VINCAM CLOSE

ENERGY STATEMENT

SEPTEMBER 2021

Report Reference	PP1830/VC/ES/202108-NR
Revision	-
Issue Purpose	For Planning
Report Prepared for:	NFC Homes Ltd
Author	Neil Rothon
Approved By	Ryan Thrower
Date of Issue	1st September 2021

1. EXECUTIVE SUMMARY

1.1 NRG Consulting have been appointed to undertake an Energy Statement on a proposed minor development at Vincam Close, Twickenham, Middlesex.

1.2 The proposed scheme is for:

Demolition of existing houses and erection of 8 new homes.

1.3 This document illustrates a reduction in regulated CO2 emissions of 41.93% achieved via:

- U-Values in-line with the upcoming Part L 2021 guidance.
- A high efficiency heating system with controls specified to reduce energy consumption
- 100% low energy lighting
- Total Site-Wide PV installation of 9.5 kWp

1.4 In the Appendices, the following can be found:

a. CO_2 emissions Spreadsheet (Appendix 1)
b. SAP Input Data Sheet (Appendix 2)
c. SAP L1a Checklists at Be Lean Stage (Appendix 3)
d. SAP L1a Checklists at Be Green Stage (Appendix 4)
e. Existing SAP Calculations (Appendix 5)
f. PV Data Sheet and Drawing (Appendix 6)
g. Photographic Survey of Existing Dwellings (Appendix 7)
h. Richmond Sustainability Checklist (Appendix 8)

1.5 It should be noted that due to the size of the scheme, a formal "Be Clean" Section has not been included. Both a connection to a District Heat Network (even if present which is not the case) and the use of on-site CHP are not suited to a minor scheme.

1.6 As well as the carbon emissions of the proposed development being assessed in-line with Local and Regional Policies, an assessment of the carbon emissions of the existing dwellings was undertaken. This assessment found very high carbon emissions and properties with an EPC Rating ranging from D to G. It is noted that the London Borough of Richmond has a Policy which suggests that *redevelopment of existing housing should normally only take place where it has first been demonstrated that the existing housing is incapable of improvement or conversion to a satisfactory standard to provide an equivalent scheme.* Upon review of the SAP Calculations of the existing dwellings combined with the photographic evidence and our Site Survey, it indicates that even with spending a significant money on:

- Full Re-Wiring
- New Bathroom and Kitchen
- New Double Glazed Windows (as the existing are at the end of their life / beyond) and Front Door
- Full new Heating System

it would only allow the current dwellings to simply a "D" or "C" standard, far below the "B" to "A" rating expected from the new dwellings. The insulation levels of the existing dwellings are poor and while in theory the the roof could be upgraded, it is not practical due to the type of roof and the reduction in carbo emissions would be minimal. Further to this, it is prohibitively expensive to fit External Wall Insulation (EWI) and Solid Floor Insulation and these measures would never provide payback for the dwellings within the accepted timeframe of 15 years.

Therefore, based on this and that the proposed dwellings will have both CO_2 emissions of between 60-90% lower than the existing dwellings and that the proposed emissions for the new scheme are less than that of the existing dwellings, it makes no sense from an energy context to retain them in-lieu of a proposed low carbon scheme.

RESULTS

	CO_2 Emissions (Tonnes per Annum)	
	Regulated	
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	**13.5**	**Regulated CO_2 Savings at *'Be Lean'* over Part L 2013** **11.11%**
Be Lean: Energy Demand Reduction	**12.0**	
Be Clean: Supply Energy Efficiently	**12.0**	
Be Green: Renewable Energy	**7.8**	
Regulated CO_2 Savings at *'Be Green'* over Part L 2013	**41.93%**	

2. POLICY FRAMEWORK

2.1 The proposed development falls within the Government's "minor" category of planning applications.

KEY POLICIES AND REFERENCE DOCUMENT SUMMARY

This document has been produced to satisfy and written in adherence too:

REGIONAL POLICIES

- The London Plan (March 2021), Policies SI 2: Minimising Carbon Dioxide Emissions, Policy SI 3: Energy Infrastructure.
- The GLA Guidance on preparing energy assessments (April 2020);
- The Mayor's Sustainable Design and Construction SPG (April 2014);

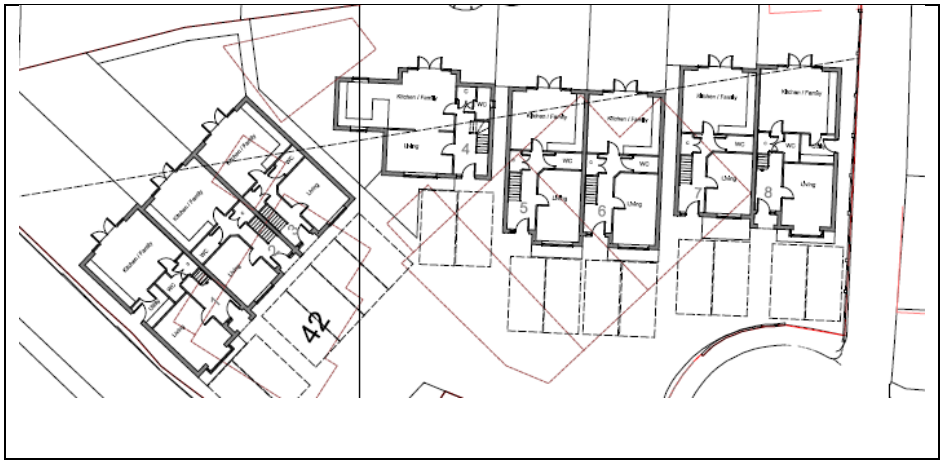


Figure 1: Proposed Ground Floor Site Plan

LOCAL POLICIES

- London Borough of Richmond Policy LP22 states:

Policy LP 22

Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:

1. Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.
2. Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).
3. New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.
4. Proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment 'Excellent' standard (where feasible).

Reducing Carbon Dioxide Emissions

B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:

1. All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.
2. All other new residential buildings should achieve a 35% reduction.
3. All non-residential buildings over 100sqm should achieve a 35% reduction. From 2019 all major non-residential buildings should achieve zero carbon standards in line with London Plan policy.

Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.

C. This should be achieved by following the Energy Hierarchy:

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy

3. EXISTING RESIDENTIAL DWELLING EMISSIONS

3.1 In order to calculate the carbon emissions from the existing dwellings on-site, SAP Calculations have been carried out by a licensed and accredited DEA Assessor using Elmhurst Design SAP 2012.

3.2 A Site Visit was undertaken on Monday 14th June 2021 to assess the properties.

3.3 Property 42 was in a very poor condition. Although it is liveable (the essentials such as electric and running water are there), it is certainly not desirable. The state of decoration is poor, the floors were filthy and there was rubbish everywhere. The gas has been disconnected and so the boiler is redundant and currently being heated with temporary portable electric heaters.

The specification of number 42 is not modern and appears that no refurbishment has been undertaken since the 1960's! The kitchen and bathroom are of an older style and again in poor condition.

Whilst a buyer could in theory move in immediately, it is unlikely they would want to and in most instances a buyer would look to fully refurbish the property prior to living there.

Properties 38 and 40 are much smarter. They are old stock originally built circa 1934 but have been extensively modified and extended in the 1980s

3.4 Insulation to all units is negligible with a mix of uninsulated and insulated roofs, floors and walls in all properties including uninsulated solid external walls which are very difficult to upgrade. They also run the risk of issues with condensation should upgrade be attempted as per feedback from the *Green Deal* scheme of recent years.

3.5 Windows, while double glazed, are old style double glazed windows that wouldn't meet current Part L requirements and appeared likely to be at the end of their intended lifespan.

Figure 2: Existing Dwelling Photos 38 and 40

ELEMENT	EXISTING U-VALUES (W/m²K)
External Walls (original) Plots 38 & 40	**2.1 W/m²K**
External Walls (Extension) Plots 38 & 40	**1.0 W/m²K**
External Wall plot 42	**1.5 W/m²K**
Party Wall	**0 W/m²K**
Ground Floors	**0.43-0.73 W/m²K**
Main Roof Plots 38 & 40	**2.3 W/m²K**
Extension Roof Plots 38 & 40	**0.68 W/m²K**
Roof Plot 42	**1.4 W/m²K**
Windows	**3.1 W/m²K**
Front Doors	**3.05 W/m²K**
Rooflights	**3.40 W/m²K**

*Table 1: Existing Fabric Specification**

Figure 3: Existing Dwelling Photo, no 42

** Element Build ups were identified generally on site and assessed against SAP 'appendix S' u-values from Building regs time of construction*

ELEMENT	PROPOSED DETAILS
Ventilation	**System 1 – Natural**
Heating (Houses 38 & 40)	**Gas Boiler**
Heating (House 42)	**Electric Heating**
Heating Controls	**Programmer/thermostat and TRVs (where gas)**
Heat Emitters	**Radiators**
Lighting	**Counted individually for each plot**
Water Heating (Houses 38 & 40)	**From Gas boiler**
Water Heating (House 42)	**Electric Immersion**

Table 2: Existing Dwellings - Mechanical and Electrical Specification

4. ENERGY CALCULATIONS – NEW DWELLINGS ("Be Lean")

4.1 In order to estimate the predicted energy demand and regulated CO_2 emissions for the site, SAP Calculations have been carried out by a licensed and OCDEA accredited SAP Assessor using Elmhurst Design SAP 2012.

4.2 The baseline CO_2 emissions covered by Part L 2013 of the Building Regulations will be expressed as the Target Emissions Rate (TER), obtained from the SAP calculations. SAP Calculations cover regulated energy use that comprises of:

- Heating
- Hot Water
- Lighting
- Pumps and Fans

House No	CO_2 Emissions (Tonnes per Annum)	
	DER	(EPC Number and Band)
38	**39.42**	**67 – (D)**
40	**39.65**	**64 – (D)**
42	**127.13**	**7 – (G)**

PASSIVE AND ACTIVE DESIGN

The design of the development prioritises passive measures to minimise heat loss. The U-values and the air permeability rate have been selected to exceed the minimum requirements of the Building Regulation and the development will incorporate efficient building services to limit carbon emissions, including a low-NOx heating system and low energy lighting. The proposed building services are compliant with the recommendations of the Domestic Building Services Compliance Guide (2013).

	CO_2 Emissions (Tonnes per Annum)
	Regulated
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	13.5
Be Lean: Energy Demand Reduction	12
Regulated CO_2 Savings at *'Be Lean'* over Part L 2013	11.1%

ELEMENT	PART L1A LIMITING FABRIC PARAMETERS	PROPOSED U-VALUES (W/m^2K)
Walls		
External Wall	*0.3 W/m^2K*	**0.17 W/m^2K**
Party Wall	*0.2 W/m^2K*	**0 W/m^2K**
Floors		
Ground Floor	*0.25 W/m^2K*	**0.11 W/m^2K**
Roof		
Main Roof	*0.2 W/m^2K*	**0.11 W/m^2K**
Openings		
Windows	*2.2 W/m^2K*	**1.4 W/m^2K**
Front Doors	*2.2 W/m^2K*	**1.4 W/m^2K**
Thermal Bridging		
Kingspan details have been followed in line with the insulation product		

Table 3: Proposed Fabric Specification

ELEMENT	PROPOSED DETAILS
Air Permeability	**5 $m^3/(hm^2)$ @50Pa**
Ventilation	**System 1 – Intermittent Extract and Trickle Ventilation**
Heating	**Gas Boiler (Combi) – Ideal Code Logic Combi ESP1**
Heating Controls	**Time and Temperature Zone Control**
Heat Emitters	**Radiators**
Lighting	**100% Low Energy**

Table 4: Proposed Mechanical and Electrical Specification

5. RENEWABLE ENERGY – NEW DWELLINGS ("Be Green")

5.1 In order to achieve the required CO_2 reduction, the implementation of low carbon or renewable technology will be required.

5.2 For a minor scheme, and based on recent legislation such as the Clean Air Act, the following technologies have been automatically discounted:

- Wind Turbines
- Biomass
- Hydropower / Wave Technology
- Biogas / Biofuel

5.3 The feasibility of remaining renewable and low carbon technologies is highlighted below. Following this review, PV has been chosen as the most suited technology for the scheme.

