	1.1755	1.1831	1.1912	1.1969	1.2029	(40)
HLP (average)												1.1940	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9402	(42)
Hot water usage for mixer showers	73.5177	72.4129	70.8029	67.7226	65.4493	62.9143	61.4733	63.0711	64.8225	67.5444	70.6910	73.2360	(42a)
Hot water usage for baths	31.7382	31.2669	30.6031	29.3792	28.4628	27.4466	26.8978	27.5569	28.2746	29.3619	30.6110	31.6309	(42b)
Hot water usage for other uses	44.7408	43.1139	41.4869	39.8600	38.2331	36.6061	36.6061	38.2331	39.8600	41.4869	43.1139	44.7408	(42c)
Average daily hot water use (litres/day)												137.8806	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.9967	146.7936	142.8929	136.9618	132.1452	126.9670	124.9772	128.8610	132.9571	138.3933	144.4158	149.6078	(44)
Energy conte	237.5581	209.0321	219.6211	187.4938	177.8928	156.1208	151.1491	159.5569	163.9494	187.7983	205.7468	234.2496	(45)
Energy content (annual)										Total = Sum(45)m =		2290.1689	
Distribution loss (46)m = 0.15 x (45)m	35.6337	31.3548	32.9432	28.1241	26.6839	23.4181	22.6724	23.9335	24.5924	28.1698	30.8620	35.1374	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.5400	(55)
Total storage loss	16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400	(56)
If cylinder contains dedicated solar storage	16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	277.5605	245.1633	259.6235	226.2058	217.8952	194.8328	191.1515	199.5593	202.6614	227.8007	244.4588	274.2520	(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	277.5605	245.1633	259.6235	226.2058	217.8952	194.8328	191.1515	199.5593	202.6614	227.8007	244.4588	274.2520	(64)
										Total per year (kWh/year) = Sum(64)m =		2761.1649	(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	110.9900	98.4081	105.0259	93.3113	91.1513	82.8798	82.2590	85.0546	85.4828	94.4449	99.3804	109.8899	(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	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.2792	33.1111	26.9277	20.3860	15.2388	12.8652	13.9013	18.0695	24.2528	30.7945	35.9418	38.3153	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	484.7886	489.8192	477.1423	450.1546	416.0875	384.0693	362.6791	357.6485	370.3254	397.3131	431.3802	463.3984	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	(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)	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	(71)
Water heating gains (Table 5)	149.1801	146.4407	141.1639	129.5990	122.5152	115.1108	110.5632	114.3207	118.7261	126.9420	138.0283	147.7015	(72)
Total internal gains	785.6339	783.7569	759.6199	714.5256	668.2274	626.4312	601.5296	604.4246	627.6903	669.4356	719.7362	763.8012	(73)

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6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W	
Northeast	11.4300	11.2829	0.7600	0.7000	0.7700	47.5459	(75)
Southeast	4.3400	36.7938	0.7600	0.7000	0.7700	58.8721	(77)
Southwest	7.7100	36.7938	0.7600	0.7000	0.7700	104.5862	(79)
Northwest	3.4000	11.2829	0.7600	0.7000	0.7700	14.1431	(81)
Southeast	0.9000	39.2172	0.7600	0.7000	1.0000	16.8995	(82)
Northwest	0.9000	16.8560	0.7600	0.7000	1.0000	7.2636	(82)

Solar gains	249.3104	450.4429	683.6912	958.2818	1173.5270	1208.7594	1147.2046	980.1653	777.8844	516.1066	303.3367	210.2891	(83)
Total gains	1034.9443	1234.1998	1443.3111	1672.8074	1841.7544	1835.1906	1748.7342	1584.5900	1405.5747	1185.5422	1023.0729	974.0904	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.1916	32.2790	32.3651	32.7758	32.8538	33.2219	33.2219	33.2910	33.0792	32.8538	32.6964	32.5334	
alpha	3.1461	3.1519	3.1577	3.1851	3.1903	3.2148	3.2148	3.2194	3.2053	3.1903	3.1798	3.1689	
util living area	0.9791	0.9634	0.9304	0.8564	0.7314	0.5702	0.4357	0.4918	0.7180	0.9039	0.9668	0.9825	(86)
Living	19.2483	19.4791	19.8386	20.2797	20.6209	20.8138	20.8757	20.8623	20.7084	20.2448	19.6658	19.2102	
Non living	17.8608	18.1543	18.6062	19.1530	19.5455	19.7512	19.8015	19.7956	19.6554	19.1267	18.4031	17.8198	
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	20.1039	19.4791	19.8386	20.2797	20.6209	20.8138	20.8757	20.8623	20.7084	20.2448	19.6658	19.4606	(87)
Th 2	19.9075	19.9101	19.9127	19.9248	19.9271	19.9376	19.9376	19.9396	19.9336	19.9271	19.9225	19.9177	(88)
util rest of house	0.9750	0.9563	0.9167	0.8284	0.6808	0.4933	0.3386	0.3910	0.6472	0.8786	0.9592	0.9791	(89)
MIT 2	19.0915	18.1543	18.6062	19.1530	19.5455	19.7512	19.8015	19.7956	19.6554	19.1267	18.4031	18.1978	(90)
Living area fraction										fLA = Living area / (4) =		0.4473	(91)
MIT	19.5444	18.7468	19.1574	19.6570	20.0265	20.2265	20.2820	20.2727	20.1264	19.6268	18.9679	18.7626	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5444	18.7468	19.1574	19.6570	20.0265	20.2265	20.2820	20.2727	20.1264	19.6268	18.9679	18.7626	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9734	0.9467	0.9052	0.8204	0.6859	0.5152	0.3710	0.4239	0.6612	0.8701	0.9504	0.9743	(94)
Useful gains	1007.3970	1168.3995	1306.5503	1372.4474	1263.2584	945.5125	648.7966	671.7284	929.3353	1031.5600	972.3374	949.0513	(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	2853.4478	2584.8425	2356.5205	1977.6031	1527.1441	1020.5067	667.8212	700.9551	1097.7573	1655.5845	2187.1366	2697.1989	(97)
Space heating kWh	1373.4618	951.8497	781.1779	435.7121	196.3310	0.0000	0.0000	0.0000	0.0000	464.2743	874.6554	1300.6218	(98a)
Space heating requirement - total per year (kWh/year)												6378.0840	
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	1373.4618	951.8497	781.1779	435.7121	196.3310	0.0000	0.0000	0.0000	0.0000	464.2743	874.6554	1300.6218	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6378.0840	
Space heating per m2											(98c) / (4) =	41.4242	(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 %)	304.1402	(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	1373.4618	951.8497	781.1779	435.7121	196.3310	0.0000	0.0000	0.0000	0.0000	464.2743	874.6554	1300.6218	(98)
Space heating efficiency (main heating system 1)	304.1402	304.1402	304.1402	304.1402	304.1402	0.0000	0.0000	0.0000	0.0000	304.1402	304.1402	304.1402	(210)
Space heating fuel (main heating system)	451.5884	312.9642	256.8480	143.2603	64.5528	0.0000	0.0000	0.0000	0.0000	152.6514	287.5830	427.6390	(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	277.5605	245.1633	259.6235	226.2058	217.8952	194.8328	191.1515	199.5593	202.6614	227.8007	244.4588	274.2520	(64)
Efficiency of water heater												176.1368	(216)
(217)m	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	(217)
Fuel for water heating, kWh/month	157.5823	139.1891	147.3988	128.4262	123.7079	110.6144	108.5244	113.2979	115.0591	129.3317	138.7891	155.7039	(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	32.6303	26.1772	23.5697	17.2682	13.3384	10.8976	12.1678	15.8161	20.5436	26.9543	30.4448	33.5372	(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	2097.0870	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.1368	
Water heating fuel used	1567.6248	(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)	263.3450	(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	3928.0569	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2097.0870	16.4900	345.8097	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1567.6248	16.4900	258.5013	(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	263.3450	16.4900	43.4256	(250)
Additional standing charges			0.0000	(251)
Total energy cost			647.7366	(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] =	1.1720	(257)
SAP value	81.0025	
SAP rating (Section 12)	81	(258)
SAP band	B	

