

Sustainability, Energy & Overheating Report

J5106 Maresfield Gardens

Ref: J5106-E-RP-0001

Revision: 02

Status: S3

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REVISION HISTORY

Revision	Status	Date	Author	Reviewer	Approver
00	S3	13/06/2023	AE	ES	ES
01	S3	10/07/2023	RG	ES	ES
02	S3	10/07/2023	RG	ES	ES

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I. INTRODUCTION

This report sets out the energy strategy for the proposed development and gives guidance on what fabric performance needs to be achieved in order to meet Building Regulations Part L compliance, along with measures in order to mitigate the risk of summertime overheating. In developing this strategy local and regional planning policies have been addressed.

Maresfield Gardens is a development which consists of the refurbishment of an existing house along with the construction of a basement and kitchen extension of a four-bedroom house, spread over four storeys located in London.

The energy consumption of the development has been assessed in line with the Local policy and the CO_2 emission savings have been estimated using SAP software.

This report identifies the proposed energy strategy to meet Building Regulations Part L requirements.



2. SUSTAINABILITY STRATEGY

With the existing extension being constructed in 2007, the current fabric quality is poorer than what is currently required from Building Regulations. New works would see a significant improvement to U-value of external walls if compared to limits set for retained and refurbished elements. The demolition of and replacement of extension would see an improvement to if the extension was retained and refurbished. This would lead to large savings in CO₂ emissions over a 60-year lifespan.

With the extension being replaced, it is also proposed to replace the existing boiler system providing heating and hot water to the whole house. Taking this under consideration, the proposed extension would lead to a significant improvement in energy consumption and savings for the whole development.

2.1. Primary Sustainable options

2.1.1. MVHR (Mechanical Ventilation with Heat Recovery)

The basement will be mechanically ventilated by supply and extract mechanical ventilation heat recovery MVHR systems.

MVHRs are an extremely energy efficient way of ventilating spaces while recovering some of the heat out of the rooms extract air into the supply via heat transfer. The heat recovery process takes away almost all the ventilation heat losses which improves the efficiency of the internal space heating loads. The unit fan pulls in fresh air from outside, through the heat recovery element within the unit and supplies the internal space. The extract fan reverses the process and takes the air from the internal supply, through the heat recovery element and exhausts to outside. Whilst the supply and extract air cross over through the unit, the temperature from the extract mixes with the supply without coming in contact, via a heat exchanger. Efficient MVHR units typically heat from 0°C to 18°C through heat transfer when the extract air is 20 °C.

The supply flow rate is matched to the extract flow rates and are sized by using Building Regulations Part F. The units will be SAP Appendix Q compliant and have a specific fan power of 0.9W/l/s or less and a heat exchanger efficiency of at least 88%, as certified by the BRE.

2.1.2. ASHP (Air Source Heat Pumps)

The buildings hot water and heating will be primarily produced via ASHPs located on the ground floor external plant space. The ASHPs will heat the water up to 55 °C and will be stored in hot water storage cylinders located in the basement plant room.

An air source heat pump extracts heat energy from the air which is used to heat up the buildings water supply/storage for hot water. This is achieved by using a compressor and refrigerant cycle to reach an efficient water temperature that can be used to provide heating or hot water. A well-designed heat pump system transfers around three to four times more energy into heat then it uses to extract it. As a result, heat pumps are incredibly efficient.

The end-users will be supplied with regular information to control and operate the system e.g. at point of occupancy and maintenance visits.

The performance of the heat pump system will need to be monitored postconstruction to ensure it is achieving the expected performance approved during planning as specified in the mechanical design documentation.

2.1.3. Fabric Upgrades

Fabric upgrades will be made to the building to reduce heat and cooling loads. The reduction in heating and cooling loads will result in the building being more energy efficient as it will keep the temperature of the building at more of a constant and will reduce the requirements to use the cooling or heating systems for longer, saving energy. It will also decrease loss of heat energy from internal to external.



3. ENERGY ASSESSMENT

An energy assessment has been carried out to demonstrate how the targets for regulated CO₂ emissions reduction over and above 2021 Building Regulations will be met. The energy assessment has also been carried in order to provide guidance on what minimum fabric performance needs to be achieved in order to meet Building Regulations Part L compliance.

As part of planning policy, the following criteria apply:

- The development should minimise carbon emissions to as high a degree possible

For the purpose of the energy assessment, the energy demand has been calculated using the approved SAP software.

See Appendix A for full SAP results.

3.1. Part L Requirements

As an existing building with no change of use, the refurbishment of existing building has different Part L requirements than the new portions of the development. As part of proposed improvements, any retained thermal elements will need to be upgraded to the following minimum performance if current U-values exceed the threshold values wherever possible. Improvement to wall and roof constructions are proposed. As more than 25% of the external envelope will undergo renovation, the development is classified as a major renovation and needs to comply with paragraph L1 of Schedule 1.

Table 4.3 Limiting U-values for existing elements in existing dwellings						
Element	lement U-value ⁽¹⁾ W/(m²·K)					
	(a) Threshold	(b) Improved				
Roof ⁽²⁾⁽³⁾⁽⁴⁾	0.35	0.16				
Wall – cavity insulation ⁽²⁾⁽⁵⁾	0.70	0.55				
Wall – internal or external insulation ⁽²⁾⁽⁶⁾	0.70	0.30				
Floor ⁽⁷⁾⁽⁸⁾	0.70	0.25				

For the basement and kitchen extension, the proposed constructions will need to achieve the following minimum U-values.

Table 4.2 Limiting U-values for new fabric elements in existing dwellings					
Element type	Maximum U-value ⁽¹⁾ W/(m²-K)				
Roof ⁽²⁾	0.15				
Wall ⁽²⁾⁽³⁾	0.18				
Floor ⁽⁴⁾⁽⁵⁾	0.18				
Swimming pool basin ⁽⁶⁾	0.25				
Window ⁽⁷⁾⁽⁸⁾⁽⁹⁾	1.4 or Window Energy Rating ⁽¹⁰⁾ Band B minimum				
Rooflight ⁽¹¹⁾⁽¹²⁾	2.2				
Doors with >60% of internal face glazed ⁽¹³⁾	1.4 or Doorset Energy Rating ⁽¹⁰⁾ Band C minimum				
Other doors(13)(14)	1.4 or Doorset Energy Rating ⁽¹⁰⁾ Band B minimum				



Compliance at the design stage is demonstrated by calculating the CO_2 emissions rate for the proposed development, known as the Building Emissions Rate (BER), which is compared to an equivalent notional building of the same geometry but with a set of benchmark performance characteristics as specified in the 2010 NCM modelling guide, known as the Target Emissions Rate (TER). Compliance is achieved when the BER is lower than TER.

In addition to the requirement for the BER to be lower than the TER of the notional building, each dwelling needs to achieve a lower dwelling fabric energy efficiency (DFEE) than the notional target fabric energy efficiency (TFEE) and lower primary energy rate than that of the notional.

The target U-values and air permeability rate given in the following section have been selected in order to meet these three criteria stipulated by Part L.

In accordance with Part L Section 10.10, Part L compliance for the extension is achieved by demonstrating that the BER, DFEE and DPER of the proposed refurbished building and new extension is lower than that of the existing house and notional extension.

3.2. SAP Model Input

The following fabric U-values have been assigned in order to meet dwelling fabric energy efficiency (DFEE) compliance. An airtightness of 3 m³m²h at 50Pa has been assumed for the extension. As can be seen these U-values are in line with those indicated on architectural detail drawings. It is currently not proposed to replace the windows of the existing house.

	Proposed U-Value [W/m²K]
Element	Design
Upgraded External Wall	0.28
Upgraded Roof	0.16
Existing Windows	2.90
New External Wall	0.18
New Floor	0.18
New Roof	0.15
New Windows	1.40
New Rooflights	2.20

Heating and hot water is provided via an ASHP system with a COP of 2.5. An MVHR system provides supply ventilation to habitable spaces and extract in kitchen and wet rooms with a heat recovery efficiency of 88%. The lighting has been assumed to have a minimum luminous efficacy of 95lm/W. A PV installation is not currently proposed for the development. Ventilation ductwork insulation is specified as type 2, in order to meet the dwelling primary energy rate criteria.



3.3. Results

SAP results demonstrate that the combined dwelling carbon dioxide emission rate calculated is 69.10% below the target CO₂ emission rate therefore meeting Part L compliance. The dwelling fabric efficiency also passes, but marginally by 0.17%. Lower performance of fabric U-values would mean the target fabric energy efficiency may not be met. The dwelling primary energy rate passes by 44.31% over the target primary energy rate.

	Existing	Refurbishment	Notional Extension	Extension
DER	20.51	4.39	8.18	4.54
DFEE	74.5	63.4	52.9	61.1
DPER	117.09	44.94	46.31	47.14

	Baseline	Proposed	Improvement (%)	Pass/Fail
DER	15.16	4.46	70.61	Pass
DFEE	65.13	62.40	4.18	Pass
DPER	86.37	45.89	46.87	Pass



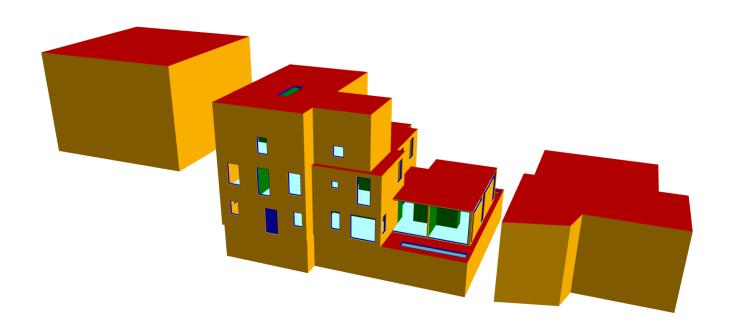
4. OVERHEATING RISK ANALYSIS

The development's design was tested in order to gauge its capabilities of mitigating overheating risk during summer months. **CIBSE TM59: Design methodology for the assessment of overheating risk in homes** was used to assess to assess this. In accordance with TM59 the following criteria need to be met.

- I) The number of hours during which delta T of indoor air temperature to outdoor is greater than or equal to one degree (K) during the period of May to September shall not exceed 3% of occupied hours.
- 2) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10pm to 7am shall not exceed 26°C for more than 1% of annual hours

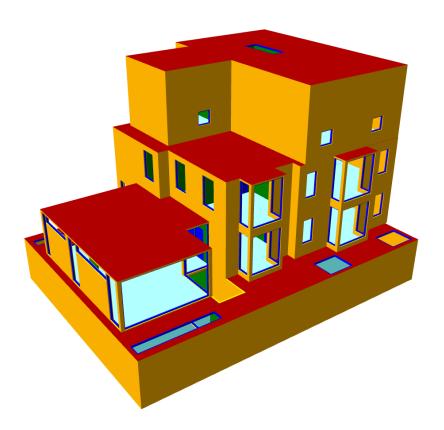
In accordance with CIBSE TM59, compliance needs to be achieved for DSY1 2020 50th percentile high emissions scenario. The weather file for London Heathrow, simulating a suburban environment was used for selected for testing.

A dynamic energy model of the property in order to test its summer overheating performance was created in TAS. The model considers the massing, orientation and external shading elements of the building.



Existing glazing is assumed to have an approximate g-value of 0.7 with new glazing set to 0.4. Degree of window openings of new and existing glazing were modelled based on architectural elevations. Window opening schedules have been modelled in accordance with guidance from TM59 and Building Regulations Part O: Overheating. Ground Floor windows have been modelled as closed at night-time due to perceived security risk. U-values were assigned based on requirements to meet Part L compliance as previously discussed.





	Proposed U-Value [W/m ² K]
Element	Design
Upgraded External Wall	0.28
Upgraded Roof	0.16
Existing Windows	2.90
New External Wall	0.18
New Floor	0.18
New Roof	0.15
New Windows	1.40
New Rooflights	2.20



A summary of testing can be seen below. Living areas need to achieve 59 hours or below to achieve Criterion 1 and bedrooms need to achieve 110 hours or below. Additionally, bedrooms need to achieve 32 hours or below to be compliant with Criterion 2.

As results indicate, there is high risk of overheating in rooms of the existing house. It will not be possible to fit external shading elements or blinds to this building. Due to its high risk of overheating and limited potential to reduce risk via passive measures it is deemed that mechanical cooling will be needed for habitable spaces.

For the portions of extension, it is proposed to provide mechanical cooling to Basement Gym, Media Room and Pool Room. With TM59 not providing representative internal conditions and occupancy profiles for these type of spaces, it is believed that risk of overheating is considerably underestimated. Design specialists of each respective room are to advise on cooling requirements.

Due to the proportion of glazing area, the kitchen is at risk of overheating. Various options to mitigate risk were considered. Due to degree of failure at baseline scenario, minor means of improvement such as improving the g-value from 0.4 to 0.3 were disregarded.

External blinds of a transparency 7% were applied to all glazing within the extension. With this degree of shading, the room meets TM59 criteria when tested against DSY1. Considering future weather scenarios and more intense heat spells of DSY2 and DSY3, the space is at risk of overheating and so it is been considered to make allowance for mechanical cooling to mitigate overheating in a limited amount of hours of the year. Results show that with the measures available, TM59 compliance will be difficult to achieve and mechanical cooling is therefore proposed.



	Baseline			External Blinds		
Zone Name	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Number of Night Hours Exceeding 26 °C for Bedrooms.	Result	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Number of Night Hours Exceeding 26 °C for Bedrooms.	Result
Ist - Bedroom II	120	42	Fail	117	41	Fail
Ist - Bedroom III	436	205	Fail	432	206	Fail
1st - Master Bedroom	198	78	Fail	197	77	Fail
2nd - Bedroom IV	3	67	Fail	3	67	Fail
2nd - Study	0	N/A	Pass	0	N/A	Pass
Basement - Games/Media	0	N/A	Pass	0	N/A	Pass
Basement - Gym	0	N/A	Pass	0	N/A	Pass
Basement - Pool	0	N/A	Pass	0	N/A	Pass
GF - Dining Room	0	N/A	Pass	0	N/A	Pass
GF - Drawing Room	104	N/A	Fail	103	N/A	Fail
GF - Kitchen	121	N/A	Fail	34	N/A	Pass
GF - Study	0	N/A	Pass	0	N/A	Pass



5. CONCLUSION

In line with the Local Plan and Part L 2021 compliance, this report outlines the requirements for the development in terms energy efficiency and fabric efficiency along with mitigating overheating risk. Target U-values and air permeability have been selected on this basis.

	Baseline	Proposed	Improvement (%)	Pass/Fail
DER	15.16	4.46	70.61	Pass
DFEE	65.13	62.40	4.18	Pass
DPER	86.37	45.89	46.87	Pass

As can be seen the fabric energy efficiency, dwelling emission rate and primary energy rate for the building is lower than that of the notional. Therefore, demonstrating full compliance with Building Regulations Part L Volume 1.