FEASIBILITY

Technology	Feasibility					Overall Feasibility
	Cost	Noise	Land Use	Tariffs	CO_2 Offset	
Photovoltaic Panels (PV)	✓	✓	✓	✗	✓	
Air Source Heat Pumps	✗	✗	✗	✓	✗	
Ground Source Heat Pumps	✗	✓	✗	✓	✓	
Solar Thermal	✓	✓	✗	✓	✗	

PV System Details	
CO_2 Reduction Required	3.32 tonnes CO_2/year
CO_2 Offset via 1kWp	Varies, depending on orientation of each house 0.377-0.448 tonnes CO_2/year
PV Proposed	9.50 kWp
Module Output	380 Watts
Number of Panels (sitewide)	25
Panel Orientation	Varies, depending on dwellings roof orientation 4 x East, 12 x South, 9 x South East/West
Tilt of Collectors	Following roof pitch (30 degrees)
Over-Shading Factor	<20%

Table 5: Proposed PV Specification

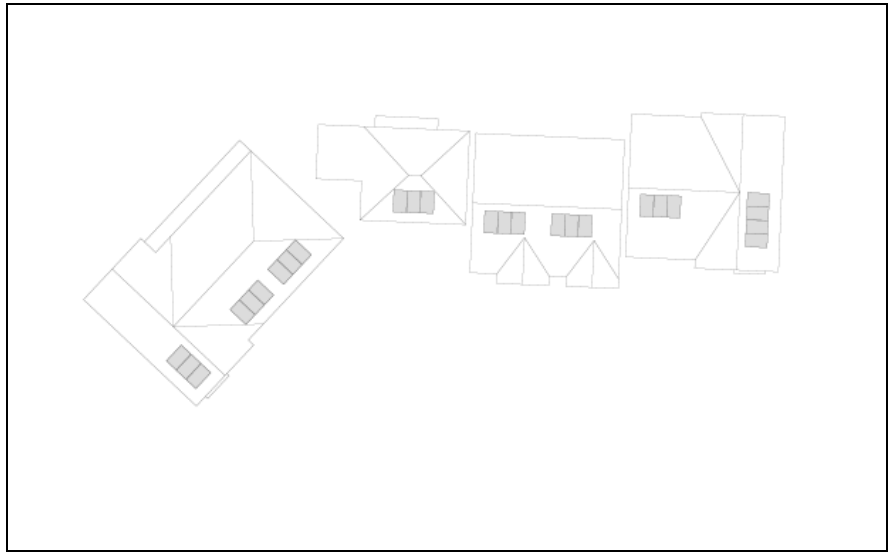


Figure 3: Proposed PV Drawing (for illustration only – not for Construction)

6. WATER EFFICIENCY

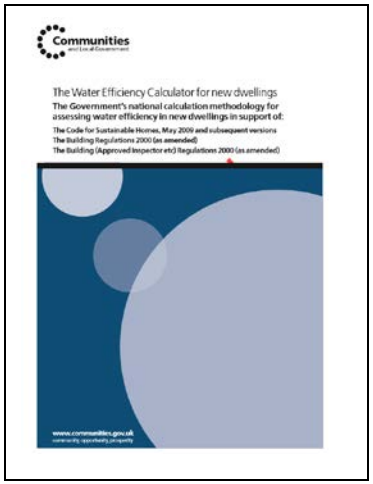
6.1 The Local Plan requires that all developments must incorporate water conservation measures to limit the consumption to 110 litres per person per day.

6.2 This target is the same as the optional target included within Part G of the Building Regulations which encourages the efficient use of potable water. The specification proposed has been produced using the calculation methodology used to assess compliance against the water performance targets in Building Regulations 17.K and is based on the Government's *"The Water Efficiency Calculator for new dwellings – September 2009"* (withdrawn in June 2016).

6.3 The current guidance and Calculation Methodology can now be found with Approved Document G - Sanitation, hot water safety and water efficiency (2015 edition with 2016 amendments)

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/504207/BR_PDF_AD_G_2015_with_2016_amendments.pdf

6.4 The proposed specification for the scheme can be found on the right-hand side of the page showing compliance with the Council's target. For the Dishwashers and Washing Machines, default consumption figures have been used as it is too early in the project to have actual specifications for these elements:



PROPOSED SANITARYWARE SPECIFICATION

ELEMENT	SPECIFICATION	UNIT OF MEASUREMENT
WC	***6/3 dual flush***	*Litres per Flush*
Basin Taps	***5***	*Litres per Minute*
Kitchen Sink Taps	***9***	*Litres per Minute*
Shower	***8***	*Litres per Minute*
Bath	***155***	*Capacity to Overflow*
Washing Machine	***8.17***	*Litres per Kilo (Dry)*
Dishwasher	***1.25***	*Litres per Place Setting*
Allowance for External Use	***5***	*Litres per Day*
Total Consumption (Litres / Person / Day)		**109.7**

Table 4: Proposed Water Consumption (litres/person/day)

Appendix 1

PROJECT: VINCAM CLOSE

RESIDENTIAL UNITS

Sample Plots	AREA	TER *Part L 2013 Baseline*	Total TER	DER 'Be Lean'	Total DER *'Be Lean'*
	m^2	kg CO2/m^2/yr	kg CO2/yr	kg CO2/m^2/yr	kg CO2/yr
Plot 1	131.65	16.39	2,158	14.87	1,958
Plot 4	117.91	19.85	2,341	17.54	2,068
Plot 5	107.55	17.24	1,854	15.39	1,655
Plot 6	107.55	17.24	1,854	15.39	1,655
Plot 8	131.65	16.39	2,158	14.87	1,958
Total Area Assessed	596.31		10,364		9,294
		Average	1m2 TER		1m2 DER
			17.38		15.59
Total Site Area (m^2):	775	TOTAL TER CO2:	13,467	TOTAL DER CO2:	12,076

Total Site TER	13,467	kg CO2/yr
Total Site DER	12,076	kg CO2/yr
CO2 Savings at 'Be Lean'	10.33%	%

CO2 Offset Required for 35% Reduction	3,322	kg CO2/yr
CO2 Offset via 1kWP PV (South)	448	kg CO2/yr
PV Proposed (South)	4.56	kWp
CO2 Offset via 1kWP PV (East)	377	kg CO2/yr
PV Proposed (East)	1.52	kWp
CO2 Offset via 1kWP PV(South East)	427	kg CO2/yr
PV Proposed (South East)	3.42	kWp
Total PV Proposed	9.50	kWp
Total CO2 Offset via Proposed PV	4,256	kg CO2/yr

Final CO2 Emissions at 'Be Green'	7,820	kg CO2/yr
CO2 Savings at 'Be Green'	41.93	%

Carbon Offsetting Contribution	N/A	£

OVERALL RESULTS		
Total CO2 Reduction at 'Be Lean'	1,391	kg CO2/yr
Total CO2 Reduction at 'Be Clean'	0	kg CO2/yr
Total CO2 Reduction at 'Be Green'	5,647	kg CO2/yr

Appendix 2

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

Design SAP
elmhurst energy

Property Reference	Plot 4	**Issued on Date**	04/08/2021
Assessment Reference	001	**Prop Type Ref**	new build d/t
Property	Plot 4, 38-42 Vincam Close, Whitton, TW2 7AB		

SAP Rating	84 B	**DER**	17.54	**TER**	19.85
Environmental	85 B	**% DER<TER**	11.63		
CO_2 Emissions (t/year)	1.61	**DFEE**	53.35	**TFEE**	68.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.55		

Assessor Details	Mr. Neil Rothon, Neil Rothon, Tel: 02037358169, neil@nrgconsulting.org	**Assessor ID**	L759-0001
Client			

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

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	37.20 m	65.63 m²	2.50 m
1st Storey:	33.00 m	52.28 m²	2.70 m

7.0 Living Area	48.04	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
external wall	Cavity Wall	0.17	246.50	224.50

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
main roof	External Plane Roof	0.11	52.58	52.58
lower	External Plane Roof	0.16	3.65	3.65
sloping	External Slope Roof	0.16	10.00	10.00

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid		0.11	65.63

12.0 Opening Types

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

Design SAP
elmhurst energy

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
front door	Manufacturer	Solid Door							1.40
windows	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.40
side door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Opening 1	Solid Door	[1] external wall	South							2.10	
Opening 2	Window	[1] external wall	South	None	0.00					8.87	
Opening 3	Window	[1] external wall	North	None	0.00					10.50	
Opening 4	Window	[1] external wall	West	None	0.00					0.53	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	15.08	0.161	Yes	kingspan
Independently assessed	E3 Sill	14.08	0.016	Yes	
Independently assessed	E4 Jamb	36.78	0.001	Yes	
Independently assessed	E5 Ground floor (normal)	37.20	0.027	No	
Independently assessed	E6 Intermediate floor within a dwelling	42.60	0.000	No	
Independently assessed	E10 Eaves (insulation at ceiling level)	29.27	0.026	No	
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	3.94	0.240	No	
Independently assessed	E11 Eaves (insulation at rafter level)	2.90	0.140	No	
Independently assessed	E12 Gable (insulation at ceiling level)	1.20	0.041	No	
Independently assessed	E13 Gable (insulation at rafter level)	8.60	0.056	No	
Independently assessed	E16 Corner (normal)	28.30	0.040	No	
Table K1 - Default	E17 Corner (inverted – internal area greater than external area)	10.20	0.000	No	

Y-value	0.020	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4

Number of passive vents	0	
Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	1	
Total number of L.E.L. fittings	1	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	17956	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.5	
In Summer	87.3	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2110	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder None

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£28	B 85	

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£348	A 93	

Appendix 3

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Plot 1	**Issued on Date**	24/08/2021
Assessment Reference	001	**Prop Type Ref**	new build et
Property	Plot 1, 38-42 Vincam Close, Whitton, TW2 7AB		

SAP Rating	86 B	**DER**	14.87	**TER**	16.39
Environmental	87 B	**% DER<TER**	9.27		
CO_2 Emissions (t/year)	1.50	**DFEE**	43.11	**TFEE**	53.93
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.06		

Assessor Details	Mr. Neil Rothon, Neil Rothon, Tel: 02037358169, neil@nrgconsulting.org	**Assessor ID**	L759-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.39	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.87	$kgCO_2/m^2$	Pass
	-1.52 (-9.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.93	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	43.11	$kWh/m^2/yr$	
	-10.8 (-20.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Floor	0.11 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	No cylinder	
Boiler interlock	Yes	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Not significant	Pass

Based on:

Overshading	Average
Windows facing East	0.48 m², No overhang
Windows facing South East	7.18 m², No overhang
Windows facing South	0.48 m², No overhang
Windows facing South West	0.70 m², No overhang
Windows facing North West	8.93 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

10 Key features

Roof U-value	0.11	W/m²K
Floor U-value	0.11	W/m²K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Plot 4	**Issued on Date**	24/08/2021
Assessment Reference	001	**Prop Type Ref**	new build d/t
Property	Plot 4, 38-42 Vincam Close, Whitton, TW2 7AB		

SAP Rating	84 B	**DER**	17.54	**TER**	19.85
Environmental	85 B	**% DER<TER**	11.63		
CO_2 Emissions (t/year)	1.61	**DFEE**	53.35	**TFEE**	68.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.55		

Assessor Details	Mr. Neil Rothon, Neil Rothon, Tel: 02037358169, neil@nrgconsulting.org	**Assessor ID**	L759-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.85	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	17.54	$kgCO_2/m^2$	Pass
	-2.31 (-11.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	68.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.35	$kWh/m^2/yr$	
	-15.5 (-22.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Plot 6	**Issued on Date**	24/08/2021
Assessment Reference	001	**Prop Type Ref**	new build s/d
Property	Plot 6, 38-42 Vincam Close, Whitton, TW2 7AB		

SAP Rating	85 B	**DER**	15.39	**TER**	17.24
Environmental	87 B	**% DER<TER**	10.73		
CO_2 Emissions (t/year)	1.27	**DFEE**	42.46	**TFEE**	53.24
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.26		

Assessor Details	Mr. Neil Rothon, Neil Rothon, Tel: 02037358169, neil@nrgconsulting.org	**Assessor ID**	L759-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.24	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.39	$kgCO_2/m^2$	Pass
	-1.85 (-10.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.24	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	42.46	$kWh/m^2/yr$	
	-10.7 (-20.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	8.80 m², No overhang
Windows facing South	7.50 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.11	W/m²K
Floor U-value	0.11	W/m²K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	10.50 m², No overhang
Windows facing South	8.87 m², No overhang
Windows facing West	0.53 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.11	W/m²K
Floor U-value	0.11	W/m²K
Thermal bridging y-value	0.020	W/m²K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

Appendix 4

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Plot 1	**Issued on Date**	24/08/2021
Assessment Reference	be green	**Prop Type Ref**	new build et
Property	Plot 1, 38-42 Vincam Close, Whitton, TW2 7AB		

SAP Rating	90 B	**DER**	11.17	**TER**	16.39
Environmental	91 B	**% DER<TER**	31.84		
CO_2 Emissions (t/year)	0.98	**DFEE**	43.11	**TFEE**	53.93
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.06		