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	2097.0870	0.1554	325.8789	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1567.6248	0.1411	221.1751	(264)
Space and water heating			547.0540	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	263.3450	0.1443	38.0088	(268)
Total CO2, kg/year			585.0628	(272)
CO2 emissions per m2			3.8000	(273)
EI value			96.0598	
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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	100.8600	(1b) x	2.6000	(2b) =	262.2360	(1b) - (3b)
First floor	53.1100	(1c) x	2.4700	(2c) =	131.1817	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 153.9700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		393.4177	(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	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1017 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3517 (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) =	0.3517 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.3000	4.3000	3.9000	4.1000	3.8000	3.7000	3.5000	3.7000	3.9000	3.8000	4.2000	(22)
Wind factor	1.1250	1.0750	1.0750	0.9750	1.0250	0.9500	0.9250	0.8750	0.9250	0.9750	0.9500	1.0500	(22a)
Adj infilt rate	0.3956	0.3780	0.3780	0.3429	0.3605	0.3341	0.3253	0.3077	0.3253	0.3429	0.3341	0.3693	(22b)
Effective ac	0.5783	0.5715	0.5715	0.5588	0.5650	0.5558	0.5529	0.5473	0.5529	0.5588	0.5558	0.5682	(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	
Main dwelling								
Windows			26.8800	1.3258	35.6364			(27)
Door			1.9000	1.0000	1.9000			(26)
Rooflight			1.8000	1.2357	2.2243			(27a)
Ground Floor			100.8600	0.1400	14.1204	110.0000	11094.6000	(28a)
New Facade	134.3200	23.7400	110.5800	0.1700	18.7986	60.0000	6634.8000	(29a)
Dormer Wall	32.8600	5.0400	27.8200	0.2000	5.5640	9.0000	250.3800	(29a)
Flat Roof	27.7200		27.7200	0.1500	4.1580	9.0000	249.4800	(30)
Semi Exposed Ceiling	47.7500		47.7500	0.1395	6.6628	9.0000	429.7500	(30)
Sloped Roof	56.2000	1.8000	54.4000	0.1500	8.1600	9.0000	489.6000	(30)
Total net area of external elements Aum(A, m2)			399.7100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.2245			(33)
Main dwelling								
Internal Wall 1			229.5200			9.0000	2065.6800	(32c)
Internal Ceiling 1			53.1100			9.0000	477.9900	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	21692.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		140.8864 (35)
Thermal bridges (User defined value 0.030 * total exposed area)		11.9913 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	109.2158 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.0746	74.1915	74.1915	72.5457	73.3485	72.1593	71.7830	71.0605	71.7830	72.5457	72.1593	73.7650	(38)
Heat transfer coeff	184.2904	183.4073	183.4073	181.7615	182.5643	181.3751	180.9988	180.2763	180.9988	181.7615	181.3751	182.9808	(39)
Average = Sum(39)m / 12 =												182.0998	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1969	1.1912	1.1912	1.1805	1.1857	1.1780	1.1755	1.1709	1.1755	1.1805	1.1780	1.1884	(40)
HLP (average)												1.1827	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9402 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.5177	72.4129	70.8029	67.7226	65.4493	62.9143	61.4733	63.0711	64.8225	67.5444	70.6910	73.2360	(42a)

Hot water usage for baths

31.7382	31.2669	30.6031	29.3792	28.4628	27.4466	26.8978	27.5569	28.2746	29.3619	30.6110	31.6309	(42b)

Hot water usage for other uses

44.7408	43.1139	41.4869	39.8600	38.2331	36.6061	36.6061	38.2331	39.8600	41.4869	43.1139	44.7408	(42c)

Average daily hot water use (litres/day)	137.8806 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.9967	146.7936	142.8929	136.9618	132.1452	126.9670	124.9772	128.8610	132.9571	138.3933	144.4158	149.6078	(44)
Energy conte	237.5581	209.0321	219.6211	187.4938	177.8928	156.1208	151.1491	159.5569	163.9494	187.7983	205.7468	234.2496	(45)
Energy content (annual)										Total = Sum(45)m =		2290.1689	
Distribution loss (46)m = 0.15 x (45)m	35.6337	31.3548	32.9432	28.1241	26.6839	23.4181	22.6724	23.9335	24.5924	28.1698	30.8620	35.1374	(46)

Water storage loss:	
Store volume	210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.0000 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.5400 (55)
Total storage loss	

16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400	(56)

If cylinder contains dedicated solar storage

16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

277.5605	245.1633	259.6235	226.2058	217.8952	194.8328	191.1515	199.5593	202.6614	227.8007	244.4588	274.2520	(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													
277.5605	245.1633	259.6235	226.2058	217.8952	194.8328	191.1515	199.5593	202.6614	227.8007	244.4588	274.2520	(64)
									Total per year (kWh/year) = Sum(64)m =		2761.1649	(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													
110.9900	98.4081	105.0259	93.3113	91.1513	82.8798	82.2590	85.0546	85.4828	94.4449	99.3804	109.8899	(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	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	37.2792	33.1111	26.9277	20.3860	15.2388	12.8652	13.9013	18.0695	24.2528	30.7945	35.9418	38.3153	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	484.7886	489.8192	477.1423	450.1546	416.0875	384.0693	362.6791	357.6485	370.3254	397.3131	431.3802	463.3984	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	(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)													
	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	(71)
Water heating gains (Table 5)													
	149.1801	146.4407	141.1639	129.5990	122.5152	115.1108	110.5632	114.3207	118.7261	126.9420	138.0283	147.7015	(72)
Total internal gains													
	785.6339	783.7569	759.6199	714.5256	668.2274	626.4312	601.5296	604.4246	627.6903	669.4356	719.7362	763.8012	(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	11.4300	13.3498	0.7600	0.7000	0.7700	56.2555	(75)
Southeast	4.3400	41.7137	0.7600	0.7000	0.7700	66.7441	(77)
Southwest	7.7100	41.7137	0.7600	0.7000	0.7700	118.5708	(79)
Northwest	3.4000	13.3498	0.7600	0.7000	0.7700	16.7339	(81)
Southeast	0.9000	45.4199	0.7600	0.7000	1.0000	19.5723	(82)
Northwest	0.9000	20.0301	0.7600	0.7000	1.0000	8.6314	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	286.5081	452.2917	695.8674	1003.0591	1197.0019	1318.9335	1238.7309	1069.9043	849.6876	562.0260	337.0445	231.4246	(83)
Total gains	1072.1420	1236.0486	1455.4873	1717.5847	1865.2294	1945.3647	1840.2605	1674.3290	1477.3779	1231.4616	1056.7808	995.2258	(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	32.6964	32.8538	32.8538	33.1513	33.0055	33.2219	33.2910	33.4244	33.2910	33.1513	33.2219	32.9304	
alpha	3.1798	3.1903	3.1903	3.2101	3.2004	3.2148	3.2194	3.2283	3.2194	3.2101	3.2148	3.1954	
util living area													
	0.9741	0.9584	0.9166	0.8168	0.6567	0.4361	0.2816	0.3273	0.6133	0.8666	0.9576	0.9788	(86)
Living	19.4047	19.6111	19.9891	20.4327	20.7323	20.8724	20.8992	20.8961	20.8051	20.4116	19.8252	19.3628	
Non living	18.0703	18.3335	18.8042	19.3419	19.6666	19.7980	19.8159	19.8189	19.7512	19.3322	18.6150	18.0223	
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	20.1839	19.6111	19.9891	20.4327	20.7323	20.8724	20.8992	20.8961	20.8051	20.4116	19.8252	19.5918	(87)
Th 2	19.9225	19.9271	19.9271	19.9356	19.9314	19.9376	19.9396	19.9434	19.9396	19.9356	19.9376	19.9293	(88)
util rest of house													
	0.9689	0.9501	0.8998	0.7812	0.5937	0.3492	0.1803	0.2187	0.5246	0.8309	0.9475	0.9744	(89)
MIT 2	19.1841	18.3335	18.8042	19.3419	19.6666	19.7980	19.8159	19.8189	19.7512	19.3322	18.6150	18.3659	(90)
Living area fraction										fLA = Living area / (4) =		0.4473	(91)
MIT	19.6313	18.9050	19.3342	19.8298	20.1433	20.2786	20.3005	20.3008	20.2226	19.8150	19.1563	18.9142	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6313	18.9050	19.3342	19.8298	20.1433	20.2786	20.3005	20.3008	20.2226	19.8150	19.1563	18.9142	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9672	0.9402	0.8887	0.7773	0.6070	0.3779	0.2152	0.2561	0.5498	0.8262	0.9381	0.9691	(94)
Useful gains	1037.0004	1162.1245	1293.5095	1335.0584	1132.1777	735.1208	396.0176	428.7155	812.2387	1017.4002	991.3290	964.4923	(95)
Ext temp.	5.0000	5.6000	7.4000	10.0000	13.1000	16.1000	18.1000	17.9000	15.3000	11.7000	7.9000	5.0000	(96)
Heat loss rate W													
	2696.4055	2440.2277	2188.8141	1786.6870	1285.8523	757.8906	398.2825	432.7989	890.9886	1474.9932	2041.6172	2546.0385	(97)
Space heating kWh													
	1234.5974	858.8853	666.1066	325.1726	114.3339	0.0000	0.0000	0.0000	0.0000	340.4492	756.2075	1176.6704	(98a)
Space heating requirement - total per year (kWh/year)												5472.4230	
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													
	1234.5974	858.8853	666.1066	325.1726	114.3339	0.0000	0.0000	0.0000	0.0000	340.4492	756.2075	1176.6704	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5472.4230	
Space heating per m2											(98c) / (4) =	35.5421	(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 %)	303.5303	(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													
	1234.5974	858.8853	666.1066	325.1726	114.3339	0.0000	0.0000	0.0000	0.0000	340.4492	756.2075	1176.6704	(98)
Space heating efficiency (main heating system 1)													
	303.5303	303.5303	303.5303	303.5303	303.5303	0.0000	0.0000	0.0000	0.0000	303.5303	303.5303	303.5303	(210)
Space heating fuel (main heating system)													
	406.7460	282.9653	219.4531	107.1302	37.6680	0.0000	0.0000	0.0000	0.0000	112.1632	249.1374	387.6616	(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

