

# Summary for Input Data



Property Reference	008619 - Plot 015		Issued on Date	30/11/2023
Assessment Reference	Rev A	Prop Type Ref	008619-SAP-Greenwood-Semi	
Property	Plot 015, High Street , Sutton			

SAP Rating	81 B	DER	4.74	TER	10.90
Environmental	96 A	% DER < TER			56.51
CO <sub>2</sub> Emissions (t/year)	0.33	DFEE	33.71	TFEE	34.75
Compliance Check	See BREL	% DFEE < TFEE			3.00
% DPER < TPER	14.37	DPER	48.78	TPER	56.97

Assessor Details	Mr. Dean Shores	Assessor ID	W976-0001
Client			

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

Orientation	West	
Property Tenure	ND	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	House, Semi-Detached	
Which Floor	0	
2.0 Number of Storeys	2	
3.0 Date Built	2023	
3.0 Property Age Band	L	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m <sup>2</sup> K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	No	
Smart gas meter fitted	No	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m <sup>2</sup>	0.00 m
Ground floor:	18.49 m	42.11 m <sup>2</sup>	2.39 m
1st Storey:	18.49 m	42.11 m <sup>2</sup>	2.67 m
2nd Storey:	0.00 m	0.00 m <sup>2</sup>	0.00 m
3rd Storey:	0.00 m	0.00 m <sup>2</sup>	0.00 m
4th Storey:	0.00 m	0.00 m <sup>2</sup>	0.00 m
5th Storey:	0.00 m	0.00 m <sup>2</sup>	0.00 m
6th Storey:	0.00 m	0.00 m <sup>2</sup>	0.00 m
7th Storey:	0.00 m	0.00 m <sup>2</sup>	0.00 m

8.0 Living Area	17.60	m <sup>2</sup>
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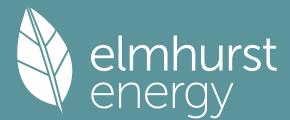
9.0 External Walls	Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Gross Area(m <sup>2</sup> )	Nett Area (m <sup>2</sup> )	Shelter Res	Shelter	Openings	Area Calculation Type
	External Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.20	9.00	93.43	81.90	0.00	None	11.53	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )	Shelter Res	Shelter
	Party Wall	Filled Cavity with Edge Sealing	Double plasterboard on both sides, twin timber f rame with/without sheathing board	0.00	20.00	41.14	0.00	None

9.2 Internal Walls	Description	Construction	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
	Ground Floor	Plasterboard on timber frame	9.00	60.13
	First Floor	Plasterboard on timber frame	9.00	96.33

10.0 External Roofs	Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Gross Area(m <sup>2</sup> )	Nett Area	Shelter Code	Shelter Factor	Calculation Type	Openings
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# Summary for Input Data



Insulated Plane	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	42.11	(m <sup>2</sup> ) 42.11	None	0.00	Enter Gross Area	0.00
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## 10.2 Internal Ceilings

Description	Storey	Construction	Area (m <sup>2</sup> )
Ground Floor	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	42.11

## 11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m <sup>2</sup> K)	Shelter Code	Shelter Factor	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
Ground Floor	Ground Floor - Solid	Lowest occupied	Suspended concrete floor, carpeted	0.13	None	0.00	75.00	42.11

## 11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
First Floor		Plasterboard ceiling, carpeted chipboard floor	9.00	42.11

## 12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m <sup>2</sup> K)
Solid Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Glazed Door	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.30

## 13.0 Openings

Name	Opening Type	Location	Orientation	Area (m <sup>2</sup> )	Pitch
Front Door	Solid Door	External Wall	West	2.15	0
Front Windows	Windows	External Wall	West	3.33	0
Rear Patio Door	Glazed Door	External Wall	East	3.33	0
Rear Windows	Windows	External Wall	East	2.72	0

## 14.0 Conservatory

## 15.0 Draught Proofing

 %

## 16.0 Draught Lobby

## 17.0 Thermal Bridging

## 17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E1 Steel lintel with perforated steel base plate	Independently assessed	7.72	0.08	0.08 Donaldson Timber Systems	No
E3 Sill	Independently assessed	5.11	0.07	0.07 Donaldson Timber Systems	No
E4 Jamb	Independently assessed	20.10	0.05	0.05 Donaldson Timber Systems	No
E5 Ground floor (normal)	Independently assessed	18.49	0.03	0.03 Donaldson Timber Systems	No
E6 Intermediate floor within a dwelling	Independently assessed	18.49	0.10	0.10 Donaldson Timber Systems	No
E10 Eaves (insulation at ceiling level)	Independently assessed	10.35	0.04	0.04 Donaldson Timber Systems	No
E12 Gable (insulation at ceiling level)	Independently assessed	8.14	0.05	0.05 Donaldson Timber Systems	No
E16 Corner (normal)	Independently assessed	10.11	0.06	0.06 Donaldson Timber Systems	No
E18 Party wall between dwellings	Independently assessed	10.11	0.05	0.05 Donaldson Timber Systems	No
P1 Party wall - Ground floor	Independently assessed	8.14	0.03	0.03 Donaldson Timber Systems	No
P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	8.14	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	8.14	0.06	0.06 Donaldson Timber Systems	No

Y-value  W/m<sup>2</sup>K

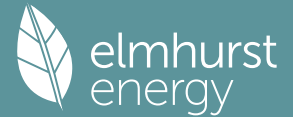
## 18.0 Pressure Testing

Designed AP<sub>50</sub>  m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa  
 Property Tested?   
 Test Method   
 As Built AP<sub>50</sub>  m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa

## 19.0 Mechanical Ventilation

**Mechanical Ventilation**  
 Mechanical Ventilation System Present   
 Approved Installation   
 Mechanical Ventilation data Type   
 Type   
 MV Reference Number   
 Configuration   
 Manufacturer SFP   
 Duct Type   
 MVHR Efficiency

# Summary for Input Data



Wet Rooms	<input type="text" value="2"/>
SFP from Installer Commissioning Certificate	<input type="text" value="No"/>
MVHR System Location	<input type="text" value="Inside heated envelope (installed exclusively)"/>
Duct Installation Specification	<input type="text" value="Level 1"/>

## 20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

## 22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Downlights	80.00	28	2240	6
Spotlights	90.00	9	810	10

## 24.0 Main Heating 1

SAP table	<input type="text" value="SAP table"/>
Percentage of Heat	<input type="text" value="100.00"/> %
Database Ref. No.	<input type="text" value="0"/>
Fuel Type	<input type="text" value="Electricity"/>
SAP Code	<input type="text" value="691"/>
In Winter	<input type="text" value="0.00"/>
In Summer	<input type="text" value="0.00"/>
Controls SAP Code	<input type="text" value="2603"/>
Delayed Start Stat	<input type="text" value="No"/>
HETAS approved System	<input type="text" value="No"/>
Oil Pump Inside	<input type="text" value="No"/>
Fan Assisted Flue	<input type="text" value="No"/>
Boiler Interlock	<input type="text" value="No"/>

25.0 Main Heating 2

26.0 Heat Networks

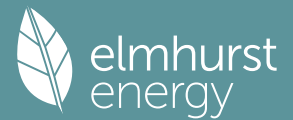
Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

## 28.0 Water Heating

Water Heating	<input type="text" value="Independent"/>
SAP Code	<input type="text" value="903"/>
Fuel Type	<input type="text" value="Electricity"/>
Flue Gas Heat Recovery System	<input type="text" value="No"/>
Waste Water Heat Recovery Instantaneous System 1	<input type="text" value="No"/>
Waste Water Heat Recovery Instantaneous System 2	<input type="text" value="No"/>
Waste Water Heat Recovery Storage System	<input type="text" value="No"/>
Solar Panel	<input type="text" value="No"/>
Water use <= 125 litres/person/day	<input type="text" value="Yes"/>
Immersion Heater	<input type="text" value="Single"/>
Summer Immersion	<input type="text" value="No"/>
Cold Water Source	<input type="text" value="From mains"/>
Bath Count	<input type="text" value="1"/>
Supplementary Immersion	<input type="text" value="No"/>
Immersion Only Heating Hot Water	<input type="text" value="No"/>

## 28.1 Showers

# Summary for Input Data



Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Bathroom	Combi boiler or unvented hot water system	6.00		No	
En Suite	Combi boiler or unvented hot water system	6.00		No	

## 28.3 Waste Water Heat Recovery System

### 29.0 Hot Water Cylinder

Hot Water Cylinder	Hot Water Cylinder
Cylinder Stat	No
Cylinder In Heated Space	Yes
Independent Time Control	No
Insulation Type	Measured Loss
Cylinder Volume	180.00
Loss	1.02
In Airing Cupboard	No

L  
kWh/day

### 31.0 Thermal Store

None

### 32.0 Photovoltaic Unit

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

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
2.38	West	30°	None Or Little	No	No	1.00		

### 34.0 Small-scale Hydro

None	
Electricity Generated	0.00
Apportioned	0.00
Connected to dwelling's electricity meter	Yes
Electricity Generation	Annual

kWh/Year

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

### 35.0 Special Features

Energy Saved	Fuel Saved	Energy Used	Fuel Used	Description	Monthly Air Change Rates	Special Technologies Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
151.05	Electricity	45.23	Electricity	PV Diverter 1		Fuel saving feature	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		8.66		PV Diverter 2		CO2 saving feature	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