Assessor Details	Mr. Neil Rothon, Neil Rothon, Tel: 02037358169, neil@nrgconsulting.org	**Assessor ID**	L759-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.39	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.17	$kgCO_2/m^2$	Pass
	-5.22 (-31.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.93	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	43.11	$kWh/m^2/yr$	
	-10.8 (-20.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Floor	0.11 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	No cylinder	
Boiler interlock	Yes	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Not significant	Pass

Based on:

Overshading	Average
Windows facing East	0.48 m², No overhang
Windows facing South East	7.18 m², No overhang
Windows facing South	0.48 m², No overhang
Windows facing South West	0.70 m², No overhang
Windows facing North West	8.93 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

10 Key features

Roof U-value	0.11	W/m²K
Floor U-value	0.11	W/m²K
Photovoltaic array	1.14	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Plot 4	**Issued on Date**	24/08/2021
Assessment Reference	be green	**Prop Type Ref**	new build d/t
Property	Plot 4, 38-42 Vincam Close, Whitton, TW2 7AB		

SAP Rating	89 B	**DER**	13.20	**TER**	19.85
Environmental	89 B	**% DER<TER**	33.50		
CO_2 Emissions (t/year)	1.07	**DFEE**	53.35	**TFEE**	68.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.55		

Assessor Details	Mr. Neil Rothon, Neil Rothon, Tel: 02037358169, neil@nrgconsulting.org	**Assessor ID**	L759-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.85	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.20	$kgCO_2/m^2$	Pass
	-6.65 (-33.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	68.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.35	$kWh/m^2/yr$	
	-15.5 (-22.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Plot 6	**Issued on Date**	24/08/2021
Assessment Reference	be green	**Prop Type Ref**	new build s/d
Property	Plot 6, 38-42 Vincam Close, Whitton, TW2 7AB		

SAP Rating	90 B	**DER**	10.64	**TER**	17.24
Environmental	92 A	**% DER<TER**	38.28		
CO_2 Emissions (t/year)	0.73	**DFEE**	42.46	**TFEE**	53.24
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.26		

Assessor Details	Mr. Neil Rothon, Neil Rothon, Tel: 02037358169, neil@nrgconsulting.org	**Assessor ID**	L759-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.24	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	10.64	$kgCO_2/m^2$	Pass
	-6.60 (-38.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.24	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	42.46	$kWh/m^2/yr$	
	-10.7 (-20.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	8.80 m², No overhang
Windows facing South	7.50 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.11	W/m²K
Floor U-value	0.11	W/m²K
Photovoltaic array	1.14	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

Appendix 5

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	House 38	**Issued on Date**	24/08/2021
Assessment Reference	001	**Prop Type Ref**	L1B james cable visit
Property	38, Vincam Close, London, TW2		

SAP Rating	67 D	**DER**	39.42	**TER**	13.85
Environmental	59 D	**% DER<TER**	-184.65		
CO_2 Emissions (t/year)	6.16	**DFEE**	135.19	**TFEE**	50.64
General Requirements Compliance	Fail	**% DFEE<TFEE**	-166.96		

Assessor Details	Mr. Neil Rothon, Neil Rothon, Tel: 02037358169, neil@nrgconsulting.org	**Assessor ID**	L759-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 193 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.85 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 39.42 kgCO□/m²Fail
Excess emissions =25.57 kgCO□/m² (185.0%)

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)135.2 kWh/m²/yrFail
Excess energy =84.6 kWh/m²/yr (167.0%)

---

2 Fabric U-values

Element	Average	Highest	
External wall	1.29 (max. 0.30)	2.10 (max. 0.70)	Fail
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.52 (max. 0.25)	0.73 (max. 0.70)	Fail
Roof	0.81 (max. 0.20)	2.30 (max. 0.35)	Fail
Openings	3.43 (max. 2.00)	6.00 (max. 3.30)	Fail

2a Thermal bridging
Thermal bridging calculated using default y-value of 0.15

---

3 Air permeability
Air permeability at 50 pascals: 15.00 (assumed) OK

---

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Post 98 Combi condens. with auto ign.

SAP default data Fail

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage No cylinder

---

6 Controls
Space heating controls: Programmer, room thermostat and TRVs Fail (TFA > 150)

Hot water controls: No cylinder

Boiler interlock Yes OK

---

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---

8 Mechanical ventilation
Not applicable

---

9 Summertime temperature
Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 14.15 m², No overhang
Windows facing South East: 13.73 m², No overhang
Windows facing North West: 13.41 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

---

10 Key features
Party wall U-value 0.00 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	114.8400	(1b)	x 2.5500	(2b) =	292.8420	(1b) - (3b)
First floor	77.6900	(1c)	x 1.8800	(2c) =	146.0572	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.5300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		438.8992	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0911	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8411	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7781	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.9920	0.9726	0.9531	0.8559	0.8364	0.7391	0.7391	0.7197	0.7781	0.8364	0.8753	0.9142	(22b)
Effective ac	0.9920	0.9729	0.9542	0.8662	0.8498	0.7732	0.7732	0.7590	0.8027	0.8498	0.8831	0.9179	(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	
front door			2.6300	3.0500	8.0215			(26a)
windows (Uw = 3.10)			36.2500	2.7580	99.9778			(27)
sliding door (Uw = 6.00)			5.0400	4.8387	24.3871			(27)
kitchen extension			24.9000	0.7300	18.1770			(28a)
original floor			56.6900	0.4300	24.3767			(28a)
original wall	44.7000	17.6400	27.0600	2.1000	56.8260			(29a)
extension	100.9200	26.2800	74.6400	1.0000	74.6400			(29a)
extension	17.1500		17.1500	0.6800	11.6620			(30)
insulated flat ceiling	88.3800		88.3800	0.6800	60.0984			(30)
original sloping	9.3100		9.3100	2.3000	21.4130			(30)
Total net area of external elements Aum(A, m2)			342.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		399.5795			(33)
Party Wall 1			54.6500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	51.3075	(36)
Total fabric heat loss (33) + (36) =	450.8870	(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	143.6850	140.9176	138.2050	125.4642	123.0804	111.9835	111.9835	109.9286	116.2579	123.0804	127.9028	132.9443	(38)
Heat transfer coeff	594.5719	591.8046	589.0920	576.3511	573.9674	562.8705	562.8705	560.8155	567.1448	573.9674	578.7897	583.8313	(39)
Average = Sum(39)m / 12 =												576.3397	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.0882	3.0738	3.0597	2.9936	2.9812	2.9235	2.9235	2.9129	2.9457	2.9812	3.0062	3.0324	(40)
HLP (average)												2.9935	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9922 (42)
Average daily hot water use (litres/day)	110.8048 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	121.8853	117.4531	113.0209	108.5887	104.1565	99.7244	99.7244	104.1565	108.5887	113.0209	117.4531	121.8853	(44)
Energy conte	180.7524	158.0872	163.1318	142.2223	136.4657	117.7595	109.1215	125.2185	126.7140	147.6730	161.1966	175.0491	(45)
Energy content (annual)										Total = Sum(45)m =		1743.3915	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Distribution loss  (46)m = 0.15 x (45)m
              27.1129    23.7131    24.4698    21.3333    20.4699    17.6639    16.3682    18.7828    19.0071    22.1509    24.1795    26.2574 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss    50.9589    46.0274    50.9589    49.3151    50.9589    49.1791    50.8184    50.9589    49.3151    50.9589    49.3151    50.9589 (61)
Total heat required for water heating calculated for each month
             231.7113   204.1146   214.0907   191.5374   187.4246   166.9386   159.9399   176.1774   176.0291   198.6319   210.5117   226.0080 (62)
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 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             231.7113   204.1146   214.0907   191.5374   187.4246   166.9386   159.9399   176.1774   176.0291   198.6319   210.5117   226.0080 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   2343.1151 (64)
Heat gains from water heating, kWh/month
              72.8399    64.0708    66.9811    59.6177    58.1146    51.4498    48.9875    54.3749    54.4612    61.8410    65.9266    70.9435 (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       149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              32.4442    28.8167    23.4353    17.7420    13.2624    11.1967    12.0984    15.7259    21.1073    26.8006    31.2803    33.3460 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             363.8895   367.6656   358.1501   337.8927   312.3215   288.2881   272.2323   268.4563   277.9718   298.2291   323.8004   347.8337 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610 (69)
Pumps, fans   10.0000    10.0000    10.0000    10.0000    10.0000    10.0000    10.0000    10.0000    10.0000    10.0000    10.0000    10.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877 (71)
Water heating gains (Table 5)
              97.9031    95.3435    90.0283    82.8023    78.1110    71.4581    65.8434    73.0845    75.6405    83.1196    91.5648    95.3542 (72)
Total internal gains
             572.1198   569.7087   549.4966   516.3200   481.5777   448.8257   428.0570   435.1496   452.6025   486.0322   524.5283   554.4168 (73)


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6. Solar gains
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[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
-------------------------------------------------------------------------------------------------------------------
Northeast                              14.1500           11.2829           0.7600           0.7000           0.7700           58.8605 (75)
Southeast                              13.7300           36.7938           0.7600           0.7000           0.7700          186.2475 (77)
Northwest                               8.3700           11.2829           0.7600           0.7000           0.7700           34.8171 (81)
Northwest                               5.0400           11.2829           0.8500           0.8000           0.7700           26.7975 (81)
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Solar gains   306.7226   562.4790   875.9006  1263.4452  1577.7820  1637.9025  1549.3452  1303.9002  1008.3830   650.3182   374.6704   257.7751 (83)
Total gains   878.8424  1132.1876  1425.3971  1779.7652  2059.3597  2086.7282  1977.4022  1739.0498  1460.9856  1136.3505   899.1987   812.1919 (84)


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7. Mean internal temperature (heating season)
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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           22.4870    22.5922    22.6962    23.1979    23.2942    23.7535    23.7535    23.8405    23.5745    23.2942    23.1002    22.9007
alpha          2.4991     2.5061     2.5131     2.5465     2.5529     2.5836     2.5836     2.5894     2.5716     2.5529     2.5400     2.5267
util living area
               0.9979     0.9958     0.9907     0.9768     0.9441     0.8804     0.7965     0.8450     0.9487     0.9882     0.9966     0.9983 (86)

MIT           17.7364    17.9655    18.4197    19.0882    19.7586    20.3492    20.6676    20.5900    20.0711    19.2273    18.3938    17.7316 (87)
Th 2          18.7065    18.7135    18.7204    18.7532    18.7594    18.7887    18.7887    18.7942    18.7774    18.7594    18.7469    18.7339 (88)
util rest of house
               0.9970     0.9939     0.9863     0.9636     0.9040     0.7634     0.5383     0.6232     0.8900     0.9795     0.9948     0.9976 (89)
MIT 2         15.9343    16.1670    16.6238    17.3057    17.9582    18.5068    18.7270    18.6986    18.2803    17.4535    16.6155    15.9459 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.0894 (91)
MIT           16.0955    16.3279    16.7844    17.4651    18.1193    18.6716    18.9005    18.8677    18.4404    17.6121    16.7746    16.1056 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  16.0955    16.3279    16.7844    17.4651    18.1193    18.6716    18.9005    18.8677    18.4404    17.6121    16.7746    16.1056 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9951     0.9905     0.9797     0.9511     0.8856     0.7538     0.5579     0.6350     0.8742     0.9712     0.9919     0.9961 (94)
Useful gains 874.5586  1121.4763  1396.5001  1692.7219  1823.8337  1573.0523  1103.1304  1104.3552  1277.2286  1103.6787   891.9380   809.0292 (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
            7013.2453  6763.0847  6058.4825  4936.5231  3684.4452  2291.7643  1294.8968  1383.9510  2461.6533  4024.7290  5599.5495  6950.8579 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
            4567.1829  3791.1608  3468.5149  2335.5369  1384.2949     0.0000     0.0000     0.0000     0.0000  2173.2614  3389.4802  4569.5205 (98)
Space heating                                                                                                                 25678.9526 (98)
Space heating per m2                                                                                                 (98) / (4) =   133.3764 (99)