277.5605	245.1633	259.6235	226.2058	217.8952	194.8328	191.1515	199.5593	202.6614	227.8007	244.4588	274.2520	(64)
Efficiency of water heater											176.1286	(216)
(217)m 176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	(217)
Fuel for water heating, kWh/month												
157.5897	139.1956	147.4057	128.4322	123.7137	110.6196	108.5295	113.3032	115.0644	129.3377	138.7956	155.7112	(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 32.6303	26.1772	23.5697	17.2682	13.3384	10.8976	12.1678	15.8161	20.5436	26.9543	30.4448	33.5372	(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	1802.9247	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.1286	
Water heating fuel used	1567.6982	(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)	263.3450	(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	3633.9680	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1802.9247	26.0600	469.8422	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1567.6982	26.0600	408.5422	(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	263.3450	26.0600	68.6277	(250)
Additional standing charges			0.0000	(251)
Total energy cost			947.0121	(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	1802.9247	0.1561	281.5049	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1567.6982	0.1411	221.1855	(264)
Space and water heating			502.6904	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	263.3450	0.1443	38.0088	(268)
Total CO2, kg/year			540.6992	(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	1802.9247	1.5780	2845.0534	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1567.6982	1.5217	2385.5766	(278)
Space and water heating			5230.6299	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	263.3450	1.5338	403.9274	(282)
Total Primary energy kWh/year			5634.5573	(286)

SAP 10 EPC IMPROVEMENTS

Heat Pump

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 90	-43 kg (7.9%)
U Solar photovoltaic panels	+ 5.8	-£ 304	-237 kg (47.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£90	0.28 kg/m²	B 82	A 96
Solar photovoltaic panels	£304	1.54 kg/m²	B 88	A 98
Total Savings	£394	1.82 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£947	£857	£90
Space heating	£470	£491	-£21
Water heating	£409	£297	£111
Lighting	£69	£69	£0
Generated (PV)	-£0	-£304	£304
Total cost of fuels	£947	£553	£394
Total cost of uses	£948	£553	£394
Delivered energy	24 kWh/m²	9 kWh/m²	14 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	2 kg/m²
Primary energy	37 kWh/m²	21 kWh/m²	15 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)	
Main dwelling						
Ground floor	100.8600 (1b)	x	2.6000 (2b)	=	262.2360	(1b) - (3b)
First floor	53.1100 (1c)	x	2.4700 (2c)	=	131.1817	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	393.4177	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1017	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3517	(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) =	0.3517	(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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132	(22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Windows			26.8800	1.3258	35.6364			(27)
Door			1.9000	1.0000	1.9000			(26)
Rooflight			1.8000	1.2357	2.2243			(27a)
Ground Floor			100.8600	0.1400	14.1204	110.0000	11094.6000	(28a)
New Facade	134.3200	23.7400	110.5800	0.1700	18.7986	60.0000	6634.8000	(29a)
Dormer Wall	32.8600	5.0400	27.8200	0.2000	5.5640	9.0000	250.3800	(29a)
Flat Roof	27.7200		27.7200	0.1500	4.1580	9.0000	249.4800	(30)
Semi Exposed Ceiling	47.7500		47.7500	0.1395	6.6628	9.0000	429.7500	(30)
Sloped Roof	56.2000	1.8000	54.4000	0.1500	8.1600	9.0000	489.6000	(30)
Total net area of external elements Aum(A, m2)			399.7100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.2245			(33)
Main dwelling								
Internal Wall 1			229.5200			9.0000	2065.6800	(32c)
Internal Ceiling 1			53.1100			9.0000	477.9900	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	21692.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		140.8864 (35)
Thermal bridges (User defined value 0.030 * total exposed area)		11.9913 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	109.2158 (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	77.9647	77.4579	76.9612	74.6280	74.1915	72.1593	72.1593	71.7830	72.9421	74.1915	75.0746	75.9978	(38)
Heat transfer coeff	187.1805	186.6737	186.1770	183.8438	183.4073	181.3751	181.3751	180.9988	182.1579	183.4073	184.2904	185.2136	(39)
Average = Sum(39)m / 12 =												183.8417	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2157	1.2124	1.2092	1.1940	1.1912	1.1780	1.1780	1.1755	1.1831	1.1912	1.1969	1.2029	(40)
HLP (average)												1.1940	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9402	(42)
Hot water usage for mixer showers													
	73.5177	72.4129	70.8029	67.7226	65.4493	62.9143	61.4733	63.0711	64.8225	67.5444	70.6910	73.2360	(42a)
Hot water usage for baths													
	31.7382	31.2669	30.6031	29.3792	28.4628	27.4466	26.8978	27.5569	28.2746	29.3619	30.6110	31.6309	(42b)
Hot water usage for other uses													
	44.7408	43.1139	41.4869	39.8600	38.2331	36.6061	36.6061	38.2331	39.8600	41.4869	43.1139	44.7408	(42c)
Average daily hot water use (litres/day)												137.8806	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	149.9967	146.7936	142.8929	136.9618	132.1452	126.9670	124.9772	128.8610	132.9571	138.3933	144.4158	149.6078	(44)
Energy conte	237.5581	209.0321	219.6211	187.4938	177.8928	156.1208	151.1491	159.5569	163.9494	187.7983	205.7468	234.2496	(45)
Energy content (annual)										Total = Sum(45)m =		2290.1689	
Distribution loss (46)m = 0.15 x (45)m													
	35.6337	31.3548	32.9432	28.1241	26.6839	23.4181	22.6724	23.9335	24.5924	28.1698	30.8620	35.1374	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.5400	(55)
Total storage loss													
	16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400	(56)
If cylinder contains dedicated solar storage													
	16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	277.5605	245.1633	258.2278	219.4522	205.1009	182.2260	178.1246	187.4628	197.2585	226.4050	244.4588	274.2520	(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)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												622.5787	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												622.5787	
Solar input	-0.0000	-16.2037	-58.4911	-80.4100	-104.9411	-96.5375	-95.6871	-83.7779	-57.8435	-28.6866	-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													
	277.5605	228.9597	199.7366	139.0422	100.1598	85.6886	82.4374	103.6849	139.4150	197.7184	244.4588	274.2520	(64)
									Total per year (kWh/year) = Sum(64)m =			2073.1138	(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													
	110.9900	98.4081	103.9094	87.9084	80.9158	72.7944	71.8374	75.3774	81.1605	93.3283	99.3804	109.8899	(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	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	37.2792	33.1111	26.9277	20.3860	15.2388	12.8652	13.9013	18.0695	24.2528	30.7945	35.9418	38.3153	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	484.7886	489.8192	477.1423	450.1546	416.0875	384.0693	362.6791	357.6485	370.3254	397.3131	431.3802	463.3984	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	(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)	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	(71)
Water heating gains (Table 5)	149.1801	146.4407	139.6631	122.0950	108.7578	101.1033	96.5557	101.3137	112.7229	125.4412	138.0283	147.7015	(72)
Total internal gains	785.6339	783.7569	758.1191	707.0216	654.4701	612.4238	587.5221	591.4177	621.6871	667.9348	719.7362	763.8012	(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	11.4300	11.2829	0.7600	0.7000	0.7700	47.5459	(75)
Southeast	4.3400	36.7938	0.7600	0.7000	0.7700	58.8721	(77)
Southwest	7.7100	36.7938	0.7600	0.7000	0.7700	104.5862	(79)
Northwest	3.4000	11.2829	0.7600	0.7000	0.7700	14.1431	(81)
Southeast	0.9000	39.2172	0.7600	0.7000	1.0000	16.8995	(82)
Northwest	0.9000	16.8560	0.7600	0.7000	1.0000	7.2636	(82)