APPENDIX A - SAP REPORT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Tue 13 Jun 2023 10:27:49

Project Information					
Assessed By	Webb Yates Engineers	Building Type	House, Detached		
OCDEA Registration	STRO037816	Assessment Date	2023-05-17		

Dwelling D	Dwelling Details							
Assessmer	nt Type	As designed	Total Floor Area	446 m ²				
Site Refere	Site Reference J5106 - Existing Maresfield		Plot Reference	Refurb				
		Gardens						
Address		NW3 5RX						

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided, WF10 5QU

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

1a Target emission rate and dwelling emission	rate			
Fuel for main heating system	Mains gas	Mains gas		
Target carbon dioxide emission rate	8.49 kgCO ₂ /m ²			
Dwelling carbon dioxide emission rate	20.51 kgCO ₂ /m ²	FAIL		
1b Target primary energy rate and dwelling pri	mary energy			
Target primary energy	45.14 kWh _{PE} /m ²			
Dwelling primary energy	117.09 kWh _{PE} /m ²	FAIL		
1c Target fabric energy efficiency and dwelling fabric energy efficiency				
Target fabric energy efficiency	43.9 kWh/m ²			
Dwelling fabric energy efficiency	74.5 kWh/m ²	FAIL		

Element	Maximum permitted	Dwelling average U-Value	Element with highest	
	average U-Value [W/m²K]	[W/m ² K]	individual U-Value	
External walls	0.26	0.36	External Wall (0.37)	FAIL
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.45	Floor (0.45)	FAIL
Roofs	0.16	0.24	Pitched Roof (0.25)	FAIL
Windows, doors,	1.6	2.81	2 (2.9)	FAIL
and roof windows				
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m²]	U-Value [W/m ² K]	
Exposed wall: External Wall	237.72	0.37	
Exposed wall: Replaced Wall	17.67	0.18	
Ground floor: Floor	17.02	0.45	
Exposed roof: Pitched Roof	285.83	0.25	
Exposed roof: Flat Roof	18.64	0.15	

Name	Area [m²]	Orientation	Frame factor	U-Value [W/m ² K]
1, Doors	4.65	West	N/A	1 (!)
2, Windows (1)	21.41	West	0.9	2.9
3, Windows (1)	14.53	North	0.9	2.9
4, Windows (1)	28.76	East	0.9	2.9
5, Windows (1)	3.06	South	0.9	2.9
6, Roof windows (1)	1.26	West	0.9	2.9
7, Roof windows (1)	2.44	North	0.9	2.9
8, Roof windows (1)	2.96	East	0.9	2.9
9, Roof windows (1)	4	South	0.9	2.9
10. Roof windows (1)	10.66	South	0.9	2.9

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2d Thermal bridging (better than typically expected values are flagged with a subsequent (!)) Building part 1 - Main Dwelling: SAP default y-value (0.2 W/m²K) used for thermal bridging 3 Air permeability (better than typically expected values are flagged with a subsequent (!)) Maximum permitted air permeability at 50Pa 8 m³/hm² Dwelling air permeability at 50Pa 10 m³/hm², Design value FAIL Air permeability test certificate reference Not Provided 4 Space heating Main heating system 1: Boiler with radiators or underfloor heating - Mains gas 80.0% Efficiency Emitter type Radiators Flow temperature System type Manufacturer Model Commissioning Secondary heating system: N/A N/A Fuel Efficiency N/A Commissioning 5 Hot water Cylinder/store - type: N/A Capacity N/A Declared heat loss N/A Primary pipework insulated N/A Manufacturer Model Commissioning Waste water heat recovery system 1 - type: N/A Efficiency Manufacturer Model 6 Controls Main heating 1 - type: Programmer, TRVs, and bypass Function Ecodesign class Manufacturer Model Water heating - type: N/A Manufacturer Model Minimum permitted light source efficacy | 75 lm/W 90 lm/W Lowest light source efficacy OK External lights control N/A 8 Mechanical ventilation System type: N/A Maximum permitted specific fan power N/A Specific fan power N/A N/A Minimum permitted heat recovery N/A efficiency Heat recovery efficiency N/A N/A Manufacturer/Model Commissioning

9 Local generation N/A

10 Heat networks

N/A

11 Supporting documentary evidence

N/A

12 Decidiations				
a. Assessor Declaration				
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for				
the purpose of carrying out the "As designed" assessment,				
evidence (SAP Conventions, Appendix 1 (documentary evidence)	'' 9 ,			
documentary evidence required) has been reviewed in the	· · · · · · · · · · · · · · · · · · ·			
Compliance Report.				
Signed:	Assessor ID:			
Signed.	Assessor id.			
Name:	Date:			
b. Client Declaration				
N/A				

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Tue 13 Jun 2023 10:25:21

Project Information			
Assessed By	Webb Yates Engineers	Building Type	House, Detached
OCDEA Registration	STR0037816	Assessment Date	2023-05-17

Dwelling Details			
Assessment Type	As designed	Total Floor Area	446 m ²
Site Reference	J5106 - Refurbishment	Plot Reference	Refurb
	Maresfield Gardens		
Address	NW3 5RX	·	

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided, WF10 5QU

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

1a Target emission rate and dwelling emission	rate			
Fuel for main heating system	Electricity			
Target carbon dioxide emission rate	8.46 kgCO ₂ /m ²			
Dwelling carbon dioxide emission rate	4.39 kgCO ₂ /m ²	OK		
1b Target primary energy rate and dwelling pri	mary energy			
Target primary energy	44.97 kWh _{PE} /m ²			
Dwelling primary energy	44.96 kWh _{PE} /m ²	OK		
1c Target fabric energy efficiency and dwelling fabric energy efficiency				
Target fabric energy efficiency	43.6 kWh/m ²			
Dwelling fabric energy efficiency	63.4 kWh/m ²	FAIL		

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m²K]	Dwelling average U-Value [W/m²K]	Element with highest individual U-Value	
External walls	0.26	0.27	External Wall (0.28)	FAIL
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.45	Floor (0.45)	FAIL
Roofs	0.16	0.16	Pitched Roof (0.16)	OK
Windows, doors,	1.6	2.52	2 (2.9)	FAIL
and roof windows				
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: External Wall	235.13	0.28	
Exposed wall: Replaced Wall	17.67	0.18	
Ground floor: Floor	17.02	0.45	
Exposed roof: Pitched Roof	285.39	0.16	
Exposed roof: Flat Roof	29.3	0.15	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
1, Doors	4.65	West	N/A	1 (!)
2, Windows (1)	21.41	West	0.9	2.9
3, Windows (1)	9.62	North	0.9	2.9
4, Windows (1)	25.82	East	0.9	2.9
5, Windows (1)	3.06	South	0.9	2.9
6, Windows (2)	2.68	North	0.9	1.4
7, Windows (2)	2.94	East	0.9	1.4
8, Windows (2)	4.82	South	0.9	1.4
9, Roof windows (1)	1.26	West	0.9	2.9
10, Roof windows (1)	2.44	North	0.9	2.9
11, Roof windows (1)	1.7	East	0.9	2.9

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Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
12, Roof windows (2)	4	South	0.9	1.4
13, Roof windows (2)	0.85	West	0.9	1.4
14, Roof windows (2)	0.85	East	0.9	1.4

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!)) Building part 1 - Main Dwelling: SAP default y-value (0.2 W/m²K) used for thermal bridging

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	$8 \text{ m}^3/\text{hm}^2$		
Dwelling air permeability at 50Pa	8 m ³ /hm ² , Design value	OK	
Air permeability test certificate reference	Not Provided		

4 Space heating				
Main heating system 1: Heat pump with	Main heating system 1: Heat pump with radiators or underfloor heating - Electricity			
Efficiency	250.0%			
Emitter type	Underfloor			
Flow temperature				
System type				
Manufacturer				
Model				
Commissioning				
Secondary heating system: N/A				
Fuel	N/A			
Efficiency	N/A			
Commissioning				

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 -	type: N/A
Efficiency	
Manufacturer	
Model	

6 Controls		
Main heating 1 - type: Programmer, TRVs, and bypass		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		

7 Lighting			
Minimum permitted light source efficacy	75 lm/W		
Lowest light source efficacy	95 lm/W	OK	(
External lights control	N/A	•	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery	N/A	
efficiency		
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		

9 Local generation N/A

N/A
11 Supporting documentary evidence N/A
12 Declarations a. Assessor Declaration
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.
Signed: Assessor ID:
Name: Date:
b. Client Declaration
N/A

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Fri 07 Jul 2023 14:37:53

Project Information			
Assessed By	Webb Yates Engineers	Building Type	House, Detached
OCDEA Registration	STRO037816	Assessment Date	2023-05-17

Dwelling Details			
Assessment Type	As designed	Total Floor Area	342 m ²
Site Reference	J5106 - Extension Maresfield	Plot Reference	J5106
	Gardens		
Address	NW3 5RX		

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided, WF10 5QU

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

1a Target emission rate and dwelling emission rate				
Fuel for main heating system	Electricity			
Target carbon dioxide emission rate	8.18 kgCO ₂ /m ²			
Dwelling carbon dioxide emission rate	4.54 kgCO ₂ /m ²	OK		
1b Target primary energy rate and dwelling primary energy				
Target primary energy	46.31 kWh _{PE} /m ²			
Dwelling primary energy	47.14 kWh _{PE} /m ²	FAIL		
1c Target fabric energy efficiency and dwelling fabric energy efficiency				
Target fabric energy efficiency 52.9 kWh/m ²				
Dwelling fabric energy efficiency	61.1 kWh/m ²	FAIL		

2a Fabric U-values					
Element	Maximum permitted average U-Value [W/m²K]	Dwelling average U-Value [W/m²K]	Element with highest individual U-Value		
External walls	0.26	0.18	Basement Wall (0.18)	ОК	
Party walls	0.2	N/A	N/A	N/A	
Curtain walls	1.6	N/A	N/A	N/A	
Floors	0.18	0.18	Basement Floor (0.18)	ОК	
Roofs	0.16	0.15	GF Roof (0.15)	ОК	
Windows, doors,	1.6	1.51	5 (2.2)	ОК	
and roof windows					
Rooflights	2.2	N/A	N/A	N/A	

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Basement wall: Basement Wall	275.1	0.18	
Exposed wall: GF Wall	26.624	0.18	
Basement floor: Basement Floor	283.7	0.18	
Exposed roof: GF Roof	78.159	0.15	
Exposed roof: Basement Roof	67.64	0.15	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
1, Windows (1)	16.51	West	0.9	1.4
2, Windows (1)	7.69	South	0.9	1.4
3, Windows (1)	16.65	East	0.9	1.4
4, Windows (1)	7.176	North	0.9	1.4
5, Roof windows (1)	7.7	South	0.9	2.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))
Building part 1 - Main Dwelling: SAP default y-value (0.2 W/m ² K) used for thermal bridging

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3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa 8 m³/hm²			
Dwelling air permeability at 50Pa	3 m ³ /hm ² , Design value (!)	OK	
Air permeability test certificate reference Not Provided			

4 Space heating			
Main heating system 1: Heat pump with	radiators or underfloor heating - Electricity		
Efficiency	250.0%		
Emitter type	Underfloor		
Flow temperature			
System type			
Manufacturer			
Model			
Commissioning			
Secondary heating system: N/A			
Fuel	N/A		
Efficiency	N/A		
Commissioning			

5 Hot water			
Cylinder/store - type: Cylinder	Cylinder/store - type: Cylinder		
Capacity	300 litres		
Declared heat loss	1.6 kWh/day		
Primary pipework insulated	Yes		
Manufacturer			
Model			
Commissioning			
Waste water heat recovery system 1 - type: N/A			
Efficiency			
Manufacturer			
Model			

6 Controls		
Main heating 1 - type: Programmer, TR\	/s, and bypass	
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	95 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation				
System type: Balanced whole-house mechanical ventilation with heat recovery				
Maximum permitted specific fan power	1.5 W/(l/s)			
Specific fan power	0.53 W/(l/s)	OK		
Minimum permitted heat recovery	73%			
efficiency				
Heat recovery efficiency	90%	OK		
Manufacturer/Model				
Commissioning	Not Provided / Not Provided			

9 Local generation N/A

10 Heat networks N/A

11 Supporting documentary evidence N/A

12 Declai	rations				
a. Ass	a. Assessor Declaration				
This de	eclaration by the assessor is confirmation that the co	entents of this BREL Compliance Repo	ort		
	rue and accurate reflection based upon the design in				
	rpose of carrying out the "As designed" assessment,				
	ce (SAP Conventions, Appendix 1 (documentary ev				
docum	entary evidence required) has been reviewed in the	course of preparing this BREL			
Compl	lance Report.				
Signed:		Assessor ID:			
l					
Name:		Date:			
b. Client Declaration					
N/A					



Dwelling Reference:

Refurb

Dwelling Type: New Dwelling Design Stage

NW3 5RX

1. Overall dwelling dimensions

	Area(m²)	Av. Height(m)		Volume(m³)	
Ground Floor	170.3 (1a)	x 2.98	(2a) =	507.49	(3a)
First Floor	168.6 (1b)	x 3	(2b) =	505.8	(3b)
2nd Floor	107.2 (1c)	x 4.6	(2c) =	493.12	(3c)
Total floor area TFA				446.1	(4)
Dwelling volume				1506.41	(5)

2. Ventilation Rate					
Chimneys/Flues	0	x 80 =		0	(6a)
Open chimneys	0	x 20 =		0	(6b)
Chimneys / flues attached to closed fire	0	x 10 =		0	(6c)
Flues attached to solid fuel boiler	0	x 20 =		0	(6d)
Flues attached to other heater	0	x 35 =		0	(6e)
Number of blocked chimneys	0	x 20 =		0	(6f)
Number of intermittent extract fans	6	x 10 =		60	(7a)
Number of passive vents	0	x 10 =		0	(7b)
Number of flueless gas fires	0	x 40 =		0	(7c)
		Air changes	per hour		
Number of storeys in the dwelling (ns)			0.04	0.04	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc			0	0	(9)
Additional infiltration			0	0	(10)
Structural infiltration			0	0	(11)
Suspended wooden ground floor No draught lobby			0	0	(12)
Percentage of windows and doors draught proofed			0	0	(13) (14)
Window infiltration			0	0	(14)
Infiltration rate			0	0	(16)
Air permeability value, AP50, (m³/h/m²)			10	10	(17)
Air permeability value, AP4, (m³/h/m²)			0	0	(17a)
Air permeability value)			0.54	0.54	(18)
Number of sides on which dwelling is sheltered Shelter factor			0	0	(19)
SHELLEL LACTOL				1	(20)



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		•	iting shelt for montl										0.54	(21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(22)
Month	ly average	e wind sp	eed from	Table U	2									
Wind F	5.1 actor	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Adjuste	1.28 ed infiltra	1.25 tion rate	1.23 (allowing	1.1 for shelt	1.08 er and w	0.95 ind spee	0.95 d)	0.93	1	1.08	1.13	1.18	13.13	(22a)
Calcula	0.69 te effecti	0.67 ve air cha	0.66 ange rate	0.59 for the a	0.58 pplicable	0.51 case:	0.51	0.5	0.54	0.58	0.61	0.63	7.09	(22b)
a) If ba	lanced m	echanical	ventilatio	on with h	neat reco	very (MV	/HR)						0 0 0	(23a) (23b) (23c)
b) If ba	0 lanced m	0 echanical	0 I ventilatio	0 on witho	0 ut heat r	0 ecovery (0 (MV)	0	0	0	0	0		(24a)
c) If wh	0 iole house	0 e extract	0 ventilatio	0 n or pos	0 itive inpu	0 t ventilat	0 tion from	0 outside	0	0	0	0		(24b)
d) If na	0 tural vent	0 tilation o	0 r whole h	0 ouse pos	0 itive inpu	0 ıt ventila	0 tion from	0 n loft	0	0	0	0		(24c)
Effectiv	0.74 ve air chai	0.73 nge rate	0.72	0.68	0.67	0.63	0.63	0.62	0.65	0.67	0.68	0.7		(24d)
Effectiv	0.74 ve air chai	0.73 nge rate f	0.72 from PCD	0.68 B:	0.67	0.63	0.63	0.62	0.65	0.67	0.68	0.7		(25)
	0.74	0.73	0.72	0.68	0.67	0.63	0.63	0.62	0.65	0.67	0.68	0.7		(25)