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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)												84.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												30570.1817	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4567.1829	3791.1608	3468.5149	2335.5369	1384.2949	0.0000	0.0000	0.0000	0.0000	2173.2614	3389.4802	4569.5205	(98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)	5437.1225	4513.2867	4129.1845	2780.4010	1647.9701	0.0000	0.0000	0.0000	0.0000	2587.2159	4035.0955	5439.9054	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	231.7113	204.1146	214.0907	191.5374	187.4246	166.9386	159.9399	176.1774	176.0291	198.6319	210.5117	226.0080	(64)
Efficiency of water heater												75.0000	(216)
(217)m	83.5161	83.4882	83.4181	83.2429	82.8149	75.0000	75.0000	75.0000	75.0000	83.1643	83.4147	83.5276	(217)
Fuel for water heating, kWh/month	277.4451	244.4833	256.6480	230.0946	226.3174	222.5848	213.2532	234.9032	234.7054	238.8428	252.3676	270.5787	(219)
Water heating fuel used												2902.2242	(219)
Annual totals kWh/year													
Space heating fuel - main system												30570.1817	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												120.0000	(230c)
Total electricity for the above, kWh/year												120.0000	(231)
Electricity for lighting (calculated in Appendix L)												572.9755	(232)
Total delivered energy for all uses												34165.3814	(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	30570.1817	0.2160	6603.1592	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2902.2242	0.2160	626.8804	(264)
Space and water heating			7230.0397	(265)
Pumps and fans	120.0000	0.5190	62.2800	(267)
Energy for lighting	572.9755	0.5190	297.3743	(268)
Total CO2, kg/year			7589.6940	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			39.4200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		39.4200	ZC1
Total Floor Area	TFA	192.5300	
Assumed number of occupants	N	2.9922	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		11.2000	ZC2
CO2 emissions from cooking, equation (L16)		0.9911	ZC3
Total CO2 emissions		51.6111	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		51.6111	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	114.8400	(1b)	x 2.5500	(2b) =	292.8420	(1b) - (3b)
First floor	77.6900	(1c)	x 1.8800	(2c) =	146.0572	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.5300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		438.8992	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0911	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3411	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3156	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4023	0.3944	0.3866	0.3471	0.3392	0.2998	0.2998	0.2919	0.3156	0.3392	0.3550	0.3708	(22b)
Effective ac	0.5809	0.5778	0.5747	0.5602	0.5575	0.5449	0.5449	0.5426	0.5498	0.5575	0.5630	0.5687	(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 Semi-glazed door			2.6300	1.2000	3.1560			(26a)
TER Opening Type (Uw = 1.40)			41.2900	1.3258	54.7405			(27)
kitchen extension			24.9000	0.1300	3.2370			(28a)
original floor			56.6900	0.1300	7.3697			(28a)
original wall	44.7000	17.6400	27.0600	0.1800	4.8708			(29a)
extension	100.9200	26.2800	74.6400	0.1800	13.4352			(29a)
extension	17.1500		17.1500	0.1300	2.2295			(30)
insulated flat ceiling	88.3800		88.3800	0.1300	11.4894			(30)
original sloping	9.3100		9.3100	0.1300	1.2103			(30)
Total net area of external elements Aum(A, m2)			342.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		101.7384			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	17.1025	(36)
Total fabric heat loss	(33) + (36) = 118.8409	(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	84.1406	83.6854	83.2392	81.1436	80.7515	78.9262	78.9262	78.5882	79.6293	80.7515	81.5447	82.3739	(38)
Heat transfer coeff	202.9815	202.5263	202.0802	199.9845	199.5924	197.7671	197.7671	197.4291	198.4702	199.5924	200.3856	201.2149	(39)
Average = Sum(39)m / 12 =												199.9826	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0543	1.0519	1.0496	1.0387	1.0367	1.0272	1.0272	1.0254	1.0309	1.0367	1.0408	1.0451	(40)
HLP (average)												1.0387	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9922 (42)
Average daily hot water use (litres/day)	105.2646 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7911	111.5805	107.3699	103.1593	98.9487	94.7381	94.7381	98.9487	103.1593	107.3699	111.5805	115.7911	(44)
Energy conte	171.7148	150.1828	154.9752	135.1112	129.6424	111.8715	103.6654	118.9576	120.3783	140.2893	153.1368	166.2966	(45)
Energy content (annual)										Total = Sum(45)m =		1656.2219	(45)
Distribution loss (46)m = 0.15 x (45)m	25.7572	22.5274	23.2463	20.2667	19.4464	16.7807	15.5498	17.8436	18.0567	21.0434	22.9705	24.9445	(46)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     50.9589    46.0274    50.9589    49.3151    50.4232    46.7202    48.2775    50.4232    49.3151    50.9589    49.3151    50.9589 (61)
Total heat required for water heating calculated for each month
              222.6737   196.2102   205.9341   184.4262   180.0656   158.5917   151.9429   169.3808   169.6934   191.2482   202.4518   217.2555 (62)
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 (63)
                                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              222.6737   196.2102   205.9341   184.4262   180.0656   158.5917   151.9429   169.3808   169.6934   191.2482   202.4518   217.2555 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   2249.8742 (64)
Heat gains from water heating, kWh/month
               69.8349    61.4426    64.2690    57.2532    55.7119    48.8773    46.5381    52.1592    52.3546    59.3859    63.2467    68.0333 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097   149.6097 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               32.4877    28.8553    23.4667    17.7658    13.2801    11.2116    12.1146    15.7470    21.1356    26.8365    31.3221    33.3906 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              363.8895   367.6656   358.1501   337.8927   312.3215   288.2881   272.2323   268.4563   277.9718   298.2291   323.8004   347.8337 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610    37.9610 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877  -119.6877 (71)
Water heating gains (Table 5)
               93.8641    91.4325    86.3831    79.5184    74.8816    67.8852    62.5512    70.1064    72.7147    79.8198    87.8427    91.4427 (72)
Total internal gains
              561.1242   558.8362   538.8827   506.0598   471.3661   438.2678   417.7811   425.1926   442.7049   475.7683   513.8481   543.5499 (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
-------------------------------------------------------------------------------------------------------------------
Northeast                                14.1500           11.2829           0.6300           0.7000           0.7700           48.7922 (75)
Southeast                                13.7300           36.7938           0.6300           0.7000           0.7700          154.3894 (77)
Northwest                                13.4100           11.2829           0.6300           0.7000           0.7700           46.2405 (81)
-------------------------------------------------------------------------------------------------------------------

Solar gains   249.4221   456.4242   708.3446  1018.2104  1268.7563  1316.0055  1245.2886  1049.7439   814.2911   527.0528   304.4987   209.7337 (83)
Total gains   810.5463  1015.2604  1247.2273  1524.2702  1740.1224  1754.2734  1663.0696  1474.9365  1256.9960  1002.8210   818.3468   753.2836 (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           65.8687    66.0168    66.1625    66.8559    66.9872    67.6055    67.6055    67.7212    67.3660    66.9872    66.7221    66.4471
alpha          5.3912     5.4011     5.4108     5.4571     5.4658     5.5070     5.5070     5.5147     5.4911     5.4658     5.4481     5.4298
util living area
               0.9997     0.9987     0.9943     0.9687     0.8713     0.6837     0.5161     0.5987     0.8798     0.9902     0.9991     0.9998 (86)