Solar gains	249.3104	450.4429	683.6912	958.2818	1173.5270	1208.7594	1147.2046	980.1653	777.8844	516.1066	303.3367	210.2891	(83)
Total gains	1034.9443	1234.1998	1441.8103	1665.3034	1827.9971	1821.1832	1734.7267	1571.5831	1399.5715	1184.0414	1023.0729	974.0904	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.1916	32.2790	32.3651	32.7758	32.8538	33.2219	33.2219	33.2910	33.0792	32.8538	32.6964	32.5334	
alpha	3.1461	3.1519	3.1577	3.1851	3.1903	3.2148	3.2148	3.2194	3.2053	3.1903	3.1798	3.1689	
util living area	0.9791	0.9634	0.9306	0.8577	0.7344	0.5735	0.4388	0.4952	0.7197	0.9042	0.9668	0.9825	(86)
Living	19.2483	19.4791	19.8377	20.2764	20.6173	20.8123	20.8751	20.8614	20.7069	20.2440	19.6658	19.2102	
Non living	17.8608	18.1543	18.6051	19.1491	19.5419	19.7500	19.8012	19.7951	19.6541	19.1257	18.4031	17.8198	
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	20.1039	19.4791	19.8377	20.2764	20.6173	20.8123	20.8751	20.8614	20.7069	20.2440	19.6658	19.4606	(87)
Th 2	19.9075	19.9101	19.9127	19.9248	19.9271	19.9376	19.9376	19.9396	19.9336	19.9271	19.9225	19.9177	(88)
util rest of house	0.9750	0.9563	0.9169	0.8298	0.6840	0.4965	0.3412	0.3939	0.6490	0.8789	0.9592	0.9791	(89)
MIT 2	19.0915	18.1543	18.6051	19.1491	19.5419	19.7500	19.8012	19.7951	19.6541	19.1257	18.4031	18.1978	(90)
Living area fraction										fLA = Living area / (4) =		0.4473	(91)
MIT	19.5444	18.7468	19.1564	19.6533	20.0229	20.2252	20.2816	20.2721	20.1250	19.6259	18.9679	18.7626	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5444	18.7468	19.1564	19.6533	20.0229	20.2252	20.2816	20.2721	20.1250	19.6259	18.9679	18.7626	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9734	0.9467	0.9054	0.8218	0.6889	0.5183	0.3737	0.4270	0.6629	0.8704	0.9504	0.9743	(94)
Useful gains	1007.3970	1168.3995	1305.4801	1368.5482	1259.2472	943.9695	648.3145	671.0065	927.7949	1030.6203	972.3374	949.0513	(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	2853.4478	2584.8425	2356.3320	1976.9297	1526.4799	1020.2631	667.7435	700.8396	1097.5043	1655.4210	2187.1366	2697.1989	(97)
Space heating kWh	1373.4618	951.8497	781.8338	438.0347	198.8211	0.0000	0.0000	0.0000	0.0000	464.8517	874.6554	1300.6218	(98a)
Space heating requirement - total per year (kWh/year)												6384.1300	
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	1373.4618	951.8497	781.8338	438.0347	198.8211	0.0000	0.0000	0.0000	0.0000	464.8517	874.6554	1300.6218	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6384.1300	
Space heating per m2											(98c) / (4) =	41.4635	(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 %)												304.1402	(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	1373.4618	951.8497	781.8338	438.0347	198.8211	0.0000	0.0000	0.0000	0.0000	464.8517	874.6554	1300.6218	(98)
Space heating efficiency (main heating system 1)	304.1402	304.1402	304.1402	304.1402	304.1402	0.0000	0.0000	0.0000	0.0000	304.1402	304.1402	304.1402	(210)
Space heating fuel (main heating system)	451.5884	312.9642	257.0637	144.0239	65.3715	0.0000	0.0000	0.0000	0.0000	152.8413	287.5830	427.6390	(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	277.5605	228.9597	199.7366	139.0422	100.1598	85.6886	82.4374	103.6849	139.4150	197.7184	244.4588	274.2520	(64)
Efficiency of water heater												176.1368	(216)
(217)m	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	176.1368	(217)
Fuel for water heating, kWh/month	157.5823	129.9896	113.3986	78.9399	56.8648	48.6489	46.8031	58.8661	79.1515	112.2527	138.7891	155.7039	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	32.6303	26.1772	23.5697	17.2682	13.3384	10.8976	12.1678	15.8161	20.5436	26.9543	30.4448	33.5372	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.2227	-60.7195	-92.3918	-107.0945	-114.5619	-102.1338	-100.5843	-94.0316	-82.2337	-70.1589	-45.1978	-34.1645	(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	-9.8638	-22.8605	-49.9544	-83.6775	-121.1209	-129.5799	-128.0673	-105.7424	-74.2294	-36.6870	-14.2120	-7.7493	(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	2099.0750	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.1368	
Water heating fuel used	1176.9904	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	80.0000	(231)
Electricity for lighting (calculated in Appendix L)	263.3450	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(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	1892.1710	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2099.0750	16.4900	346.1375	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1176.9904	16.4900	194.0857	(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)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	263.3450	16.4900	43.4256	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-943.4951	16.4900	-155.5823	
PV Unit electricity exported	-783.7443	5.5900	-43.8113	
Total			-199.3936	(252)
Total energy cost			397.4471	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7191 (257)
SAP value		88.3433
SAP rating (Section 12)		88 (258)
SAP band		B