3. Heat losses and heat loss parameter

Items in the table below are to be expanded as ne	cessary to allow for all different types of eleme	nt e.g. 4 wall types. The k -value	
ELEMENT	A X U (W/K)	A X k kJ/K	
Doors	4.65	(2	26)
Windows	176.08	(2	27)
Roof window	55.4	(2	27a)
Basement floor	0	0 (2	28)
Ground floor	7.66	340.4 (2	28a)
Exposed floor	0	0 (2	28b)
Basement wall	0	0 (2	29)
External wall	91.14	48524.1 (2	29a)
Roof	74.25	2740.23 (3	30)



Page 2



Total	area of exte	rnal elen	nents ∑A,	m²									670.61	(31)
Party	Wall							0					0	(32)
Party	floor												0	(32a)
Party	ceiling												0	(32b)
Inter	nal wall **												0	(33c)
Inter	nal floor												0	(32d)
Inter	nal ceiling flo	oor											0	(32e)
Fabri	c heat loss, \	$N/K = \sum (x^2)^2$	A x U)										409.18	(33)
Heat	capacity Cm	= ∑(A x k	:)										51604.73	(34)
Theri	mal mass pai	rameter (TMP = Cr	m ÷ TFA)	in kJ/m²K								250	(35)
Linea	r Thermal bi	ridges: ∑	(L x Ѱ) ca	lculated	using App	oendix K							0	(36)
Point	Thermal bri	dges: ∑χ	(W/K) if s	ignifican	t point th	ermal br	idge pres	ent and v	values av	ailable			0	(36a)
Total	fabric heat l	loss H = ∑	((A × U) +	$\Sigma(L\times\Psi)$	+∑χ								409.18	(37)
Vent	lation heat l	oss calcu	lated moi	nthly										
Heat	366.31 transfer coe		357.25 N/K	336.2	332.26	313.93	313.93	310.53	320.99	332.26	340.23	348.56		(38)
Heat	775.49 loss parame			745.38	741.44	723.11	723.11	719.71	730.17	741.44	749.41	757.74		(39)
Num	1.74 ber of days i	1.73 n month	1.72 (Table 1a	1.67)	1.66	1.62	1.62	1.61	1.64	1.66	1.68	1.7		(40)
	31	28	31	30	31	30	31	31	30	31	30	31		(41)
	31	20	21	30	J I	50								
	31	20	21	30	31	30	31	31	30	-		31		,
	31	20	31	30	31	30	31	31	30					
4.	Water heat						J1	<u></u>						
4.						30	31	31						
		ing ener				30	31	31					3.32	(42)
Assui	Water heat	ing ener	gy requi	irement									3.32	
Assur Hot v	Water heat	ing ener ncy, N in litres p	rgy requi er day for 0	irement r mixer sl 0	howers, \	/d,showe	r (from A			0	0	0	3.32	
Assur Hot v	Water heat med occupai vater usage i 0 vater usage i	ing ener ncy, N in litres p 0 in litres p	rgy requi er day for 0 er day for	r mixer sl 0 r baths, \	howers, \ 0 /d,bath (f	/d,showe 0 from App	er (from A O endix J)	appendix 0) J)	0	0	0	3.32	(42) (42a)
Assur Hot v	Water heat med occupar vater usage 0 vater usage 92.22 vater usage	ing ener ncy, N in litres p 0 in litres p 90.85 in litres p	er day for 0 er day for 88.92 er day for	r mixer sl 0 r baths, \ 85.36 r other u	howers, \ 0 /d,bath (f 82.7 ses, Vd,ot	/d,showe 0 From App 79.75 ther (fror	er (from A 0 endix J) 78.15 m Append	appendix 0 80.07 dix J)	J) 0 82.15	0 85.31	0 88.94	0 91.91	3.32	(42) (42a) (42b)
Assur Hot v Hot v	Water heat med occupai vater usage 0 vater usage 92.22 vater usage	ing ener ncy, N in litres p 0 in litres p 90.85 in litres p 46.88	er day for 0 er day for 88.92 er day for 45.11	r mixer sl 0 r baths, \ 85.36 r other us	howers, \ 0 /d,bath (f 82.7 ses, Vd,ot 41.57	/d,showe 0 from App 79.75 ther (fror 39.8	er (from A 0 endix J) 78.15 m Append 39.8	appendix 0 80.07 dix J) 41.57	J) 0 82.15	0 85.31	0 88.94	0		(42) (42a) (42b) (42c)
Assur Hot v Hot v Annu	water heat med occupal vater usage 0 vater usage 92.22 vater usage 48.65 al average h	cing ener ncy, N in litres p 0 in litres p 90.85 in litres p 46.88 ot water	er day for 0 er day for 88.92 er day for 45.11 usage in	r mixer sl 0 r baths, \ 85.36 r other u: 43.34 litres per	howers, \ 0 /d,bath (f 82.7 ses, Vd,o 41.57 r day Vd,a	/d,showe 0 rom App 79.75 ther (fror 39.8 verage (f	or (from A 0 endix J) 78.15 m Append 39.8 From App	appendix 0 80.07 dix J) 41.57 endix J)	J) 0 82.15	0 85.31	0 88.94	0 91.91	3.32	(42) (42a) (42b)
Assur Hot v Hot v Annu	water heat med occupai vater usage 0 vater usage 48.65 al average h	ing ener ncy, N in litres p 0 in litres p 90.85 in litres p 46.88 ot water in litres p	er day for 0 er day for 88.92 er day for 45.11 usage in er day for	r mixer sl 0 r baths, N 85.36 r other us 43.34 litres per r each me	howers, \ 0 /d,bath (f 82.7 ses, Vd,ot 41.57 day Vd,a onth Vd,r	/d,showe 0 from App 79.75 ther (fror 39.8 overage (f m = (42a)	or (from A 0 endix J) 78.15 m Append 39.8 From App + (42b) +	80.07 dix J) 41.57 endix J)	J) 0 82.15 43.34	0 85.31 45.11	0 88.94 46.88	0 91.91 48.65	129.73	(42) (42a) (42b) (42c) (43)
Assur Hot v Hot v Annu Hot v	water heat med occupai vater usage 0 vater usage 48.65 al average h	ing ener oncy, N in litres p on litres p 90.85 in litres p 46.88 ot water in litres p 137.73	er day for 0 er day for 88.92 er day for 45.11 usage in er day for 134.03	r mixer sl 0 r baths, N 85.36 r other us 43.34 litres per r each me	howers, \ 0 /d,bath (f 82.7 ses, Vd,or 41.57 day Vd,a onth Vd,r 124.27	/d,showe 0 79.75 ther (fror 39.8 overage (1 m = (42a)	or (from A 0 endix J) 78.15 in Append 39.8 From App + (42b) +	80.07 dix J) 41.57 endix J) - (42c) 121.64	J) 0 82.15 43.34	0 85.31 45.11	0 88.94 46.88	0 91.91 48.65		(42) (42a) (42b) (42c) (43)
Assur Hot v Hot v Annu Hot v	water heat water usage 0 vater usage 92.22 vater usage 48.65 al average h	cing ener ncy, N in litres p 0 in litres p 90.85 in litres p 46.88 ot water in litres p 137.73 f hot water	er day for 0 er day for 88.92 er day for 45.11 usage in er day for 134.03 er used =	r mixer sl 0 r baths, N 85.36 r other us 43.34 litres per r each me	howers, N 0 /d,bath (f 82.7 ses, Vd,or 41.57 day Vd,a onth Vd,r 124.27 d,m x nm	/d,showe 0 79.75 ther (fror 39.8 overage (1 m = (42a)	or (from A 0 endix J) 78.15 n Append 39.8 from App + (42b) + 117.96 3600 kW	80.07 dix J) 41.57 endix J) - (42c) 121.64	J) 0 82.15 43.34	0 85.31 45.11 130.42 opendix J	0 88.94 46.88	0 91.91 48.65	129.73	(42) (42a) (42b) (42c) (43) (44)
Assur Hot v Hot v Annu Hot v	Water heat med occupat vater usage 92.22 vater usage 48.65 tal average h vater usage 140.87 gy content of	cing ener ncy, N in litres p 0 in litres p 90.85 in litres p 46.88 ot water in litres p 137.73 f hot water	er day for 0 er day for 88.92 er day for 45.11 usage in er day for 134.03 er used =	r mixer sl 0 r baths, N 85.36 r other us 43.34 litres per r each most	howers, N 0 /d,bath (f 82.7 ses, Vd,or 41.57 day Vd,a onth Vd,r 124.27 d,m x nm	/d,showe 0 79.75 ther (fror 39.8 overage (1 n = (42a) 119.55 x DTm /	or (from A 0 endix J) 78.15 n Append 39.8 from App + (42b) + 117.96 3600 kW	80.07 dix J) 41.57 endix J) - (42c) 121.64	J) 0 82.15 43.34 125.5 (from Ap	0 85.31 45.11 130.42 opendix J	0 88.94 46.88	0 91.91 48.65 140.56	129.73 1557.05	(42) (42a) (42b) (42c) (43) (44)
Assur Hot v Hot v Annu Hot v Energ Distri	water heat med occupat vater usage 92.22 vater usage 48.65 tal average h vater usage 140.87 gy content of 223.1 bution loss (33.46 tal average (cing ener ncy, N in litres p 0 in litres p 90.85 in litres p 46.88 ot water in litres p 137.73 f hot water 196.12 46) = 0.1 29.42 litres) inc	er day for o er day for 88.92 er day for 45.11 usage in er day for 134.03 er used = 206 5 x (45) 30.9 luding an	r mixer sl 0 r baths, V 85.36 r other us 43.34 litres per r each months 128.71 4.18 x V 176.19	howers, N 0 /d,bath (f 82.7 ses, Vd,ot 41.57 day Vd,a onth Vd,r 124.27 d,m x nm 167.3	/d,showe 0 79.75 ther (fror 39.8 overage (1 m = (42a) 119.55 x DTm / 147	or (from A 0 endix J) 78.15 m Append 39.8 From App + (42b) + 117.96 3600 kW 142.66	80.07 dix J) 41.57 rendix J) + (42c) 121.64 rh/month 150.62	J) 0 82.15 43.34 125.5 (from Ap 154.75	0 85.31 45.11 130.42 opendix J 176.98	0 88.94 46.88 135.82)	0 91.91 48.65 140.56 220.08	129.73 1557.05	(42) (42a) (42b) (42c) (43) (44) (45)
Assur Hot v Hot v Annu Hot v Energ Distri	water heat med occupat vater usage 0 vater usage 92.22 vater usage 48.65 tal average h vater usage 140.87 gy content of 223.1 bution loss (33.46	ing ener ocy, N in litres p 0 in litres p 90.85 in litres p 46.88 ot water in litres p 137.73 f hot water 196.12 (46) = 0.1 29.42 litres) inc	er day for 0 er day for 88.92 er day for 45.11 usage in er day for 134.03 er used = 206 5 x (45) 30.9 luding an loss)	r mixer sl 0 r baths, V 85.36 r other u: 43.34 litres per r each mo 128.71 4.18 x V 176.19 26.43 y solar of	howers, N 0 /d,bath (f 82.7 ses, Vd,or 41.57 day Vd,a onth Vd,r 124.27 d,m x nm 167.3 25.09 r WWHRS	/d,showe 0 79.75 ther (fron 39.8 average (fon 119.55 x DTm / 147 22.05 S storage	or (from A 0 endix J) 78.15 m Append 39.8 From App + (42b) + 117.96 3600 kW 142.66	80.07 dix J) 41.57 rendix J) + (42c) 121.64 rh/month 150.62	J) 0 82.15 43.34 125.5 (from Ap 154.75	0 85.31 45.11 130.42 opendix J 176.98	0 88.94 46.88 135.82)	0 91.91 48.65 140.56 220.08	129.73 1557.05 2154.3	(42) (42a) (42b) (42c) (43) (44) (45) (46)



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Temperature factor from Table 2b	0	(49)
Energy lost from water storage, kWh/day (48) x (49) =	0	(50)
b) If manufacturer's declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
Volume factor from Table 2a	0	(52)
Temperature factor from Table 2b	0	(53)
Energy lost from water storage, kWh/day	0	(54)
Enter (50) or (54) in (55)	0	(55)
Water storage (or HIU) loss calculated for each month (56) = (55) \times (41)		
0 0 0 0 0 0 0 0 0 0		(56)
If the vessel contains dedicated solar storage or dedicated WWHRS storage,		
(57)m = (56)m ② [(47) − Vs] ÷ (47), else (57)m = (56)m		
where Vs is Vww from Appendix G3 or (H12) from Appendix H (as applicable).		
0 0 0 0 0 0 0 0 0 0		(57)
Primary circuit loss for each month from Table 3		
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only he	eat netwo	rks)
0 0 0 0 0 0 0 0 0 0		(59)
Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)		
50.96 46.03 50.96 49.32 50.96 49.32 50.96 50.96 49.32 50.96 49.32 50.96		(61)
Total heat required for water heating calculated for each month (62) = $0.85 \times (45) + (46) + (57) + (59) + (61)$		
274.06 242.15 256.96 225.51 218.26 196.32 193.62 201.58 204.06 227.94 242.82 271.03	2754.3	(62)
CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heati	ng)	
0 0 0 0 0 0 0 0 0 0 0		(63a)
PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)		
0 0 0 0 0 0 0 0 0 0		(63b)
Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0		(63c)
FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heating)		
0 0 0 0 0 0 0 0 0 0		(63d)
Output from water heater for each month, $kWh/month$ (64) = (62) + (63a) + (63b) + (63c) + (63d)		
274.06 242.15 256.96 225.51 218.26 196.32 193.62 201.58 204.06 227.94 242.82 271.03	2754.3	(64)
Output from water heater for each month, $kWh/month$ (64) = (62) + (63a) + (63b) + (63c) + (63d)		
0 0 0 0 0 0 0 0 0 0		(64a)
Heat gains from water heating, kWh/month 0.25 x $[0.85 \times (45) + (61) + (64a)] + 0.8 \times [(46) + (57) + (59)]$		
86.92 76.72 81.23 70.91 68.37 61.21 60.17 62.82 63.78 71.59 76.67 85.91		(65)
include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network		
5. Internal gains (see Tables 5 and 5a)		

Metabolic gains (Table 5), watts

199.31 199.31 199.31 199.31 199.31 199.31 199.31 199.31 199.31 199.31 199.31 199.31 (66)