### Recommendations

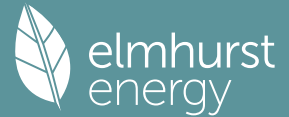
Lower cost measures

None

Further measures to achieve even higher standards

None

# Full SAP Calculation Printout



Property Reference	008619 - Plot 015		Issued on Date	30/11/2023	
Assessment Reference	Rev A	Prop Type Ref	008619-SAP-Greenwood-Semi		
Property	Plot 015, High Street, Sutton				
SAP Rating	81 B	DER	4.74	TER	10.90
Environmental	96 A	% DER < TER			56.51
CO <sub>2</sub> Emissions (t/year)	0.33	DFEE	33.71	TFEE	34.75
Compliance Check	See BREL	% DFEE < TFEE			3.00
% DPER < TPER	14.37	DPER	48.78	TPER	56.97
Assessor Details	Mr. Dean Shores			Assessor ID	W976-0001
Client					

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

### 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	42.1100 (1b)	x 2.3900 (2b)	= 100.6429 (1b) - (3b)
First floor	42.1100 (1c)	x 2.6700 (2c)	= 112.4337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.0766 (5)

### 2. Ventilation rate

	m3 per hour											
Number of open chimneys	0 * 80 =											0.0000 (6a)
Number of open flues	0 * 20 =											0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000 (6d)
Number of flues attached to other heater	0 * 35 =											0.0000 (6e)
Number of blocked chimneys	0 * 20 =											0.0000 (6f)
Number of intermittent extract fans	0 * 10 =											0.0000 (7a)
Number of passive vents	0 * 10 =											0.0000 (7b)
Number of flueless gas fires	0 * 40 =											0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =											0.0000 (8)
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	3.0000											(17)
Infiltration rate	0.1500											(18)
Number of sides sheltered	2											(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1275 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Balanced mechanical ventilation with heat recovery	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.2666	0.2634	0.2602	0.2442	0.2411	0.2251	0.2251	0.2219	0.2315	0.2411	0.2474	0.2538 (25)

### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Solid Door			2.1500	1.2000	2.5800		(26)
Windows (Uw = 1.20)			6.0500	1.1450	6.9275		(27)
Glazed Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
Ground Floor			42.1100	0.1300	5.4743	75.0000	3158.2500 (28a)
External Wall	93.4300	11.5300	81.9000	0.2000	16.3800	9.0000	737.1000 (29a)
Insulated Plane	42.1100		42.1100	0.1100	4.6321	9.0000	378.9900 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			177.6500				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	40.1089			
Party Wall			41.1400	0.0000	0.0000	20.0000	822.8000 (32)
Ground Floor			60.1300			9.0000	541.1700 (32c)
First Floor			96.3300			9.0000	866.9700 (32c)
First Floor			42.1100			18.0000	757.9800 (32d)
Ground Floor			42.1100			9.0000	378.9900 (32e)

# Full SAP Calculation Printout



Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7642.2500 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 90.7415 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	7.7200	0.0840	0.6485
E3 Sill	5.1100	0.0680	0.3475
E4 Jamb	20.1000	0.0520	1.0452
E5 Ground floor (normal)	18.4900	0.0260	0.4807
E6 Intermediate floor within a dwelling	18.4900	0.1000	1.8490
E10 Eaves (insulation at ceiling level)	10.3500	0.0400	0.4140
E12 Gable (insulation at ceiling level)	8.1400	0.0540	0.4396
E16 Corner (normal)	10.1100	0.0580	0.5864
E18 Party wall between dwellings	10.1100	0.0480	0.4853
P1 Party wall - Ground floor	8.1400	0.0270	0.2198
P2 Party wall - Intermediate floor within a dwelling	8.1400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.1400	0.0620	0.5047

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.0206 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 47.1295 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.7434	18.5193	18.2952	17.1745	16.9504	15.8297	15.8297	15.6056	16.2780	16.9504	17.3986	17.8469
Average = Sum(39)m / 12 =	65.8729	65.6488	65.4246	64.3040	64.0799	62.9592	62.9592	62.7351	63.4075	64.0799	64.5281	64.2480

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.7822	0.7795	0.7768	0.7635	0.7609	0.7476	0.7476	0.7449	0.7529	0.7609	0.7662	0.7715
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5381 (42)

Hot water usage for mixer showers 66.7749 65.7714 64.3091 61.5113 59.4465 57.1440 55.8352 57.2864 58.8772 61.3495 64.2074 66.5190 (42a)

Hot water usage for baths 28.8386 28.4103 27.8072 26.6951 25.8624 24.9391 24.4404 25.0393 25.6914 26.6794 27.8143 28.7411 (42b)

Hot water usage for other uses 40.6224 39.1452 37.6680 36.1909 34.7137 33.2365 33.2365 34.7137 36.1909 37.6680 39.1452 40.6224 (42c)

Average daily hot water use (litres/day) 125.2316 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	136.2359	133.3269	129.7843	124.3972	120.0226	115.3196	113.5121	117.0394	120.7595	125.6969	131.1670	135.8825
Energy content (annual)	215.7643	189.8557	199.4737	170.2936	161.5735	141.7989	137.2830	144.9192	148.9085	170.5695	186.8714	212.7592
Distribution loss (46)m = 0.15 x (45)m	32.3647	28.4784	29.9210	25.5440	24.2360	21.2698	20.5924	21.7379	22.3363	25.5854	28.0307	31.9139
Water storage loss:												
Store volume												180.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.0200
Temperature factor from Table 2b												0.6000
Enter (49) or (54) in (55)												0.6120
Total storage loss	18.9720	17.1360	18.9720	18.3600	18.9720	18.3600	18.9720	18.9720	18.3600	18.9720	18.3600	18.9720
If cylinder contains dedicated solar storage	18.9720	17.1360	18.9720	18.3600	18.9720	18.3600	18.9720	18.9720	18.3600	18.9720	18.3600	18.9720
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	234.7363	206.9917	218.4457	188.6536	180.5455	160.1589	156.2550	163.8912	167.2685	189.5415	205.2314	231.7312
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PV diverter	-6.2285	-15.5193	-37.7151	-67.8259	-99.2966	-103.7689	-101.2259	-79.0882	-50.2897	-24.1592	-8.7700	-4.6803
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	228.5079	191.4724	180.7305	120.8277	81.2489	56.3900	55.0291	84.8030	116.9788	165.3823	196.4614	227.0509
12Total per year (kWh/year)												
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000
Heat gains from water heating, kWh/month	86.9192	76.8358	81.5026	71.3106	68.9008	61.8361	60.8242	63.3632	64.2001	71.8920	76.8227	85.9200

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

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.7775	143.6822	129.7775	134.1034	129.7775	134.1034	129.7775	129.7775	134.1034	129.7775	134.1034	129.7775
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.0339	230.4002	224.4373	211.7429	195.7184	180.6578	170.5963	168.2300	174.1930	186.8874	202.9118	217.9725
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229
Water heating gains (Table 5)	116.8269	114.3390	109.5465	99.0425	92.6086	85.8835	81.7530	85.1656	89.1668	96.6290	106.6982	115.4839
Total internal gains	535.7094	549.4925	524.8323	505.9599	479.1756	461.7157	443.1978	444.2442	458.5342	474.3649	504.7845	524.3050

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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East		2.7200		19.6403		0.6300		0.7000		0.7700		16.3263 (76)
West		3.3300		19.6403		0.6300		0.7000		0.7700		19.9877 (80)
East		3.3300		19.6403		0.6300		0.7000		0.7700		19.9877 (76)

Solar gains	56.3018	110.1382	181.3819	264.5347	324.1972	331.8735	315.9571	271.4025	210.9547	130.6882	70.2017	46.2998 (83)
Total gains	592.0112	659.6307	706.2142	770.4946	803.3728	793.5893	759.1549	715.6467	669.4889	605.0531	574.9862	570.6048 (84)

## 7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.2264	32.3364	32.4472	33.0127	33.1282	33.7178	33.7178	33.8383	33.4795	33.1282	32.8980	32.6711
alpha	3.1484	3.1558	3.1631	3.2008	3.2085	3.2479	3.2479	3.2559	3.2320	3.2085	3.1932	3.1781
util living area	0.9289	0.9012	0.8579	0.7657	0.6391	0.4784	0.3560	0.3905	0.5849	0.7978	0.8973	0.9349 (86)
MIT	19.3692	19.6275	19.9817	20.4379	20.7533	20.9300	20.9797	20.9725	20.8622	20.4505	19.8629	19.3381 (87)
Th 2	20.2688	20.2711	20.2735	20.2851	20.2874	20.2990	20.2990	20.3013	20.2944	20.2874	20.2827	20.2781 (88)
util rest of house	0.9212	0.8908	0.8430	0.7421	0.6045	0.4327	0.3022	0.3351	0.5383	0.7721	0.8849	0.9278 (89)
MIT 2	18.3421	18.6661	19.1079	19.6705	20.0393	20.2394	20.2855	20.2822	20.1698	19.6977	18.9737	18.3093 (90)
Living area fraction										FLA = Living area / (4) = 0.2090 (91)		
MIT	18.5567	18.8670	19.2905	19.8309	20.1885	20.3837	20.4306	20.4265	20.3145	19.8550	19.1595	18.5243 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5567	18.8670	19.2905	19.8309	20.1885	20.3837	20.4306	20.4265	20.3145	19.8550	19.1595	18.5243 (93)