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	2099.0750	0.1554	326.1550	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1176.9904	0.1457	171.5145	(264)
Space and water heating			497.6695	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	263.3450	0.1443	38.0088	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-943.4951	0.1344	-126.7643	
PV Unit electricity exported	-783.7443	0.1224	-95.9543	
Total			-222.7186	(269)
Total CO2, kg/year			324.0568	(272)
CO2 emissions per m2			2.1000	(273)
EI value			97.8176	
EI rating			98	(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)	
Main dwelling						
Ground floor	100.8600 (1b)	x	2.6000 (2b)	=	262.2360	(1b) - (3b)
First floor	53.1100 (1c)	x	2.4700 (2c)	=	131.1817	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	153.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	393.4177	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1017	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3517	(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) =	0.3517	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.3000	4.3000	3.9000	4.1000	3.8000	3.7000	3.5000	3.7000	3.9000	3.8000	4.2000	(22)
Wind factor	1.1250	1.0750	1.0750	0.9750	1.0250	0.9500	0.9250	0.8750	0.9250	0.9750	0.9500	1.0500	(22a)
Adj infilt rate	0.3956	0.3780	0.3780	0.3429	0.3605	0.3341	0.3253	0.3077	0.3253	0.3429	0.3341	0.3693	(22b)
Effective ac	0.5783	0.5715	0.5715	0.5588	0.5650	0.5558	0.5529	0.5473	0.5529	0.5588	0.5558	0.5682	(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	
Main dwelling								
Windows			26.8800	1.3258	35.6364			(27)
Door			1.9000	1.0000	1.9000			(26)
Rooflight			1.8000	1.2357	2.2243			(27a)
Ground Floor			100.8600	0.1400	14.1204	110.0000	11094.6000	(28a)
New Facade	134.3200	23.7400	110.5800	0.1700	18.7986	60.0000	6634.8000	(29a)
Dormer Wall	32.8600	5.0400	27.8200	0.2000	5.5640	9.0000	250.3800	(29a)
Flat Roof	27.7200		27.7200	0.1500	4.1580	9.0000	249.4800	(30)
Semi Exposed Ceiling	47.7500		47.7500	0.1395	6.6628	9.0000	429.7500	(30)
Sloped Roof	56.2000	1.8000	54.4000	0.1500	8.1600	9.0000	489.6000	(30)
Total net area of external elements Aum(A, m2)			399.7100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.2245			(33)
Main dwelling								
Internal Wall 1			229.5200			9.0000	2065.6800	(32c)
Internal Ceiling 1			53.1100			9.0000	477.9900	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		21692.2800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							140.8864	(35)
Thermal bridges (User defined value 0.030 * total exposed area)							11.9913	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		109.2158	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.0746	74.1915	74.1915	72.5457	73.3485	72.1593	71.7830	71.0605	71.7830	72.5457	72.1593	73.7650	(38)
Heat transfer coeff	184.2904	183.4073	183.4073	181.7615	182.5643	181.3751	180.9988	180.2763	180.9988	181.7615	181.3751	182.9808	(39)
Average = Sum(39)m / 12 =												182.0998	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1969	1.1912	1.1912	1.1805	1.1857	1.1780	1.1755	1.1709	1.1755	1.1805	1.1780	1.1884	(40)
HLP (average)												1.1827	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9402	(42)
Hot water usage for mixer showers		
73.5177 72.4129 70.8029 67.7226 65.4493 62.9143 61.4733 63.0711 64.8225 67.5444 70.6910 73.2360		(42a)
Hot water usage for baths		
31.7382 31.2669 30.6031 29.3792 28.4628 27.4466 26.8978 27.5569 28.2746 29.3619 30.6110 31.6309		(42b)
Hot water usage for other uses		
44.7408 43.1139 41.4869 39.8600 38.2331 36.6061 36.6061 38.2331 39.8600 41.4869 43.1139 44.7408		(42c)
Average daily hot water use (litres/day)	137.8806	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.9967	146.7936	142.8929	136.9618	132.1452	126.9670	124.9772	128.8610	132.9571	138.3933	144.4158	149.6078	(44)
Energy conte	237.5581	209.0321	219.6211	187.4938	177.8928	156.1208	151.1491	159.5569	163.9494	187.7983	205.7468	234.2496	(45)
Energy content (annual)										Total = Sum(45)m =		2290.1689	
Distribution loss (46)m = 0.15 x (45)m													

	35.6337	31.3548	32.9432	28.1241	26.6839	23.4181	22.6724	23.9335	24.5924	28.1698	30.8620	35.1374	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.5400	(55)
Total storage loss													
	16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400	(56)
If cylinder contains dedicated solar storage													
	16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	277.5605	245.1633	258.2278	219.4522	205.1009	182.2260	178.1246	187.4628	197.2585	226.4050	244.4588	274.2520	(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)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												686.9509	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												686.9509	
Solar input	-0.0000	-17.5014	-61.3342	-86.2394	-108.2557	-107.2114	-105.1377	-94.3708	-67.3410	-36.7111	-2.8482	-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													
	277.5605	227.6620	196.8935	133.2128	96.8452	75.0147	72.9868	93.0921	129.9175	189.6939	241.6106	274.2520	(64)
											Total per year (kWh/year) = Sum(64)m =	2008.7416	(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													
	110.9900	98.4081	103.9094	87.9084	80.9158	72.7944	71.8374	75.3774	81.1605	93.3283	99.3804	109.8899	(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	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	176.4133	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	37.2792	33.1111	26.9277	20.3860	15.2388	12.8652	13.9013	18.0695	24.2528	30.7945	35.9418	38.3153	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	484.7886	489.8192	477.1423	450.1546	416.0875	384.0693	362.6791	357.6485	370.3254	397.3131	431.3802	463.3984	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	55.5815	(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)													
	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	-117.6088	(71)
Water heating gains (Table 5)													
	149.1801	146.4407	139.6631	122.0950	108.7578	101.1033	96.5557	101.3137	112.7229	125.4412	138.0283	147.7015	(72)
Total internal gains													
	785.6339	783.7569	758.1191	707.0216	654.4701	612.4238	587.5221	591.4177	621.6871	667.9348	719.7362	763.8012	(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	11.4300	13.3498	0.7600	0.7000	0.7700	56.2555	(75)
Southeast	4.3400	41.7137	0.7600	0.7000	0.7700	66.7441	(77)
Southwest	7.7100	41.7137	0.7600	0.7000	0.7700	118.5708	(79)
Northwest	3.4000	13.3498	0.7600	0.7000	0.7700	16.7339	(81)
Southeast	0.9000	45.4199	0.7600	0.7000	1.0000	19.5723	(82)
Northwest	0.9000	20.0301	0.7600	0.7000	1.0000	8.6314	(82)

Solar gains	286.5081	452.2917	695.8674	1003.0591	1197.0019	1318.9335	1238.7309	1069.9043	849.6876	562.0260	337.0445	231.4246	(83)
Total gains	1072.1420	1236.0486	1453.9865	1710.0807	1851.4720	1931.3573	1826.2530	1661.3220	1471.3747	1229.9608	1056.7808	995.2258	(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	32.6964	32.8538	32.8538	33.1513	33.0055	33.2219	33.2910	33.4244	33.2910	33.1513	33.2219	32.9304	
alpha	3.1798	3.1903	3.1903	3.2101	3.2004	3.2148	3.2194	3.2283	3.2194	3.2101	3.2148	3.1954	
util living area													
	0.9741	0.9584	0.9168	0.8183	0.6598	0.4389	0.2837	0.3297	0.6151	0.8670	0.9576	0.9788	(86)
Living	19.4047	19.6111	19.9882	20.4298	20.7298	20.8718	20.8991	20.8959	20.8042	20.4109	19.8252	19.3628	
Non living	18.0703	18.3335	18.8031	19.3388	19.6644	19.7977	19.8159	19.8189	19.7506	19.3314	18.6150	18.0223	
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	20.1839	19.6111	19.9882	20.4298	20.7298	20.8718	20.8991	20.8959	20.8042	20.4109	19.8252	19.5918	(87)
Th 2	19.9225	19.9271	19.9271	19.9356	19.9314	19.9376	19.9396	19.9434	19.9396	19.9356	19.9376	19.9293	(88)
util rest of house													
	0.9689	0.9501	0.9000	0.7828	0.5969	0.3516	0.1817	0.2204	0.5263	0.8313	0.9475	0.9744	(89)
MIT 2	19.1841	18.3335	18.8031	19.3388	19.6644	19.7977	19.8159	19.8189	19.7506	19.3314	18.6150	18.3659	(90)
Living area fraction											fLA = Living area / (4) =	0.4473	(91)
MIT	19.6313	18.9050	19.3332	19.8268	20.1409	20.2781	20.3004	20.3006	20.2219	19.8142	19.1563	18.9142	(92)
Temperature adjustment												0.0000	