MIT           19.7194    19.8841    20.1603    20.5304    20.8306    20.9669    20.9941    20.9875    20.8686    20.4607    20.0207    19.6934 (87)
Th 2          20.0383    20.0403    20.0422    20.0512    20.0529    20.0607    20.0607    20.0622    20.0577    20.0529    20.0495    20.0459 (88)
util rest of house
               0.9995     0.9983     0.9922     0.9566     0.8267     0.5985     0.4097     0.4853     0.8189     0.9849     0.9987     0.9997 (89)
MIT 2         18.3046    18.5470    18.9512    19.4883    19.8861    20.0388    20.0585    20.0568    19.9459    19.3970    18.7537    18.2721 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.0894 (91)
MIT           18.4311    18.6666    19.0593    19.5815    19.9706    20.1218    20.1422    20.1401    20.0285    19.4922    18.8670    18.3992 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  18.4311    18.6666    19.0593    19.5815    19.9706    20.1218    20.1422    20.1401    20.0285    19.4922    18.8670    18.3992 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9992     0.9973     0.9890     0.9488     0.8222     0.6044     0.4191     0.4951     0.8167     0.9803     0.9980     0.9995 (94)
Useful gains  809.9071  1012.4999  1233.5056  1446.2127  1430.7425  1060.2810   697.0463   730.1889  1026.5552   983.0732   816.6705   752.8851 (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
             2868.3528  2788.0971  2537.9945  2136.1286  1650.7398  1092.0363   700.5273   738.4009  1176.6242  1774.8116  2357.9405  2857.0877 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             1531.4836  1193.2013   970.5398   496.7394   163.6780     0.0000     0.0000     0.0000     0.0000   589.0534  1109.7144  1565.5268 (98)
Space heating                                                                                                                  7619.9367 (98)
Space heating per m2                                                                                                 (98) / (4) =     39.5779 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
```

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												8158.3905	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1531.4836	1193.2013	970.5398	496.7394	163.6780	0.0000	0.0000	0.0000	0.0000	589.0534	1109.7144	1565.5268	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1639.7041	1277.5174	1039.1218	531.8409	175.2441	0.0000	0.0000	0.0000	0.0000	630.6781	1188.1310	1676.1529	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	222.6737	196.2102	205.9341	184.4262	180.0656	158.5917	151.9429	169.3808	169.6934	191.2482	202.4518	217.2555	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.9793	88.8223	88.4526	87.4228	84.8120	80.3000	80.3000	80.3000	80.3000	87.6965	88.6791	89.0353	(217)
Fuel for water heating, kWh/month													
	250.2533	220.9020	232.8187	210.9589	212.3115	197.4990	189.2191	210.9349	211.3243	218.0796	228.2972	244.0106	(219)
Water heating fuel used												2626.6089	(219)
Annual totals kWh/year													
Space heating fuel - main system												8158.3905	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												573.7423	(232)
Total delivered energy for all uses												11433.7417	(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	8158.3905	0.2160	1762.2123	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2626.6089	0.2160	567.3475	(264)
Space and water heating			2329.5599	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	573.7423	0.5190	297.7723	(268)
Total CO2, kg/m2/year			2666.2571	(272)
Emissions per m2 for space and water heating			12.0997	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.5466	(272b)
Emissions per m2 for pumps and fans			0.2022	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.0997 * 1.00) + 1.5466 + 0.2022, rounded to 2 d.p.			13.8500	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	House 40	**Issued on Date**	24/08/2021
Assessment Reference	001	**Prop Type Ref**	L1B james cable visit
Property	40, Vincam Close, London, TW2		

SAP Rating	64 D	**DER**	39.65	**TER**	14.42
Environmental	61 D	**% DER<TER**	-174.87		
CO_2 Emissions (t/year)	4.47	**DFEE**	142.26	**TFEE**	46.75
General Requirements Compliance	Fail	**% DFEE<TFEE**	-204.27		

Assessor Details	Mr. Neil Rothon, Neil Rothon, Tel: 02037358169, neil@nrgconsulting.org	**Assessor ID**	L759-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 138 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.42 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 39.65 kgCO□/m²Fail
Excess emissions =25.23 kgCO□/m² (175.0%)

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)46.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)142.3 kWh/m²/yrFail
Excess energy =95.5 kWh/m²/yr (204.0%)
---
2 Fabric U-values

Element	Average	Highest	
External wall	1.51 (max. 0.30)	2.10 (max. 0.70)	Fail
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.52 (max. 0.25)	0.73 (max. 0.70)	Fail
Roof	1.12 (max. 0.20)	2.30 (max. 0.35)	Fail
Openings	3.11 (max. 2.00)	3.40 (max. 3.30)	Fail

2a Thermal bridging
Thermal bridging calculated using default y-value of 0.15
---
3 Air permeability
Air permeability at 50 pascals: 15.00 (assumed) OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Post 98 Combi condens. with auto ign.

SAP default data Fail

Secondary heating system: Room heaters - Wood Logs

Closed room heater
Efficiency: 60%
Minimum: 65% Fail
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:83%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 10.92 m², No overhang
Windows facing South West: 7.61 m², No overhang
Windows facing North West: 7.26 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None
---
10 Key features
Party wall U-value 0.00 W/m²K
Secondary heating (wood logs)
Secondary heating fuel: wood logs

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	81.6000 (1b)	x	2.5500 (2b)	=	208.0800	(1b) - (3b)
First floor	56.6900 (1c)	x	2.2000 (2c)	=	124.7180	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.2900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	332.7980	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.0901	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8401	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7771	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.9908	0.9714	0.9520	0.8548	0.8354	0.7383	0.7383	0.7188	0.7771	0.8354	0.8743	0.9131	(22b)
Effective ac	0.9909	0.9718	0.9531	0.8654	0.8490	0.7725	0.7725	0.7584	0.8020	0.8490	0.8822	0.9169	(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	
front door			1.8900	3.0500	5.7645			(26a)
windows (Uw = 3.10)			25.7900	2.7580	71.1290			(27)
rooflights (Uw = 3.40)			1.5600	2.9930	4.6690			(27a)
kitchen extension			24.9000	0.7300	18.1770			(28a)
original floor			56.6900	0.4300	24.3767			(28a)
original wall	57.2200	17.9400	39.2800	2.1000	82.4880			(29a)
kitchen extension	25.9500	8.1200	17.8300	1.0000	17.8300			(29a)
dormer	13.1000	1.6200	11.4800	0.2800	3.2144			(29a)
kitchen extension	24.9100		24.9100	0.6800	16.9388			(30)
insulated flat ceiling	22.7100		22.7100	0.6800	15.4428			(30)
dormer roof	8.2200		8.2200	0.1800	1.4796			(30)
original sloping	25.7600	1.5600	24.2000	2.3000	55.6600			(30)
Total net area of external elements Aum(A, m2)			259.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		317.1698			(33)
Party Wall 1			54.6500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	38.9190	(36)
Total fabric heat loss	(33) + (36) = 356.0888	(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	108.8226	106.7292	104.6772	95.0391	93.2359	84.8415	84.8415	83.2869	88.0749	93.2359	96.8838	100.6976	(38)
Heat transfer coeff	464.9114	462.8180	460.7660	451.1280	449.3247	440.9303	440.9303	439.3757	444.1637	449.3247	452.9727	456.7864	(39)
Average = Sum(39)m / 12 =												451.1193	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.3619	3.3467	3.3319	3.2622	3.2491	3.1884	3.1884	3.1772	3.2118	3.2491	3.2755	3.3031	(40)
HLP (average)												3.2621	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9138 (42)
Average daily hot water use (litres/day)	108.8440 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	119.7283	115.3746	111.0208	106.6671	102.3133	97.9596	97.9596	102.3133	106.6671	111.0208	115.3746	119.7283	(44)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	177.5537	155.2896	160.2449	139.7054	134.0507	115.6755	107.1904	123.0025	124.4716	145.0596	158.3439	171.9513	(45)
Energy content (annual)										Total = Sum(45)m =		1712.5392	(45)
Distribution loss (46)m = 0.15 x (45)m													
	26.6331	23.2934	24.0367	20.9558	20.1076	17.3513	16.0786	18.4504	18.6707	21.7589	23.7516	25.7927	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.3088	49.9191	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	228.5126	201.3170	211.2038	189.0205	185.0096	163.9844	157.1095	173.9614	173.7867	196.0185	207.6590	222.9102	(62)
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	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	228.5126	201.3170	211.2038	189.0205	185.0096	163.9844	157.1095	173.9614	173.7867	196.0185	207.6590	222.9102	(64)
									Total per year (kWh/year) = Sum(64)m =			2310.4932	(64)
Heat gains from water heating, kWh/month													
	71.7763	63.1406	66.0212	58.7808	57.3116	50.5393	48.1206	53.6381	53.7156	60.9721	64.9781	69.9135	(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	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.2025	28.6019	23.2607	17.6098	13.1635	11.1132	12.0082	15.6087	20.9500	26.6009	31.0471	33.0975	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	307.4593	310.6498	302.6099	285.4940	263.8882	243.5818	230.0159	226.8254	234.8653	251.9812	273.5870	293.8934	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	(69)
Pumps, fans	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	(71)
Water heating gains (Table 5)													
	96.4736	93.9593	88.7381	81.6400	77.0317	70.1935	64.6782	72.0942	74.6050	81.9517	90.2474	93.9698	(72)
Total internal gains													
	512.8417	509.9173	491.3150	461.4502	430.7898	401.5949	383.4087	391.2347	407.1266	437.2401	471.5879	497.6670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.9200	36.7938	0.7600	0.7000	0.7700	148.1298	(77)
Southwest	7.6100	36.7938	0.7600	0.7000	0.7700	103.2297	(79)
Northwest	7.2600	11.2829	0.7600	0.7000	0.7700	30.1998	(81)
Southwest	1.5600	38.2331	0.7600	0.7000	1.0000	28.5573	(82)

Solar gains	310.1166	543.2225	780.6301	1025.9255	1199.8299	1212.6947	1160.2588	1027.7300	865.4052	610.6859	374.2347	263.5604	(83)
Total gains	822.9583	1053.1398	1271.9451	1487.3757	1630.6197	1614.2896	1543.6675	1418.9647	1272.5318	1047.9260	845.8226	761.2274	(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	20.6566	20.7500	20.8424	21.2877	21.3731	21.7800	21.7800	21.8571	21.6215	21.3731	21.2010	21.0240	
alpha	2.3771	2.3833	2.3895	2.4192	2.4249	2.4520	2.4520	2.4571	2.4414	2.4249	2.4134	2.4016	
util living area													
	0.9957	0.9919	0.9846	0.9683	0.9352	0.8727	0.7862	0.8230	0.9281	0.9792	0.9932	0.9965	(86)
MIT	17.6381	17.8924	18.3617	19.0292	19.6962	20.3001	20.6402	20.5767	20.0700	19.2084	18.3287	17.6265	(87)
Th 2	18.5800	18.5867	18.5932	18.6246	18.6306	18.6587	18.6587	18.6640	18.6478	18.6306	18.6186	18.6061	(88)
util rest of house													
	0.9939	0.9884	0.9772	0.9505	0.8886	0.7459	0.5096	0.5772	0.8496	0.9641	0.9896	0.9950	(89)
MIT 2	15.7620	16.0190	16.4893	17.1664	17.8126	18.3688	18.5988	18.5769	18.1843	17.3542	16.4739	15.7655	(90)
Living area fraction									fLA = Living area / (4) =			0.1133	(91)
MIT	15.9746	16.2313	16.7015	17.3775	18.0260	18.5876	18.8301	18.8035	18.3980	17.5643	16.6841	15.9764	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.9746	16.2313	16.7015	17.3775	18.0260	18.5876	18.8301	18.8035	18.3980	17.5643	16.6841	15.9764	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9904	0.9825	0.9675	0.9352	0.8698	0.7400	0.5400	0.6003	0.8354	0.9520	0.9844	0.9922	(94)