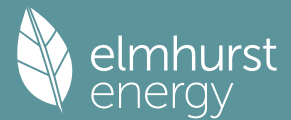
## 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8986	0.8669	0.8199	0.7259	0.5995	0.4383	0.3124	0.3452	0.5397	0.7547	0.8618	0.9061 (94)
Ext temp.	531.9720	571.8207	579.0121	559.2834	481.6020	347.8475	237.1684	247.0286	361.3417	456.6348	495.5197	517.0410 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	939.1308	916.9185	836.8120	702.8981	543.9426	364.1367	241.1696	252.6009	394.0426	593.0617	778.1791	930.7427 (97)
Space heating requirement - total per year (kWh/year)	302.9262	231.9057	191.8032	103.4026	46.3814	0.0000	0.0000	0.0000	0.0000	101.5016	203.5147	307.7941 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	302.9262	231.9057	191.8032	103.4026	46.3814	0.0000	0.0000	0.0000	0.0000	101.5016	203.5147	307.7941 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	302.9262	231.9057	191.8032	103.4026	46.3814	0.0000	0.0000	0.0000	0.0000	101.5016	203.5147	307.7941 (98c)
Space heating per m2										(98c) / (4) =		17.6826 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	302.9262	231.9057	191.8032	103.4026	46.3814	0.0000	0.0000	0.0000	0.0000	101.5016	203.5147	307.7941 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	302.9262	231.9057	191.8032	103.4026	46.3814	0.0000	0.0000	0.0000	0.0000	101.5016	203.5147	307.7941 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	228.5079	191.4724	180.7305	120.8277	81.2489	56.3900	55.0291	84.8030	116.9788	165.3823	196.4614	227.0509 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	228.5079	191.4724	180.7305	120.8277	81.2489	56.3900	55.0291	84.8030	116.9788	165.3823	196.4614	227.0509 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	19.1639	17.3093	19.1639	18.5457	19.1639	18.5457	19.1639	18.5457	19.1639	18.5457	19.1639	18.5457 (231)
Lighting	26.5737	21.3184	19.1949	14.0630	10.8627	8.8749	9.9093	12.8805	16.7304	21.9512	24.7939	27.3123 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-30.5749	-50.3845	-84.4071	-103.5526	-112.1415	-98.7598	-96.9995	-91.9670	-77.9689	-60.5604	-35.4197	-25.4173 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-0.1957	-1.1982	-5.3526	-16.3544	-33.5238	-43.2870	-42.1078	-30.4213	-17.4113	-4.6343	-0.7443	-0.0956 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1489.2294 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												100.0000

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Water heating fuel used	1704.8829 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680) mechanical ventilation fans (SFP = 0.8680)	225.6396 (230a)
Total electricity for the above, kWh/year	225.6396 (231)
Electricity for lighting (calculated in Appendix L)	214.4650 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1063.4794 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-151.0500 (236)
Energy used	45.2300 (237)
Total delivered energy for all uses	2464.9176 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1489.2294	0.1554	231.4420 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1704.8829	0.1463	249.3487 (264)
Space and water heating			480.7908 (265)
Pumps, fans and electric keep-hot	225.6396	0.1387	31.2990 (267)
Energy for lighting	214.4650	0.1443	30.9539 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-868.1532	0.1333	-115.7285
PV Unit electricity exported	-195.3261	0.1127	-22.0204
Total			-137.7489 (269)
Appendix Q item 'PV Diverter 1 ' - energy saved	-151.0500	0.1360	-20.5428 (270)
Appendix Q item 'PV Diverter 1 ' - energy used	45.2300	0.1360	6.1513 (271)
Appendix Q item 'PV Diverter 2 ' - energy saved	-0.0000	0.0000	-0.0000 (270)
Appendix Q item 'PV Diverter 2 ' - energy used	8.6600	0.0000	8.6600 (271)
Total CO2, kg/year			399.5633 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1489.2294	1.5754	2346.0720 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1704.8829	1.5411	2627.3436 (278)
Space and water heating			4973.4156 (279)
Pumps, fans and electric keep-hot	225.6396	1.5128	341.3476 (281)
Energy for lighting	214.4650	1.5338	328.9536 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-868.1532	1.4926	-1295.8283
PV Unit electricity exported	-195.3261	0.4129	-80.6418
Total			-1376.4702 (283)
Appendix Q item 'PV Diverter 1 ' - energy saved	-151.0500	1.5010	-226.7260 (284)
Appendix Q item 'PV Diverter 1 ' - energy used	45.2300	1.5010	67.8902 (285)
Total Primary energy kWh/year			4108.4108 (286)
Dwelling Primary energy Rate (DPER)			48.7800 (287)

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS  
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-----  
1. Overall dwelling characteristics  
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	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	42.1100 (1b)	x 2.3900 (2b)	= 100.6429 (1b) - (3b)
First floor	42.1100 (1c)	x 2.6700 (2c)	= 112.4337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.0766 (5)

-----  
2. Ventilation rate  
-----

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
	Air changes per hour



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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1408 (8)  
 Pressure test Yes  
 Pressure Test Method Blower Door  
 Measured/design AP50 5.0000 (17)  
 Infiltration rate 0.3908 (18)  
 Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3322 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4235	0.4152	0.4069	0.3654	0.3571	0.3156	0.3156	0.3073	0.3322	0.3571	0.3737	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5698	0.5762 (25)

### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			9.3800	1.1450	10.7405		(27)
Ground Floor			42.1100	0.1300	5.4743		(28a)
External Wall	93.4300	11.5300	81.9000	0.1800	14.7420		(29a)
Insulated Plane	42.1100		42.1100	0.1100	4.6321		(30)
Total net area of external elements Aum(A, m2)			177.6500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 37.7389		(33)
Party Wall			41.1400	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 90.7415 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	7.7200	0.0500	0.3860
E3 Sill	5.1100	0.0500	0.2555
E4 Jamb	20.1000	0.0500	1.0050
E5 Ground floor (normal)	18.4900	0.1600	2.9584
E6 Intermediate floor within a dwelling	18.4900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	10.3500	0.0600	0.6210
E12 Gable (insulation at ceiling level)	8.1400	0.0600	0.4884
E16 Corner (normal)	10.1100	0.0900	0.9099
E18 Party wall between dwellings	10.1100	0.0600	0.6066
P1 Party wall - Ground floor	8.1400	0.0800	0.6512
P2 Party wall - Intermediate floor within a dwelling	8.1400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.1400	0.1200	0.9768

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.8588 (36)

#### Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 46.5977 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.4639	41.2191	40.9790	39.8516	39.6407	38.6587	38.6587	38.4769	39.0369	39.6407	40.0674	40.5135 (38)
Heat transfer coeff	88.0616	87.8167	87.5767	86.4493	86.2383	85.2564	85.2564	85.0745	85.6346	86.2383	86.6650	87.1112 (39)
Average = Sum(39)m / 12 =												86.4482

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0456	1.0427	1.0399	1.0265	1.0240	1.0123	1.0123	1.0101	1.0168	1.0240	1.0290	1.0343 (40)
HLP (average)												1.0265
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5381 (42)

Hot water usage for mixer showers 66.7749 65.7714 64.3091 61.5113 59.4465 57.1440 55.8352 57.2864 58.8772 61.3495 64.2074 66.5190 (42a)

Hot water usage for baths 28.8386 28.4103 27.8072 26.6951 25.8624 24.9391 24.4404 25.0393 25.6914 26.6794 27.8143 28.7411 (42b)

Hot water usage for other uses 40.6224 39.1452 37.6680 36.1909 34.7137 33.2365 33.2365 34.7137 36.1909 37.6680 39.1452 40.6224 (42c)

Average daily hot water use (litres/day) 125.2316 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	136.2359	133.3269	129.7843	124.3972	120.0226	115.3196	113.5121	117.0394	120.7595	125.6969	131.1670	135.8825 (44)
Energy conte	215.7643	189.8557	199.4737	170.2936	161.5735	141.7989	137.2830	144.9192	148.9085	170.5695	186.8714	212.7592 (45)
Energy content (annual)										Total = Sum(45)m =		2080.0705

Distribution loss (46)m = 0.15 x (45)m 32.3647 28.4784 29.9210 25.5440 24.2360 21.2698 20.5924 21.7379 22.3363 25.5854 28.0307 31.9139 (46)

Water storage loss: Store volume 180.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): Temperature factor from Table 2b 1.5520 (48)

Enter (49) or (54) in (55) 0.5400 (49)

Total storage loss 0.8381 (55)

25.9803 23.4661 25.9803 25.1422 25.9803 25.1422 25.9803 25.9803 25.1422 25.9803 25.1422 25.9803 (56)

If cylinder contains dedicated solar storage 25.9803 23.4661 25.9803 25.1422 25.9803 25.1422 25.9803 25.9803 25.1422 25.9803 25.1422 25.9803 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 265.0070 234.3330 248.7163 217.9478 210.8162 189.4531 186.5257 194.1619 196.5627 219.8122 234.5256 262.0019 (62)

WWHRS -30.5267 -26.9980 -28.2708 -23.4093 -21.8167 -18.6687 -17.4989 -18.6083 -19.3153 -22.7706 -25.7964 -29.9614 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 234.4803 207.3349 220.4455 194.5385 188.9996 170.7844 169.0268 175.5535 177.2474 197.0415 208.7292 232.0405 (64)

12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2376.2221 (64)

Electric shower(s) 2376 (64)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

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

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

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0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

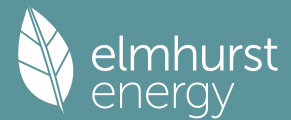
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

# Full SAP Calculation Printout



Heat gains from water heating, kWh/month  
 111.1358 98.7088 105.7191 94.7460 93.1173 85.2715 85.0407 87.5798 87.6354 96.1085 100.2581 110.1366 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	129.7775	143.6822	129.7775	134.1034	129.7775	134.1034	129.7775	129.7775	134.1034	129.7775	134.1034	129.7775
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	228.0339	230.4002	224.4373	211.7429	195.7184	180.6578	170.5963	168.2300	174.1930	186.8874	202.9118	217.9725
Pumps, fans	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000
Water heating gains (Table 5)	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229
Total internal gains	149.3760	146.8881	142.0956	131.5916	125.1577	118.4326	114.3021	117.7147	121.7159	129.1781	139.2473	148.0330
	571.2585	585.0416	560.3814	541.5090	514.7247	494.2649	475.7469	476.7933	491.0833	509.9140	540.3336	559.8541