adjusted MIT	19.6313	18.9050	19.3332	19.8268	20.1409	20.2781	20.3004	20.3006	20.2219	19.8142	19.1563	18.9142	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9672	0.9402	0.8889	0.7788	0.6101	0.3804	0.2168	0.2580	0.5515	0.8265	0.9381	0.9691	(94)
Useful gains	1037.0004	1162.1245	1292.5036	1331.7939	1129.5119	734.6075	395.9543	428.6028	811.4160	1016.6068	991.3290	964.4923	(95)
Ext temp.	5.0000	5.6000	7.4000	10.0000	13.1000	16.1000	18.1000	17.9000	15.3000	11.7000	7.9000	5.0000	(96)
Heat loss rate W	2696.4055	2440.2277	2188.6388	1786.1344	1285.4223	757.8092	398.2705	432.7787	890.8571	1474.8571	2041.6172	2546.0385	(97)
Space heating kWh	1234.5974	858.8853	666.7246	327.1252	115.9973	0.0000	0.0000	0.0000	0.0000	340.9382	756.2075	1176.6704	(98a)
Space heating requirement - total per year (kWh/year)												5477.1460	
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	1234.5974	858.8853	666.7246	327.1252	115.9973	0.0000	0.0000	0.0000	0.0000	340.9382	756.2075	1176.6704	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5477.1460	
Space heating per m2											(98c) / (4) =	35.5728	(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 %)												303.5303	(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													
	1234.5974	858.8853	666.7246	327.1252	115.9973	0.0000	0.0000	0.0000	0.0000	340.9382	756.2075	1176.6704	(98)
Space heating efficiency (main heating system 1)													
	303.5303	303.5303	303.5303	303.5303	303.5303	0.0000	0.0000	0.0000	0.0000	303.5303	303.5303	303.5303	(210)
Space heating fuel (main heating system)													
	406.7460	282.9653	219.6567	107.7735	38.2161	0.0000	0.0000	0.0000	0.0000	112.3243	249.1374	387.6616	(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													
	277.5605	227.6620	196.8935	133.2128	96.8452	75.0147	72.9868	93.0921	129.9175	189.6939	241.6106	274.2520	(64)
Efficiency of water heater												176.1286	(216)
(217)m	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	176.1286	(217)
Fuel for water heating, kWh/month													
	157.5897	129.2589	111.7896	75.6338	54.9855	42.5908	41.4395	52.8546	73.7629	107.7020	137.1785	155.7112	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	32.6303	26.1772	23.5697	17.2682	13.3384	10.8976	12.1678	15.8161	20.5436	26.9543	30.4448	33.5372	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-45.4929	-60.7544	-92.5699	-107.9094	-112.7973	-106.1722	-104.0192	-98.1776	-86.6623	-73.8333	-49.3290	-37.2728	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.4379	-23.5169	-52.2856	-90.8829	-126.0863	-145.0101	-141.2750	-118.6925	-83.8875	-42.8254	-17.0705	-9.1739	(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												1804.4807	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												176.1286	
Water heating fuel used												1140.4971	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												263.3450	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1838.1348	(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												1450.1881	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1804.4807	26.0600	470.2477	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1140.4971	26.0600	297.2136	(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)

Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	263.3450	26.0600	68.6277	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-974.9902	26.0600	-254.0825	
PV Unit electricity exported	-863.1446	5.8100	-50.1487	
Total			-304.2312	(252)
Total energy cost			552.7058	(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	1804.4807	0.1561	281.7223	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1140.4971	0.1464	166.9179	(264)
Space and water heating			448.6402	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	263.3450	0.1443	38.0088	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-974.9902	0.1344	-131.0405	
PV Unit electricity exported	-863.1446	0.1222	-105.4627	
Total			-236.5032	(269)
Total CO2, kg/year			261.2429	(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	1804.4807	1.5780	2847.4140	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1140.4971	1.5414	1757.9753	(278)
Space and water heating			4605.3893	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	263.3450	1.5338	403.9274	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-974.9902	1.4967	-1459.2871	
PV Unit electricity exported	-863.1446	0.4482	-386.8845	
Total			-1846.1716	(283)
Total Primary energy kWh/year			3284.1691	(286)

Summary for Input Data

elmhurst energy

Property Reference	42 White Heart Avenue	**Issued on Date**	16/04/2025
Assessment Reference	Heat Pump	**Prop Type Ref**	Conversion
Property	42, White Heart Avenue, Uxbridge, UB8 3EP		

SAP Rating	81 B	**DER**	3.87	**TER**	9.41
Environmental	96 A	**% DER < TER**			58.87
CO_2 Emissions (t/year)	0.54	**DFEE**	45.05	**TFEE**	45.17
Compliance Check	See BREL	**% DFEE < TFEE**			0.27
% DPER < TPER	19.22	**DPER**	40.28	**TPER**	49.87

Assessor Details	Mr. Alexander Cotterill	**Assessor ID**	AV67-0001
Client			

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

Orientation	Southwest	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	House, Detached	
2.0 Number of Storeys	2	
3.0 Date Built	2025	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	140.89	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	No	
Smart gas meter fitted	Yes	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	44.25 m	100.86 m²	2.60 m
1st Storey:	36.46 m	53.11 m²	2.47 m

8.0 Living Area	68.87	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
New Facade	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.17	60.00	134.32	110.58	0.00	None	23.74	Enter Gross Area
Dormer Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.20	9.00	32.86	27.82	0.00	None	5.04	Enter Gross Area

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	229.52

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.15	9.00	27.72	27.72	None	0.00	Enter Gross Area	0.00
Semi Exposed Ceiling	External Plane Roof	Plasterboard, insulated at ceiling level	0.15	9.00	47.75	47.75	Room In Roof	0.50	Enter Gross Area	0.00
Sloped Roof	External Slope Roof	Plasterboard, insulated slope	0.15	9.00	56.20	54.40	None	0.00	Enter Gross Area	1.80

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	53.11

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.14	None	0.00	110.00	100.86

Summary for Input Data

elmhurst energy

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double glazed			0.76		0.70	1.40
Door	Manufacturer	Solid Door				0.00			1.00
Rooflight	Manufacturer	Roof Light	Double glazed			0.76		0.70	1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Windows SW	Windows	New Facade	South West	7.71	
Door SW	Door	New Facade	South West	1.90	
Windows NE	Windows	New Facade	North East	11.43	
Windows SE	Windows	New Facade	South East	2.70	
Windows NW	Windows	Dormer Wall	North West	3.40	
Windows SE	Windows	Dormer Wall	South East	1.64	
Rooflight SE	Rooflight	Sloped Roof	South East	0.90	40
Rooflight NW	Rooflight	Sloped Roof	North West	0.90	40

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	User Input	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)		18.90			No
E3 Sill		18.90			No
E4 Jamb		33.50			No
E5 Ground floor (normal)		44.25			No
E6 Intermediate floor within a dwelling		36.46			No
E13 Gable (insulation at rafter level)		18.00			No
E10 Eaves (insulation at ceiling level)		20.76			No
E14 Flat roof		14.82			No
E14 Flat roof		21.60			No
E16 Corner (normal)		22.50			No
E17 Corner (inverted – internal area greater than external area)		15.40			No

Y-value	0.03	W/m²K
Description	Thermal Bridging	

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys	0
Number of open flues	0
Number of chimneys/flues attached to closed fire	0
Number of flues attached to solid fuel boiler	0
Number of flues attached to other heater	0
Number of blocked chimneys	0
Number of intermittent extract fans	4
Number of passive vents	0
Number of flueless gas fires	0

21.0 Fixed Cooling System	No	
22.0 Pressure Testing	Yes	
Designed AP_{50}	5.00	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	

22.0 Lighting

No Fixed Lighting	No				
	Name	**Efficacy**	**Power**	**Capacity**	**Count**
	Lighting 1	95.00	12.00	1140.00	30

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%

Summary for Input Data

Database Ref. No.	108532
Fuel Type	Electricity
In Winter	304.14
In Summer	176.14
Model Name	aroTHERM plus 7kW & AI 300l
Manufacturer	Vaillant Group UK Ltd
System Type	Heat Pump
Controls SAP Code	2207
Is MHS Pumped	Pump in heated space
Heating Pump Age	2013 or later
Heat Emitter	Radiators and Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	Enter value
Flow Temperature Value	35.00