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Lighting	gains (cal	culated i	n Append	lix L, equ	ation L12	or L12a)	, also see	Table 5						
Appliand	75.98 ces gains (67.49 (calculate	54.89 d in Appe	41.55 endix L, e	31.06 quation l	26.22 _16 or L10		36.83 see Table		62.77	73.26	78.1		(67)
Cooking	847.86 gains (ca	856.65 Iculated i				671.71 or L18a)		625.5 Table 5	647.67	694.87	754.45	810.45		(68)
Pumps a	58.25 and fans g	58.25 ains (Tab		58.25	58.25	58.25	58.25	58.25	58.25	58.25	58.25	58.25		(69)
Losses e	7 .g. evapo	7 ration (ne	7 egative va	7 alues) (Ta	7 ble 5	0	0	0	0	7	7	7		(70)
Water h	-132.87 eating gai	-132.87 ins (Table		-132.87	-132.87	-132.87	-132.87	-132.87	-132.87	-132.87	-132.87	-132.87		(71)
Total int	116.83 ernal gair	114.16 ns	109.19	98.49	91.89	85.01	80.88	84.44	88.59	96.22	106.48	115.48		(72)
	1172.36	5 1170	1130.25	1059.02	982.34	907.63	868.2	871.45	910.38	985.54	1065.88	1135.71		(73)
6. Sol	ar gains													
Solar gai	ins in wat	ts calcula	ated for e	each mon	th									
		1328.96	2211.95	3290.52		4242.72	4023.54	3402.63	2591.11	1581.41	845.71	558.12		(83)
Total Sai			•		5090.27	5150.35	4891.74	4274.08	3501.49	2566.96	1911.59	1693.83		(84)
7 Ma	ean inter	nal tomr	oraturo	/hoating	T coacan	١								
/. IVIE	ean inter	пат септ	Derature	(Heating	g season	,								
· ·	ature duri on factor	_			_		ble 9, Th1	L (°C)					21	(85)
Mean in	1 ternal ter	1 nperatur	0.99 e in living	0.97 area T1	0.89 (follow st	0.75 teps 3 and	0.6 d 4 in Tak	0.68 ole 9c)	0.91	0.99	1	1		(86)
Tempera	18.59 ature duri	18.84 ing heatir							20.59	19.86	19.14	18.59		(87)
Roof	19.51	19.52	19.53		19.57	19.6	19.6	19.6	19.59	19.57	19.56	19.54		(88)
11001	1	1	0.99	0.95	Itilisation 0.84	0.64	0.43	0.52	0.84	0.98	1	9a) 1		(89)
Roof	_	-	0.55	0.55					the rest			-		()
Living ar	17.35 ea fractio	17.61 on	18.07	18.73	19.23	19.52	19.59	19.58	19.35	18.66	17.93	17.37	0.11	(90) (91)
Mean in	ternal ter	nperatur	e (for the		o.									
Adjusted	17.5 d mean in	17.75 ternal ter	18.21 mperatur	18.86 e:	19.37	19.67	19.74	19.73	19.49	18.8	18.07	17.51		(92)

8. Space heating requirement



Page 5



r rette e	C	C												
Utilisa	tion factor													(0.1)
Usefu	1 I gains, mGr	1 m,W	0.98	0.94	0.83	0.64	0.45	0.53	0.84	0.98	1	1		(94)
Month	1847.8 nly average	2487.17 external t					2206.89	2279.01	2930.04	2509.29	1905.45	1692		(95)
Heat l	4.3 oss rate for	4.9 mean into	6.5 ernal tem	8.9 nperature	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Space	10232.8 heating red	319908.23 quirement			5687.17	3668.33	2271.64	2398.8	3939.01	6078.77	8217.8	10086.18		(97)
Solar	6238.45 space heatii	5 4986.95 ng calcula					0 ntity)	0	0	2655.69	4544.89	6245.27		(98a)
Space	0 heating red	0 quirement	0 for each	0 month a	0 Ifter solar	0 contribu	0 Ition	0	0	0	0	0		(98b)
Space	6238.45 heating red	5 4986.95 quirement			1078.52	0	0	0	0	2655.69	4544.89	6245.27	72.6	(98c) (99)
_														
8c.	Space Coo	ling requ	iirement											
Heat l	oss rate,													
Utilisa	0 tion factor	0 for loss	0	0	0	0	0	0	0	0	0	0		(100)
Usefu	0 I loss, mLm	0 (watts)	0	0	0	0	0	0	0	0	0	0		(101)
Gains	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Space	0 cooling req	0 uirement	0 for mont	0 th, whole	0 dwelling	0 , continu	0 ous (kWł	0 n)	0	0	0	0		(103) (104)
·	0	0	0	0	0	0	0	0	0	0	0	0		(104)
	d fraction nittency fac	tor											0	(105)
Space	0 cooling req	0 uirement	0 for mont	0 th	0	0	0	0 0	0	0	0	0	0	(106)
Space	0 cooling req	0 uirement	0 in kWh/i	0 m²/year	0	0	0	0	0	0	0	0	0	(107) (108)
														_ 3 - 7
8f.	Space hea [.]	ting requ	irement											
Fabric	Energy Effi	ciency,						0					0	(109)

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



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Fraction of space heat from secondary/supplementary system, 0		0	(201)
Fraction of space heat from main system(s),		1	(202)
Fraction of main heating from main system 2,		0	(203)
Fraction of total space heat from main system 1,		1	(204)
Fraction of total space heat from main system 2,		0	(205)
Efficiency of main space heating system 1 (in %),		80	(206)
Efficiency of main space heating system 2 (in %),		0	(207)
Efficiency of secondary/supplementary heating system, %,		0	(208)
Cooling System Seasonal Energy Efficiency Ratio, 0		0	(209)
Space heating requirement (calculated above),			
	0 0		(210)
Space heating fuel (main heating system 1), kWh/month 0		0	
	5681.11 7806.59		(211)
Space heating fuel (main heating system 2), kWh/month 0		0	
	0 0		(213)
Space heating fuel (secondary), kWh/month 0		0	
	0 0		(215)
Output from water heater), 0		85	(216)
Efficiency of water heater			
	85 85		(217)
Fuel for water heating			(2.1.0)
322.42 284.88 302.3 265.3 256.77 230.96 227.79 237.15 240.08 268.17 Space Cooling	285.67 318.86	3240.35	(219)
	0 0		(221)
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Annual totals	0 0		(221)
Space heating fuel used, main system 1		40482.69	(211)
Space heating fuel used, main system 2		0	(211)
Space heating fuel used, secondary		0	(215)
Water heating fuel used		3240.35	(219)
Electricity for instantaneous electric shower(s)		0	(64a)
Space cooling fuel used		0	(221)
Electricity for pumps, fans and electric keep-hot		_	(/
Mechanical vent fans - balanced, extract or positive input from outside 0 0		0	(230a)
warm air heating system fans		0	(230b)
Heating circulation pump or water pump within warm air heating unit		149.5	(230c)
Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump)		0	(230d)
Gas boiler auxiliary (flue fan, etc; excludes circulation pump)		0	(230e)
Maintaining electric keep-hot facility for gas combi boiler		0	(230f)
Pump for solar water heating		0	(230g)
Pump for storage WWHRS		0	(230h)
Total electricity for the above		149.5	(231)
Electricity for lighting		536.76	(232)



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Energ	y saving/g	generatio	n techno	logies (A	ppendice	es M, N) -	Energy ι	used in dv	velling					
Electr	icity gene	rated by	PVs (App	endix M) (negativ	e quantit	ty)							
	0	0	0	0	0	0	0	0	0	0	0	0	0	(233a)
Electr	icity gene	rated by	wind tur	bines (Ap	pendix N	И) (negat	ive quan	tity)						
	0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)
Electr	icity gene	rated by	hydro-el	ectric ger	nerators									
FI .	0	0	0	0	0 .	0	0	0	0	0	0	0	0	(235a)
Electr	icity used			generate	a by mic									
Enorg	0 coving/a	0	0	0	0 nnondice	0	0 Enorgy o	0	0	0	0	0	0	(235c)
	y saving/g icity gene							exported						
Liecti	icity gene		r vs (App	enuix ivi,) (Hegativ			0	0	0	0		0	(2226)
Flectr	icity gene	0 rated by	wind tur	U bines (Ar	U ppendix N	0 ∕I) (negati	0 ive guant	0 titv)	0	0	0	0	0	(233b)
Licoti	0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)
Electr	icity gene	_	_	ectric ger	•	U	U	U	U	U	U	U	U	(2340)
	0	0	, 0	0	0	0	0	0	0	0	0	0	0	(235b)
Electr	icity used	•	Ū	generate	Ū	•	Ü	Ü	Ü	Ü	Ü	Ü	Ü	(,
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)
Appei	ndix Q iter	ns: annu	al energy	/										
Appei	ndix Q, <it< td=""><td>em 1 des</td><td>scription></td><td>></td><td></td><td></td><td></td><td>Fue</td><td>el</td><td>kWh/yea</td><td>ır</td><td></td><td></td><td></td></it<>	em 1 des	scription>	>				Fue	el	kWh/yea	ır			
energ	y saved												0	(236a)
	y used												0	(237a)
Total	delivered	energy f	or all use	S									44409.3	

10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	kWh/year	Fuel price	Fuel cost £/yea	ır
Space heating - main system 1 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		1473.57	(240a)
Low-rate fraction	0		1473.57	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		1473.57	(241a)
Low-rate fraction	0		1473.57	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		1473.57	(242a)



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Low-rate fraction	0		1473.57	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Space heating - secondary cost (other fuel)	0		0	(242e)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		0	(243)
Low-rate fraction	0		0	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Water heating cost (other fuel)	0		117.95	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (247)			
Energy For instantaneous electric shower(s)	0		0	(247a)
Space cooling	0		0	(248)
Pumps, fans And electric keep-hot	0		24.65	(249)
Energy For lighting	0		88.51	(250)
Additional standing charges	0		92	(251)
Energy saving/generation technologies	0		0	(252)
Appendix Q, <item 1="" description=""></item>	Fuel	kWh/year		
energy saved Or generated	0		0	(253)
energy used	0		0	(254)
Total energy cost	0		1796.68	(255)
11a. SAP rating – Individual heating systems including micro-CHP				
Energy cost deflator	0		0	(256)
Energy cost factor (ECF)	0		0	(257)
SAP rating	0		0	(258)

11a. SAP rating – Individual heating systems including micro-CHP		
Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	1.32	(257)
SAP rating	78.65	(258)
12a. CO2 emissions – Individual heating systems including micro-CHP		

Energy	Emission factor	Emissions	
KWh/year	kg	kg CO2/year	
Space heating - main system 1		8501.36	(261)
Space heating - main system 2		0	(262)
Space heating - secondary		0	(263)
Energy for water heating		456.65	(264)
Energy for instantaneous electric shower(s)		0	(264a)



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Space and water heating		0	(265)
Space cooling		0	(266)
Electricity for pumps, fans and electric keep		20.74	(267)
Electricity for lighting		77.47	(268)
energy saved or generated	0	0	(269b)
Appendix Q items			
energy saved	0	0	
energy used	0	0	
energy saved	0	0	(270b)
energy used		0	(271b)
Total CO2, kg/year		9056.22	(272)
Dwelling CO2 Emission Rate		20.3	(273)
El rating		75	(274)

13a. Primary Energy – Individual heating systems including micro-CHP

	Energy E	Emission factor	Emissionsr	
	KWh/year	kg	kg CO2/year	
Space heating - main system 1			45745.43	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			4928.89	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			0	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			226.16	(281)
Electricity for lighting			823.31	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			51723.8	(286)
Dwelling PE Rate			115.95	(287)



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Dwelling Reference:

New Dwelling Design Stage Dwelling Type:

Refurb

NW3 5RX

1. Overall dwelling dimensions

	Area(m²)	Av. Height(m)		Volume(m³)	
Ground Floor First Floor	·	1a) x 2.98 1b) x 3	(2a) = (2b) =	507.49 505.8	(3a) (3b)
2nd Floor Total floor area TFA Dwelling volume	•	1c) x 4.6	(2c) =	493.12 446.1 1506.41	(3c) (4) (5)

2. Ventilation Rate					
Chimneys/Flues	0	x 80 =		0	(6a)
Open chimneys	0	x 20 =		0	(6b)
Chimneys / flues attached to closed fire	0	x 10 =		0	(6c)
Flues attached to solid fuel boiler	0	x 20 =		0	(6d)
Flues attached to other heater	0	x 35 =		0	(6e)
Number of blocked chimneys	0	x 20 =		0	(6f)
Number of intermittent extract fans	6	x 10 =		60	(7a)
Number of passive vents	0	x 10 =		0	(7b)
Number of flueless gas fires	0	x 40 =		0	(7c)
		Air changes	per hour		` '
Number of storeys in the dwelling (ns)			0.04	0.04	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc			0	0	(9)
Additional infiltration			0	0	(10)
Structural infiltration			0	0	(11)
Suspended wooden ground floor			0	0	(12)
No draught lobby			0	0	(13)
Percentage of windows and doors draught proofed			0	0	(14)
Window infiltration			0	0	(15)
Infiltration rate			0	0	(16)
Air permeability value, AP50, (m³/h/m²)			8	8	(17)
Air parmaahility value APA $(m^3/h/m^2)$			0	0	(47-)



Air permeability value)

Shelter factor

Air permeability value, AP50, (m³/h/m²) Air permeability value, AP4, (m³/h/m²)

Number of sides on which dwelling is sheltered

Page 1

0

0.44

0

1

(17a)

(18)

(19)

(20)

0

0.44

0



	ion rate i	-	_										0.44	(21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(22)
Monthl	y average	wind sp	eed from	Table U	2									
Wind F	5.1 actor	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Adjuste	1.28 ed infiltra	1.25 tion rate	1.23 (allowing	1.1 for shelt	1.08 er and w	0.95 ind spee	0.95 d)	0.93	1	1.08	1.13	1.18	13.13	(22a)
Calcula	0.56 te effecti	0.55 ve air cha	0.54 ange rate	0.48 for the a	0.47 pplicable	0.42 case:	0.42	0.41	0.44	0.47	0.49	0.52	5.77	(22b)
a) If bal	anced mo	echanical	ventilati	on with h	neat reco	very (MV	/HR)						0 0 0	(23a) (23b) (23c)
b) If ba	0 lanced m	0 echanica	0 I ventilati	0 on witho	0 ut heat r	0 ecovery (0 (MV)	0	0	0	0	0		(24a)
c) If wh	0 ole house	0 e extract	0 ventilatio	0 on or pos	0 itive inpu	0 t ventila	0 tion from	0 outside	0	0	0	0		(24b)
d) If na	0 tural vent	0 ilation o	0 r whole h	0 ouse pos	0 itive inpu	0 ut ventila	0 tion from	0 n loft	0	0	0	0		(24c)
Effectiv	0.66 e air chai	0.65 nge rate	0.65	0.62	0.61	0.59	0.59	0.58	0.6	0.61	0.62	0.63		(24d)
Effectiv	0.66 e air chai	0.65 nge rate f	0.65 from PCD	0.62 B:	0.61	0.59	0.59	0.58	0.6	0.61	0.62	0.63		(25)
	0.66	0.65	0.65	0.62	0.61	0.59	0.59	0.58	0.6	0.61	0.62	0.63		(25)

3. Heat losses and heat loss parameter

Items in the table below are to be expanded as ne	ecessary to allow for all different types of eleme	nt e.g. 4 wall types. The k -value	
ELEMENT	A X U (W/K)	A X k kJ/K	
Doors	4.65		(26)
Windows	169.52		(27)
Roof window	24.37		(27a)
Basement floor	0	0	(28)
Ground floor	7.66	340.4	(28a)
Exposed floor	0	0	(28b)
Basement wall	0	0	(29)
External wall	69.02	48032	(29a)
Roof	50.06	2832.21	(30)