Useful gains	815.0642	1034.7165	1230.6230	1391.0255	1418.2948	1194.5498	833.6336	851.7582	1063.0285	997.6313	832.6260	755.2523	(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													
	5427.6706	5244.3347	4700.4925	3824.4251	2842.4343	1758.2699	983.3139	1056.0271	1909.0018	3129.2366	4341.3250	5379.2907	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	3431.7792	2828.8635	2581.5829	1752.0477	1059.5598	0.0000	0.0000	0.0000	0.0000	1585.9143	2526.2633	3440.2846	(98)
Space heating												19206.2953	(98)
Space heating per m2											(98) / (4) =	138.8842	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000	(201)
Fraction of space heat from main system(s)	0.9000	(202)
Efficiency of main space heating system 1 (in %)	84.0000	(206)
Efficiency of secondary/supplementary heating system, %	60.0000	(208)
Space heating requirement	20578.1735	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	3431.7792	2828.8635	2581.5829	1752.0477	1059.5598	0.0000	0.0000	0.0000	0.0000	1585.9143	2526.2633	3440.2846	(98)
Space heating efficiency (main heating system 1)													
	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)													
	3676.9063	3030.9251	2765.9817	1877.1940	1135.2427	0.0000	0.0000	0.0000	0.0000	1699.1939	2706.7107	3686.0192	(211)
Water heating requirement													
	571.9632	471.4772	430.2638	292.0080	176.5933	0.0000	0.0000	0.0000	0.0000	264.3191	421.0439	573.3808	(215)
Water heating													
Water heating requirement													
	228.5126	201.3170	211.2038	189.0205	185.0096	163.9844	157.1095	173.9614	173.7867	196.0185	207.6590	222.9102	(64)
Efficiency of water heater												75.0000	(216)
(217)m	83.3113	83.2678	83.1684	82.9347	82.3935	75.0000	75.0000	75.0000	75.0000	82.8002	83.1648	83.3285	(217)
Fuel for water heating, kWh/month													
	274.2876	241.7705	253.9473	227.9148	224.5440	218.6458	209.4793	231.9486	231.7155	236.7367	249.6958	267.5079	(219)
Water heating fuel used												2868.1940	(219)
Annual totals kWh/year													
Space heating fuel - main system												20578.1735	(211)
Space heating fuel - secondary												3201.0492	(215)
Electricity for pumps and fans:													
central heating pump												120.0000	(230c)
Total electricity for the above, kWh/year												120.0000	(231)
Electricity for lighting (calculated in Appendix L)												568.7054	(232)
Total delivered energy for all uses												27336.1221	(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	20578.1735	0.2160	4444.8855	(261)
Space heating - secondary	3201.0492	0.0190	60.8199	(263)
Water heating (other fuel)	2868.1940	0.2160	619.5299	(264)
Space and water heating			5125.2353	(265)
Pumps and fans	120.0000	0.5190	62.2800	(267)
Energy for lighting	568.7054	0.5190	295.1581	(268)
Total CO2, kg/year			5482.6734	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			39.6500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		39.6500	ZC1
Total Floor Area	TFA	138.2900	
Assumed number of occupants	N	2.9138	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.1748	ZC2
CO2 emissions from cooking, equation (L16)		1.3662	ZC3
Total CO2 emissions		54.1910	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		54.1910	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	81.6000	(1b)	x 2.5500	(2b) =	208.0800	(1b) - (3b)
First floor	56.6900	(1c)	x 2.2000	(2c) =	124.7180	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.2900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		332.7980	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1202	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3702	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3424	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4366	0.4280	0.4195	0.3767	0.3681	0.3253	0.3253	0.3167	0.3424	0.3681	0.3852	0.4024	(22b)
Effective ac	0.5953	0.5916	0.5880	0.5709	0.5678	0.5529	0.5529	0.5502	0.5586	0.5678	0.5742	0.5809	(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 Semi-glazed door			1.8900	1.2000	2.2680			(26a)
TER Opening Type (Uw = 1.40)			25.7900	1.3258	34.1913			(27)
TER Room Window (Uw = 1.70)			1.5600	1.5918	2.4831			(27a)
kitchen extension			24.9000	0.1300	3.2370			(28a)
original floor			56.6900	0.1300	7.3697			(28a)
original wall	57.2200	17.9400	39.2800	0.1800	7.0704			(29a)
kitchen extension	25.9500	8.1200	17.8300	0.1800	3.2094			(29a)
dormer	13.1000	1.6200	11.4800	0.1800	2.0664			(29a)
kitchen extension	24.9100		24.9100	0.1300	3.2383			(30)
insulated flat ceiling	22.7100		22.7100	0.1300	2.9523			(30)
dormer roof	8.2200		8.2200	0.1300	1.0686			(30)
original sloping	25.7600	1.5600	24.2000	0.1300	3.1460			(30)
Total net area of external elements Aum(A, m2)			259.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.3005			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	12.9730	(36)
Total fabric heat loss (33) + (36) =	85.2735	(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	65.3787	64.9723	64.5739	62.7026	62.3525	60.7227	60.7227	60.4209	61.3505	62.3525	63.0608	63.8012	(38)
Heat transfer coeff	150.6523	150.2458	149.8474	147.9761	147.6260	145.9962	145.9962	145.6944	146.6240	147.6260	148.3343	149.0748	(39)
Average = Sum(39)m / 12 =												147.9745	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0894	1.0865	1.0836	1.0700	1.0675	1.0557	1.0557	1.0535	1.0603	1.0675	1.0726	1.0780	(40)
HLP (average)												1.0700	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9138	(42)
Average daily hot water use (litres/day)	103.4018	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7419	109.6059	105.4698	101.3337	97.1976	93.0616	93.0616	97.1976	101.3337	105.4698	109.6059	113.7419	(44)
Energy conte	168.6760	147.5251	152.2327	132.7201	127.3481	109.8918	101.8309	116.8524	118.2480	137.8067	150.4267	163.3537	(45)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1626.9122 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.3014	22.1288	22.8349	19.9080	19.1022	16.4838	15.2746	17.5279	17.7372	20.6710	22.5640	24.5031	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.5309	45.8934	47.4232	49.5309	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	219.6349	193.5525	203.1916	182.0352	176.8790	155.7851	149.2540	166.3833	167.5631	188.7656	199.7418	214.3126	(62)
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	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	219.6349	193.5525	203.1916	182.0352	176.8790	155.7851	149.2540	166.3833	167.5631	188.7656	199.7418	214.3126	(64)
									Total per year (kWh/year) = Sum(64)m =			2217.0987	(64)
Heat gains from water heating, kWh/month													
	68.8245	60.5589	63.3571	56.4582	54.7260	48.0124	45.7146	51.2361	51.6462	58.5604	62.3457	67.0548	(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	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	145.6879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.6021	24.5159	19.9377	15.0941	11.2830	9.5256	10.2928	13.3789	17.9572	22.8007	26.6118	28.3693	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	307.4593	310.6498	302.6099	285.4940	263.8882	243.5818	230.0159	226.8254	234.8653	251.9812	273.5870	293.8934	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	37.5688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	-116.5503	(71)
Water heating gains (Table 5)													
	92.5060	90.1175	85.1574	78.4142	73.5564	66.6838	61.4443	68.8658	71.7309	78.7103	86.5912	90.1275	(72)
Total internal gains													
	497.2738	494.9895	477.4113	448.7086	418.4340	389.4976	371.4593	378.7765	394.2597	423.1986	456.4964	482.0965	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.9200	36.7938	0.6300	0.7000	0.7700	122.7918	(77)
Southwest	7.6100	36.7938	0.6300	0.7000	0.7700	85.5720	(79)
Northwest	7.2600	11.2829	0.6300	0.7000	0.7700	25.0340	(81)
Southwest	1.5600	38.2331	0.6300	0.7000	1.0000	23.6725	(82)

Solar gains	257.0704	450.3028	647.1012	850.4382	994.5959	1005.2601	961.7935	851.9341	717.3754	506.2264	310.2209	218.4777	(83)
Total gains	754.3442	945.2924	1124.5126	1299.1469	1413.0299	1394.7577	1333.2528	1230.7106	1111.6350	929.4250	766.7172	700.5742	(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	63.7460	63.9184	64.0883	64.8988	65.0527	65.7789	65.7789	65.9152	65.4973	65.0527	64.7421	64.4205	
alpha	5.2497	5.2612	5.2726	5.3266	5.3368	5.3853	5.3853	5.3943	5.3665	5.3368	5.3161	5.2947	
util living area													
	0.9987	0.9956	0.9848	0.9428	0.8298	0.6422	0.4769	0.5350	0.8007	0.9717	0.9967	0.9992	(86)
MIT	19.7897	19.9847	20.2676	20.6101	20.8619	20.9733	20.9954	20.9919	20.9160	20.5641	20.1061	19.7583	(87)
Th 2	20.0095	20.0119	20.0143	20.0254	20.0275	20.0372	20.0372	20.0390	20.0334	20.0275	20.0232	20.0189	(88)
util rest of house													
	0.9983	0.9942	0.9795	0.9231	0.7783	0.5570	0.3752	0.4282	0.7248	0.9583	0.9954	0.9989	(89)
MIT 2	18.3866	18.6728	19.0843	19.5741	19.8965	20.0201	20.0355	20.0357	19.9684	19.5214	18.8592	18.3473	(90)
Living area fraction									fLA = Living area / (4) =			0.1133	(91)
MIT	18.5456	18.8214	19.2184	19.6915	20.0059	20.1281	20.1443	20.1440	20.0758	19.6396	19.0005	18.5072	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5456	18.8214	19.2184	19.6915	20.0059	20.1281	20.1443	20.1440	20.0758	19.6396	19.0005	18.5072	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9915	0.9736	0.9148	0.7770	0.5654	0.3867	0.4401	0.7286	0.9510	0.9932	0.9981	(94)
Useful gains	752.3198	937.2994	1094.8751	1188.4402	1097.8939	788.6470	515.5110	541.6950	809.8837	883.8973	761.5402	699.2773	(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													
	2146.1274	2091.6362	1905.8174	1596.8851	1226.1686	807.0766	517.4519	545.4850	876.1987	1334.4748	1765.2525	2132.8448	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1036.9928	775.7143	603.3411	294.0803	95.4363	0.0000	0.0000	0.0000	0.0000	335.2297	722.6728	1066.5742	(98)
Space heating												4930.0416	(98)
Space heating per m2											(98) / (4) =	35.6500	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5278.4171	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1036.9928	775.7143	603.3411	294.0803	95.4363	0.0000	0.0000	0.0000	0.0000	335.2297	722.6728	1066.5742	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1110.2707	830.5293	645.9754	314.8612	102.1802	0.0000	0.0000	0.0000	0.0000	358.9183	773.7397	1141.9424	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.6349	193.5525	203.1916	182.0352	176.8790	155.7851	149.2540	166.3833	167.5631	188.7656	199.7418	214.3126	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4554	88.1851	87.6234	86.2522	83.5723	80.3000	80.3000	80.3000	80.3000	86.4815	88.0031	88.5368	(217)
Fuel for water heating, kWh/month													
	248.3001	219.4844	231.8919	211.0500	211.6478	194.0039	185.8705	207.2021	208.6713	218.2729	226.9713	242.0606	(219)
Water heating fuel used												2605.4267	(219)
Annual totals kWh/year													
Space heating fuel - main system												5278.4171	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												487.4618	(232)
Total delivered energy for all uses												8446.3055	(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	5278.4171	0.2160	1140.1381	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2605.4267	0.2160	562.7722	(264)
Space and water heating			1702.9103	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	487.4618	0.5190	252.9927	(268)
Total CO2, kg/m2/year			1994.8279	(272)
Emissions per m2 for space and water heating			12.3141	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8294	(272b)
Emissions per m2 for pumps and fans			0.2815	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.3141 * 1.00) + 1.8294 + 0.2815, rounded to 2 d.p.			14.4200	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	House 42	**Issued on Date**	24/08/2021
Assessment Reference	001	**Prop Type Ref**	L1B james cable visit
Property	42, Vincam Close, London, TW2		

SAP Rating	7 G	**DER**	127.13	**TER**	31.60