25.0 Main Heating 2 None

26.0 Heat Networks None

27.0 Secondary Heating None

28.0 Water Heating

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

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Shower	Vented hot water system	7.00		No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	210.00	L
Loss	1.00	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store None

34.0 Small-scale Hydro None

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

Recommendations

Lower cost measures

None

Summary for Input Data

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
	£4,000 - £6,000	£90	B 82	A 96
	£3,500 - £5,500	£304	B 88	A 98
			0	0

Predicted Energy Assessment

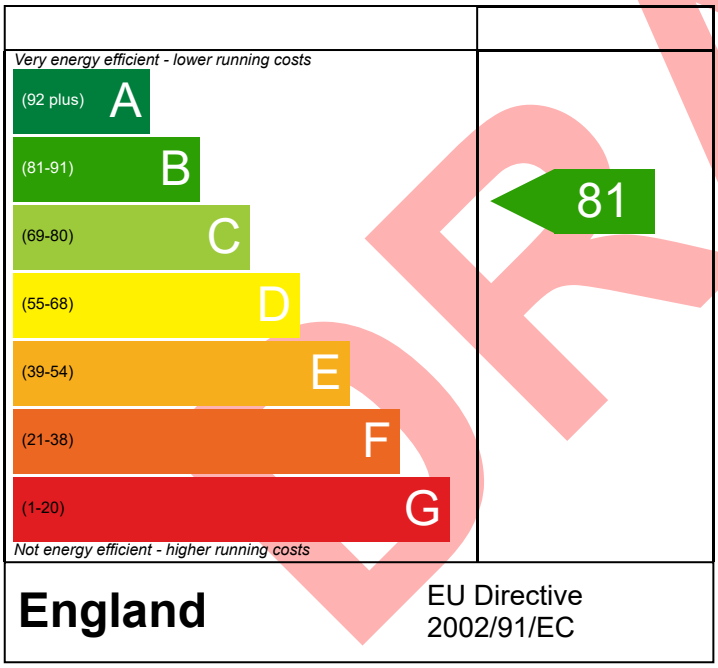
42, White Heart Avenue, Uxbridge, UB8 3EP

Dwelling type:	House, Detached
Date of assessment:	16/04/2025
Produced by:	Alexander Cotterill
Total floor area:	153.97 m²
DRRN:	

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

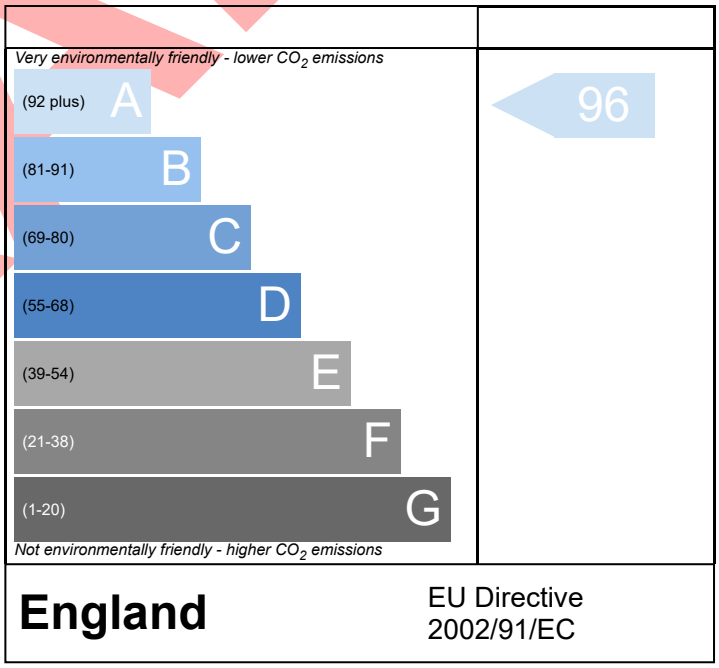
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Thermal Bridging

Property Reference	42 White Heart Avenue	**Issued on Date**	16/04/2025
Assessment Reference	Heat Pump	**Prop Type Ref**	Detached House
Property	42, White Heart Avenue, Uxbridge, UB8 3EP		

SAP Rating	81 B	**DER**	3.87	**TER**	9.41
Environmental	96 A	**% DER < TER**			58.87
CO_2 Emissions (t/year)	0.54	**DFEE**	45.05	**TFEE**	45.17
Compliance Check	See BREL	**% DFEE < TFEE**			0.27
% DPER < TPER	19.22	**DPER**	40.28	**TPER**	49.87

Assessor Details	Mr. Alexander Cotterill	**Assessor ID**	AV67-0001
Client			

	Junction details	Length (m)	Reference
External wall	E2 Other lintels (including other steel lintels)	18.90	
External wall	E3 Sill	18.90	
External wall	E4 Jamb	33.50	
External wall	E5 Ground floor (normal)	44.25	
External wall	E6 Intermediate floor within a dwelling	36.46	
External wall	E13 Gable (insulation at rafter level)	18.00	
External wall	E10 Eaves (insulation at ceiling level)	20.76	
External wall	E14 Flat roof	14.82	
External wall	E14 Flat roof	21.60	
External wall	E16 Corner (normal)	22.50	
External wall	E17 Corner (inverted – internal area greater than external area)	15.40	

Y-Value: 0.03 W/m²K:

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	#2275-040325-NA-ESMAEILI	Issued on Date	24/03/2025
Assessment Reference		Prop Type Ref	ESMAEILI
Project			
Calculation Type	New Build (As Built)		

SAP Rating		DER		TER	
Environmental		% DER<TER			
CO_2 Emissions (t/year)		DFEE		TFEE	
General Requirements Compliance		% DFEE<TFEE			

Assessor Details		Assessor ID	AV67-0001
Client			

Building Elements

Wall External Facade

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	**Render - Cement and Sand**				
	Main construction	20	1.0000	0.0200	100.00
Layer 2	**Celcon Hi-Ten - Normal - Trad joint 10mm**				
	Main construction	100	0.1900	0.5263	93.18
	Main construction	100	0.8803	0.1136	6.82
Layer 3	**Rockwool NyRock**				
	Main construction	150	0.0320	4.6875	100.00
Layer 4	**Celcon Hi-Ten - Normal - Trad joint 10mm**				
	Main construction	100	0.1900	0.5263	93.18
	Main construction	100	0.8803	0.1136	6.82
Layer 5	**airspace/plaster dabs**				
	Main construction	15	0.0882	0.1700	80.00
	Main construction	15	0.0882	0.1700	20.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	**Plasterboard, standard**				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 7	**Plaster, standard**				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance: **Upper limit =** 6.107 m² K/W **Lower limit =** 5.958 m² K/W **Average =** 6.033 m² K/W

Total correction = 0.0000 m² K/W **U-value (unrounded) =** 0.17 W/m² K

Unheated space: None

Total thickness: 401 mm **U-value: 0.17 W/m² K** **Kappa: n/a**

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	#2275-040325-NA-ESMAEILI	Issued on Date	24/03/2025
Assessment Reference		Prop Type Ref	ESMAEILI
Project			
Calculation Type	New Build (As Built)		

SAP Rating		DER		TER	
Environmental		% DER<TER			
CO_2 Emissions (t/year)		DFEE		TFEE	
General Requirements Compliance		% DFEE<TFEE			

Assessor Details		Assessor ID	AV67-0001
Client			

Building Elements

Floor Ground Floor

Floor Type: Suspended Floor
Area = 100.36 m², Perimeter = 47.50 m, Wall thickness = 350.00 mm, Soil: Unknown
Depth of underfloor space below ground:0.200 m Floor wind shielding: Average (suburban)
Floor height above ground:h = 0.200 m
U-value of walls above ground:Uw = 1.500 m
Ventilation openings per perimeter length:e = 0.0015 %
Mean wind speed:v = 5.000 m/s
Resistance on solum:Rg = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	**Screed**				
	Main construction	75	1.1500	0.0652	100.00
Layer 2	**Kingspan K103**				
	Main construction	100	0.0180	5.5556	100.00
Layer 3	**Blockwork, dense**				
	Main construction	100	1.5900	0.0629	100.00
Int surface				0.1700	

Total resistance: **Upper limit =** 6.024 m² K/W **Lower limit =** 6.024 m² K/W **Average =** 6.024 m² K/W