Page 2



Total are Party W	a of exte													
Party W	ca or cate	rnai eiem	ients ∑A,	m²									670.61	(31)
	all							0					0	(32)
Party flo	or												0	(32a)
Party ce	iling												0	(32b)
Internal	wall **												0	(33c)
Internal	floor												0	(32d)
Internal	ceiling flo	oor											0	(32e)
Fabric h	eat loss, \	$N/K = \sum (A$	4 x U)										325.28	(33)
Heat cap	oacity Cm	= ∑(A x k)										51204.61	(34)
Thermal	mass pai	rameter (⁻	TMP = Cr	n ÷ TFA)	in kJ/m²K	(250	(35)
		ridges:∑(0	(36)
		dges: ∑χ (_	•	ermal bri	idge pres	ent and v	values av	ailable			0	(36a)
		oss H = ∑			+∑χ								325.28	(37)
Ventilati	ion heat l	oss calcul	ated moi	nthly										
Heat tra		323.69 fficient, V		306.74	304.12	291.95	291.95	289.7	296.64	304.12	309.41	314.94		(38)
Heat los	652 s parame	648.97 ter (HLP),	645.99 W/m²K	632.02	629.4	617.23	617.23	614.98	621.92	629.4	634.69	640.22		(39)
	1.46	1.45	1.45	1.42	1.41	1.38	1.38	1.38	1.39	1.41	1.42	1.44		(40)
Number	of days i	n month ((Table 1a)										
	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ener	gy requi	rement										
			gy requi	rement									3 32	(42)
Assume	d occupar	ncy, N			nowers, \	/d,showe	r (from A	Appendix	٦)				3.32	(42)
Assume	d occupar	ncy, N in litres pe			nowers, \	/d,showe	r (from A			0	0	0	3.32	
Assumed Hot wate	d occupar er usage i 0	ncy, N	er day foi	r mixer sl 0	0	0	0	Appendix 0	0 1)	0	0	0	3.32	(42) (42a)
Assumed Hot wate	d occupar er usage i 0	ncy, N in litres po O in litres po	er day foi 0 er day foi	r mixer sl 0 r baths, \	0 /d,bath (f	0 rom App	0 endix J)		0				3.32	(42a)
Assumed Hot wate	d occupar er usage i 0 er usage i 92.22	ncy, N in litres po	er day for 0 er day for 88.92	r mixer sl 0 r baths, V 85.36	0 /d,bath (f 82.7	0 rom App 79.75	0 endix J) 78.15	0 80.07		0 85.31	0 88.94	0 91.91	3.32	
Assumed Hot wate	d occupar er usage i 0 er usage i 92.22 er usage i	ncy, N in litres po 0 in litres po 90.85 in litres po	er day for 0 er day for 88.92 er day for	r mixer sl 0 r baths, V 85.36 r other us	0 /d,bath (f 82.7 ses, Vd,o	0 rom App 79.75 ther (fror	0 endix J) 78.15 n Append	0 80.07 dix J)	0 82.15	85.31	88.94	91.91	3.32	(42a) (42b)
Assumed Hot water Hot water Hot water	d occupar er usage i 0 er usage i 92.22 er usage i 48.65	ncy, N in litres po 0 in litres po 90.85	er day for 0 er day for 88.92 er day for 45.11	r mixer sl 0 r baths, V 85.36 r other us	0 /d,bath (f 82.7 ses, Vd,o [.] 41.57	0 from App 79.75 ther (fror 39.8	0 endix J) 78.15 n Append 39.8	0 80.07 dix J) 41.57	0 82.15	85.31			3.32	(42a)
Assumed Hot wate Hot wate Annual a	d occupar er usage i 0 er usage i 92.22 er usage i 48.65 average h	ncy, N in litres po 0 in litres po 90.85 in litres po 46.88	er day for 0 er day for 88.92 er day for 45.11 usage in	r mixer sl 0 r baths, V 85.36 r other us 43.34 litres per	0 /d,bath (f 82.7 ses, Vd,o 41.57 day Vd,a	0 79.75 ther (fror 39.8 average (f	0 endix J) 78.15 m Append 39.8 From App	0 80.07 dix J) 41.57 eendix J)	0 82.15	85.31	88.94	91.91		(42a) (42b) (42c)
Assumed Hot wate Hot wate Annual a	d occupar er usage i 0 er usage i 92.22 er usage i 48.65 average h er usage i	ncy, N in litres po in litres po 90.85 in litres po 46.88 ot water in litres po	er day for 0 er day for 88.92 er day for 45.11 usage in er day for	r mixer sl 0 r baths, V 85.36 r other us 43.34 litres per r each me	0 /d,bath (f 82.7 ses, Vd,o 41.57 day Vd,a onth Vd,r	0 79.75 ther (fron 39.8 average (f m = (42a)	0 endix J) 78.15 n Append 39.8 From App + (42b) +	0 80.07 dix J) 41.57 pendix J)	0 82.15 43.34	85.31 45.11	88.94 46.88	91.91 48.65	129.73	(42a) (42b) (42c) (43)
Assumed Hot wate Hot wate Annual a Hot wate	d occupar er usage i 0 er usage i 92.22 er usage i 48.65 average h er usage i 140.87	ncy, N in litres po o in litres po 90.85 in litres po 46.88 ot water in litres po 137.73 f hot water	er day for 0 er day for 88.92 er day for 45.11 usage in er day for 134.03 er used =	r mixer sl 0 r baths, V 85.36 r other us 43.34 litres per r each mo 128.71 4.18 x Vo	0 /d,bath (f 82.7 ses, Vd,o 41.57 day Vd,a onth Vd,r 124.27 d,m x nm	0 79.75 ther (fron 39.8 average (f m = (42a) 119.55 x DTm /	0 78.15 n Append 39.8 from App + (42b) + 117.96 3600 kW	80.07 dix J) 41.57 pendix J) + (42c) 121.64 'h/month	0 82.15 43.34 125.5 (from Ap	85.31 45.11 130.42 opendix J	88.94 46.88 135.82	91.91 48.65 140.56	129.73 1557.05	(42a) (42b) (42c) (43) (44)
Assumed Hot wate Hot wate Annual a Hot wate Energy of	d occupar er usage i 0 er usage i 92.22 er usage i 48.65 average h er usage i 140.87 content of	ncy, N in litres po 90.85 in litres po 46.88 ot water in litres po 137.73 f hot water 196.12	er day for 0 er day for 88.92 er day for 45.11 usage in er day for 134.03 er used = 206 5 x (45)	r mixer sl 0 r baths, V 85.36 r other us 43.34 litres per r each mo	0 /d,bath (f 82.7 ses, Vd,o 41.57 day Vd,a onth Vd,r 124.27 d,m x nm	0 79.75 ther (fron 39.8 average (f m = (42a) 119.55	0 endix J) 78.15 n Append 39.8 from App + (42b) + 117.96 3600 kW	80.07 dix J) 41.57 pendix J) + (42c) 121.64 'h/month	0 82.15 43.34 125.5 (from Ap	85.31 45.11 130.42	88.94 46.88 135.82	91.91 48.65	129.73	(42a) (42b) (42c) (43) (44) (45)
Assumed Hot wate Hot wate Annual a Hot wate Energy of Distribution	d occupar er usage i 0 er usage i 92.22 er usage i 48.65 average h er usage i 140.87 content of 223.1 tion loss (90.85 in litres po 90.85 in litres po 46.88 ot water in litres po 137.73 f hot water 196.12	er day for 0 er day for 88.92 er day for 45.11 usage in er day for 134.03 er used = 206 5 x (45) 30.9	r mixer sl 0 r baths, V 85.36 r other us 43.34 litres per r each mo 128.71 4.18 x V 176.19	0 /d,bath (f 82.7 ses, Vd,o 41.57 day Vd,a onth Vd,r 124.27 d,m x nm 167.3	79.75 ther (from 39.8 average (fin = (42a) 119.55 x DTm / 147	0 endix J) 78.15 n Append 39.8 from App + (42b) + 117.96 3600 kW 142.66	80.07 dix J) 41.57 pendix J) + (42c) 121.64 th/month 150.62	0 82.15 43.34 125.5 (from A) 154.75 23.21	85.31 45.11 130.42 opendix J	88.94 46.88 135.82	91.91 48.65 140.56	129.73 1557.05 2154.3	(42a) (42b) (42c) (43) (44) (45) (46)
Assumed Hot water Hot water Annual and Hot water Energy of Distributer Storage	d occupar er usage i 0 er usage i 92.22 er usage i 48.65 average h er usage i 140.87 content of 223.1 tion loss (33.46 volume (l	ncy, N in litres po 90.85 in litres po 46.88 ot water in litres po 137.73 f hot wate 196.12 46) = 0.15 29.42 litres) incl	er day for 0 er day for 88.92 er day for 45.11 usage in er day for 134.03 er used = 206 5 x (45) 30.9 luding an	r mixer sl 0 r baths, V 85.36 r other us 43.34 litres per r each mo 128.71 4.18 x V 176.19	0 /d,bath (f 82.7 ses, Vd,o 41.57 day Vd,a onth Vd,r 124.27 d,m x nm 167.3	79.75 ther (from 39.8 average (fin = (42a) 119.55 x DTm / 147	0 endix J) 78.15 n Append 39.8 from App + (42b) + 117.96 3600 kW 142.66	80.07 dix J) 41.57 pendix J) + (42c) 121.64 th/month 150.62	0 82.15 43.34 125.5 (from A) 154.75 23.21	85.31 45.11 130.42 opendix J 176.98	88.94 46.88 135.82)	91.91 48.65 140.56 220.08	129.73 1557.05	(42a) (42b) (42c) (43) (44) (45)
Assumed Hot water Hot water Annual a Hot water Distributer Storage Water st	d occupar er usage i 0 er usage i 92.22 er usage i 48.65 average h er usage i 140.87 content of 223.1 tion loss (33.46 volume (l	90.85 in litres po 90.85 in litres po 46.88 ot water in litres po 137.73 f hot water 196.12	er day for 0 er day for 88.92 er day for 45.11 usage in er day for 134.03 er used = 206 5 x (45) 30.9 luding an loss)	r mixer sl 0 r baths, V 85.36 r other us 43.34 litres per r each mo 128.71 4.18 x Vo 176.19 26.43 y solar of	0 /d,bath (f 82.7 ses, Vd,o 41.57 day Vd,a onth Vd,r 124.27 d,m x nm 167.3 25.09	79.75 ther (from 39.8 everage (fom = (42a) 119.55 x DTm / 147 22.05 S storage	0 endix J) 78.15 n Append 39.8 from App + (42b) + 117.96 3600 kW 142.66	80.07 dix J) 41.57 pendix J) + (42c) 121.64 th/month 150.62	0 82.15 43.34 125.5 (from A) 154.75 23.21	85.31 45.11 130.42 opendix J 176.98	88.94 46.88 135.82)	91.91 48.65 140.56 220.08	129.73 1557.05 2154.3	(42a) (42b) (42c) (43) (44) (45) (46)



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FSAP¹⁰

SAP WORKSHEET

Energy lost from water storage, kWh/day (48) x (49) =	Temperature factor from Table 2b	0	(49)
Signature Sign	Energy lost from water storage, kWh/day (48) x (49) =	0	(50)
Volume factor from Table 2 0	b) If manufacturer's declared loss factor is not known :		
Colume factor from Table 2	Hot water storage loss factor from Table 2 (kWh/litre/day)	0.14	(51)
Finding fost from water storage kWh / day	Volume factor from Table 2a	0	(52)
Companies Comp	Temperature factor from Table 2b	0	(53)
Mater storage (or HIU) loss calculated for each month (56) = (55) × (41)	Energy lost from water storage, kWh/day	0	(54)
Signature	Enter (50) or (54) in (55)	0	(55)
If the vessel contains dedicated solar storage or dedicated WWHRS storage,	Water storage (or HIU) loss calculated for each month (56) = (55) \times (41)		
Combined Combined	If the vessel contains dedicated solar storage or dedicated WWHRS storage, $(57)m = (56)m \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$		(56)
Primary circuit loss for each month from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only heat networks) 128.38 115.95 128.38 124.24 128.38 41.92 43.31 43.31 41.92 128.38 124.24 128.38 (59) Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi bioler) 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			/ >
128.38 135.95 128.38 124.24 128.38 41.92 43.31 43.31 41.92 128.38 124.24 128.38 (59)			(57)
128.38 115.95 128.38 124.24 128.38 41.92 43.31 43.31 41.92 128.38 124.24 128.38 124.24 128.38 (59) (61)		nly hoat not	works)
Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		•	•
Total heat required for water heating calculated for each month (62) = 0.85 × (45) + (46) + (57) + (59) + (61) 351.48 312.08 334.38 300.43 295.67 188.92 185.97 193.93 196.66 305.36 317.74 348.45 3331.07 (62) CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating) PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution) 0			(59)
351.48 312.08 334.38 300.43 295.67 188.92 185.97 193.93 196.66 305.36 317.74 348.45 3331.07 (62) CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating) PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			(61)
CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating) PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Total heat required for water heating calculated for each month (62) = $0.85 \times (45) + (46) + (57) + (59) + (61)$		
PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution) O O O O O O O O O O O O O O O O O O O			.07 (62)
Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating) O O O O O O O O O O O O O O O O O O O			(63a)
Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)		
FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heating) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		l	(63b)
FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heating) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0		(63c)
Output from water heater for each month, kWh/month $(64) = (62) + (63a) + (63b) + (63c) + (63d)$ 351.48 312.08 334.38 300.43 295.67 188.92 185.97 193.93 196.66 305.36 317.74 348.45 3331.07 (64) Output from water heater for each month, kWh/month $(64) = (62) + (63a) + (63b) + (63c) + (63d)$ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heat	ing)	, ,
351.48 312.08 334.38 300.43 295.67 188.92 185.97 193.93 196.66 305.36 317.74 348.45 Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			(63d)
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	351.48 312.08 334.38 300.43 295.67 188.92 185.97 193.93 196.66 305.36 317.74 348.45	3331.	.07 (64)
Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45) + (61) + (64a)] + 0.8 \times [(46) + (57) + (59)]$ 176.88 157.97 171.2 157.97 158.33 82.41 82.08 84.73 84.99 161.55 163.73 175.88 (65)			(64-)
			(64a)
			(65)
5. Internal gains (see Tables 5 and 5a)	Funtarnal gains (see Tables F and Fa)		

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

Metabolic gains (Table 5), watts

199.31 199.31 199.31 199.31 199.31 199.31 199.31 199.31 199.31 199.31 199.31 199.31 (66)