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	6.0500	19.6403	0.6300	0.7000	0.7700	36.3140 (76)						
West	3.3300	19.6403	0.6300	0.7000	0.7700	19.9877 (80)						
Solar gains	56.3018	110.1382	181.3819	264.5347	324.1972	331.8735	315.9571	271.4025	210.9547	130.6882	70.2017	46.2998
Total gains	627.5603	695.1798	741.7633	806.0437	838.9219	826.1384	791.7041	748.1958	702.0380	640.6023	610.5353	606.1539

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	24.1064	24.1736	24.2399	24.5560	24.6161	24.8996	24.8996	24.9528	24.7896	24.6161	24.4948	24.3694
util living area	2.6071	2.6116	2.6160	2.6371	2.6411	2.6600	2.6600	2.6635	2.6526	2.6411	2.6330	2.6246
	0.9347	0.9137	0.8811	0.8116	0.7088	0.5652	0.4373	0.4741	0.6611	0.8337	0.9100	0.9396
MIT	18.6430	18.9217	19.3532	19.9475	20.4426	20.7874	20.9218	20.9010	20.6583	20.0245	19.2584	18.6062
Th 2	20.0455	20.0479	20.0503	20.0613	20.0634	20.0731	20.0731	20.0749	20.0694	20.0634	20.0592	20.0548
util rest of house	0.9265	0.9030	0.8658	0.7866	0.6686	0.5034	0.3564	0.3930	0.6038	0.8064	0.8971	0.9319
MIT 2	17.2909	17.6419	18.1833	18.9212	19.5102	19.8974	20.0248	20.0105	19.7674	19.0300	18.0780	17.2502
Living area fraction	17.5734	17.9093	18.4278	19.1357	19.7050	20.0834	20.2123	20.1966	19.9535	19.2379	18.3247	17.5336
MIT	17.5734	17.9093	18.4278	19.1357	19.7050	20.0834	20.2123	20.1966	19.9535	19.2379	18.3247	17.5336
Temperature adjustment												0.0000
adjusted MIT	17.5734	17.9093	18.4278	19.1357	19.7050	20.0834	20.2123	20.1966	19.9535	19.2379	18.3247	17.5336

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8976	0.8717	0.8333	0.7580	0.6515	0.5042	0.3691	0.4042	0.5960	0.7776	0.8661	0.9042
Useful gains	563.3164	605.9731	618.0854	610.9432	546.5761	416.5199	292.2025	302.4549	418.3905	498.1052	528.8044	548.0729
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	1168.8801	1142.4360	1044.5985	884.8650	690.3392	467.4948	307.9694	322.9924	501.2658	744.9148	972.7876	1161.5042
Space heating kWh	450.5394	360.5031	317.3258	197.2237	106.9598	0.0000	0.0000	0.0000	0.0000	183.6263	319.6679	456.3929
Space heating requirement - total per year (kWh/year)												2392.2389
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	450.5394	360.5031	317.3258	197.2237	106.9598	0.0000	0.0000	0.0000	0.0000	183.6263	319.6679	456.3929
Space heating requirement after solar contribution - total per year (kWh/year)												2392.2389
Space heating per m <sup>2</sup>										(98c) / (4) =		28.4046

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	450.5394	360.5031	317.3258	197.2237	106.9598	0.0000	0.0000	0.0000	0.0000	183.6263	319.6679	456.3929
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000
Space heating fuel (main heating system)	488.1250	390.5776	343.7982	213.6768	115.8828	0.0000	0.0000	0.0000	0.0000	198.9451	346.3358	494.4668
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000



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Property Reference	008619 - Plot 015		Issued on Date	30/11/2023	
Assessment Reference	Rev A	Prop Type Ref	008619-SAP-Greenwood-Semi		
Property	Plot 015, High Street, Sutton				
SAP Rating	81 B	DER	4.74	TER	10.90
Environmental	96 A	% DER < TER			56.51
CO <sub>2</sub> Emissions (t/year)	0.33	DFEE	33.71	TFEE	34.75
Compliance Check	See BREL	% DFEE < TFEE			3.00
% DPER < TPER	14.37	DPER	48.78	TPER	56.97
Assessor Details	Mr. Dean Shores			Assessor ID	W976-0001
Client					

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

### 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	42.1100 (1b)	x 2.3900 (2b)	= 100.6429 (1b) - (3b)
First floor	42.1100 (1c)	x 2.6700 (2c)	= 112.4337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.0766 (5)

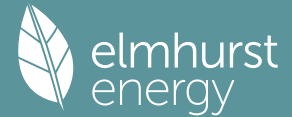
### 2. Ventilation rate

	m <sup>3</sup> per hour												
Number of open chimneys	0 * 80 =											0.0000 (6a)	
Number of open flues	0 * 20 =											0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =											0.0000 (6e)	
Number of blocked chimneys	0 * 20 =											0.0000 (6f)	
Number of intermittent extract fans	3 * 10 =											30.0000 (7a)	
Number of passive vents	0 * 10 =											0.0000 (7b)	
Number of flueless gas fires	0 * 40 =											0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =											0.1408 (8)	
Pressure test	Yes												
Pressure Test Method	Blower Door												
Measured/design AP50	3.0000											(17)	
Infiltration rate	0.2908											(18)	
Number of sides sheltered	2											(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.2472 (21)	
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3151	0.3090	0.3028	0.2719	0.2657	0.2348	0.2348	0.2286	0.2472	0.2657	0.2781	0.2904	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)	
Effective ac	0.5497	0.5477	0.5458	0.5370	0.5353	0.5276	0.5276	0.5261	0.5305	0.5353	0.5387	0.5422	(25)

### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Solid Door			2.1500	1.2000	2.5800		(26)
Windows (Uw = 1.20)			6.0500	1.1450	6.9275		(27)
Glazed Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
Ground Floor			42.1100	0.1300	5.4743	75.0000	3158.2500 (28a)
External Wall	93.4300	11.5300	81.9000	0.2000	16.3800	9.0000	737.1000 (29a)
Insulated Plane	42.1100		42.1100	0.1100	4.6321	9.0000	378.9900 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			177.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			40.1089	(33)
Party Wall			41.1400	0.0000	0.0000	20.0000	822.8000 (32)
Ground Floor			60.1300			9.0000	541.1700 (32c)
First Floor			96.3300			9.0000	866.9700 (32c)
First Floor			42.1100			18.0000	757.9800 (32d)
Ground Floor			42.1100			9.0000	378.9900 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				7642.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							90.7415 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	7.7200	0.0840	0.6485
E3 Sill	5.1100	0.0680	0.3475
E4 Jamb	20.1000	0.0520	1.0452
E5 Ground floor (normal)	18.4900	0.0260	0.4807
E6 Intermediate floor within a dwelling	18.4900	0.1000	1.8490
E10 Eaves (insulation at ceiling level)	10.3500	0.0400	0.4140
E12 Gable (insulation at ceiling level)	8.1400	0.0540	0.4396
E16 Corner (normal)	10.1100	0.0580	0.5864
E18 Party wall between dwellings	10.1100	0.0480	0.4853
P1 Party wall - Ground floor	8.1400	0.0270	0.2198
P2 Party wall - Intermediate floor within a dwelling	8.1400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.1400	0.0620	0.5047
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.0206 (36)
Point Thermal bridges			0.0000
Total fabric heat loss			(33) + (36) + (36a) = 47.1295 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.6494	38.5139	38.3809	37.7567	37.6399	37.0962	37.0962	36.9955	37.3056	37.6399	37.8762	38.1232 (38)
Heat transfer coeff	85.7789	85.6433	85.5104	84.8862	84.7694	84.2257	84.2257	84.1250	84.4351	84.7694	85.0057	85.2527 (39)
Average = Sum(39)m / 12 =												84.8856
HLP	1.0185	1.0169	1.0153	1.0079	1.0065	1.0001	1.0001	0.9989	1.0026	1.0065	1.0093	1.0123 (40)
HLP (average)												1.0079
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42)
Hot water usage for baths	28.8386	28.4103	27.8072	26.6951	25.8624	24.9391	24.4404	25.0393	25.6914	26.6794	27.8143	28.7411 (42b)
Hot water usage for other uses	40.6224	39.1452	37.6680	36.1909	34.7137	33.2365	33.2365	34.7137	36.1909	37.6680	39.1452	40.6224 (42c)
Average daily hot water use (litres/day)												63.6674 (43)
Daily hot water use	69.4610	67.5555	65.4752	62.8860	60.5761	58.1756	57.6769	59.7530	61.8822	64.3474	66.9596	69.3635 (44)
Energy content (annual)	110.0093	96.1982	100.6330	86.0878	81.5471	71.5337	69.7552	73.9867	76.3070	87.3188	95.3962	108.6065 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	93.5079	81.7685	85.5380	73.1746	69.3150	60.8036	59.2919	62.8887	64.8609	74.2210	81.0867	92.3155 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	93.5079	81.7685	85.5380	73.1746	69.3150	60.8036	59.2919	62.8887	64.8609	74.2210	81.0867	92.3155 (64)
Total per year (kWh/year)												898.7725 (64)
Electric shower(s)	53.4755	47.6472	52.0289	49.6505	50.5822	48.2505	49.8588	50.5822	49.6505	52.0289	51.0505	53.4755 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												608.2812 (64a)
Heat gains from water heating, kWh/month	36.7459	32.3539	34.3917	30.7063	29.9743	27.2635	27.2877	28.3677	28.6279	31.5625	33.0343	36.4478 (65)