Total correction = 0.0000 m² K/W **U-value (unrounded) =** 0.14 W/m² K

Unheated space: None

Total thickness: 275 mm **U-value: 0.14 W/m² K** **Kappa: n/a**

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	#2275-040325-NA-ESMAEILI	Issued on Date	24/03/2025
Assessment Reference		Prop Type Ref	ESMAEILI
Project			
Calculation Type	New Build (As Built)		

SAP Rating		DER		TER	
Environmental		% DER<TER			
CO_2 Emissions (t/year)		DFEE		TFEE	
General Requirements Compliance		% DFEE<TFEE			

Assessor Details		Assessor ID	AV67-0001
Client			

Building Elements

Roof Flat Roof

Roof Type: Flat Roof standard (no precipitation)

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	**Plywood**				
	Main construction	18	0.1300	0.1385	100.00
Layer 2	**Thermaroof TR27 (120mm +)**				
	Main construction	150	0.0240	6.2500	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	**Plywood**				
	Main construction	18	0.1300	0.1385	100.00
Layer 4	**Joists**				
	Main construction	150	0.9375	0.1600	85.71
	Main construction	150	0.1300	1.1538	14.29
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 5	**Plasterboard, standard**				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 6	**Plaster, standard**				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance: **Upper limit =** 7.020 m² K/W **Lower limit =** 6.916 m² K/W **Average =** 6.968 m² K/W

Total correction = 0.0080 m² K/W **U-value (unrounded) =** 0.15 W/m² K

Unheated space: None

Total thickness: 352 mm **U-value: 0.15 W/m² K** **Kappa: n/a**

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	#2275-040325-NA-ESMAEILI	Issued on Date	24/03/2025
Assessment Reference		Prop Type Ref	ESMAEILI
Project			
Calculation Type	New Build (As Built)		

SAP Rating		DER		TER	
Environmental		% DER<TER			
CO_2 Emissions (t/year)		DFEE		TFEE	
General Requirements Compliance		% DFEE<TFEE			

Assessor Details		Assessor ID	AV67-0001
Client			

Building Elements

Roof Sloped Roof

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	**Tiles**				
	Main construction	10	1.0000	0.0100	100.00
Layer 2	**Counter/Battens**				
	Main construction	50	0.3125	0.1600	85.71
	Main construction	50	0.1300	0.3846	14.29
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	**Breather membrane**				
	Main construction	1	0.0000	0.0000	100.00
Layer 4	**Rafters**				
	Main construction	50	0.3125	0.1600	85.71
	Main construction	50	0.1300	0.3846	14.29
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 5	**Kingspan K107**				
	Main construction	120	0.0180	6.6667	85.71
	Main construction	120	0.1300	0.9231	14.29
Layer 6	**Kooltherm K18 Insulated Plasterboard (52.5mm)**				
	Main construction	52.5	0.0269	1.9500	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	**Plaster, standard**				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance: **Upper limit =** 7.381 m² K/W **Lower limit =** 5.986 m² K/W **Average =** 6.684 m² K/W

Total correction = 0.0009 m² K/W **U-value (unrounded) =** 0.15 W/m² K

Unheated space: None

Total thickness: 287 mm **U-value: 0.15 W/m² K** **Kappa: n/a**

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	#2275-040325-NA-ESMAEILI	**Issued on Date**	24/03/2025
Assessment Reference		**Prop Type Ref**	ESMAEILI
Project			
Calculation Type	New Build (As Built)		

SAP Rating		**DER**		**TER**	
Environmental		**% DER<TER**			
CO_2 Emissions (t/year)		**DFEE**		**TFEE**	
General Requirements Compliance		**% DFEE<TFEE**			

Assessor Details		**Assessor ID**	AV67-0001
Client			

Building Elements

Roof Ceiling

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	**Mineral wool quilt**				
	Main construction	200	0.0420	4.7619	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	**Mineral wool quilt**				
	Main construction	100	0.0420	2.3810	85.71
	Main construction	100	0.1300	0.7692	14.29
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	**Plasterboard, standard**				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 4	**Plaster, standard**				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance: **Upper limit =** 7.066 m² K/W **Lower limit =** 6.801 m² K/W **Average =** 6.934 m² K/W

Total correction = 0.0054 m² K/W **U-value (unrounded) =** 0.15 W/m² K

Unheated space: None

Total thickness: 316 mm **U-value: 0.15 W/m² K** **Kappa: n/a**

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	#2275-040325-NA-ESMAEILI	**Issued on Date**	24/03/2025
Assessment Reference		**Prop Type Ref**	ESMAEILI
Project			
Calculation Type	New Build (As Built)		

SAP Rating		**DER**		**TER**	
Environmental		**% DER<TER**			
CO_2 Emissions (t/year)		**DFEE**		**TFEE**	
General Requirements Compliance		**% DFEE<TFEE**			

Assessor Details		**Assessor ID**	AV67-0001
Client			

Building Elements

Wall Dormer Wall

Wall Type: Timber framed Wall with I-beams

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	**Plywood**				
	Main construction	15	0.1300	0.1154	100.00
Layer 2	**Standard cavity**				
	Main construction	50	0.2778	0.1800	85.71
	Main construction	50	0.1300	0.3846	14.29
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	**Kooltherm K12 Frame board (45mm +)**				
	Main construction	100	0.0200	5.0000	90.91
	Main construction	100	0.1300	0.7692	9.09
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	**Kooltherm K18 Insulated Plasterboard (32.5mm)**				
	Main construction	32.5	0.0361	0.9000	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	**Plaster, standard**				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance: **Upper limit =** 5.437 m² K/W **Lower limit =** 4.721 m² K/W **Average =** 5.079 m² K/W

Total correction = 0.0046 m² K/W **U-value (unrounded) =** 0.2 W/m² K

Unheated space: None

Total thickness: 201 mm **U-value: 0.20 W/m² K** **Kappa: n/a**

Installation Type	Unit of Measure	Capacity/Flow rate (1)	Use Factor (2)	Fixed use (litres/person/day) (3)	Litres/person/day = [(1)x(2)] + (3) (4)
WC (single flush)	Flush Volume (litres)		4.42	0.00	0
WC (dual flush)	Full flush Volume (litres)	3	1.46	0.00	4.38
	Part flush Volume (litres)	6	2.96	0.00	17.76
WC (multiple fittings)	Average effective flushing Volume (litres)		4.42	0.00	0
Taps (excluding kitchen/utility room taps)	Flow rate (litres/min)	5.00	1.58	1.58	9.48
Bath (where shower also present)	Capacity to overflow(litres)	165.00	0.11	0.00	18.15
Shower (where bath also present)	Flow Rate(litres / minute)	8.00	4.37	0.00	34.96
Bath Only	Capacity to overflow(litres)		0.50	0.00	0
Shower Only	Flow Rate (litres/minute)		5.60	0.00	0
Kitchen/Utility room sink taps	Flow rate (litres/minute)	5.00	0.44	10.36	12.56
Washing Machine	(Litres/kg dry load)	8.17	2.1	0.00	17.16
Dishwasher	(Litres/place setting)	1.25	3.6	0.00	4.50
Waste disposal unit	(Litres/use)	☐ Present	3.08	0.00	0
Water Softener	(Litres/person/day)		1.00	0.00	0
	(5)	Total Calculated use (litres/person/day) =SUM(column 4)			118.95

	(6)	Contribution from greywater (litres/person/day)	0
	(7)	Contribution from rainwater (litres/person/day)	0
	(8)	Normalisation factor	0.91
	(9)	Total internal water consumption = [(5)-(6)-(7)]x(8) (litres/person/day)	108.24
	(10)	External water use	5.0
	(11)	Total water consumption (Building Regulation 17.K) =(9)+(10)(litres/person/day)	113.2

Installation Type	Make/Model (mandatory)	Litres/Person/Day
WC (dual flush)		22.14
Taps		9.48
Baths (shower(s) present)		18.15
Showers (bath(s) present)		34.96
Kitchen Taps		12.56
Washing Machines		17.16
Dishwasher		4.50

Terms and Conditions
System Requirements