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gains (cal	culated in	n Append	dix L, equ	ation L12	or L12a)	, also see	Table 5						
73.82 ces gains (30.18 quation l					60.98	71.18	75.88		(67)
							625.5 Table 5	647.67	694.87	754.45	810.45		(68)
58.25 and fans g			58.25	58.25	58.25	58.25	58.25	58.25	58.25	58.25	58.25		(69)
3 .g. evapo	3 ration (ne	3 egative va	3 alues) (Ta	3 ble 5	0	0	0	0	3	3	3		(70)
			-132.87	-132.87	-132.87	-132.87	-132.87	-132.87	-132.87	-132.87	-132.87		(71)
		230.1	219.41	212.81	114.46	110.33	113.89	118.04	217.14	227.4	236.39		(72)
		1245.6	1174.75	1098.38	936.33	896.84	899.86	938.42	1100.68	1180.72	1250.41		(73)
ar gains													
	•				3412.79	3246.18	2785.55	2184.13	1389.31	773.25	520.46		(83)
ins – inter	rnal and s	olar (wat	ts)										
1913.45	5 2471.92	3139.54	3894.04	4426.5	4349.12	4143.03	3685.41	3122.55	2489.98	1953.97	1770.87		(84)
ean inter	nal temp	perature	(heating	g season)								
	_			_		ble 9, Th1	L (°C)					21	(85)
on ractor 1	ior gains	0.99	area, ⊡1, 0.97	o.9	0.77	0.62	0.69	0.92	0.99	1	1		(86)
ternal ter	mperature	e in living	area T1	(follow st	eps 3 an	d 4 in Tak	ole 9c)						
								20.67	20.06	19.43	18.95		(87)
19.72	19.72	19.73	19.75	19.75	19.78	19.78	19.78	19.77	19.75	19.75	19.74		(88)
						_		_					(00)
1	1	0.99	0.96								1		(89)
17.87 ea fractio	18.09 on	18.49	19.04	19.47	19.71	19.77	19.76	19.57	19	18.35	17.87		, ,
												0.11	(90) (91)
ternal ter	nperature	e (for the	whole d	welling)								0.11	(90)
ternal ter 17.99 d mean in	nperature 18.22	18.61	19.16	welling) 19.59	19.84	19.9	19.9	19.7	19.12	18.48	17.99	0.11	(90)
	73.82 ces gains (847.86 gains (ca 58.25 and fans g 3 .g. evapo -132.87 eating ga 237.74 ernal gains 1287.11 ar gains ins in wat 626.34 ins – inter 1913.45 ean inter 1913.45 ean inter 19.72 1 17.87	73.82 65.57 ces gains (calculated and second	73.82 65.57 53.32 designs (calculated in Appetential States and solar (calculated in Appetential States and fans gains (Table 5a) and gains (Table 5b) and fans gains (Table 5c) argains	73.82 65.57 53.32 40.37 res gains (calculated in Appendix L, es gains (calculated in Appendix L, equiting 58.25 58.25 58.25 58.25 58.25 58.25 and fans gains (Table 5a) 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	73.82 65.57 53.32 40.37 30.18 tes gains (calculated in Appendix L, equation II 847.86 856.65 834.48 787.28 727.7 gains (calculated in Appendix L, equation II 58.25 58.25 58.25 58.25 58.25 and fans gains (Table 5a) 3 3 3 3 g. evaporation (negative values) (Table 5 -132.87 -132.87 -132.87 -132.87 -132.87 eating gains (Table 5) 237.74 235.08 230.1 219.41 212.81 ernal gains 1287.11 1284.99 1245.6 1174.75 1098.38 ar gains ar	73.82 65.57 53.32 40.37 30.18 25.48 res gains (calculated in Appendix L, equation L16 or L16 847.86 856.65 834.48 787.28 727.7 671.71 gains (calculated in Appendix L, equation L18 or L18a) 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 ind fans gains (Table 5a) 3 3 3 0 0.g. evaporation (negative values) (Table 5 -132.87 -132.87 -132.87 -132.87 -132.87 -132.87 -132.87 eating gains (Table 5) 237.74 235.08 230.1 219.41 212.81 114.46 ernal gains 1287.11 1284.99 1245.6 1174.75 1098.38 936.33 er gains in watts, calculated for each month 626.34 1186.92 1893.94 2719.29 3328.12 3412.79 ins – internal and solar (watts) 1913.45 2471.92 3139.54 3894.04 4426.5 4349.12 ean internal temperature (heating season) eature during heating periods in the living area from Table factor for gains for living area, 11,m (see Table 9a) 1 1 0.99 0.97 0.9 0.77 ternal temperature in living area T1 (follow steps 3 and 18.96 19.18 19.58 20.11 20.58 20.86 eature during heating periods in rest of dwelling from T3 19.72 19.72 19.73 19.75 19.75 19.78 Utilisation factor for 19.72 19.72 19.73 19.75 19.75 19.78 Utilisation factor for 17.87 18.09 18.49 19.04 19.47 19.71	73.82 65.57 53.32 40.37 30.18 25.48 27.53 are sgains (calculated in Appendix L, equation L16 or L16a), also see gains (calculated in Appendix L, equation L18 or L18a), also see sgains (calculated in Appendix L, equation L18 or L18a), also see sgains (calculated in Appendix L, equation L18 or L18a), also see 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 ind fans gains (Table 5a) 3 3 3 0 0 0 a.g. evaporation (negative values) (Table 5 -132.87 -132.87 -132.87 -132.87 -132.87 -132.87 -132.87 -132.87 -132.87 -132.87 -132.87 -132.87 areating gains (Table 5) 237.74 235.08 230.1 219.41 212.81 114.46 110.33 ernal gains 1287.11 1284.99 1245.6 1174.75 1098.38 936.33 896.84 ar gains in watts, calculated for each month 626.34 1186.92 1893.94 2719.29 3328.12 3412.79 3246.18 ins – internal and solar (watts) 1913.45 2471.92 3139.54 3894.04 4426.5 4349.12 4143.03 arean internal temperature (heating season) arean internal temperature (heating season) 1 0.99 0.97 0.9 0.77 0.62 ternal temperature in living area, □1,m (see Table 9a) 1 1 0.99 0.97 0.9 0.77 0.62 ternal temperature in living area T1 (follow steps 3 and 4 in Table 19.18 19.58 20.11 20.58 20.86 20.96 arture during heating periods in rest of dwelling from Table 9, The 19.72 19.72 19.73 19.75 19.75 19.78 19.78 Utilisation factor for gains for Utilisat	Res gains (calculated in Appendix L, equation L16 or L16a), also see Table 847.86 856.65 834.48 787.28 727.7 671.71 634.3 625.5 gains (calculated in Appendix L, equation L18 or L18a), also see Table 5 58.25 ind fans gains (Table 5a) 3 3 3 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	73.82 65.57 53.32 40.37 30.18 25.48 27.53 35.78 48.03 see gains (calculated in Appendix L, equation L16 or L16a), also see Table 5 847.86 856.65 834.48 787.28 727.7 671.71 634.3 625.5 647.67 gains (calculated in Appendix L, equation L18 or L18a), also see Table 5 58.25	73.82 65.57 53.32 40.37 30.18 25.48 27.53 35.78 48.03 60.98 are gains (calculated in Appendix L, equation L16 or L16a), also see Table 5 847.86 856.65 834.48 787.28 727.7 671.71 634.3 625.5 647.67 694.87 gains (calculated in Appendix L, equation L18 or L18a), also see Table 5 847.86 856.65 834.48 787.28 727.7 671.71 634.3 625.5 647.67 694.87 gains (calculated in Appendix L, equation L18 or L18a), also see Table 5 58.25	73.82 65.57 53.32 40.37 30.18 25.48 27.53 35.78 48.03 60.98 71.18 resignis (calculated in Appendix L, equation L16 or L16a), also see Table 5 847.86 856.65 834.48 787.28 727.7 671.71 634.3 625.5 647.67 694.87 754.45 gains (calculated in Appendix L, equation L18 or L18a), also see Table 5 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 10 d fans gains (Table 5a) 3 3 3 3 0 0 0 0 0 3 3 3 3 3 3 3 0 0 0 0	73.82 65.57 53.32 40.37 30.18 25.48 27.53 35.78 48.03 60.98 71.18 75.88 es gains (calculated in Appendix L, equation L16 or L16a), also see Table 5 847.86 856.65 834.48 787.28 727.7 671.71 634.3 625.5 647.67 694.87 754.45 810.45 gains (calculated in Appendix L, equation L18 or L18a), also see Table 5 58.25 58	73.82 65.57 53.32 40.37 30.18 25.48 27.53 35.78 48.03 60.98 71.18 75.88 res gains (calculated in Appendix L, equation L16 or L16a), also see Table 5 847.86 856.65 834.48 787.28 727.7 671.71 634.3 625.5 647.67 694.87 754.45 810.45 gains (calculated in Appendix L, equation L18 or L18a), also see Table 5 847.86 856.65 834.48 787.28 727.7 671.71 634.3 625.5 647.67 694.87 754.45 810.45 gains (calculated in Appendix L, equation L18 or L18a), also see Table 5 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 ind fans gains (Table 5a) 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3

8. Space heating requirement



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	Utilisation	factor f	or gains,												
	1 Useful gair	-	1 1 , W	0.99	0.95	0.85	0.68	0.48	0.56	0.85	0.98	1	1		(94)
	1 Monthly av	1911 verage e				3781.49 Table U1		1990.1	2059.34	2664.9	2439.08	1948.48	1769.27		(95)
	∠ Heat loss r	I.3 ate for i	4.9 mean into	6.5 ernal tem	8.9 perature	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
į	8 Space heat					4967.98	3236.75	2038.7	2149.9	3481.73	5360.83	7221.15	8829.79		(97)
		219.28	4153.07	3516.06	2000.78	882.75 ix H (nega		0 ntity)	0	0	2173.78	3796.32	5253.03		(98a)
	(Space heat)	0	0	0	0	0	0	0	0	0	0	0		(98b)
		219.28	4153.07	3516.06	2000.78	882.75		0	0	0	2173.78	3796.32	5253.03	60.51	(98c) (99)
	8c. Spa	ce Cool	ing requ	iirement	:										
	Heat loss r	ate,													
	(Utilisation	,	0 or loss	0	0	0	0	0	0	0	0	0	0		(100)
1) Useful loss	,	0 watts)	0	0	0	0	0	0	0	0	0	0		(101)
	(Gains)	0	0	0	0	0	0	0	0	0	0	0		(102)
,) Space cool	,	0 uirement	0 for mont	0 th, whole	0 dwelling	0 , continu	0 ous (kWł	0 h)	0	0	0	0		(103) (104)
((Cooled fra Intermitte) ction	0	0	0	0	0	0	0	0	0	0	0		(104) (105)
)	0	0	0	0	0	0	0 0	0	0	0	0	0	(106)
) Space cool		0 uirement	0 in kWh/r	0 m²/year	0	0	0	0	0	0	0	0		(107) (108)
	8f. Spac	ce heat	ing requ	irement											
	Fabric Ene	rgy Effic	iency,						0					0	(109)

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



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For all or a Common I														
Fraction of space I				iementar	y system	,		0					0	(201)
Fraction of space I				,									1	(202)
Fraction of main h	_		-										0	(203)
Fraction of total sp			-										1	(204)
Fraction of total sp													0	(205)
Efficiency of main	-												250	(206)
Efficiency of main	-		•		0/								0	(207)
Efficiency of secon					111, %,								0	(208)
Cooling System Se		• .	•	•				0					0	(209)
Space heating req		t (caicula	ted abov											(0.1.0)
0 Space heating fue	0 L(main b	0	0	0 W/h/ma	0 n+h	0	0		0	0	0	0		(210)
_	-		•				_	0					0	(244)
2087.71 Space heating fue			2 800.31		0 nth	0	0	0	0	869.51	1518.53	3 2101.21	0	(211)
Space nearing rue								0					0	(212)
Space heating fue	0 L(second	0 lary) kW/	0 h/month	0	0	0	0	0	0	0	0	0	0	(213)
	(3000114			0	0	0	0	0	0	0	0	0	0	(215)
0 Output from wate	U r heater)	0	0	0	0	0	0	0	0	0	0	0	250	(215)
Efficiency of water	•	,						0					250	(216)
250		250	250	250	250	250	25	^	250	250	250	250		(217)
Fuel for water hea	250 iting	250	250	250	250	250	25	U	250	250	250	250		(217)
	124.83	133.75	120.17	118.27	75.57	74.39	77	.57	78.67	122.14	127.1	139.38	1332.43	(219)
Space Cooling	124.03	133.73	120.17	110.27	73.37	74.55	//	.57	78.07	122.14	127.1	133.36	1552.43	(213)
. 0	0	0	0	0	0	0	0		0	0	0	0		(221)
Annual totals	Ü	Ü	Ü	Ü	Ü	Ü		h/yea		Vh/year	Ü	Ü		()
Space heating fue	l used, m	ain syste	m 1					.,		.,			10798.03	(211)
Space heating fue	l used, m	ain syste	m 2										0	(213)
Space heating fue	l used, se	econdary											0	(215)
Water heating fue	l used												1332.43	(219)
Electricity for insta	antaneou	ıs electric	c shower	(s)									0	(64a)
Space cooling fuel	used												0	(221)
Electricity for pum	ıps, fans	and elect	tric keep-	hot										
Mechanical vent f	ans - bala	anced, ex	tract or p	ositive ii	nput from	n outside	<u> </u>	0		0			0	(230a)
warm air heating s	system fa	ans											0	(230b)
Heating circulation	n pump c	or water _l	pump wit	hin warn	n air heat	ing unit							0	(230c)
Oil boiler auxiliary	(oil pum	ıp, flue fa	ın, etc; ex	cludes ci	irculation	pump)							0	(230d)
Gas boiler auxiliar													0	(230e)
Maintaining electr			y for gas	combi bo	oiler								0	(230f)
Pump for solar wa		ing											0	(230g)
Pump for storage													0	(230h)
Total electricity fo		ove											0	(231)
Electricity for light	ing												521.5	(232)



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Energy s	saving/ge	neration	technolo	gies (App	endices	M, N) - Er	nergy use	ed in dwe	lling					
Electricit	ty genera	ited by P	Vs (Apper	ndix M) (r	negative	quantity)								
	0	0	0	0	0	0	0	0	0	0	0	0	0	(233a)
Electricit	ty genera	ited by w	ind turbii	nes (Appe	endix M)	(negative	e quantity	/)						
	0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)
Electricit	ty genera	ited by h	ydro-elec	tric gene	rators									
e	0	0	0	0	0	0	0	0	0	0	0	0	0	(235a)
Electrici	ty used o		ctricity ge	nerated I	by micro-									
Enorgy	0 : aving/go	0	0 tachnala	0 gios (App	0	0 N/ N/ E*	0	0	0	0	0	0	0	(235c)
			technolo Vs (Apper					orteu						
LIECTICI								0	0	0	0	0	0	(2226)
Electricit	0 tv genera	0 Ited by w	0 vind turbii	0 nes (Appe	0 endix M)	0 (negative	0 guantity	v) 0	0	0	0	0	0	(233b)
	n	0	0	0	0	0	0	0	0	0	0	0	0	(234b)
Electricit	ty genera	•	ydro-elec	0	0	O	O	O	O	O	O	O	O	(23.5)
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235b)
Electricit	ty used o	r net ele	ctricity ge	nerated l	by micro	-CHP								,
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)
Appendi	ix Q item	s: annual	energy											
	ix Q, <ite< td=""><td>m 1 desc</td><td>ription></td><td></td><td></td><td></td><td></td><td>Fuel</td><td>k</td><td>:Wh/year</td><td></td><td></td><td></td><td></td></ite<>	m 1 desc	ription>					Fuel	k	:Wh/year				
energy s													0	(236a)
energy u													0	(237a)
Total de	livered e	nergy for	all uses										12651.95	

10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	kWh/year	Fuel price	Fuel cost £/yea	ır
Space heating - main system 1 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		1780.59	(240a)
Low-rate fraction	0		1780.59	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		1780.59	(241a)
Low-rate fraction	0		1780.59	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				•
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		1780.59	(242a)