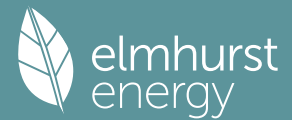
#### 5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.7775	143.6822	129.7775	134.1034	129.7775	134.1034	129.7775	129.7775	134.1034	129.7775	134.1034	129.7775 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.0339	230.4002	224.4373	211.7429	195.7184	180.6578	170.5963	168.2300	174.1930	186.8874	202.9118	217.9725 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229 (71)
Water heating gains (Table 5)	49.3896	48.1457	46.2254	42.6476	40.2880	37.8660	36.6770	38.1286	39.7609	42.4227	45.8810	48.9889 (72)
Total internal gains	468.2721	483.2992	461.5113	449.5649	426.8550	413.6983	398.1219	397.2072	409.1284	420.1586	443.9672	457.8100 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	2.7200	19.6403	0.6300	0.7000	0.7700	16.3263 (76)						
West	3.3300	19.6403	0.6300	0.7000	0.7700	19.9877 (80)						
East	3.3300	19.6403	0.6300	0.7000	0.7700	19.9877 (76)						
Solar gains	56.3018	110.1382	181.3819	264.5347	324.1972	331.8735	315.9571	271.4025	210.9547	130.6882	70.2017	46.2998 (83)

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Total gains 524.5738 593.4374 642.8932 714.0996 751.0523 745.5718 714.0790 668.6097 620.0830 550.8468 514.1689 504.1098 (84)

## 7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.7479	24.7871	24.8256	25.0082	25.0426	25.2043	25.2043	25.2344	25.1418	25.0426	24.9730	24.9007
alpha	2.6499	2.6525	2.6550	2.6672	2.6695	2.6803	2.6803	2.6823	2.6761	2.6695	2.6649	2.6600
util living area	0.9546	0.9362	0.9074	0.8430	0.7449	0.6025	0.4717	0.5139	0.7049	0.8699	0.9354	0.9588 (86)
MIT	18.4898	18.7806	19.2291	19.8500	20.3804	20.7563	20.9084	20.8822	20.6056	19.9109	19.1058	18.4374 (87)
Th 2	20.0679	20.0693	20.0706	20.0767	20.0779	20.0833	20.0833	20.0843	20.0812	20.0779	20.0756	20.0731 (88)
util rest of house	0.9486	0.9279	0.8949	0.8209	0.7068	0.5406	0.3877	0.4300	0.6497	0.8469	0.9256	0.9534 (89)
MIT 2	17.7647	18.0515	18.4923	19.0960	19.5926	19.9238	20.0384	20.0233	19.8044	19.1660	18.3802	17.7165 (90)
Living area fraction	fLA = Living area / (4) = 0.2090 (91)											
MIT	17.9162	18.2039	18.6463	19.2536	19.7572	20.0978	20.2202	20.2028	19.9718	19.3216	18.5318	17.8672 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.9162	18.2039	18.6463	19.2536	19.7572	20.0978	20.2202	20.2028	19.9718	19.3216	18.5318	17.8672 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9302	0.9064	0.8710	0.7978	0.6921	0.5417	0.4009	0.4415	0.6424	0.8240	0.9044	0.9359 (94)
Useful gains	487.9530	537.9129	559.9876	569.7174	519.8006	403.8458	286.2415	295.1716	398.3673	453.9078	465.0075	471.8095 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1167.9833	1139.3882	1038.6333	878.8751	683.0034	463.0541	304.9117	319.9083	495.7851	739.3278	971.7695	1165.1625 (97)
Space heating kWh	505.9425	404.1914	356.1124	222.5935	121.4229	0.0000	0.0000	0.0000	0.0000	212.3524	364.8686	515.8546 (98a)
Space heating requirement - total per year (kWh/year)	2703.3383											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	505.9425	404.1914	356.1124	222.5935	121.4229	0.0000	0.0000	0.0000	0.0000	212.3524	364.8686	515.8546 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2703.3383											
Space heating per m2	(98c) / (4) = 32.0985 (99)											

## 8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	791.7213	623.2699	639.3499	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7367	0.8026	0.7729	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	583.2362	500.2307	494.1390	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	810.2916	776.3964	725.9183	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	163.4799	205.4672	172.4438	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fC = cooled area / (4) = 1.0000 (105)											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.8700	51.3668	43.1109	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	135.3477 (107)											
Energy for space heating	32.0985 (99)											
Energy for space cooling	1.6071 (108)											
Total	33.7056 (109)											
Fabric Energy Efficiency (DFEE)	33.7 (109)											

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

### 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	42.1100 (1b)	x	2.3900 (2b) = 100.6429 (1b) - (3b)
First floor	42.1100 (1c)	x	2.6700 (2c) = 112.4337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 213.0766 (5)

### 2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)

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Number of intermittent extract fans		3 * 10 =	30.0000 (7a)										
Number of passive vents		0 * 10 =	0.0000 (7b)										
Number of flueless gas fires		0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =			30.0000 / (5) = 0.1408 (8)										
Pressure test			Yes										
Pressure Test Method			Blower Door										
Measured/design AP50			5.0000 (17)										
Infiltration rate			0.3908 (18)										
Number of sides sheltered			2 (19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3322 (21)										
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4235	0.4152	0.4069	0.3654	0.3571	0.3156	0.3156	0.3073	0.3322	0.3571	0.3737	0.3903	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5698	0.5762	(25)

### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			9.3800	1.1450	10.7405		(27)
Ground Floor			42.1100	0.1300	5.4743		(28a)
External Wall	93.4300	11.5300	81.9000	0.1800	14.7420		(29a)
Insulated Plane	42.1100		42.1100	0.1100	4.6321		(30)
Total net area of external elements Aum(A, m2)			177.6500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26) ... (30) + (32) = 37.7389		(33)
Party Wall			41.1400	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							90.7415 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	7.7200	0.0500	0.3860
E3 Sill	5.1100	0.0500	0.2555
E4 Jamb	20.1000	0.0500	1.0050
E5 Ground floor (normal)	18.4900	0.1600	2.9584
E6 Intermediate floor within a dwelling	18.4900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	10.3500	0.0600	0.6210
E12 Gable (insulation at ceiling level)	8.1400	0.0600	0.4884
E16 Corner (normal)	10.1100	0.0900	0.9099
E18 Party wall between dwellings	10.1100	0.0600	0.6066
P1 Party wall - Ground floor	8.1400	0.0800	0.6512
P2 Party wall - Intermediate floor within a dwelling	8.1400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.1400	0.1200	0.9768
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.8588 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 46.5977 (37)

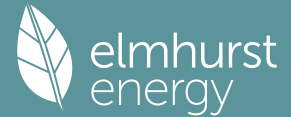
#### Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.4639	41.2191	40.9790	39.8516	39.6407	38.6587	38.6587	38.4769	39.0369	39.6407	40.0674	40.5135 (38)
Heat transfer coeff	88.0616	87.8167	87.5767	86.4493	86.2383	85.2564	85.2564	85.0745	85.6346	86.2383	86.6650	87.1112 (39)
Average = Sum(39)m / 12 =												86.4482
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0456	1.0427	1.0399	1.0265	1.0240	1.0123	1.0123	1.0101	1.0168	1.0240	1.0290	1.0343 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5381 (42)	
Hot water usage for mixer showers														0.0000 (42a)
Hot water usage for baths	28.8386	28.4103	27.8072	26.6951	25.8624	24.9391	24.4404	25.0393	25.6914	26.6794	27.8143	28.7411	(42b)	
Hot water usage for other uses	40.6224	39.1452	37.6680	36.1909	34.7137	33.2365	33.2365	34.7137	36.1909	37.6680	39.1452	40.6224	(42c)	
Average daily hot water use (litres/day)													63.6674 (43)	
Daily hot water use	69.4610	67.5555	65.4752	62.8860	60.5761	58.1756	57.6769	59.7530	61.8822	64.3474	66.9596	69.3635	(44)	
Energy content (annual)	110.0093	96.1982	100.6330	86.0878	81.5471	71.5337	69.7552	73.9867	76.3070	87.3188	95.3962	108.6065	(45)	
Distribution loss (46)m = 0.15 x (45)m													1057.3794	
Water storage loss:													0.0000 (46)	
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	93.5079	81.7685	85.5380	73.1746	69.3150	60.8036	59.2919	62.8887	64.8609	74.2210	81.0867	92.3155	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
FV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	93.5079	81.7685	85.5380	73.1746	69.3150	60.8036	59.2919	62.8887	64.8609	74.2210	81.0867	92.3155	(64)	
Total per year (kWh/year) = Sum(64)m =													898.7725 (64)	
													899 (64)	

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Electric shower(s)	53.4755	47.6472	52.0289	49.6505	50.5822	48.2505	49.8588	50.5822	49.6505	52.0289	51.0505	53.4755 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a) m =												608.2812 (64a)
Heat gains from water heating, kWh/month	36.7459	32.3539	34.3917	30.7063	29.9743	27.2635	27.2877	28.3677	28.6279	31.5625	33.0343	36.4478 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.7775	143.6822	129.7775	134.1034	129.7775	134.1034	129.7775	129.7775	134.1034	129.7775	134.1034	129.7775 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.0339	230.4002	224.4373	211.7429	195.7184	180.6578	170.5963	168.2300	174.1930	186.8874	202.9118	217.9725 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229 (71)
Water heating gains (Table 5)	49.3896	48.1457	46.2254	42.6476	40.2880	37.8660	36.6770	38.1286	39.7609	42.4227	45.8810	48.9889 (72)
Total internal gains	468.2721	483.2992	461.5113	449.5649	426.8550	413.6983	398.1219	397.2072	409.1284	420.1586	443.9672	457.8100 (73)