Environmental	21 F	**% DER<TER**	-302.30		
CO_2 Emissions (t/year)	7.86	**DFEE**	240.32	**TFEE**	67.85
General Requirements Compliance	Fail	**% DFEE<TFEE**	-254.21		

Assessor Details	Mr. Neil Rothon, Neil Rothon, Tel: 02037358169, neil@nrgconsulting.org	**Assessor ID**	L759-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Detached Bungalow, total floor area 73 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 31.60 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)127.13 kgCO□/m²Fail
Excess emissions =95.53 kgCO□/m² (302.0%)

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)67.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)240.3 kWh/m²/yrFail
Excess energy =172.5 kWh/m²/yr (254.0%)
---
2 Fabric U-values

Element	Average	Highest	
External wall	1.50 (max. 0.30)	1.50 (max. 0.70)	Fail
Floor	0.59 (max. 0.25)	0.59 (max. 0.70)	Fail
Roof	1.40 (max. 0.20)	1.40 (max. 0.35)	Fail
Openings	3.85 (max. 2.00)	4.00 (max. 3.30)	Fail

2a Thermal bridging
Thermal bridging calculated using default y-value of 0.15
---
3 Air permeability
Air permeability at 50 pascals: 15.00 (assumed) OK
---
4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage Nominal cylinder loss: 4.74 kWh/day
Permitted by DBSCG 1.58 Fail
Primary pipework insulated: No primary pipework
---
6 Controls
Space heating controls: Appliance thermostats OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:89%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Thames Valley): Not significant OK
Based on:
Oversha ding: Average
Windows facing South East: 4.32 m², No overhang
Windows facing North West: 7.62 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None
---
10 Key features
None

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.9700 (1b)	x	2.4500 (2b)	=	178.7765	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	178.7765	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							1 * 10 =	10.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	10.0000 / (5) =	0.0559	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8059	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7455	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.9505	0.9319	0.9132	0.8200	0.8014	0.7082	0.7082	0.6896	0.7455	0.8014	0.8387	0.8760	(22b)
Effective ac	0.9517	0.9342	0.9170	0.8362	0.8211	0.7508	0.7508	0.7378	0.7779	0.8211	0.8517	0.8836	(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	
Front door			3.5900	3.3500	12.0265			(26a)
windows (Uw = 4.00)			11.9400	3.4483	41.1724			(27)
Heat Loss Floor 1			72.9700	0.5900	43.0523			(28a)
External Wall 1	90.8500	15.5300	75.3200	1.5000	112.9800			(29a)
External Roof 1	72.9700		72.9700	1.4000	102.1580			(30)
Total net area of external elements Aum(A, m2)			236.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	311.3892			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	35.5185	(36)
Total fabric heat loss (33) + (36) =	346.9077	(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	56.1482	55.1134	54.0990	49.3346	48.4432	44.2935	44.2935	43.5250	45.8919	48.4432	50.2465	52.1318	(38)
Heat transfer coeff	403.0559	402.0211	401.0067	396.2423	395.3509	391.2012	391.2012	390.4328	392.7996	395.3509	397.1542	399.0395	(39)
Average = Sum(39)m / 12 =												396.2380	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	5.5236	5.5094	5.4955	5.4302	5.4180	5.3611	5.3611	5.3506	5.3830	5.4180	5.4427	5.4685	(40)
HLP (average)												5.4301	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3160 (42)
Average daily hot water use (litres/day)	93.9004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.2905	99.5345	95.7784	92.0224	88.2664	84.5104	84.5104	88.2664	92.0224	95.7784	99.5345	103.2905	(44)
Energy conte	153.1768	133.9694	138.2444	120.5248	115.6464	99.7941	92.4739	106.1151	107.3825	125.1440	136.6044	148.3435	(45)
Energy content (annual)										Total = Sum(45)m =		1477.4194	(45)
Distribution loss (46)m = 0.15 x (45)m	22.9765	20.0954	20.7367	18.0787	17.3470	14.9691	13.8711	15.9173	16.1074	18.7716	20.4907	22.2515	(46)

Water storage loss:	
Store volume	110.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0418 (51)
Volume factor from Table 2a	1.0294 (52)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Temperature factor from Table 2b												0.6000	(53)
Enter (49) or (54) in (55)												2.8414	(55)
Total storage loss													
	88.0819	79.5579	88.0819	85.2406	88.0819	85.2406	88.0819	88.0819	85.2406	88.0819	85.2406	88.0819	(56)
If cylinder contains dedicated solar storage													
	88.0819	79.5579	88.0819	85.2406	88.0819	85.2406	88.0819	88.0819	85.2406	88.0819	85.2406	88.0819	(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)
Total heat required for water heating calculated for each month													
	241.2587	213.5273	226.3263	205.7654	203.7284	185.0346	180.5558	194.1971	192.6231	213.2259	221.8450	236.4255	(62)
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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	241.2587	213.5273	226.3263	205.7654	203.7284	185.0346	180.5558	194.1971	192.6231	213.2259	221.8450	236.4255	(64)
								Total per year (kWh/year) = Sum(64)m =				2514.5129	(64)
Heat gains from water heating, kWh/month													
	121.3968	108.1911	116.4318	108.2670	108.9180	101.3740	101.2131	105.7488	103.8971	112.0759	113.6134	119.7898	(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	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5331	18.2373	14.8316	11.2284	8.3934	7.0861	7.6567	9.9525	13.3582	16.9614	19.7964	21.1037	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.1273	206.2455	200.9077	189.5441	175.1997	161.7179	152.7113	150.5931	155.9309	167.2944	181.6389	195.1206	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	(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)													
	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	(71)
Water heating gains (Table 5)													
	163.1678	160.9987	156.4943	150.3708	146.3951	140.7972	136.0391	142.1355	144.3016	150.6396	157.7964	161.0077	(72)
Total internal gains													
	445.5683	443.2217	429.9738	408.8836	387.7284	367.3414	354.1474	360.4214	371.3310	392.6357	416.9719	434.9724	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3200	36.7938	0.7600	0.8000	0.7700	66.9724	(77)
Northwest	7.6200	11.2829	0.7600	0.8000	0.7700	36.2255	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	103.1978	187.8167	288.9399	411.5818	509.9033	527.7242	499.8317	423.1912	330.8925	216.1950	125.7985	86.8979	(83)
Total gains	548.7662	631.0384	718.9137	820.4654	897.6317	895.0657	853.9791	783.6126	702.2234	608.8306	542.7704	521.8703	(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	12.5724	12.6047	12.6366	12.7885	12.8174	12.9533	12.9533	12.9788	12.9006	12.8174	12.7592	12.6989	
alpha	1.8382	1.8403	1.8424	1.8526	1.8545	1.8636	1.8636	1.8653	1.8600	1.8545	1.8506	1.8466	
util living area													
	0.9908	0.9875	0.9813	0.9683	0.9437	0.9003	0.8423	0.8677	0.9386	0.9752	0.9877	0.9917	(86)
MIT	16.6004	16.8341	17.3557	18.1259	18.9640	19.7705	20.2745	20.1909	19.5184	18.4689	17.4237	16.5741	(87)
Th 2	18.0189	18.0201	18.0212	18.0271	18.0282	18.0340	18.0340	18.0351	18.0317	18.0282	18.0259	18.0235	(88)
util rest of house													
	0.9871	0.9823	0.9725	0.9498	0.8988	0.7722	0.5097	0.5828	0.8593	0.9567	0.9813	0.9884	(89)
MIT 2	12.9365	13.2687	14.0120	15.1023	16.2782	17.3559	17.9033	17.8459	17.0561	15.5977	14.1080	12.8935	(90)
Living area fraction									fLA = Living area / (4) =			0.3118	(91)
MIT	14.0788	14.3803	15.0544	16.0450	17.1156	18.1087	18.6426	18.5770	17.8238	16.4928	15.1417	14.0410	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.0788	14.3803	15.0544	16.0450	17.1156	18.1087	18.6426	18.5770	17.8238	16.4928	15.1417	14.0410	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9693	0.9551	0.9263	0.8736	0.7779	0.6290	0.6771	0.8486	0.9373	0.9686	0.9791	(94)
Useful gains	536.1204	611.6847	686.6079	759.9569	784.1591	696.2587	537.1227	530.5977	595.9406	570.6666	525.7054	510.9433	(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													
	3941.3941	3811.2918	3430.3893	2831.1485	2141.0559	1372.6123	799.0642	849.9833	1462.6931	2329.7425	3193.8070	3926.9534	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	2533.5236	2150.1360	2041.3734	1491.2580	1009.5312	0.0000	0.0000	0.0000	0.0000	1308.7525	1921.0332	2541.5115	(98)
Space heating												14997.1193	(98)
Space heating per m2											(98) / (4) =	205.5245	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	14997.1193	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2533.5236	2150.1360	2041.3734	1491.2580	1009.5312	0.0000	0.0000	0.0000	0.0000	1308.7525	1921.0332	2541.5115	(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)													
	2533.5236	2150.1360	2041.3734	1491.2580	1009.5312	0.0000	0.0000	0.0000	0.0000	1308.7525	1921.0332	2541.5115	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	241.2587	213.5273	226.3263	205.7654	203.7284	185.0346	180.5558	194.1971	192.6231	213.2259	221.8450	236.4255	(64)
Efficiency of water heater												100.0000	(216)
(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	(217)
Fuel for water heating, kWh/month													
	241.2587	213.5273	226.3263	205.7654	203.7284	185.0346	180.5558	194.1971	192.6231	213.2259	221.8450	236.4255	(219)
Water heating fuel used												2514.5129	(219)
Annual totals kWh/year													
Space heating fuel - main system												14997.1193	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												362.6203	(232)
Total delivered energy for all uses												17874.2525	(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	14997.1193	0.5190	7783.5049	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2514.5129	0.5190	1305.0322	(264)
Space and water heating			9088.5371	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	362.6203	0.5190	188.1999	(268)
Total CO2, kg/year			9276.7370	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			127.1300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		127.1300	ZC1
Total Floor Area	TFA	72.9700	
Assumed number of occupants	N	2.3160	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5769	ZC2
CO2 emissions from cooking, equation (L16)		2.3926	ZC3
Total CO2 emissions		146.0994	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		146.0994	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.9700 (1b)	x	2.4500 (2b)	=	178.7765	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	178.7765	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1678	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4178	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3865	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4928	0.4831	0.4734	0.4251	0.4155	0.3671	0.3671	0.3575	0.3865	0.4155	0.4348	0.4541	(22b)
Effective ac	0.6214	0.6167	0.6121	0.5904	0.5863	0.5674	0.5674	0.5639	0.5747	0.5863	0.5945	0.6031	(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 Semi-glazed door			3.5900	1.2000	4.3080			(26a)
TER Opening Type (Uw = 1.40)			11.9400	1.3258	15.8295			(27)
Heat Loss Floor 1			72.9700	0.1300	9.4861			(28a)
External Wall 1	90.8500	15.5300	75.3200	0.1800	13.5576			(29a)
External Roof 1	72.9700		72.9700	0.1300	9.4861			(30)
Total net area of external elements Aum(A, m2)			236.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.6673			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							11.8395	(36)
Total fabric heat loss						(33) + (36) =	64.5068	(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	36.6604	36.3823	36.1097	34.8292	34.5896	33.4744	33.4744	33.2679	33.9040	34.5896	35.0743	35.5810	(38)
Heat transfer coeff	101.1672	100.8891	100.6165	99.3360	99.0965	97.9812	97.9812	97.7747	98.4108	99.0965	99.5811	100.0878	(39)
Average = Sum(39)m / 12 =												99.3349	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3864	1.3826	1.3789	1.3613	1.3580	1.3428	1.3428	1.3399	1.3486	1.3580	1.3647	1.3716	(40)
HLP (average)												1.3613	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3160 (42)
Average daily hot water use (litres/day)		89.2054 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.1260	94.5577	90.9895	87.4213	83.8531	80.2849	80.2849	83.8531	87.4213	90.9895	94.5577	98.1260	(44)
Energy conte	145.5180	127.2709	131.3322	114.4986	109.8641	94.8044	87.8502	100.8094	102.0134	118.8868	129.7742	140.9264	(45)
Energy content (annual)										Total = Sum(45)m =		1403.5485	(45)
Distribution loss (46)m = 0.15 x (45)m	21.8277	19.0906	19.6998	17.1748	16.4796	14.2207	13.1775	15.1214	15.3020	17.8330	19.4661	21.1390	(46)
Water storage loss:													
Store volume												110.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1652	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6292	(55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss													
	19.5057	17.6181	19.5057	18.8765	19.5057	18.8765	19.5057	19.5057	18.8765	19.5057	18.8765	19.5057	(56)
If cylinder contains dedicated solar storage													
	19.5057	17.6181	19.5057	18.8765	19.5057	18.8765	19.5057	19.5057	18.8765	19.5057	18.8765	19.5057	(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)
Total heat required for water heating calculated for each month													
	188.2861	165.9002	174.1003	155.8871	152.6323	136.1929	130.6183	143.5775	143.4019	161.6549	171.1627	183.6945	(62)
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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	188.2861	165.9002	174.1003	155.8871	152.6323	136.1929	130.6183	143.5775	143.4019	161.6549	171.1627	183.6945	(64)
									Total per year (kWh/year) = Sum(64)m =			1907.1086	(64)
Heat gains from water heating, kWh/month													
	82.5992	73.2210	77.8825	71.1816	70.7443	64.6333	63.4247	67.7336	67.0303	73.7443	76.2607	81.0725	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	115.8009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.9030	16.7895	13.6541	10.3371	7.7271	6.5235	7.0489	9.1624	12.2978	15.6149	18.2248	19.4284	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.1273	206.2455	200.9077	189.5441	175.1997	161.7179	152.7113	150.5931	155.9309	167.2944	181.6389	195.1206	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	34.5801	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	-92.6407	(71)
Water heating gains (Table 5)													
	111.0205	108.9598	104.6807	98.8633	95.0865	89.7684	85.2482	91.0398	93.0976	99.1187	105.9177	108.9684	(72)
Total internal gains													
	394.7910	392.7350	379.9828	359.4847	338.7535	318.7501	305.7487	311.5356	322.0665	342.7683	366.5216	384.2577	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3200	36.7938	0.6300	0.7000	0.7700	48.5770	(77)
Northwest	7.6200	11.2829	0.6300	0.7000	0.7700	26.2754	(81)

Solar gains	74.8524	136.2289	209.5765	298.5322	369.8476	382.7737	362.5424	306.9528	240.0059	156.8125	91.2453	63.0296	(83)
Total gains	469.6434	528.9639	589.5592	658.0169	708.6011	701.5238	668.2911	618.4884	562.0724	499.5808	457.7669	447.2873	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.0890	50.2270	50.3631	51.0123	51.1356	51.7177	51.7177	51.8269	51.4919	51.1356	50.8868	50.6292	
alpha	4.3393	4.3485	4.3575	4.4008	4.4090	4.4478	4.4478	4.4551	4.4328	4.4090	4.3925	4.3753	
util living area													
	0.9972	0.9949	0.9884	0.9668	0.9044	0.7679	0.6092	0.6690	0.8839	0.9784	0.9948	0.9978	(86)
MIT	19.4932	19.6442	19.9174	20.2988	20.6519	20.8901	20.9702	20.9552	20.7737	20.3281	19.8496	19.4719	(87)
Th 2	19.7738	19.7767	19.7796	19.7931	19.7956	19.8075	19.8075	19.8097	19.8029	19.7956	19.7905	19.7852	(88)
util rest of house													
	0.9962	0.9930	0.9840	0.9529	0.8619	0.6689	0.4614	0.5226	0.8153	0.9668	0.9926	0.9970	(89)
MIT 2	17.7902	18.0123	18.4114	18.9671	19.4478	19.7328	19.7967	19.7912	19.6156	19.0178	18.3222	17.7668	(90)
Living area fraction										fLA = Living area / (4) =		0.3118	(91)
MIT	18.3211	18.5211	18.8810	19.3823	19.8232	20.0936	20.1626	20.1541	19.9767	19.4263	18.7984	18.2984	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3211	18.5211	18.8810	19.3823	19.8232	20.0936	20.1626	20.1541	19.9767	19.4263	18.7984	18.2984	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9945	0.9903	0.9794	0.9467	0.8631	0.6953	0.5080	0.5684	0.8274	0.9619	0.9899	0.9955	(94)
Useful gains	467.0418	523.8118	577.4160	622.9421	611.5714	487.7895	339.5101	351.5589	465.0421	480.5268	453.1446	445.2791	(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													
	1418.4791	1374.2197	1245.7289	1041.2666	804.9811	538.2744	349.0666	367.0568	578.3275	874.6586	1164.9414	1411.0762	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	707.8694	571.4741	497.2248	301.1936	143.8968	0.0000	0.0000	0.0000	0.0000	293.2341	512.4936	718.5531	(98)
Space heating												3745.9395	(98)
Space heating per m2											(98) / (4) =	51.3353	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4006.3524	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	707.8694	571.4741	497.2248	301.1936	143.8968	0.0000	0.0000	0.0000	0.0000	293.2341	512.4936	718.5531	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	757.0795	611.2023	531.7912	322.1322	153.9003	0.0000	0.0000	0.0000	0.0000	313.6193	548.1215	768.5059	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	188.2861	165.9002	174.1003	155.8871	152.6323	136.1929	130.6183	143.5775	143.4019	161.6549	171.1627	183.6945	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.0203	87.8498	87.4588	86.5424	84.6572	79.8000	79.8000	79.8000	79.8000	86.3838	87.5606	88.0951	(217)
Fuel for water heating, kWh/month													
	213.9121	188.8453	199.0656	180.1279	180.2945	170.6678	163.6821	179.9217	179.7016	187.1356	195.4792	208.5185	(219)
Water heating fuel used												2247.3520	(219)
Annual totals kWh/year													
Space heating fuel - main system												4006.3524	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												333.8333	(232)
Total delivered energy for all uses												6662.5377	(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	4006.3524	0.2160	865.3721	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2247.3520	0.2160	485.4280	(264)
Space and water heating			1350.8001	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	333.8333	0.5190	173.2595	(268)
Total CO2, kg/m2/year			1562.9846	(272)
Emissions per m2 for space and water heating			18.5117	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.3744	(272b)
Emissions per m2 for pumps and fans			0.5334	(272c)
Target Carbon Dioxide Emission Rate (TER) = (18.5117 * 1.55) + 2.3744 + 0.5334, rounded to 2 d.p.			31.6000	(273)

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Not significant	Pass
Based on:		
Overshading	Average	
Windows facing North	10.50 m², No overhang	
Windows facing South	8.87 m², No overhang	
Windows facing West	0.53 m², No overhang	
Air change rate	8.00 ach	
Blinds/curtains	None	

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.11	W/m²K
Floor U-value	0.11	W/m²K
Thermal bridging y-value	0.020	W/m²K
Photovoltaic array	1.14	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

Appendix 6

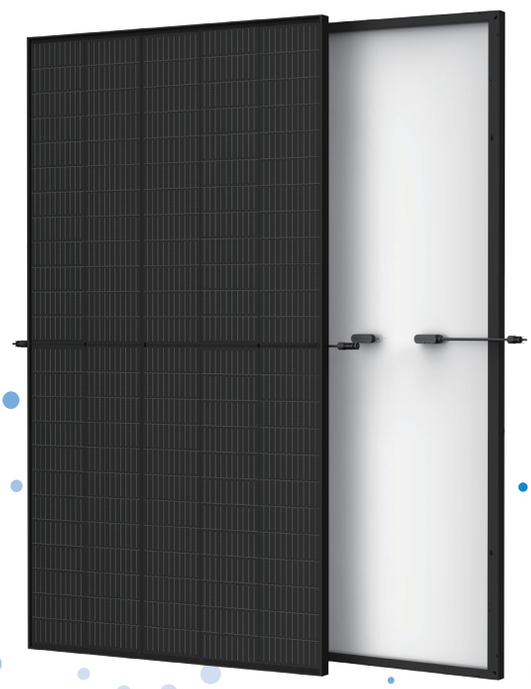
Vertex S

BACKSHEET MONOCRYSTALLINE MODULE

PRODUCT: TSM-DE09.05

PRODUCT RANGE: 380-395W

395W+	0~+5W	20.5%
MAXIMUM POWER OUTPUT	POSITIVE POWER TOLERANCE	MAXIMUM EFFICIENCY



Outstanding Visual Appearance

- Designed with aesthetics in mind
- Excellent cell color control by dedicated cell blackening treatment and machine selection.
- Thinner wires that appear all black at a distance

Small in size, big on power

- Small form factor. Generate a huge amount of energy even in limited space.
- Up to 395W, 20.5% module efficiency with high density interconnect technology
- Multi-busbar technology for better light trapping effect, lower series resistance and improved current collection
- Reduce installation cost with higher power bin and efficieny
- Boost performance in warm weather lower temperature coefficient (-0.34%) and operating temperature

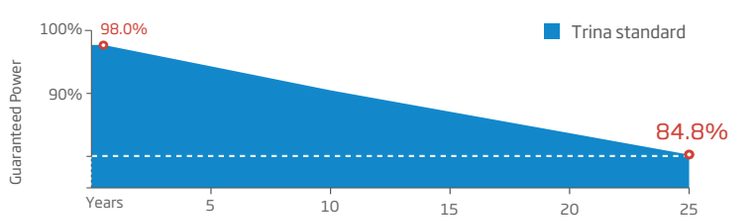
Universal solution for residential and C&I rooftops

- Designed for compatibility with existing mainstream optimizers, inverters and mounting systems
- Perfect size and low weight. Easy for handling. Economy for transporting
- Diverse installation solutions. Flexible for system deployment

High Reliability

- 15 year product warranty
- 25 year performance warranty with lowest degradation;
- Minimized micro-cracks with innovative non-destructive cutting technology
- Ensured PID resistance through cell process and module material control
- Mechanical performance up to 6000 Pa positive load and 4000 Pa negative load

Trina Solar's Backsheet Performance Warranty



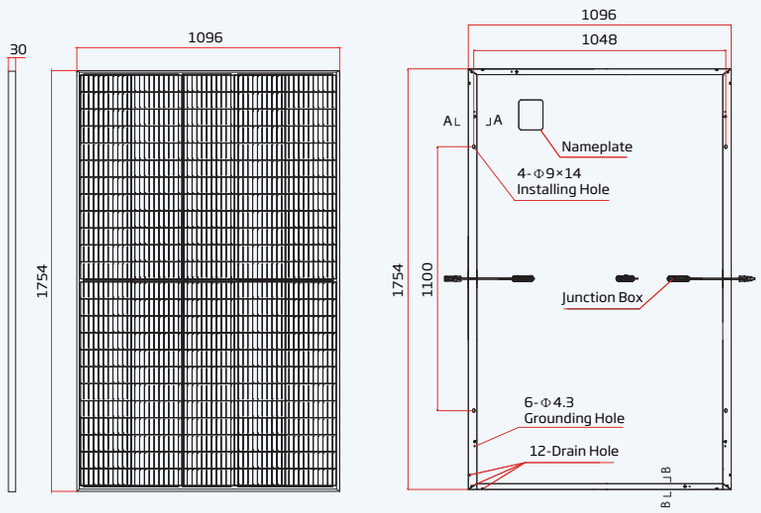
Comprehensive Products and System Certificates

IEC61215/IEC61730/IEC61701/IEC62716
ISO 9001: Quality Management System
ISO 14001: Environmental Management System
ISO14064: Greenhouse Gases Emissions Verification
ISO45001: Occupational Health and Safety Management System

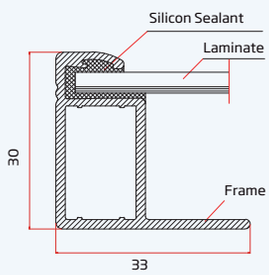
Trinasolar

Vertex S BACKSHEET MONOCRYSTALLINE MODULE

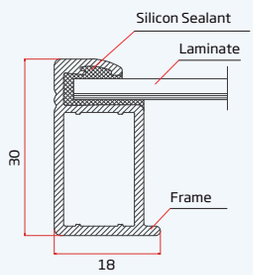
DIMENSIONS OF PV MODULE(mm)



Front View

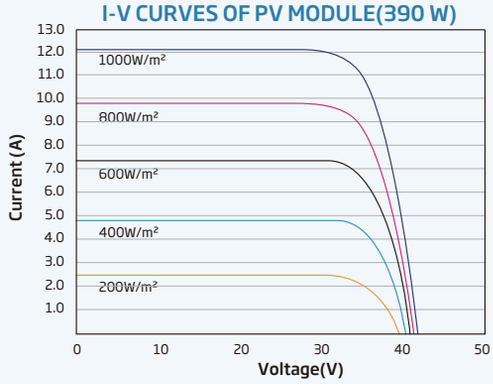


A-A

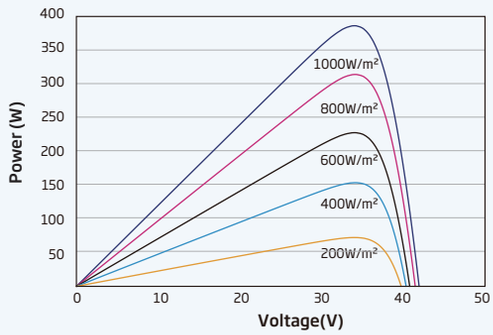


B-B

I-V CURVES OF PV MODULE(390 W)



P-V CURVES OF PV MODULE(390W)



ELECTRICAL DATA (STC)

Peak Power Watts-PMAX (Wp)*	380	385	390	395
Power Tolerance-PMAX (W)	0 ~ +5			
Maximum Power Voltage-VMPP (V)	33.4	33.6	33.8	34.0
Maximum Power Current-IMPP (A)	11.38	11.46	11.54	11.62
Open Circuit Voltage-VOC (V)	40.4	40.6	40.8	41.0
Short Circuit Current-ISC (A)	12.00	12.07	12.14	12.21
Module Efficiency η m (%)	19.8	20.0	20.3	20.5

STC: Irrdiance 1000W/m2, Cell Temperature 25°C, Air Mass AM1.5. *Measuring tolerance: ±3%.

ELECTRICAL DATA (NOCT)

Maximum Power-PMAX (Wp)	286	290	294	298
Maximum Power Voltage-VMPP (V)	31.4	31.6	31.8	31.9
Maximum Power Current-IMPP (A)	9.12	9.18	9.24	9.32
Open Circuit Voltage-VOC (V)	38.0	38.2	38.4	38.6
Short Circuit Current-ISC (A)	9.67	9.73	9.78	9.84

NOCT: Irradiance at 800W/m², Ambient Temperature 20°C, Wind Speed 1m/s.

MECHANICAL DATA

Solar Cells	Monocrystalline
No. of cells	120 cells
Module Dimensions	1754×1096×30 mm (69.06×43.15×1.18 inches)
Weight	21.0 kg (46.3 lb)
Glass	3.2 mm (0.13 inches), High Transmission, AR Coated Heat Strengthened Glass
Encapsulant material	EVA/POE
Backsheet	Black-White
Frame	30mm(1.18 inches) Anodized Aluminium Alloy
J-Box	IP 68 rated
Cables	Photovoltaic Technology Cable 4.0mm² (0.006 inches²), Portrait: 280/280 mm(11.02/11.02 inches) Landscape: 1100/1100 mm(43.31/43.31 inches)
Connector	MC4 EVO2 / TS4*

*Please refer to regional datasheet for specified connector.

TEMPERATURE RATINGS

NOCT (Nominal Operating Cell Temperature)	43°C (±2°C)
Temperature Coefficient of PMAX	- 0.34%/°C
Temperature Coefficient of VOC	- 0.25%/°C
Temperature Coefficient of ISC	0.04%/°C

MAXIMUMRATINGS

Operational Temperature	-40~+85°C
Maximum System Voltage	1500V DC (IEC)
Max Series Fuse Rating	20A

WARRANTY

15 year Product Workmanship Warranty

25 year Power Warranty

2% first year degradation

0.55% Annual Power Attenuation

(Please refer to product warranty for details)

PACKAGING CONFIGUREATION

Modules per box: 36 pieces

Modules per 40' container: 936 pieces

CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.

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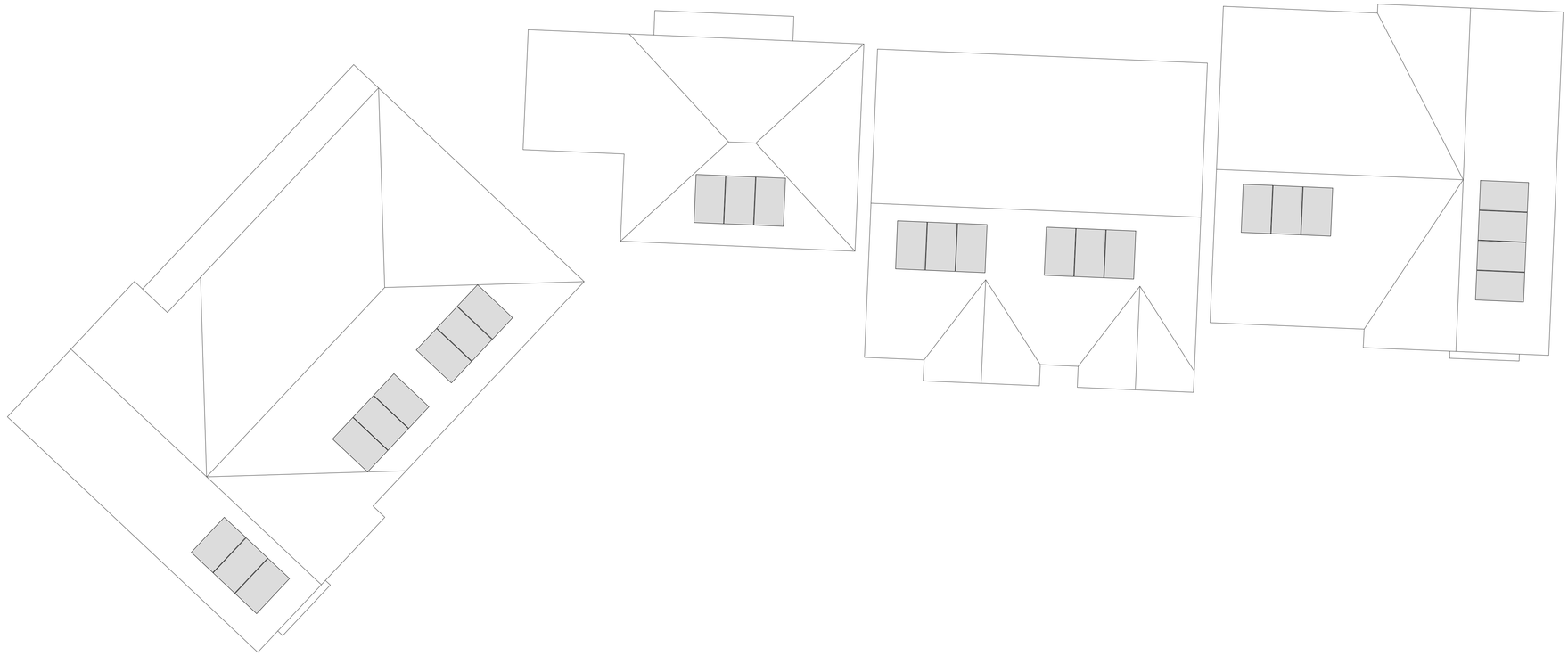
25No 380W modules



Rev.	Date	Revision	Drawn	Checked

NRG PV
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Site: **VINCAM CLOSE**

Client: **NFC HOMES LIMITED**

Drawing Title: **PV LAYOUT**

Scale 1:100 @ A1

0 1m 5m 10m

N

Job Number:	*Drawing Number:*	*Revision:*	*Date:*
PP1830	**1**	**-**	**August 2021**

Appendix 7

Number 38 – Pictures

Number 40 – Pictures

Number 42 – Pictures