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Low-rate fraction	0		1780.59	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Space heating - secondary cost (other fuel)	0		0	(242e)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		0	(243)
Low-rate fraction	0		0	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Water heating cost (other fuel)	0		219.72	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (247)				
Energy For instantaneous electric shower(s)	0		0	(247a)
Space cooling	0		0	(248)
Pumps, fans And electric keep-hot	0		0	(249)
Energy For lighting	0		86	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		0	(252)
Appendix Q, <item 1="" description=""></item>	Fuel	kWh/year		
energy saved Or generated	0		0	(253)
energy used	0		0	(254)
Total energy cost	0		2086.31	(255)
11a. SAP rating – Individual heating systems including micro-CHP				
Energy cost deflator	0		0	(256)
Energy cost factor (ECF)	0		0	(257)
SAP rating	0		0	(258)

11a. SAP rating – Individual heating systems including micro-CHP		
Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	1.53	(257)
SAP rating	75.21	(258)
12a. CO2 emissions – Individual heating systems including micro-CHP		

	Energy	Emission factor	Emissions	
	KWh/year	kg	kg CO2/year	
Space heating - main system 1			1672.38	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			190.28	(264)
Energy for instantaneous electric shower(s)			0	(264a)



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Space	e and water heating		0	(265)
Space	e cooling		0	(266)
Electi	ricity for pumps, fans and electric keep		0	(267)
Electi	ricity for lighting		75.27	(268)
energ	gy saved or generated	0	0	(269b)
Appe	ndix Q items			
energ	gy saved	0	0	
energ	gy used	0	0	
energ	gy saved	0	0	(270b)
energ	gy used		0	(271b)
Total	CO2, kg/year		1937.93	(272)
Dwel	ling CO2 Emission Rate		4.34	(273)
EI rat	ing		95	(274)

13a. Primary Energy – Individual heating systems including micro-CHP

	Energy Er	mission factor	Emissionsr	
	KWh/year	kg	kg CO2/year	
Space heating - main system 1			16989.62	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			2036.2	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			0	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			0	(281)
Electricity for lighting			799.89	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			19825.71	(286)
Dwelling PE Rate			44.44	(287)



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Dwelling Reference: J5106

Dwelling Type: New Dwelling Design Stage

NW3 5RX

1. Overall dwelling dimensions

	Area(m²)	Av. Height(m)		Volume(m³)	
Basement Ground Floor	· ·	a) x 3.93 b) x 2.98	(2a) = (2b) =	1114.94 173.63	(3a) (3b)
Total floor area TFA Dwelling volume				341.96 1288.57	(4) (5)

2. Ventilation Rate				
2. Vertification Nate				
Chimneys/Flues	0	x 80 =	0	(6a)
Open chimneys	0	x 20 =	0	(6b)
Chimneys / flues attached to closed fire	0	x 10 =	0	(6c)
Flues attached to solid fuel boiler	0	x 20 =	0	(6d)
Flues attached to other heater	0	x 35 =	0	(6e)
Number of blocked chimneys	0	x 20 =	0	(6f)
Number of intermittent extract fans	0	x 10 =	0	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)
	Ü	Air changes per hour	Ü	(70)
Number of storeys in the dwelling (ns)		0	0	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc		0	0	(9)
Additional infiltration		0	0	(10
Structural infiltration		0	0	(11
Suspended wooden ground floor		0	0	(12)
No draught lobby		0	0	(13)
Percentage of windows and doors draught proofed		0	0	(14)
Window infiltration Infiltration rate		0	0	(15)
Air permeability value, AP50, (m³/h/m²)		0	0	(16
Air permeability value, AP30, (m²/h/m²) Air permeability value, AP4, (m³/h/m²)		3	3	(17)
Air permeability value)		0 0.15	0	(17)
Number of sides on which dwelling is sheltered		0.15	0.15 0	(18) (19)
Shelter factor		U	1	(20)
Infiltration rate incorporating shelter factor			0.15	(21)
			0.13	(41)





Infiltration	on rate m	odified f	or month	ly wind s	peed									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(22)
Monthly	average	wind spe	ed from	Table U2										
Wind Fa	5.1 ctor	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Adjusted	1.28 d infiltrati	1.25 on rate (1.23 allowing	1.1 for shelte	1.08 er and wir	0.95 nd speed	0.95)	0.93	1	1.08	1.13	1.18	13.13	(22a)
Calculate	0.19 e effectiv	0.19 e air chai	0.18 nge rate f	0.17 for the ap	0.16 plicable	0.14 case:	0.14	0.14	0.15	0.16	0.17	0.18	1.97	(22b)
													0.5	(23a)
													0.5	(23b)
a) If hala	nced me	chanical	ventilatio	n with he	eat recov	erv (MVF	IR)						45	(23c)
u, Ju.	0.47	0.46	0.46	0.44	0.44	0.42	0.42	0.41	0.43	0.44	0.44	0.45		(24a)
b) If bala	anced me	0	0					0.41	0.45	0.44	0.44	0.43		(= : :-)
\ .c .	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If who	ole house	extract v	entilation	n or posit	ive input	ventilati	on from (outside						
d) If nati	0 ural venti	0 lation or	0 whole ho	0 ouse posit	0 tive input	0 : ventilati	0 on from	0 loft	0	0	0	0		(24c)
.,	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective	air chan	-	U	U	U	U	U	U	O	O	O	O		(240)
Γffo.ot∷	0.47	0.46	0.46	0.44	0.44	0.42	0.42	0.41	0.43	0.44	0.44	0.45		(25)
ETTECTIVE	e air chan	_												
	0.47	0.46	0.46	0.44	0.44	0.42	0.42	0.41	0.43	0.44	0.44	0.45		(25)

3. Heat losses and heat loss parameter

Items in the table below are to be expanded as necessary to allow for all different types of element e.g. 4 wall types. The k -value

ELEMENT	A X U (W/K)	A X k kJ/K	
Doors	0		(26)
Windows	63.07		(27)
Roof window	15.57		(27a)
Basement floor	51.07	31207	(28)
Ground floor	0	0	(28a)
Exposed floor	0	0	(28b)
Basement wall	49.52	52269	(29)
External wall	4.87	5145.2	(29a)
Roof	21.87	1312.19	(30)
Total area of external elements ∑A, m²		786.95	(31)





Party Wall Party floor Party ceiling Internal wall ** Internal floor Internal ceiling floor Fabric heat loss, $W/K = \sum (A \times U)$ Heat capacity $Cm = \sum (A \times k)$ Thermal mass parameter ($TMP = Cm \div TFA$) in kJ/m^2K Linear Thermal bridges: $\sum (L \times \Psi)$ calculated using Appendix K Point Thermal bridges: $\sum (W/K)$ if significant point thermal bridge present and values available												
Total fabric heat loss I	$A = \sum (A \times D) + A$	- Σ(L × Ψ)	•	ermai br	iage pres	ent and v	alues av	ailable			0 205.96	(36a) (37)
Ventilation heat loss of 198.26 198.46 Heat transfer coefficients	.67 195.07	-	185.51	177.53	177.53	175.94	180.72	185.51	188.69	191.88		(38)
404.23 402 Heat loss parameter (.63 401.04		391.47	383.5	383.5	381.9	386.69	391.47	394.66	397.85		(39)
1.18 1.1 Number of days in mo	3 1.17	1.15	1.14	1.12	1.12	1.12	1.13	1.14	1.15	1.16		(40)
31 28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heating	energy requ	iirement										
Assumed occupancy, I		or mixer s	howers, \	/d,showe	er (from A	appendix	J)				3.19	(42)
0 0 Hot water usage in liti	0 es per day fo	0 or baths, \	0 /d,bath (1	0 rom App	0 endix J)	0	0	0	0	0		(42a)
89.59 88. Hot water usage in liti		82.93 or other u	80.34 ses, Vd,o	77.48 ther (fror	75.93 n Append	77.79 dix J)	79.81	82.88	86.41	89.29		(42b)
47.26 45. Annual average hot w Hot water usage in liti	ater usage in	-	-				42.11	43.83	45.54	47.26	126.03	(42c) (43)
136.85 133 Energy content of hot		125.04 = 4.18 x V						126.71 opendix J		136.55	1512.68	(44)
216.74 190 Distribution loss (46) =		171.17	162.53	142.81	138.59	146.33	150.34	171.94	187.99	213.8	2092.91	(45)
32.51 28. Storage volume (litres Water storage loss (or) including a	25.68 ny solar o	24.38 r WWHR	21.42 S storage	20.79 within sa	21.95 ame vesse	22.55 el	25.79	28.2	32.07	0	(46) (47)
a) If manufacturer's d	eclared loss f	actor is k	nown (kV	Vh/day):							1.6	(48)



Temperature factor from Table 2b

0.54

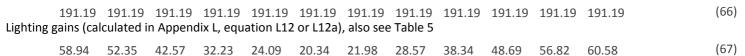
(49)



Energy lost from water storage, kWh/day (48) x (49) = 0.86													
b) If manufacturer's declared loss factor is not known:													
Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)											
Volume factor from Table 2a	0	(52)											
Temperature factor from Table 2b	0	(53)											
Energy lost from water storage, kWh/day Enter (50) or (54) in (55)	0	(54)											
Water storage (or HIU) loss calculated for each month (56) = $(55) \times (41)$	0.86	(55)											
26.78 24.19 26.78 25.92 26.78 25.92 26.78 25.92 26.78 25.92 26.78 25.92 26.78		(56)											
If the vessel contains dedicated solar storage or dedicated WWHRS storage,		(30)											
If the vessel contains dedicated solar storage or dedicated WWHRS storage, (57)m = (56)m ② [(47) − Vs] ÷ (47), else (57)m = (56)m													
(57)m = (56)m $\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$													
26.78 24.19 26.78 25.92 26.78 25.92 26.78 25.92 26.78 25.92 26.78 Primary circuit loss for each month from Table 3		(57)											
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only	heat netwo	orks)											
23.26 21.01 23.26 22.51 23.26 0 0 0 0 23.26 22.51 23.26	Treat Trette	(59)											
Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)		(33)											
0 0 0 0 0 0 0 0 0 0		(61)											
Total heat required for water heating calculated for each month (62) = $0.85 \times (45) + (46) + (57) + (59) + (61)$													
266.79 235.74 250.18 219.6 212.58 168.73 165.38 173.11 176.26 221.99 236.42 263.85 CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water he	2590.62 ating)	2 (62)											
0 0 0 0 0 0 0 0 0 0		(63a)											
PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)													
0 0 0 0 0 0 0 0 0 0 0		(63b)											
Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating)													
	۸.	(63c)											
FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heating)	(C2-I)											
0 0 0 0 0 0 0 0 0 0		(63d)											
266.79 235.74 250.18 219.6 212.58 0 0 0 0 221.99 236.42 263.85	1907.14	1 (64)											
Output from water heater for each month, $kWh/month$ (64) = (62) + (63a) + (63b) + (63c) + (63d)	1907.12	+ (04)											
0 0 0 0 0 0 0 0 0 0 0		(64a)											
Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45) + (61) + (64a)] + 0.8 \times [(46) + (57) + (59)]$													
112.1 99.52 106.58 95.66 94.08 68.22 67.51 70.08 70.72 97.21 101.25 111.13 include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network		(65)											
include (37) III III calculation of (63) III only if not water store is in the dwelling of not water is noth heat network													
Funtarnal gains (see Tables Fand Fa)													