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	6.0500	19.6403	0.6300	0.7000	0.7700	36.3140 (76)						
West	3.3300	19.6403	0.6300	0.7000	0.7700	19.9877 (80)						
Solar gains	56.3018	110.1382	181.3819	264.5347	324.1972	331.8735	315.9571	271.4025	210.9547	130.6882	70.2017	46.2998 (83)
Total gains	524.5738	593.4374	642.8932	714.0996	751.0523	745.5718	714.0790	668.6097	620.0830	550.8468	514.1689	504.1098 (84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	24.1064	24.1736	24.2399	24.5560	24.6161	24.8996	24.8996	24.9528	24.7896	24.6161	24.4948	24.3694
tau	2.6071	2.6116	2.6160	2.6371	2.6411	2.6600	2.6600	2.6635	2.6526	2.6411	2.6330	2.6246
util living area	0.9551	0.9372	0.9090	0.8455	0.7487	0.6062	0.4756	0.5175	0.7085	0.8718	0.9362	0.9592 (86)
MIT	18.4149	18.7106	19.1684	19.8121	20.3556	20.7471	20.9041	20.8775	20.5914	19.8798	19.0593	18.3760 (87)
Th 2	20.0455	20.0479	20.0503	20.0613	20.0634	20.0731	20.0731	20.0749	20.0694	20.0634	20.0592	20.0548 (88)
util rest of house	0.9492	0.9289	0.8965	0.8234	0.7105	0.5438	0.3904	0.4326	0.6530	0.8488	0.9264	0.9537 (89)
MIT 2	17.6761	17.9685	18.4194	19.0490	19.5590	19.9078	20.0262	20.0116	19.7829	19.1263	18.3237	17.6439 (90)
Living area fraction	17.8305	18.1236	18.5759	19.2085	19.7255	20.0832	20.2097	20.1925	19.9518	19.2838	18.4775	17.7969 (92)
Temperature adjustment	17.8305	18.1236	18.5759	19.2085	19.7255	20.0832	20.2097	20.1925	19.9518	19.2838	18.4775	0.0000
adjusted MIT	17.8305	18.1236	18.5759	19.2085	19.7255	20.0832	20.2097	20.1925	19.9518	19.2838	18.4775	17.7969 (93)

## 8. Space heating requirement

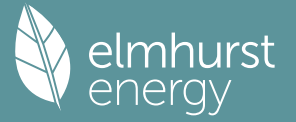
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1191.5156	1161.2552	1057.5710	891.1594	692.1046	467.4781	307.7475	322.6473	501.1186	748.8739	986.0277	1184.4407 (97)
Space heating kWh	523.3444	418.6302	369.6276	230.4524	126.5197	0.0000	0.0000	0.0000	0.0000	218.8730	374.9445	530.1377 (98a)
Space heating requirement - total per year (kWh/year)												2792.5293
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	523.3444	418.6302	369.6276	230.4524	126.5197	0.0000	0.0000	0.0000	0.0000	218.8730	374.9445	530.1377 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2792.5293
Space heating per m <sup>2</sup>												(98c) / (4) = 33.1576 (99)

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	801.4099	630.8972	646.5664	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7308	0.7972	0.7677	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	585.6436	502.9573	496.3375	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	810.2916	776.3964	725.9183	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	161.7465	203.4387	170.8081	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.4366	50.8597	42.7020	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												133.9983 (107)

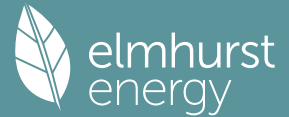


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Energy for space heating	33.1576 (99)
Energy for space cooling	1.5911 (108)
Total	34.7486 (109)
Fabric Energy Efficiency (TFEE)	34.7 (109)

# Full SAP Calculation Printout



Property Reference	008619 - Plot 015		Issued on Date	30/11/2023	
Assessment Reference	Rev A	Prop Type Ref	008619-SAP-Greenwood-Semi		
Property	Plot 015, High Street, Sutton				
SAP Rating	81 B	DER	4.74	TER	10.90
Environmental	96 A	% DER < TER			56.51
CO <sub>2</sub> Emissions (t/year)	0.33	DFEE	33.71	TFEE	34.75
Compliance Check	See BREL	% DFEE < TFEE			3.00
% DPER < TPER	14.37	DPER	48.78	TPER	56.97
Assessor Details	Mr. Dean Shores			Assessor ID	W976-0001
Client					

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

### 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	42.1100 (1b)	x 2.3900 (2b)	= 100.6429 (1b) - (3b)
First floor	42.1100 (1c)	x 2.6700 (2c)	= 112.4337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.0766 (5)

### 2. Ventilation rate

	m3 per hour											
Number of open chimneys	0 * 80 =											0.0000 (6a)
Number of open flues	0 * 20 =											0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000 (6d)
Number of flues attached to other heater	0 * 35 =											0.0000 (6e)
Number of blocked chimneys	0 * 20 =											0.0000 (6f)
Number of intermittent extract fans	0 * 10 =											0.0000 (7a)
Number of passive vents	0 * 10 =											0.0000 (7b)
Number of flueless gas fires	0 * 40 =											0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =											0.0000 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												3.0000 (17)
Infiltration rate												0.1500 (18)
Number of sides sheltered												2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1275 (21)
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.2666	0.2634	0.2602	0.2442	0.2411	0.2251	0.2251	0.2219	0.2315	0.2411	0.2474	0.2538 (25)

### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Solid Door			2.1500	1.2000	2.5800		(26)
Windows (Uw = 1.20)			6.0500	1.1450	6.9275		(27)
Glazed Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
Ground Floor			42.1100	0.1300	5.4743	75.0000	3158.2500 (28a)
External Wall	93.4300	11.5300	81.9000	0.2000	16.3800	9.0000	737.1000 (29a)
Insulated Plane	42.1100		42.1100	0.1100	4.6321	9.0000	378.9900 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			177.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	40.1089			(33)
Party Wall			41.1400	0.0000	0.0000	20.0000	822.8000 (32)
Ground Floor			60.1300			9.0000	541.1700 (32c)
First Floor			96.3300			9.0000	866.9700 (32c)
First Floor			42.1100			18.0000	757.9800 (32d)
Ground Floor			42.1100			9.0000	378.9900 (32e)

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Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7642.2500 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 90.7415 (35)

List of Thermal Bridges	K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate		7.7200	0.0840	0.6485
E3 Sill		5.1100	0.0680	0.3475
E4 Jamb		20.1000	0.0520	1.0452
E5 Ground floor (normal)		18.4900	0.0260	0.4807
E6 Intermediate floor within a dwelling		18.4900	0.1000	1.8490
E10 Eaves (insulation at ceiling level)		10.3500	0.0400	0.4140
E12 Gable (insulation at ceiling level)		8.1400	0.0540	0.4396
E16 Corner (normal)		10.1100	0.0580	0.5864
E18 Party wall between dwellings		10.1100	0.0480	0.4853
P1 Party wall - Ground floor		8.1400	0.0270	0.2198
P2 Party wall - Intermediate floor within a dwelling		8.1400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)		8.1400	0.0620	0.5047

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.0206 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 47.1295 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.7434	18.5193	18.2952	17.1745	16.9504	15.8297	15.8297	15.6056	16.2780	16.9504	17.3986	17.8469 (38)
Average = Sum(39)m / 12 =	65.8729	65.6488	65.4246	64.3040	64.0799	62.9592	62.9592	62.7351	63.4075	64.0799	64.5281	64.2480 (39)
HLP	0.7822	0.7795	0.7768	0.7635	0.7609	0.7476	0.7476	0.7449	0.7529	0.7609	0.7662	0.7715 (40)
HLP (average)												0.7629
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5381 (42)												
Hot water usage for mixer showers												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for baths	66.7749	65.7714	64.3091	61.5113	59.4465	57.1440	55.8352	57.2864	58.8772	61.3495	64.2074	66.5190 (42a)
Hot water usage for other uses	28.8386	28.4103	27.8072	26.6951	25.8624	24.9391	24.4404	25.0393	25.6914	26.6794	27.8143	28.7411 (42b)
Hot water usage for other uses	40.6224	39.1452	37.6680	36.1909	34.7137	33.2365	33.2365	34.7137	36.1909	37.6680	39.1452	40.6224 (42c)
Average daily hot water use (litres/day)												125.2316 (43)
Daily hot water use	136.2359	133.3269	129.7843	124.3972	120.0226	115.3196	113.5121	117.0394	120.7595	125.6969	131.1670	135.8825 (44)
Energy content (annual)	215.7643	189.8557	199.4737	170.2936	161.5735	141.7989	137.2830	144.9192	148.9085	170.5695	186.8714	212.7592 (45)
Distribution loss (46)m = 0.15 x (45)m												2080.0705
Water storage loss:	32.3647	28.4784	29.9210	25.5440	24.2360	21.2698	20.5924	21.7379	22.3363	25.5854	28.0307	31.9139 (46)
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0200 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.6120 (55)
Total storage loss	18.9720	17.1360	18.9720	18.3600	18.9720	18.3600	18.9720	18.9720	18.3600	18.9720	18.3600	18.9720 (56)
If cylinder contains dedicated solar storage	18.9720	17.1360	18.9720	18.3600	18.9720	18.3600	18.9720	18.9720	18.3600	18.9720	18.3600	18.9720 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	234.7363	206.9917	218.4457	188.6536	180.5455	160.1589	156.2550	163.8912	167.2685	189.5415	205.2314	231.7312 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-6.2285	-15.5193	-37.7151	-67.8259	-99.2966	-103.7689	-101.2259	-79.0882	-50.2897	-24.1592	-8.7700	-4.6803 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	228.5079	191.4724	180.7305	120.8277	81.2489	56.3900	55.0291	84.8030	116.9788	165.3823	196.4614	227.0509 (64)
12Total per year (kWh/year)												1704.8829 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	86.9192	76.8358	81.5026	71.3106	68.9008	61.8361	60.8242	63.3632	64.2001	71.8920	76.8227	85.9200 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.7775	143.6822	129.7775	134.1034	129.7775	134.1034	129.7775	129.7775	134.1034	129.7775	134.1034	129.7775 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.0339	230.4002	224.4373	211.7429	195.7184	180.6578	170.5963	168.2300	174.1930	186.8874	202.9118	217.9725 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229 (71)
Water heating gains (Table 5)	116.8269	114.3390	109.5465	99.0425	92.6086	85.8835	81.7530	85.1656	89.1668	96.6290	106.6982	115.4839 (72)
Total internal gains	535.7094	549.4925	524.8323	505.9599	479.1756	461.7157	443.1978	444.2442	458.5342	474.3649	504.7845	524.3050 (73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	

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East		2.7200		19.6403		0.6300		0.7000		0.7700		16.3263 (76)
West		3.3300		19.6403		0.6300		0.7000		0.7700		19.9877 (80)
East		3.3300		19.6403		0.6300		0.7000		0.7700		19.9877 (76)

Solar gains	56.3018	110.1382	181.3819	264.5347	324.1972	331.8735	315.9571	271.4025	210.9547	130.6882	70.2017	46.2998 (83)
Total gains	592.0112	659.6307	706.2142	770.4946	803.3728	793.5893	759.1549	715.6467	669.4889	605.0531	574.9862	570.6048 (84)

## 7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.2264	32.3364	32.4472	33.0127	33.1282	33.7178	33.7178	33.8383	33.4795	33.1282	32.8980	32.6711
alpha	3.1484	3.1558	3.1631	3.2008	3.2085	3.2479	3.2479	3.2559	3.2320	3.2085	3.1932	3.1781
util living area	0.9289	0.9012	0.8579	0.7657	0.6391	0.4784	0.3560	0.3905	0.5849	0.7978	0.8973	0.9349 (86)
MIT	19.3692	19.6275	19.9817	20.4379	20.7533	20.9300	20.9797	20.9725	20.8622	20.4505	19.8629	19.3381 (87)
Th 2	20.2688	20.2711	20.2735	20.2851	20.2874	20.2990	20.2990	20.3013	20.2944	20.2874	20.2827	20.2781 (88)
util rest of house	0.9212	0.8908	0.8430	0.7421	0.6045	0.4327	0.3022	0.3351	0.5383	0.7721	0.8849	0.9278 (89)
MIT 2	18.3421	18.6661	19.1079	19.6705	20.0393	20.2394	20.2855	20.2822	20.1698	19.6977	18.9737	18.3093 (90)
Living area fraction										FLA = Living area / (4) = 0.2090 (91)		
MIT	18.5567	18.8670	19.2905	19.8309	20.1885	20.3837	20.4306	20.4265	20.3145	19.8550	19.1595	18.5243 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5567	18.8670	19.2905	19.8309	20.1885	20.3837	20.4306	20.4265	20.3145	19.8550	19.1595	18.5243 (93)

## 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8986	0.8669	0.8199	0.7259	0.5995	0.4383	0.3124	0.3452	0.5397	0.7547	0.8618	0.9061 (94)
Ext temp.	531.9720	571.8207	579.0121	559.2834	481.6020	347.8475	237.1684	247.0286	361.3417	456.6348	495.5197	517.0410 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	939.1308	916.9185	836.8120	702.8981	543.9426	364.1367	241.1696	252.6009	394.0426	593.0617	778.1791	930.7427 (97)
Space heating requirement - total per year (kWh/year)	302.9262	231.9057	191.8032	103.4026	46.3814	0.0000	0.0000	0.0000	0.0000	101.5016	203.5147	307.7941 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	302.9262	231.9057	191.8032	103.4026	46.3814	0.0000	0.0000	0.0000	0.0000	101.5016	203.5147	307.7941 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	302.9262	231.9057	191.8032	103.4026	46.3814	0.0000	0.0000	0.0000	0.0000	101.5016	203.5147	307.7941 (98c)
Space heating per m2										(98c) / (4) =		17.6826 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	302.9262	231.9057	191.8032	103.4026	46.3814	0.0000	0.0000	0.0000	0.0000	101.5016	203.5147	307.7941 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	302.9262	231.9057	191.8032	103.4026	46.3814	0.0000	0.0000	0.0000	0.0000	101.5016	203.5147	307.7941 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	228.5079	191.4724	180.7305	120.8277	81.2489	56.3900	55.0291	84.8030	116.9788	165.3823	196.4614	227.0509 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	228.5079	191.4724	180.7305	120.8277	81.2489	56.3900	55.0291	84.8030	116.9788	165.3823	196.4614	227.0509 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	19.1639	17.3093	19.1639	18.5457	19.1639	18.5457	19.1639	18.5457	19.1639	18.5457	19.1639	18.5457 (231)
Lighting	26.5737	21.3184	19.1949	14.0630	10.8627	8.8749	9.9093	12.8805	16.7304	21.9512	24.7939	27.3123 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-30.5749	-50.3845	-84.4071	-103.5526	-112.1415	-98.7598	-96.9995	-91.9670	-77.9689	-60.5604	-35.4197	-25.4173 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-0.1957	-1.1982	-5.3526	-16.3544	-33.5238	-43.2870	-42.1078	-30.4213	-17.4113	-4.6343	-0.7443	-0.0956 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1489.2294 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												100.0000

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Water heating fuel used	1704.8829 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680) mechanical ventilation fans (SFP = 0.8680)	225.6396 (230a)
Total electricity for the above, kWh/year	225.6396 (231)
Electricity for lighting (calculated in Appendix L)	214.4650 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1063.4794 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-151.0500 (236)
Energy used	45.2300 (237)
Total delivered energy for all uses	2464.9176 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1489.2294	0.1554	231.4420 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1704.8829	0.1463	249.3487 (264)
Space and water heating			480.7908 (265)
Pumps, fans and electric keep-hot	225.6396	0.1387	31.2990 (267)
Energy for lighting	214.4650	0.1443	30.9539 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-868.1532	0.1333	-115.7285
PV Unit electricity exported	-195.3261	0.1127	-22.0204
Total			-137.7489 (269)
Appendix Q item 'PV Diverter 1 ' - energy saved	-151.0500	0.1360	-20.5428 (270)
Appendix Q item 'PV Diverter 1 ' - energy used	45.2300	0.1360	6.1513 (271)
Appendix Q item 'PV Diverter 2 ' - energy saved	-0.0000	0.0000	-0.0000 (270)
Appendix Q item 'PV Diverter 2 ' - energy used	8.6600	0.0000	8.6600 (271)
Total CO2, kg/year			399.5633 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1489.2294	1.5754	2346.0720 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1704.8829	1.5411	2627.3436 (278)
Space and water heating			4973.4156 (279)
Pumps, fans and electric keep-hot	225.6396	1.5128	341.3476 (281)
Energy for lighting	214.4650	1.5338	328.9536 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-868.1532	1.4926	-1295.8283
PV Unit electricity exported	-195.3261	0.4129	-80.6418
Total			-1376.4702 (283)
Appendix Q item 'PV Diverter 1 ' - energy saved	-151.0500	1.5010	-226.7260 (284)
Appendix Q item 'PV Diverter 1 ' - energy used	45.2300	1.5010	67.8902 (285)
Total Primary energy kWh/year			4108.4108 (286)
Dwelling Primary energy Rate (DPER)			48.7800 (287)

-----  
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS  
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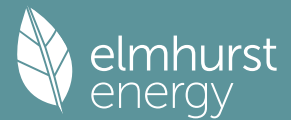
-----  
1. Overall dwelling characteristics  
-----

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	42.1100 (1b)	x 2.3900 (2b)	= 100.6429 (1b) - (3b)
First floor	42.1100 (1c)	x 2.6700 (2c)	= 112.4337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.0766 (5)

-----  
2. Ventilation rate  
-----

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
	Air changes per hour

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1408 (8)  
 Pressure test Yes  
 Pressure Test Method Blower Door  
 Measured/design AP50 5.0000 (17)  
 Infiltration rate 0.3908 (18)  
 Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3322 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4235	0.4152	0.4069	0.3654	0.3571	0.3156	0.3156	0.3073	0.3322	0.3571	0.3737	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5698	0.5762 (25)

### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			9.3800	1.1450	10.7405		(27)
Ground Floor			42.1100	0.1300	5.4743		(28a)
External Wall	93.4300	11.5300	81.9000	0.1800	14.7420		(29a)
Insulated Plane	42.1100		42.1100	0.1100	4.6321		(30)
Total net area of external elements Aum(A, m2)			177.6500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 37.7389		(33)
Party Wall			41.1400	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 90.7415 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	7.7200	0.0500	0.3860
E3 Sill	5.1100	0.0500	0.2555
E4 Jamb	20.1000	0.0500	1.0050
E5 Ground floor (normal)	18.4900	0.1600	2.9584
E6 Intermediate floor within a dwelling	18.4900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	10.3500	0.0600	0.6210
E12 Gable (insulation at ceiling level)	8.1400	0.0600	0.4884
E16 Corner (normal)	10.1100	0.0900	0.9099
E18 Party wall between dwellings	10.1100	0.0600	0.6066
P1 Party wall - Ground floor	8.1400	0.0800	0.6512
P2 Party wall - Intermediate floor within a dwelling	8.1400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.1400	0.1200	0.9768