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

Metabolic gains (Table 5), watts







Applianc	es gains (calculate	d in Appe	endix L, e	quation I	.16 or L16	sa), also s	see Table	: 5					
Cooking	733.47 gains (cal	741.08 Iculated i							560.29	601.12	652.66	701.1		(68)
Pumps a	57.31 nd fans g	57.31 ains (Tab	57.31 le 5a)	57.31	57.31	57.31	57.31	57.31	57.31	57.31	57.31	57.31		(69)
	3	3	3	3	3	0	0	0	0	3	3	3		(70)
Losses e.	.g. evapoi	ration (ne	egative va	alues) (Ta	ble 5									
Water he	-127.46 eating gai	-127.46 ins (Table		-127.46	-127.46	-127.46	-127.46	-127.46	-127.46	-127.46	-127.46	-127.46		(71)
Total into	150.68 ernal gair	148.09 ns	143.25	132.86	126.45	94.75	90.74	94.19	98.23	130.66	140.63	149.36		(72)
	1067.12	1065.55	1031.76	970.19	904.1	817.21	782.47	784.91	817.89	904.5	974.15	1035.08		(73)
6. Sol	ar gains													
Solar gai	ns in wat	ts, calcula	ated for e	ach mon	th									
		444.18			1243.57	1274.56	1212.61	1041.42	817.3	519.99	289.27	194.62		(83)
Total gai	ns – inter	nal and s	olar (wat	ts)										
	1201 29	1 [0 7 7 2	4740 6											(0.4)
	1301.30	1509.73	1/40.6	1987.23	2147.67	2091.77	1995.08	1826.33	1635.19	1424.48	1263.42	1229.7		(84)
	1301.30	1509.73	1/40.6	1987.23	2147.67	2091.77	1995.08	1826.33	1635.19	1424.48	1263.42	1229.7		(84)
7. Me	ean inter						1995.08	1826.33	1635.19	1424.48	1263.42	1229.7		(84)
7. Me							1995.08	1826.33	1635.19	1424.48	1263.42	1229.7		(84)
Tempera		nal temp	perature	(heating	g season ving area) from Tal			1635.19	1424.48	1263.42	1229.7	21	(84)
Tempera Utilisatio	ean inter ature duri on factor f	nal temping heating for gains	perature ng period: for living	(heating s in the li area, 121, 0.99	g season ving area m (see Ta 0.97	from Talable 9a)	ole 9, Th1 0.76	. (°C)	0.97	1424.48	1263.42	1229.7	21	
Tempera Utilisatio	ean inter ature duri on factor f 1 ternal ter	nal temping heating for gains	perature ng period: for living 1 e in living	(heating s in the li area, 121, 0.99 s area T1	ying area m (see Ta 0.97 (follow st	from Tak able 9a) 0.9 eps 3 and	ole 9, Th1 0.76	. (°C)	0.97	1	1	1	21	(85)
Tempera Utilisatio	ean inter ature duri on factor f 1 ternal ter 19.3	nal tempong heating for gains 1 mperature 19.45	perature ng period: for living 1 e in living 19.73	(heating s in the li area, 21, 0.99 s area T1 20.13	ying area m (see Ta 0.97 (follow st 20.51	from Tak able 9a) 0.9 eps 3 and 20.82	0.76 d 4 in Tab 20.95	0.82 ole 9c) 20.92					21	(85)
Tempera Utilisatio	ean internature duri on factor f ternal ter 19.3 ature duri	nal temp ng heatir for gains 1 nperature 19.45 ng heatir	perature og period: for living 1 e in living 19.73 og period:	(heating s in the li area, 121, 0.99 g area T1 20.13 s in rest o	ying area m (see Ta 0.97 (follow st 20.51 of dwellin	from Tak able 9a) 0.9 eps 3 and 20.82 g from Ta	0.76 d 4 in Tab 20.95 able 9, Th	0.82 ole 9c) 20.92	0.97	1 20.17	1 19.68	1 19.29	21	(85) (86) (87)
Tempera Utilisatio	ean internature duri on factor f ternal ter 19.3 ature duri	nal tempong heating for gains 1 mperature 19.45	perature og period: for living 1 e in living 19.73 og period:	(heating s in the li area, 21, 0.99 s area T1 20.13 s in rest o	ying area m (see Ta 0.97 (follow st 20.51 of dwellin 19.96	from Tabable 9a) 0.9 eps 3 and 20.82 g from Ta	0.76 d 4 in Tab 20.95 able 9, Th 19.98	0.82 ole 9c) 20.92 ole (°C)	0.97	1 20.17 19.96	1 19.68 19.96	1 19.29 19.95	21	(85)
Tempera Utilisation Mean into Tempera Roof	ean internature duri on factor f ternal ter 19.3 ature duri	nal temp ng heatir for gains 1 nperature 19.45 ng heatir	perature og period: for living 1 e in living 19.73 og period:	(heating s in the li area, 21, 0.99 s area T1 20.13 s in rest o	ying area m (see Ta 0.97 (follow st 20.51 of dwellin 19.96	from Tabable 9a) 0.9 eps 3 and 20.82 g from Ta	0.76 d 4 in Tab 20.95 able 9, Th 19.98	0.82 ole 9c) 20.92 ole (°C)	0.97 20.66 19.98	1 20.17 19.96	1 19.68 19.96	1 19.29 19.95	21	(85) (86) (87)
Tempera Utilisation Mean into	ean interior factor fac	nal tempong heating for gains of the second	perature ng period: for living 1 e in living 19.73 ng period: 19.94	(heating s in the li area, 121, 0.99 area T1 20.13 s in rest o	ving area m (see Ta 0.97 (follow st 20.51 of dwellin 19.96 (tilisation 0.95	from Tab able 9a) 0.9 eps 3 and 20.82 g from Ta 19.98 factor fo 0.83	0.76 d 4 in Tab 20.95 able 9, Th 19.98 r gains fo 0.62	0.82 ole 9c) 20.92 oz (°C) 19.99 or rest of 0.7	0.97 20.66 19.98 dwelling,	1 20.17 19.96 22,m (se 0.99	1 19.68 19.96 ee Table 9	1 19.29 19.95 9a)	21	(85) (86) (87) (88) (89)
Tempera Utilisation Mean into Tempera Roof	ean inter eature duri on factor f 1 ternal ter 19.3 eature duri 19.93	nal temporal ng heating for gains of the second of the sec	perature ng period: for living 1 e in living 19.73 ng period: 19.94	(heating s in the li area, 121, 0.99 area T1 20.13 s in rest o	ving area m (see Ta 0.97 (follow st 20.51 of dwellin 19.96 (tilisation 0.95	from Tab able 9a) 0.9 eps 3 and 20.82 g from Ta 19.98 factor fo 0.83	0.76 d 4 in Tab 20.95 able 9, Th 19.98 r gains fo 0.62	0.82 ole 9c) 20.92 oz (°C) 19.99 or rest of 0.7	0.97 20.66 19.98 dwelling, 0.94	1 20.17 19.96 22,m (se 0.99	1 19.68 19.96 ee Table 9	1 19.29 19.95 9a)		(85) (86) (87) (88) (89) (90)
Tempera Utilisation Mean into Tempera Roof Roof Living are	ean interior factor fac	nal tempong heating for gains of the second	operature ong period: for living 1 e in living 19.73 ong period: 19.94 1 18.8	(heating s in the li area, 121, 0.99 area T1 20.13 s in rest of 19.96 U 0.99	ying area m (see Ta 0.97 (follow st 20.51 of dwellin 19.96 ltilisation 0.95 Mea	from Tab able 9a) 0.9 eps 3 and 20.82 g from Ta 19.98 factor fo 0.83 an interna	0.76 d 4 in Tab 20.95 able 9, Th 19.98 r gains fo 0.62 al tempe	0.82 ole 9c) 20.92 or (°C) 19.99 or rest of 0.7 rature in	0.97 20.66 19.98 dwelling, 0.94 the rest (1 20.17 19.96 22,m (se 0.99 of dwellir	1 19.68 19.96 ee Table 9 1 ng T2	1 19.29 19.95 Đa) 1	0.28	(85) (86) (87) (88) (89)
Tempera Utilisation Mean into Tempera Roof Roof Living are	ean interion factor fac	nal tempong heating for gains of the second	perature ng period: for living 1 e in living 19.73 ng period: 19.94 1 18.8 e (for the	(heating s in the li area, 121, 0.99 area T1 20.13 s in rest of 19.96 U 0.99 19.21 whole do	ying area m (see Ta 0.97 (follow st 20.51 of dwellin 19.96 ltilisation 0.95 Mea 19.59 welling)	from Table 9a) 0.9 eps 3 and 20.82 g from Table 19.98 factor for 0.83 an internation	0.76 d 4 in Tab 20.95 able 9, Th 19.98 r gains fo 0.62 al tempe 19.97	0.82 ole 9c) 20.92 or 2 (°C) 19.99 or rest of 0.7 rature in 19.96	0.97 20.66 19.98 dwelling, 0.94 the rest of	1 20.17 19.96 22,m (se 0.99 of dwellin 19.26	1 19.68 19.96 ee Table 9 1 ng T2 18.76	1 19.29 19.95 9a) 1 18.37		(85) (86) (87) (88) (89) (90) (91)
Tempera Utilisation Mean interperation Roof Roof Living are Mean interperation	ean interior factor fac	nal tempong heating for gains of the second	perature ng period: for living 1 e in living 19.73 ng period: 19.94 1 18.8 e (for the	(heating s in the li area, 121, 0.99 area T1 20.13 s in rest of 19.96 U 0.99 19.21 whole do 19.47	ying area m (see Ta 0.97 (follow st 20.51 of dwellin 19.96 ltilisation 0.95 Mea	from Tab able 9a) 0.9 eps 3 and 20.82 g from Ta 19.98 factor fo 0.83 an interna	0.76 d 4 in Tab 20.95 able 9, Th 19.98 r gains fo 0.62 al tempe	0.82 ole 9c) 20.92 or (°C) 19.99 or rest of 0.7 rature in	0.97 20.66 19.98 dwelling, 0.94 the rest (1 20.17 19.96 22,m (se 0.99 of dwellir	1 19.68 19.96 ee Table 9 1 ng T2	1 19.29 19.95 Đa) 1		(85) (86) (87) (88) (89) (90)
Tempera Utilisation Mean interperation Roof Roof Living are Mean interperation	ean interion factor fac	nal tempong heating for gains of the second	perature ng period: for living 1 e in living 19.73 ng period: 19.94 1 18.8 e (for the	(heating s in the li area, 12, 0.99 area T1 20.13 s in rest of 19.96 U 0.99 19.21 whole do 19.47	ying area m (see Ta 0.97 (follow st 20.51 of dwellin 19.96 ltilisation 0.95 Mea 19.59 welling)	from Table 9a) 0.9 eps 3 and 20.82 g from Table 19.98 factor for 0.83 an internation	0.76 d 4 in Tab 20.95 able 9, Th 19.98 r gains fo 0.62 al tempe 19.97	0.82 ole 9c) 20.92 or 2 (°C) 19.99 or rest of 0.7 rature in 19.96	0.97 20.66 19.98 dwelling, 0.94 the rest of	1 20.17 19.96 22,m (se 0.99 of dwellin 19.26	1 19.68 19.96 ee Table 9 1 ng T2 18.76	1 19.29 19.95 9a) 1 18.37		(85) (86) (87) (88) (89) (90) (91)



8. Space heating requirement



Utilisatio	n factor fo	or gains,												
Useful ga	1 ins, mGm	1 , W	1	0.99	0.95	0.84	0.66	0.73	0.94	0.99	1	1		(94)
Monthly	1300.72 average e						1320.11	1336.75	1537.38	1415.25	1262.14	1229.25		(95)
Heat loss	4.3 rate for r	4.9 nean inte	6.5 ernal tem	8.9 nperature	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Space he	5792.48 ating requ				3189.75	2125.21	1395.68	1460.9	2280.99	3488.86	4703.44	5741.27		(97)
Solar spa	3341.87	2741.81	2456.69	1578.7			0 ntity)	0	0	1542.77	2477.74	3356.94		(98a)
Space he	0	0	0	0	0	0	0	0	0	0	0	0		(98b)
Space he	3341.87	2741.81	2456.69	1578.7			0	0	0	1542.77	2477.74	3356.94	53.66	(98c) (99)
8c. Sp	ace Cooli	ing requ	irement	:										
Heat loss	rate,													
Utilisatio	•	0 or loss	0	0	0	0	0	0	0	0	0	0		(100)
Useful los	•	0 watts)	0	0	0	0	0	0	0	0	0	0		(101)
Gains	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Space co	-	0 iirement	0 for mont	0 th, whole	0 dwelling	0 , continu	0 ious (kWl	0 h)	0	0	0	0		(103) (104)
Cooled fr	action	0 or	0	0	0	0	0	0	0	0	0	0	0	(104) (105)
Space co		0 iirement	0 for mont	0 :h	0	0	0	0 0	0	0	0	0	0	(106)
Space cod	0 oling requ	0 iirement	0 in kWh/r	0 m²/year	0	0	0	0	0	0	0	0	0	(107) (108)
8f. Spa	ace heati	ng requ	irement											
Fabric En	ergy Effic	iency						0					0	(100)
I GOITC EIT	C. DY LINE	city,						0					0	(109)

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





Fraction of space heat from secondary/supplementary system,												0	(201)
Fraction of space hea	t from main s	ystem(s),										1	(202)
Fraction of main heat	ing from mair	n system	2,									0	(203)
Fraction of total space	e heat from m	nain syste	m 1,									1	(204)
Fraction of total space heat from main system 2,													
Efficiency of main space heating system 1 (in %),													(206)
Efficiency of main space heating system 2 (in %),													(207)
Efficiency of secondary/supplementary heating system, %,													(208)
Cooling System Seasonal Energy Efficiency Ratio,													(209)
Space heating requirement (calculated above),													
0 0	0	0	0	0	0	0		0	0	0	0		(210)
Space heating fuel (m							0					0	(5.4.1)
	96.72 982.68				0	0		0	617.11	991.1	1342.78	0	(211)
Space heating fuel (m		-					0					0	(242)
0 0 Space heating fuel (se	0 Acondary) kW	0 /h/month	0	0	0	0	0	0	0	0	0	0	(213)
				0	0	0	0	0	0	0	0	0	(215)
0 0 Output from water h	0 eater).	0	0	0	0	0	0	0	0	0	0	250	(215) (216)
Efficiency of water he	*						U					230	(210)
250 25		250	250	250	250	25	n	250	250	250	250		(217)
Fuel for water heatin		230	230	230	250	25	0	230	230	250	230		(==,)
106.71 94	.29 100.07	87.84	85.03	0	0	0		0	88.79	94.57	105.54	762.85	(219)
Space Cooling													
0 0	0	0	0	0	0	0		0	0	0	0		(221)
Annual totals						kW	h/yea	ar	kWh/year				
Space heating fuel us												7339.98	(211)
Space heating fuel us												0	(213)
Space heating fuel us	-	′										0	(215)
Water heating fuel us			, ,									762.85	(219)
Electricity for instant		c shower	(s)									0	(64a)
Space cooling fuel us												0	(221)
Electricity for pumps,		-		£ £		_							
Mechanical vent fans		xtract or	positive ii	nput fron	n outside	3	0		0			1041.48	(230a)
warm air heating syst Heating circulation p		numn wi	thin warn	n air baat	ting unit							0	(230b)
Oil boiler auxiliary (oil	=	•			_							0	(230c)
Gas boiler auxiliary (f	• • •				i puilip)							0	(230d)
• •												0	(230e)
Maintaining electric keep-hot facility for gas combi boiler Pump for solar water heating 0													(230f) (230g)
Pump for storage WWHRS 0													(230g) (230h)
												1041.48	(231)
Electricity for lighting													(232)
, - 0												416.36	(232)





	saving/gecity gener							ısed in dv	velling					
Electri	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (233a) Electricity generated by wind turbines (Appendix M) (negative quantity)													
Electri	0 city gener	0 ated by	0 hydro-el	0 ectric ger	0 nerators	0	0	0	0	0	0	0	0	(234a)
Electri	0 city used o	0 or net ele	0 ectricity	0 generate	0 d by mic	0 ro-CHP	0	0	0	0	0	0	0	(235a)
	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													
Electri	0 city gener	0 ated by	0 wind tur	0 bines (Ap	0 pendix N	0 ∕I) (negati	0 ive quant	0 ti ty)	0	0	0	0	0	(233b)
Electri	0 city gener	0 ated by	0 hydro-el	0 ectric ger	0 nerators	0	0	0	0	0	0	0	0	(234b)
Electri	0 city used o	0 or net ele	0 ectricity	0 generate	0 d by mic	0 ro-CHP	0	0	0	0	0	0	0	(235b)
Appen	0 dix Q item	0 ns: annua	0 al energy	0	0	0	0	0	0	0	0	0	0	(235d)
Appen	dix Q, <ite< td=""><td>em 1 des</td><td>cription></td><td>></td><td></td><td></td><td></td><td>Fue</td><td>el</td><td>kWh/year</td><td></td><td></td><td></td><td></td></ite<>	em 1 des	cription>	>				Fue	el	kWh/year				
	saved												0	(236a)
energy													0	(237a)
Total c	lelivered e	energy fo	or all use	S									10244.16	

10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	kWh/year	Fuel price	Fuel cost £/yea	r
Space heating - main system 1 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		1210.36	(240a)
Low-rate fraction	0		1210.36	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		1210.36	(241a)
Low-rate fraction	0		1210.36	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		1210.36	(242a)





Low-rate fraction	0		1210.36	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Space heating - secondary cost (other fuel)	0		0	(242e)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		0	(243)
Low-rate fraction	0		0	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Water heating cost (other fuel)	0		125.79	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (24)	7)			
Energy For instantaneous electric shower(s)	0		0	(247a)
Space cooling	0		0	(248)
Pumps, fans And electric keep-hot	0		171.74	(249)
Energy For lighting	0		68.66	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		0	(252)
Appendix Q, <item 1="" description=""></item>	Fuel	kWh/year		
energy saved Or generated	0		0	(253)
energy used	0		0	(254)
Total energy cost	0		1689.26	(255)
11a. SAP rating – Individual heating systems including micro-CHP				
Energy cost deflator	0		0	(256)
Energy cost factor (ECF)	0		0	(257)
SAP rating	0		0	(258)
11a. SAP rating – Individual heating systems including mic	ro-CHP			
Energy cost deflator			0.36	(256)
Energy cost factor (ECF)			1.57	(257)
SAP rating			74.53	(258)
12a. CO2 emissions – Individual heating systems including	; micro-CHP			
	Energy	Emission factor	Emissions	
	KWh/year	kg	kg CO2/year	
Space heating - main system 1		<u> </u>	1131.53	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			115.14	(264)
Energy for instantaneous electric shower(s)			0	(264a)
• •			·	, ,





Space and water heating		0	(265)
Space cooling		0	(266)
Electricity for pumps, fans and electric keep		144.47	(267)
Electricity for lighting		60.09	(268)
energy saved or generated	0	0	(269b)
Appendix Q items			
energy saved	0	0	
energy used	0	0	
energy saved	0	0	(270b)
energy used		0	(271b)
Total CO2, kg/year		1530.73	(272)
Dwelling CO2 Emission Rate		4.48	(273)
EI rating		95	(274)
			. ,

13a. Primary Energy – Individual heating systems including micro-CHP

	Energy	Emission factor	Emissionsr	
	KWh/year	kg	kg CO2/year	
Space heating - main system 1			11529.25	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			1189.09	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			0	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			1575.56	(281)
Electricity for lighting			638.62	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			15908.84	(286)
Dwelling PE Rate			46.52	(287)