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.8588 (36)

Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 46.5977 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.4639	41.2191	40.9790	39.8516	39.6407	38.6587	38.6587	38.4769	39.0369	39.6407	40.0674	40.5135 (38)
Heat transfer coeff	88.0616	87.8167	87.5767	86.4493	86.2383	85.2564	85.2564	85.0745	85.6346	86.2383	86.6650	87.1112 (39)
Average = Sum(39)m / 12 =												86.4482

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0456	1.0427	1.0399	1.0265	1.0240	1.0123	1.0123	1.0101	1.0168	1.0240	1.0290	1.0343 (40)
HLP (average)												1.0265
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5381 (42)

Hot water usage for mixer showers 66.7749 65.7714 64.3091 61.5113 59.4465 57.1440 55.8352 57.2864 58.8772 61.3495 64.2074 66.5190 (42a)

Hot water usage for baths 28.8386 28.4103 27.8072 26.6951 25.8624 24.9391 24.4404 25.0393 25.6914 26.6794 27.8143 28.7411 (42b)

Hot water usage for other uses 40.6224 39.1452 37.6680 36.1909 34.7137 33.2365 33.2365 34.7137 36.1909 37.6680 39.1452 40.6224 (42c)

Average daily hot water use (litres/day) 125.2316 (43)

Daily hot water use

Energy conte 136.2359 133.3269 129.7843 124.3972 120.0226 115.3196 113.5121 117.0394 120.7595 125.6969 131.1670 135.8825 (44)

Energy content (annual) 215.7643 189.8557 199.4737 170.2936 161.5735 141.7989 137.2830 144.9192 148.9085 170.5695 186.8714 212.7592 (45)

Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 2080.0705

Water storage loss: 32.3647 28.4784 29.9210 25.5440 24.2360 21.2698 20.5924 21.7379 22.3363 25.5854 28.0307 31.9139 (46)

Store volume 180.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5520 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8381 (55)

Total storage loss 25.9803 23.4661 25.9803 25.1422 25.9803 25.1422 25.9803 25.9803 25.1422 25.9803 25.1422 25.9803 (56)

If cylinder contains dedicated solar storage 25.9803 23.4661 25.9803 25.1422 25.9803 25.1422 25.9803 25.9803 25.1422 25.9803 25.1422 25.9803 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month

WWHRS 265.0070 234.3330 248.7163 217.9478 210.8162 189.4531 186.5257 194.1619 196.5627 219.8122 234.5256 262.0019 (62)

PV diverter -30.5267 -26.9980 -28.2708 -23.4093 -21.8167 -18.6687 -17.4989 -18.6083 -19.3153 -22.7706 -25.7964 -29.9614 (63a)

Solar input -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

Output from w/h 234.4803 207.3349 220.4455 194.5385 188.9996 170.7844 169.0268 175.5535 177.2474 197.0415 208.7292 232.0405 (64)

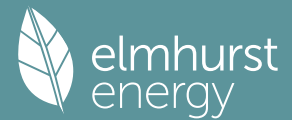
12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2376.2221 (64)

Electric shower(s) 2376 (64)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

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

# Full SAP Calculation Printout



Heat gains from water heating, kWh/month  
 111.1358 98.7088 105.7191 94.7460 93.1173 85.2715 85.0407 87.5798 87.6354 96.1085 100.2581 110.1366 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037	126.9037 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.7775	143.6822	129.7775	134.1034	129.7775	134.1034	129.7775	129.7775	134.1034	129.7775	134.1034	129.7775 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.0339	230.4002	224.4373	211.7429	195.7184	180.6578	170.5963	168.2300	174.1930	186.8874	202.9118	217.9725 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904	35.6904 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229	-101.5229 (71)
Water heating gains (Table 5)	149.3760	146.8881	142.0956	131.5916	125.1577	118.4326	114.3021	117.7147	121.7159	129.1781	139.2473	148.0330 (72)
Total internal gains	571.2585	585.0416	560.3814	541.5090	514.7247	494.2649	475.7469	476.7933	491.0833	509.9140	540.3336	559.8541 (73)

## 6. Solar gains

[Jan]	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
East	6.0500		19.6403		0.6300		0.7000		0.7700		36.3140	(76)
West	3.3300		19.6403		0.6300		0.7000		0.7700		19.9877	(80)
Solar gains	56.3018	110.1382	181.3819	264.5347	324.1972	331.8735	315.9571	271.4025	210.9547	130.6882	70.2017	46.2998 (83)
Total gains	627.5603	695.1798	741.7633	806.0437	838.9219	826.1384	791.7041	748.1958	702.0380	640.6023	610.5353	606.1539 (84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.1064	24.1736	24.2399	24.5560	24.6161	24.8996	24.8996	24.9528	24.7896	24.6161	24.4948	24.3694
alpha	2.6071	2.6116	2.6160	2.6371	2.6411	2.6600	2.6600	2.6635	2.6526	2.6411	2.6330	2.6246
util living area	0.9347	0.9137	0.8811	0.8116	0.7088	0.5652	0.4373	0.4741	0.6611	0.8337	0.9100	0.9396 (86)
MIT	18.6430	18.9217	19.3532	19.9475	20.4426	20.7874	20.9218	20.9010	20.6583	20.0245	19.2584	18.6062 (87)
Th 2	20.0455	20.0479	20.0503	20.0613	20.0634	20.0731	20.0731	20.0749	20.0694	20.0634	20.0592	20.0548 (88)
util rest of house	0.9265	0.9030	0.8658	0.7866	0.6686	0.5034	0.3564	0.3930	0.6038	0.8064	0.8971	0.9319 (89)
MIT 2	17.2909	17.6419	18.1833	18.9212	19.5102	19.8974	20.0248	20.0105	19.7674	19.0300	18.0780	17.2502 (90)
Living area fraction	17.5734	17.9093	18.4278	19.1357	19.7050	20.0834	20.2123	20.1966	19.9535	fLA = Living area / (4) = 19.2379	18.3247	17.5336 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5734	17.9093	18.4278	19.1357	19.7050	20.0834	20.2123	20.1966	19.9535	19.2379	18.3247	17.5336 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8976	0.8717	0.8333	0.7580	0.6515	0.5042	0.3691	0.4042	0.5960	0.7776	0.8661	0.9042 (94)
Useful gains	563.3164	605.9731	618.0854	610.9432	546.5761	416.5199	292.2025	302.4549	418.3905	498.1052	528.8044	548.0729 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1168.8801	1142.4360	1044.5985	884.8650	690.3392	467.4948	307.9694	322.9924	501.2658	744.9148	972.7876	1161.5042 (97)
Space heating kWh	450.5394	360.5031	317.3258	197.2237	106.9598	0.0000	0.0000	0.0000	0.0000	183.6263	319.6679	456.3929 (98a)
Space heating requirement - total per year (kWh/year)												2392.2389
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	450.5394	360.5031	317.3258	197.2237	106.9598	0.0000	0.0000	0.0000	0.0000	183.6263	319.6679	456.3929 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2392.2389
Space heating per m2										(98c) / (4) =		28.4046 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	450.5394	360.5031	317.3258	197.2237	106.9598	0.0000	0.0000	0.0000	0.0000	183.6263	319.6679	456.3929 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	488.1250	390.5776	343.7982	213.6768	115.8828	0.0000	0.0000	0.0000	0.0000	198.9451	346.3358	494.4668 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)





# Thermal Bridging



Property Reference	008619 - Plot 015	Issued on Date	30/11/2023
Assessment Reference	Rev A	Prop Type Ref	Semi-Detached House
Property	Plot 015, High Street , Sutton		

SAP Rating	81 B	DER	4.74	TER	10.90
Environmental	96 A	% DER < TER			56.51
CO <sub>2</sub> Emissions (t/year)	0.33	DFEE	33.71	TFEE	34.75
Compliance Check	See BREL	% DFEE < TFEE			3.00
% DPER < TPER	14.37	DPER	48.78	TPER	56.97

Assessor Details	Mr. Dean Shores	Assessor ID	W976-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E1 Steel lintel with perforated steel base plate	Independently assessed	0.084	7.72	0.65	Donaldson Timber Systems
External wall	E3 Sill	Independently assessed	0.068	5.11	0.35	Donaldson Timber Systems
External wall	E4 Jamb	Independently assessed	0.052	20.10	1.05	Donaldson Timber Systems
External wall	E5 Ground floor (normal)	Independently assessed	0.026	18.49	0.48	Donaldson Timber Systems
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.100	18.49	1.85	Donaldson Timber Systems
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.040	10.35	0.41	Donaldson Timber Systems
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.054	8.14	0.44	Donaldson Timber Systems
External wall	E16 Corner (normal)	Independently assessed	0.058	10.11	0.59	Donaldson Timber Systems
External wall	E18 Party wall between dwellings	Independently assessed	0.048	10.11	0.49	Donaldson Timber Systems
Party wall	P1 Party wall - Ground floor	Independently assessed	0.027	8.14	0.22	Donaldson Timber Systems
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.14	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.062	8.14	0.50	Donaldson Timber Systems

Total:  W/mK:  
 Y-Value:  W/m²K: