SAP Calculations

Client: Vivid Design Studio

Project: Plot 1, 23 & 23a, Meadow Grove
Eastleigh, Hampshire

Contact: Mark Rogers MRICS CBuildE FCABE
Surecalc Ltd
surecalc@btinternet.com

EXCELLENCE
IN ENERGY
ASSESSMENT

Property Reference: sc120305
Survey Reference: 002 With PV

Issued on Date: 19.Jul.2016
Prop Type Ref: New Dwelling

Property: Plot 1, 23 & 23a, Meadow Grove, Eastleigh, Hampshire

SAP Rating:	87 B	**CO2 Emissions (t/year):**	0.82	**DER:**	14.65 Pass	**TER:**	19.07	**Percentage DER<TER:**	23.20 %
Environmental:	89 B	**General Requirements Compliance:**	Pass	**DFEE:**	46.05 Pass	**TFEE:**	53.99	**Percentage DFEE<TFEE:**	14.70 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 3.3 **ENE2 Credits:** 7.0 **ENE7 Credits:** 1 **CfSH Level:** 4

Surveyor: Mark Rogers MRICS CBuildE FCABE, Tel: 023 9225 4347 Surveyor ID: A320-0001
Address: 2, St Jacques Way, Denmead, Waterlooville, Hampshire, PO7 6LA
Client: Vivid Design Studio, Vivid Design Studio

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.05r04
SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

ENE 1 calculation

Total floor area	77.6 m2
DER	14.65 kgCO2/yr/m2
TER	19.07 kgCO2/yr/m2
CO2 emissions offset from additional allowable electricity generation	0.00 kgCO2/yr/m2 (ZC7)
Residual CO2 emissions offset from biofuel CHP	0.00 kgCO2/yr/m2 (ZC5)
Total CO2 emissions offset from SAP Section 16 allowances	0.00 kgCO2/yr/m2
DER accounting for SAP Section 16 allowances	14.65 kgCO2/yr/m2
% reduction DER/TER	23.20 %
CfSH ENE1 credits achieved	3.3
CfSH ENE1 level achieved	4

ENE 2 calculation

Dwelling type	House, Semi-Detached
Fabric energy efficiency (F.E.E.)	46.05
CfSH ENE2 credits achieved	7.0
CfSH ENE1 and 2 overall level achieved	4

ENE 7 calculation

Standard case CO2 emissions

Total floor area	77.6 m2	
DER	20.20 kgCO2/yr/m2	
CO2 emissions from electrical appliances	16.37 kgCO2/yr/m2	(ZC2)
CO2 emissions from cooking	2.28 kgCO2/yr/m2	(ZC3)
Standard case total CO2 emissions	38.85 kgCO2/yr/m2	(ZC4)
Net Standard case CO2 emissions	38.85 kgCO2/yr/m2	(ZC8)

Actual case CO2 emissions

DER	15.90 kgCO2/yr/m2	
CO2 emissions from electrical appliances	16.37 kgCO2/yr/m2	(ZC2)
CO2 emissions from cooking	2.28 kgCO2/yr/m2	(ZC3)
Actual case total CO2 emissions	34.55 kgCO2/yr/m2	(ZC4)
CO2 emissions from Biomass	0.00 kgCO2/yr/m2	(ZC5)
CO2 reduction from additional allowable electricity generation	0.00 kgCO2/yr/m2	(ZC7)
Net Actual case CO2 emissions	34.55 kgCO2/yr/m2	(ZC8)
% improvement in net actual/net standard case CO2 emissions	11 %	
ENE7 credits achieved	1	

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Building Regulation Compliance

Property Reference: sc120305
Survey Reference: 002 With PV
Property: Plot 1, 23 & 23a, Meadow Grove, Eastleigh, Hampshire

Issued on Date: 19.Jul.2016
Prop Type Ref: New Dwelling

SAP Rating:	87 B	**CO2 Emissions (t/year):**	0.82	**DER:**	14.65 Pass	**TER:**	19.07	**Percentage DER<TER:**	23.20 %
Environmental:	89 B	**General Requirements Compliance:**	Pass	**DFEE:**	46.05 Pass	**TFEE:**	53.99	**Percentage DFEE<TFEE:**	14.70 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 3.3 **ENE2 Credits:** 7.0 **ENE7 Credits:** 1 **CfSH Level:** 4

Surveyor: Mark Rogers MRICS CBuildE FCABE, Tel: 023 9225 4347 Surveyor ID: A320-0001
Address: 2, St Jacques Way, Denmead, Waterlooville, Hampshire, PO7 6LA
Client: Vivid Design Studio, Vivid Design Studio

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.05r04
SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

1a TER and DER

Fuel for main heating:	Mains gas	
Fuel factor:	1.00 (mains gas)	
Target Carbon Dioxide Emission Rate (TER)	19.07 kg/m^2	
Dwelling Carbon Dioxide Emission Rate (DER)	14.65 kg/m^2	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.99 kWh/m^2	
Dwelling Fabric Energy Efficiency (DFEE)	46.05 kWh/m^2	OK

2 Fabric U-values

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

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	OK

4 Heating efficiency

Main heating system:	Boiler system with radiators or underfloor - Mains gas Data from database Worcester Greenstar CDi 25 Cdi Combi boiler Efficiency: 90.0% SEDBUK2009 Minimum: 88.0%	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls:	Time and temperature zone control	OK
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

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Not applicable

9 Summertime temperature

Overheating risk (Southern England):	Slight	OK
Based On:		
Overshading:	Average	
Windows facing East:	3.05 m^2, No overhang	
Windows facing South:	0.49 m^2, No overhang	
Windows facing West:	7.31 m^2, No overhang	
Air change rate:	4.00 ach	
Blinds/curtains:	None	

10 Key features

Party wall U-value	0.00 W/m^2K
Roof U-value	0.11 W/m^2K
Floor U-value	0.12 W/m^2K
Photovoltaic array	

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Full SAP Calculation Printout

Property Reference: sc120305
Survey Reference: 002 With PV
Property: Plot 1, 23 & 23a, Meadow Grove, Eastleigh, Hampshire

Issued on Date: 19.Jul.2016
Prop Type Ref: New Dwelling

SAP Rating:	87 B	**CO2 Emissions (t/year):**	0.82	**DER:** 14.65 Pass	**TER:** 19.07	**Percentage DER<TER:**	23.20 %
Environmental:	89 B	**General Requirements Compliance:**	Pass	**DFEE:** 46.05 Pass	**TFEE:** 53.99	**Percentage DFEE<TFEE:**	14.70 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 3.3 **ENE2 Credits:** 7.0 **ENE7 Credits:** 1 **CfSH Level:** 4

Surveyor: Mark Rogers MRICS CBuildE FCABE, Tel: 023 9225 4347 Surveyor ID: A320-0001
Address: 2, St Jacques Way, Denmead, Waterlooville, Hampshire, PO7 6LA
Client: Vivid Design Studio, Vivid Design Studio

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.05r04
SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

CALCULATION DETAILS for survey reference no '002 With PV'
SAP2012 - 9.92 input data (DesignData) -


```
SAP2012 Input Data (House)     19/07/2016

FullRefNo:                     002 With PV

Regs Region:                   England
SAP Region:                    Southern England
Postcode:
DwellingOrientation:           East
Property Type:                 House, Semi-Detached
Storeys:                       2
Date Built:                    2016
Sheltered Sides:               1
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
    1st Storey:               17.61, 38.8, 2.39
    2nd Storey:               17.61, 38.8, 2.76
Living Area:                   21.95 m2, fraction: 28.3%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Medium
Thermal MassValue:             250
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Cavity Walls          77.83, 90.69, 0, Other, Cavity, 0, 0.2, Calculate
Party Walls                    Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall                     46.25, 0, Other, FilledWithEdge, 0, 0
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
    External Roof             38.8, 38.8, 0, Other, 0.11
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
    Ground Floor              38.8, 0, Other, Ground Floor - Solid, 0, 0.12
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
    New Dwelling Glazed Door  Manufacturer, Half Glazed Door, Double Low-E Soft 0.05, , , 0.71, , 0.7,
    New Dwelling Windows      Manufacturer, Window, Double Low-E Soft 0.05, , , 0.71, , 0.7,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
    Front East Door           Half Glazed Door, External Cavity Walls, East, , , , , 0, 0, 0, 2.01,
    Front East Windows        Window, External Cavity Walls, East, , None, 0, , 0, 0, 0, 2.56,
    Front East Window         Window, External Cavity Walls, East, , None, 1, False, 0, 0, 0, 0.49,
    Side South Window         Window, External Cavity Walls, South, , None, 0, , 0, 0, 0, 0.49,
    Rear West Windows         Window, External Cavity Walls, West, , None, 0, , 0, 0, 0, 7.31,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 No
Thermal Bridges
    Bridging:                 Calculate Bridges
    Y                         0.048
    List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
    0.                        External wall, E1 Steel lintel with perforated steel base plate, , No, 0, 0, 0, 0.00,
    1.                        External wall, E2 Other lintels (including other steel lintels), Independently assessed, No, 8.18, 0.05, 0.05, 0.41, IG Hi Therm Lintels
    2.                        External wall, E3 Sill, Independently assessed, No, 7.23, 0.03, 0.03, 0.22, LABC Construction Detail
    3.                        External wall, E4 Jamb, Independently assessed, No, 17.4, 0.032, 0.032, 0.56, LABC Construction Detail
    4.                        External wall, E5 Ground floor (normal), Independently assessed, No, 17.61, 0.049, 0.049, 0.86, LABC Construction Detail
    5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
    6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
    7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
    8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
    9.                        External wall, E6 Intermediate floor within a dwelling, Independently assessed, No, 17.61, 0.002, 0.002, 0.04, LABC Construction Detail
    10.                       External wall, E7 Party floor between dwellings (in blocks of flats), , No, 0, 0, 0, 0.00,
    11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
    12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, , No, 0, 0, 0, 0.00,
    13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 0, 0, 0.00,
    14.                       External wall, E10 Eaves (insulation at ceiling level), Independently assessed, No, 17.61, 0.089, 0.089, 1.57, LABC Construction Detail
    15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
    16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
    17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
    18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
    19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
    20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
    21.                       External wall, E16 Corner (normal), Independently assessed, No, 10.3, 0.046, 0.046, 0.47, LABC Construction Detail
    22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
    23.                       External wall, E18 Party wall between dwellings, Independently assessed, No, 10.3, 0.036, 0.036, 0.37, LABC Construction Detail
    24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
    25.                       Party wall, P1 Party wall - Ground floor, Table K1 - Default, No, 8.98, 0.16, 0.16, 1.44,
    26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
    27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, Table K1 - Default, No, 8.98, 0, 0, 0.00,
    28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), , No, 0, 0, 0, 0.00,
    29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
    30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
    31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), Table K1 - Default, No, 8.98, 0.24, 0.24, 2.16,
    32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
    33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
    34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
```

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

```
    35.                     External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
    36.                     External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
    37.                     External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
    38.                     External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
    39.                     External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
    40.                     External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
    41.                     External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:               True
Designed q50:                5
AsBuilt q50:                 15
Property Tested:             False
Mechanical Ventilation       None
Chimneys MHS:                0
Chimneys SHS:                0
Chimneys Other:              0
Chimneys Total:              0
Open Flues MHS:              0
Open Flues SHS:              0
Open Flues Other:            0
Open Flues Total:            0
Intermittent Fans:           4
Passive Vents:               0
Flueless Gas Fires:          0
Cooling System               None
Light Fittings:              12
LEL Fittings:                12
Percentage of LEL Fittings:  100
External Lights Fitted:      No
External LELs Fitted:        No
Electricity Tariff:          Standard
Main Heating 1
    Description              Gas Condensing Combi
    Percentage               100
    Sedbuk ID                10263
    Fuel Type                Mains gas
    MHS                      Mains gas BGW Post 98 Combi condens. with auto ign.
    SAP Code                 104
    Boiler Efficiency Type   Split Efficiences
    Efficiency Winter        90.9
    Efficiency Summer        80.8
    Controls by PCDF         0
    MHS Controls             CBI Time and temperature zone control
    Boiler Interlock         Yes
    Compensator              0
    Delayed Start Stat       Yes
    Ctrl SAP Code            2110
    Flue Type                Balanced
    Fan Assisted Flue        Yes
    Pumped                   No pump
    Heat Emitter             Radiators
    Flow Temperature         Normal (> 45°C)
    Combi boiler type        Standard Combi
    Combi keep hot type      None
Main Heating 2               None
Heating Systems Interaction  Each system heats separate parts of dwelling
Smoke Control Area           Unknown
Community Heating            None
Secondary Heating            None
Water Heating
    Type                     MainHeating1
    WHS                      HWP From main heating 1
    Low Water Usage          Yes
    SAP Code                 901
    Showers in Property      Non-electric only
    Hot Water Cylinder       None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery    none
PV Unit
Type                         One Dwelling
PVUnit 1                     Cells Peak = 0.93, Orientation = South, Elevation = 30°, Overshading = Modest, , Connected to Dwelling = Yes
Wind Turbine                 None
Terrain Type:                Urban
Small Scale Hydro            None
Special Features             None


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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 78 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) 19.07 kg/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.65 kg/m²OK
-------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.0 kWh/m²
Dwelling Fabric Energy Efficiency (DFEE)46.0 kWh/m²OK
-------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average               Highest
External wall   0.20 (max. 0.30)      0.20 (max. 0.70)         OK
Party wall      0.00 (max. 0.20)       -                       OK
Floor           0.12 (max. 0.25)      0.12 (max. 0.70)         OK
Roof            0.11 (max. 0.20)      0.11 (max. 0.35)         OK
Openings        1.40 (max. 2.00)      1.40 (max. 3.30)         OK
-------------------------------------------------------------------------------------------------
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                                          OK
```

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

---

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar CDi 25 Cdi
Combi boiler
Efficiency: 90.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage: No cylinder

---

6 Controls
Space heating controls: Time and temperature zone control OK

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 (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing East: 3.05 m², No overhang
Windows facing South: 0.49 m², No overhang
Windows facing West: 7.31 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---

10 Key features
Party wall U-value: 0.00 W/m²K
Roof U-value: 0.11 W/m²K
Floor U-value: 0.12 W/m²K
Photovoltaic array

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

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	38.8000 (1b)	x	2.3900 (2b)	=	92.7320 (1b) - (3b)	
First floor	38.8000 (1c)	x	2.7600 (2c)	=	107.0880 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.8200	(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) =	0.2002	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.4502	(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) =	0.4164	(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	0.5309	0.5205	0.5101	0.4581	0.4476	0.3956	0.3956	0.3852	0.4164	0.4476	0.4685	0.4893	(22b)
Effective ac	0.6409	0.6355	0.6301	0.6049	0.6002	0.5782	0.5782	0.5742	0.5867	0.6002	0.6097	0.6197	(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	
New Dwelling Glazed Door			2.0100	1.4000	2.8140			(26a)
New Dwelling Windows (Uw = 1.40)			10.8500	1.3258	14.3845			(27)
Ground Floor			38.8000	0.1200	4.6560			(28a)
External Cavity Walls	90.6900	12.8600	77.8300	0.2000	15.5660			(29a)
External Roof	38.8000		38.8000	0.1100	4.2680			(30)
Total net area of external elements Aum(A, m2)			168.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6885			(33)
Party Wall			46.2500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0847	(36)
Total fabric heat loss					(33) + (36) =		49.7732	(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	42.2642	41.9033	41.5496	39.8880	39.5772	38.1300	38.1300	37.8620	38.6874	39.5772	40.2061	40.8635	(38)
Heat transfer coeff	92.0374	91.6765	91.3228	89.6612	89.3503	87.9032	87.9032	87.6352	88.4606	89.3503	89.9792	90.6367	(39)
Average = Sum(39)m / 12 =												89.6597	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1860	1.1814	1.1768	1.1554	1.1514	1.1328	1.1328	1.1293	1.1400	1.1514	1.1595	1.1680	(40)
HLP (average)												1.1554	(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		2.4157 (42)
Average daily hot water use (litres/day)		91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(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	44.6781	47.5984	44.2566	43.8652	40.6438	41.9986	43.8652	44.2566	47.5984	47.8693	50.9589	(61)
Total heat required for water heating calculated for each month	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(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	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(64)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Total per year (kWh/year) = Sum(64)m = 1989.3627 (64)

Heat gains from water heating, kWh/month

	62.4091	54.6107	56.7270	50.1458	48.4660	42.5204	40.4854	45.3754	45.8842	52.4790	56.2630	60.8419 (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	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)

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

	20.5068	18.2140	14.8126	11.2141	8.3827	7.0770	7.6470	9.9398	13.3412	16.9397	19.7711	21.0768	(67)

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

	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)

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

	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)

	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)

Water heating gains (Table 5)

	83.8832	81.2659	76.2460	69.6469	65.1425	59.0561	54.4159	60.9884	63.7281	70.5363	78.1430	81.7767	(72)

Total internal gains

	377.9778	375.2919	361.2654	339.1351	316.7364	295.1873	281.6593	288.3004	300.0465	322.3860	347.8870	366.9835	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0500	19.6403	0.7100	0.7000	0.7700	20.6318	(76)
South	0.4900	46.7521	0.7100	0.7000	0.7700	7.8902	(78)
West	7.3100	19.6403	0.7100	0.7000	0.7700	49.4486	(80)

Solar gains	77.9706	150.0142	242.2317	347.8778	422.9239	431.7493	411.5097	355.5252	279.7762	176.6091	96.7346	64.4486	(83)
Total gains	455.9484	525.3062	603.4971	687.0129	739.6604	726.9365	693.1690	643.8255	579.8227	498.9951	444.6216	431.4320	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.5511	58.7816	59.0093	60.1028	60.3119	61.3048	61.3048	61.4923	60.9185	60.3119	59.8904	59.4559	
alpha	4.9034	4.9188	4.9340	5.0069	5.0208	5.0870	5.0870	5.0995	5.0612	5.0208	4.9927	4.9637	
util living area	0.9982	0.9960	0.9886	0.9602	0.8784	0.7138	0.5449	0.6033	0.8557	0.9791	0.9963	0.9986	(86)
MIT	19.6992	19.8534	20.1238	20.4859	20.7807	20.9469	20.9890	20.9822	20.8615	20.4668	20.0241	19.6829	(87)
Th 2	19.9312	19.9349	19.9386	19.9558	19.9591	19.9742	19.9742	19.9770	19.9683	19.9591	19.9525	19.9457	(88)
util rest of house	0.9976	0.9946	0.9845	0.9450	0.8329	0.6225	0.4246	0.4804	0.7857	0.9684	0.9948	0.9982	(89)
MIT 2	18.1986	18.4264	18.8217	19.3501	19.7431	19.9388	19.9701	19.9696	19.8554	19.3335	18.6888	18.1851	(90)
Living area fraction									fLA = Living area / (4) =			0.2829	(91)
MIT	18.6231	18.8301	19.1900	19.6713	20.0366	20.2239	20.2583	20.2560	20.1400	19.6541	19.0665	18.6087	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4731	18.6801	19.0400	19.5213	19.8866	20.0739	20.1083	20.1060	19.9900	19.5041	18.9165	18.4587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9922	0.9795	0.9368	0.8292	0.6321	0.4409	0.4967	0.7874	0.9619	0.9925	0.9971	(94)
Useful gains	454.2323	521.1866	591.1169	643.5926	613.3528	459.4725	305.5914	319.7879	456.5511	479.9660	441.2744	430.1903	(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	1304.4530	1263.3075	1145.1903	952.3216	731.4768	481.1755	308.3927	324.7759	521.0342	795.5803	1063.2398	1292.3652	(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	632.5642	498.7053	412.2306	222.2849	87.8843	0.0000	0.0000	0.0000	0.0000	234.8170	447.8151	641.4581	(98)
Space heating												3177.7595	(98)
Space heating per m2											(98) / (4) =	40.9505	(99)

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 %)	90.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3495.8850 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	632.5642	498.7053	412.2306	222.2849	87.8843	0.0000	0.0000	0.0000	0.0000	234.8170	447.8151	641.4581	(98)
Space heating efficiency (main heating system 1)	90.9000	90.9000	90.9000	90.9000	90.9000	0.0000	0.0000	0.0000	0.0000	90.9000	90.9000	90.9000	(210)
Space heating fuel (main heating system)	695.8902	548.6306	453.4990	244.5379	96.6824	0.0000	0.0000	0.0000	0.0000	258.3246	492.6459	705.6745	(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)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Water heating
Water heating requirement

200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271 (64)

Efficiency of water heater 80.8000 (216)

(217)m	88.2467	88.0375	87.5431	86.3529	84.1608	80.8000	80.8000	80.8000	80.8000	86.3717	87.7419	88.3199 (217)

Fuel for water heating, kWh/month

227.0233	199.1518	208.3747	187.3651	186.1274	170.7492	163.5908	182.3654	184.3794	196.4091	206.3885	221.4982 (219)

Water heating fuel used 2333.4228 (219)
Annual totals kWh/year
Space heating fuel - main system 3495.8850 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 45.0000 (231)
Electricity for lighting (calculated in Appendix L) 362.1571 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.93 * 1080 * 0.80) = -642.5331 -642.5331 (233)
Total delivered energy for all uses 5593.9319 (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	3495.8850	0.2160	755.1112	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2333.4228	0.2160	504.0193	(264)
Space and water heating			1259.1305	(265)
Pumps and fans	45.0000	0.5190	23.3550	(267)
Energy for lighting	362.1571	0.5190	187.9595	(268)
Energy saving/generation technologies				
PV Unit	-642.5331	0.5190	-333.4747	(269)
Total CO2, kg/year			1136.9704	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6500	(273)

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

DER		14.6500	ZC1
Total Floor Area	TFA	77.6000	
Assumed number of occupants	N	2.4157	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3686	ZC2
CO2 emissions from cooking, equation (L16)		2.2806	ZC3
Total CO2 emissions		33.2992	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		33.2992	ZC8

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF STANDARD ENE7 CO2 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.8000 (1b)	x	2.3900 (2b)	=	92.7320 (1b) - (3b)	
First floor	38.8000 (1c)	x	2.7600 (2c)	=	107.0880 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.8200	(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) =	0.2002	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.4502	(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) =	0.4164	(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	0.5309	0.5205	0.5101	0.4581	0.4476	0.3956	0.3956	0.3852	0.4164	0.4476	0.4685	0.4893	(22b)
Effective ac	0.6409	0.6355	0.6301	0.6049	0.6002	0.5782	0.5782	0.5742	0.5867	0.6002	0.6097	0.6197	(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	
New Dwelling Glazed Door			2.0100	1.4000	2.8140			(26a)
New Dwelling Windows (Uw = 1.40)			10.8500	1.3258	14.3845			(27)
Ground Floor			38.8000	0.1200	4.6560			(28a)
External Cavity Walls	90.6900	12.8600	77.8300	0.2000	15.5660			(29a)
External Roof	38.8000		38.8000	0.1100	4.2680			(30)
Total net area of external elements Aum(A, m2)			168.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6885			(33)
Party Wall			46.2500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0847	(36)
Total fabric heat loss					(33) + (36) =		49.7732	(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	42.2642	41.9033	41.5496	39.8880	39.5772	38.1300	38.1300	37.8620	38.6874	39.5772	40.2061	40.8635	(38)
Heat transfer coeff	92.0374	91.6765	91.3228	89.6612	89.3503	87.9032	87.9032	87.6352	88.4606	89.3503	89.9792	90.6367	(39)
Average = Sum(39)m / 12 =												89.6597	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1860	1.1814	1.1768	1.1554	1.1514	1.1328	1.1328	1.1293	1.1400	1.1514	1.1595	1.1680	(40)
HLP (average)												1.1554	(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		2.4157 (42)
Average daily hot water use (litres/day)		91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(46)
Water storage loss:													
Store volume												150.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0191	(51)
Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.4364	(55)
Total storage loss	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282	(56)
If cylinder contains dedicated solar storage	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282	(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)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Total heat required for water heating calculated for each month

	217.1723	191.8804	202.6099	183.1425	180.5718	162.9254	157.9734	171.2766	170.3258	189.8340	198.8237	212.4588 (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

	217.1723	191.8804	202.6099	183.1425	180.5718	162.9254	157.9734	171.2766	170.3258	189.8340	198.8237	212.4588 (64)

Total per year (kWh/year) = Sum(64)m = 2238.9944 (64)

Heat gains from water heating, kWh/month

	103.9019	92.4254	99.0599	91.5647	91.7322	84.8425	84.2182	88.6416	87.3031	94.8119	96.7787	102.3346 (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	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)

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

	20.5068	18.2140	14.8126	11.2141	8.3827	7.0770	7.6470	9.9398	13.3412	16.9397	19.7711	21.0768	(67)

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

	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)

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

	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)

	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)

Water heating gains (Table 5)

	139.6531	137.5377	133.1450	127.1731	123.2960	117.8368	113.1966	119.1419	121.2543	127.4353	134.4148	137.5466	(72)

Total internal gains

	436.7476	434.5637	421.1645	399.6614	377.8899	356.9680	343.4400	349.4538	360.5728	382.2851	407.1589	425.7533	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0500	19.6403	0.7100	0.7000	0.7700	20.6318	(76)
South	0.4900	46.7521	0.7100	0.7000	0.7700	7.8902	(78)
West	7.3100	19.6403	0.7100	0.7000	0.7700	49.4486	(80)

Solar gains	77.9706	150.0142	242.2317	347.8778	422.9239	431.7493	411.5097	355.5252	279.7762	176.6091	96.7346	64.4486	(83)
Total gains	514.7182	584.5780	663.3962	747.5392	800.8138	788.7172	754.9496	704.9790	640.3490	558.8941	503.8934	490.2019	(84)

---

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.5511	58.7816	59.0093	60.1028	60.3119	61.3048	61.3048	61.4923	60.9185	60.3119	59.8904	59.4559	
alpha	4.9034	4.9188	4.9340	5.0069	5.0208	5.0870	5.0870	5.0995	5.0612	5.0208	4.9927	4.9637	
util living area	0.9969	0.9936	0.9832	0.9461	0.8489	0.6712	0.5039	0.5572	0.8144	0.9674	0.9936	0.9976	(86)
MIT	19.7689	19.9228	20.1908	20.5434	20.8171	20.9597	20.9922	20.9875	20.8922	20.5299	20.0938	19.7531	(87)
Th 2	19.9312	19.9349	19.9386	19.9558	19.9591	19.9742	19.9742	19.9770	19.9683	19.9591	19.9525	19.9457	(88)
util rest of house	0.9958	0.9915	0.9773	0.9267	0.7981	0.5804	0.3908	0.4407	0.7370	0.9519	0.9910	0.9967	(89)
MIT 2	18.8177	18.9737	19.2414	19.5949	19.8395	19.9564	19.9723	19.9735	19.9111	19.5910	19.1586	18.8135	(90)
Living area fraction									fLA = Living area / (4) =			0.2829	(91)
MIT	19.0867	19.2422	19.5099	19.8632	20.1160	20.2402	20.2608	20.2603	20.1886	19.8565	19.4232	19.0793	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0867	19.2422	19.5099	19.8632	20.1160	20.2402	20.2608	20.2603	20.1886	19.8565	19.4232	19.0793	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9896	0.9743	0.9246	0.8066	0.6052	0.4230	0.4739	0.7554	0.9500	0.9893	0.9958	(94)
Useful gains	511.9888	578.5038	646.3336	691.2037	645.9455	477.3422	319.3684	334.0918	483.7310	530.9249	498.4869	488.1431	(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	1360.9339	1314.8403	1188.1020	982.9703	751.9728	495.7932	321.7940	338.3018	538.6036	827.0752	1108.8293	1348.6089	(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	631.6151	494.8181	403.0757	210.0720	78.8844	0.0000	0.0000	0.0000	0.0000	220.3358	439.4466	640.1866	(98)
Space heating												3118.4342	(98)
Space heating per m2											(98) / (4) =	40.1860	(99)

8c. Space cooling requirement

Not applicable

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

DER		15.9000	ZC1
Total Floor Area	TFA	77.6000	
Assumed number of occupants	N	2.4157	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3686	ZC2
CO2 emissions from cooking, equation (L16)		2.2806	ZC3
Total CO2 emissions		34.5492	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		34.5492	ZC8

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

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	38.8000 (1b)	x	2.3900 (2b)	=	92.7320 (1b) - (3b)	
First floor	38.8000 (1c)	x	2.7600 (2c)	=	107.0880 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		199.8200	(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) =	0.1501 (8)
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.4001 (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) =	0.3701 (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	0.4719	0.4627	0.4534	0.4071	0.3979	0.3516	0.3516	0.3424	0.3701	0.3979	0.4164	0.4349	(22b)
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5792	0.5618	0.5618	0.5586	0.5685	0.5792	0.5867	0.5946	(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			2.0100	1.2000	2.4120			(26a)
TER Opening Type (Uw = 1.40)			10.8500	1.3258	14.3845			(27)
Ground Floor			38.8000	0.1300	5.0440			(28a)
External Cavity Walls	90.6900	12.8600	77.8300	0.1800	14.0094			(29a)
External Roof	38.8000		38.8000	0.1300	5.0440			(30)
Total net area of external elements Aum(A, m2)			168.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.8939			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8557	(36)
Total fabric heat loss					(33) + (36) =		49.7496	(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	40.3127	40.0276	39.7481	38.4355	38.1899	37.0466	37.0466	36.8349	37.4870	38.1899	38.6867	39.2061	(38)
Heat transfer coeff	90.0623	89.7772	89.4977	88.1851	87.9395	86.7962	86.7962	86.5845	87.2366	87.9395	88.4363	88.9557	(39)
Average = Sum(39)m / 12 =												88.1839	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1606	1.1569	1.1533	1.1364	1.1332	1.1185	1.1185	1.1158	1.1242	1.1332	1.1396	1.1463	(40)
HLP (average)												1.1364	(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		2.4157 (42)
Average daily hot water use (litres/day)		91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(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	44.6781	47.5984	44.2566	43.8652	40.6438	41.9986	43.8652	44.2566	47.5984	47.8693	50.9589	(61)
Total heat required for water heating calculated for each month	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(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	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(64)
								Total per year (kWh/year) = Sum(64)m =				1989.3627	(64)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Heat gains from water heating, kWh/month

62.4091	54.6107	56.7270	50.1458	48.4660	42.5204	40.4854	45.3754	45.8842	52.4790	56.2630	60.8419 (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	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)

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

	20.5068	18.2140	14.8126	11.2141	8.3827	7.0770	7.6470	9.9398	13.3412	16.9397	19.7711	21.0768	(67)

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

	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)

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

	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)

	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)

Water heating gains (Table 5)

	83.8832	81.2659	76.2460	69.6469	65.1425	59.0561	54.4159	60.9884	63.7281	70.5363	78.1430	81.7767	(72)

Total internal gains

	380.9778	378.2919	364.2654	342.1351	319.7364	298.1873	284.6593	291.3004	303.0465	325.3860	350.8870	369.9835	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0500	19.6403	0.6300	0.7000	0.7700	18.3071	(76)
South	0.4900	46.7521	0.6300	0.7000	0.7700	7.0011	(78)
West	7.3100	19.6403	0.6300	0.7000	0.7700	43.8770	(80)

Solar gains	69.1852	133.1112	214.9380	308.6803	375.2705	383.1015	365.1424	315.4660	248.2521	156.7095	85.8349	57.1868	(83)
Total gains	450.1630	511.4031	579.2034	650.8154	695.0070	681.2887	649.8017	606.7664	551.2986	482.0955	436.7220	427.1702	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8351	60.0251	60.2126	61.1089	61.2795	62.0867	62.0867	62.2385	61.7733	61.2795	60.9353	60.5795	
alpha	4.9890	5.0017	5.0142	5.0739	5.0853	5.1391	5.1391	5.1492	5.1182	5.0853	5.0624	5.0386	
util living area	0.9983	0.9964	0.9902	0.9666	0.8956	0.7415	0.5713	0.6285	0.8710	0.9814	0.9966	0.9987	(86)
MIT	19.7261	19.8688	20.1241	20.4686	20.7628	20.9388	20.9870	20.9794	20.8519	20.4641	20.0372	19.7068	(87)
Th 2	19.9517	19.9546	19.9575	19.9712	19.9738	19.9857	19.9857	19.9880	19.9811	19.9738	19.9686	19.9632	(88)
util rest of house	0.9977	0.9952	0.9866	0.9534	0.8542	0.6516	0.4480	0.5039	0.8051	0.9718	0.9952	0.9983	(89)
MIT 2	18.2524	18.4629	18.8362	19.3390	19.7357	19.9438	19.9808	19.9792	19.8579	19.3411	18.7193	18.2323	(90)
Living area fraction									fLA = Living area / (4) =			0.2829	(91)
MIT	18.6692	18.8605	19.2005	19.6585	20.0262	20.2253	20.2655	20.2621	20.1390	19.6588	19.0921	18.6494	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6692	18.8605	19.2005	19.6585	20.0262	20.2253	20.2655	20.2621	20.1390	19.6588	19.0921	18.6494	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9933	0.9830	0.9484	0.8567	0.6746	0.4832	0.5393	0.8170	0.9678	0.9934	0.9974	(94)
Useful gains	448.6476	507.9684	569.3667	617.2205	595.3822	459.5749	313.9588	327.2336	450.4037	466.5619	433.8305	426.0607	(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	1294.1247	1253.3387	1136.6662	948.7392	732.2013	488.2526	318.1475	334.3997	526.8256	796.6221	1060.5356	1285.3551	(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	629.0349	500.8888	422.0708	238.6935	101.7935	0.0000	0.0000	0.0000	0.0000	245.5648	451.2276	639.3150	(98)
Space heating												3228.5889	(98)
Space heating per m2											(98) / (4) =	41.6055	(99)

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	3456.7333 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	629.0349	500.8888	422.0708	238.6935	101.7935	0.0000	0.0000	0.0000	0.0000	245.5648	451.2276	639.3150	(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)	673.4849	536.2835	451.8960	255.5605	108.9866	0.0000	0.0000	0.0000	0.0000	262.9173	483.1131	684.4914	(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)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Water heating
Water heating requirement

200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271 (64)

Efficiency of water heater 80.3000 (216)

(217)m 87.7344	87.5450	87.0942	86.0286	83.9964	80.3000	80.3000	80.3000	80.3000	85.9815	87.2569	87.8122 (217)

Fuel for water heating, kWh/month

228.3489	200.2721	209.4486	188.0716	186.4919	171.8124	164.6094	183.5009	185.5275	197.3004	207.5358	222.7790 (219)

Water heating fuel used 2345.6984 (219)
Annual totals kWh/year
Space heating fuel - main system 3456.7333 (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) 362.1571 (232)
Total delivered energy for all uses 6239.5888 (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	3456.7333	0.2160	746.6544 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2345.6984	0.2160	506.6709 (264)
Space and water heating			1253.3253 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	362.1571	0.5190	187.9595 (268)
Total CO2, kg/m2/year			1480.2098 (272)
Emissions per m2 for space and water heating			16.1511 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4222 (272b)
Emissions per m2 for pumps and fans			0.5016 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1511 * 1.00) + 2.4222 + 0.5016, rounded to 2 d.p.			19.0700 (273)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.8000 (1b)	x	2.3900 (2b)	=	92.7320 (1b) - (3b)	
First floor	38.8000 (1c)	x	2.7600 (2c)	=	107.0880 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.8200	(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) =	0.1501	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.4001	(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) =	0.3701	(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	0.4719	0.4627	0.4534	0.4071	0.3979	0.3516	0.3516	0.3424	0.3701	0.3979	0.4164	0.4349	(22b)
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5792	0.5618	0.5618	0.5586	0.5685	0.5792	0.5867	0.5946	(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	
New Dwelling Glazed Door			2.0100	1.4000	2.8140			(26a)
New Dwelling Windows (Uw = 1.40)			10.8500	1.3258	14.3845			(27)
Ground Floor			38.8000	0.1200	4.6560			(28a)
External Cavity Walls	90.6900	12.8600	77.8300	0.2000	15.5660			(29a)
External Roof	38.8000		38.8000	0.1100	4.2680			(30)
Total net area of external elements Aum(A, m2)			168.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6885			(33)
Party Wall			46.2500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.0847 (36)
Total fabric heat loss	(33) + (36) =	49.7732 (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	40.3127	40.0276	39.7481	38.4355	38.1899	37.0466	37.0466	36.8349	37.4870	38.1899	38.6867	39.2061	(38)
Heat transfer coeff	90.0859	89.8008	89.5213	88.2087	87.9631	86.8198	86.8198	86.6081	87.2602	87.9631	88.4599	88.9793	(39)
Average = Sum(39)m / 12 =												88.2075	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1609	1.1572	1.1536	1.1367	1.1335	1.1188	1.1188	1.1161	1.1245	1.1335	1.1399	1.1466	(40)
HLP (average)												1.1367	(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	2.4157 (42)
Average daily hot water use (litres/day)	91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	31.7436	27.7632	28.6491	24.9770	23.9660	20.6808	19.1638	21.9908	22.2534	25.9342	28.3092	30.7420	(65)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

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	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)

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

	20.5068	18.2140	14.8126	11.2141	8.3827	7.0770	7.6470	9.9398	13.3412	16.9397	19.7711	21.0768	(67)

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

	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)

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

	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)

	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)

Water heating gains (Table 5)

	42.6661	41.3142	38.5068	34.6902	32.2124	28.7234	25.7578	29.5575	30.9075	34.8578	39.3184	41.3199	(72)

Total internal gains

	336.7607	335.3402	323.5263	304.1785	283.8063	264.8546	253.0012	256.8694	267.2260	286.7075	309.0624	326.5266	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0500	19.6403	0.7100	0.7000	0.7700	20.6318	(76)
South	0.4900	46.7521	0.7100	0.7000	0.7700	7.8902	(78)
West	7.3100	19.6403	0.7100	0.7000	0.7700	49.4486	(80)

Solar gains	77.9706	150.0142	242.2317	347.8778	422.9239	431.7493	411.5097	355.5252	279.7762	176.6091	96.7346	64.4486	(83)
Total gains	414.7313	485.3545	565.7580	652.0563	706.7302	696.6038	664.5109	612.3946	547.0022	463.3166	405.7970	390.9752	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8194	60.0094	60.1967	61.0925	61.2631	62.0698	62.0698	62.2216	61.7566	61.2631	60.9190	60.5634	
alpha	4.9880	5.0006	5.0131	5.0728	5.0842	5.1380	5.1380	5.1481	5.1171	5.0842	5.0613	5.0376	
util living area													
	0.9988	0.9972	0.9912	0.9664	0.8902	0.7303	0.5602	0.6238	0.8739	0.9842	0.9975	0.9991	(86)
MIT	19.6832	19.8375	20.1083	20.4696	20.7707	20.9429	20.9881	20.9800	20.8491	20.4431	20.0000	19.6628	(87)
Th 2	19.9514	19.9544	19.9573	19.9710	19.9735	19.9855	19.9855	19.9877	19.9809	19.9735	19.9683	19.9629	(88)
util rest of house													
	0.9984	0.9962	0.9879	0.9531	0.8476	0.6401	0.4386	0.4997	0.8087	0.9759	0.9965	0.9988	(89)
MIT 2	18.7485	18.9048	19.1762	19.5402	19.8173	19.9591	19.9825	19.9820	19.8948	19.5215	19.0784	18.7373	(90)
Living area fraction										fLA = Living area / (4) =		0.2829	(91)
MIT	19.0129	19.1686	19.4398	19.8031	20.0870	20.2374	20.2669	20.2643	20.1647	19.7822	19.3391	18.9991	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0129	19.1686	19.4398	19.8031	20.0870	20.2374	20.2669	20.2643	20.1647	19.7822	19.3391	18.9991	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9951	0.9857	0.9505	0.8530	0.6641	0.4733	0.5352	0.8224	0.9738	0.9956	0.9984	(94)
Useful gains	413.8637	482.9978	557.6813	619.7675	602.8739	462.6266	314.5377	327.7432	449.8469	451.1961	404.0252	390.3688	(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													
	1325.4245	1281.3312	1158.3915	961.7481	737.7440	489.4355	318.3610	334.6778	529.2098	807.6923	1082.6700	1316.8147	(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													
	678.2013	536.4801	446.9284	246.2260	100.3433	0.0000	0.0000	0.0000	0.0000	265.2332	488.6242	689.2757	(98)
Space heating												3451.3123	(98)
Space heating per m2											(98) / (4) =	44.4757	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	816.1059	642.4664	658.2212	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8770	0.9336	0.9093	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	715.7245	599.7941	598.5323	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	904.7427	865.4294	806.2048	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	136.0931	197.6326	154.5084	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												488.2341	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	34.0233	49.4082	38.6271	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												122.0585	(107)
Space cooling per m2												1.5729	(108)
Energy for space heating												44.4757	(99)
Energy for space cooling												1.5729	(108)
Total												46.0486	(109)
Dwelling Fabric Energy Efficiency (DFEE)												46.0	(109)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.8000 (1b)	x	2.3900 (2b)	=	92.7320 (1b) - (3b)	
First floor	38.8000 (1c)	x	2.7600 (2c)	=	107.0880 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		199.8200	(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) =	0.1501 (8)
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.4001 (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) =	0.3701 (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	0.4719	0.4627	0.4534	0.4071	0.3979	0.3516	0.3516	0.3424	0.3701	0.3979	0.4164	0.4349	(22b)
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5792	0.5618	0.5618	0.5586	0.5685	0.5792	0.5867	0.5946	(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			2.0100	1.2000	2.4120			(26a)
TER Opening Type (Uw = 1.40)			10.8500	1.3258	14.3845			(27)
Ground Floor			38.8000	0.1300	5.0440			(28a)
External Cavity Walls	90.6900	12.8600	77.8300	0.1800	14.0094			(29a)
External Roof	38.8000		38.8000	0.1300	5.0440			(30)
Total net area of external elements Aum(A, m2)			168.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.8939			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8557	(36)
Total fabric heat loss					(33) + (36) =		49.7496	(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	40.3127	40.0276	39.7481	38.4355	38.1899	37.0466	37.0466	36.8349	37.4870	38.1899	38.6867	39.2061	(38)
Heat transfer coeff	90.0623	89.7772	89.4977	88.1851	87.9395	86.7962	86.7962	86.5845	87.2366	87.9395	88.4363	88.9557	(39)
Average = Sum(39)m / 12 =												88.1839	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1606	1.1569	1.1533	1.1364	1.1332	1.1185	1.1185	1.1158	1.1242	1.1332	1.1396	1.1463	(40)
HLP (average)												1.1364	(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		2.4157 (42)
Average daily hot water use (litres/day)		91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	31.7436	27.7632	28.6491	24.9770	23.9660	20.6808	19.1638	21.9908	22.2534	25.9342	28.3092	30.7420	(65)

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

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)

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

	20.5068	18.2140	14.8126	11.2141	8.3827	7.0770	7.6470	9.9398	13.3412	16.9397	19.7711	21.0768	(67)

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

	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)

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

	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)

	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)

Water heating gains (Table 5)

	42.6661	41.3142	38.5068	34.6902	32.2124	28.7234	25.7578	29.5575	30.9075	34.8578	39.3184	41.3199	(72)

Total internal gains

	336.7607	335.3402	323.5263	304.1785	283.8063	264.8546	253.0012	256.8694	267.2260	286.7075	309.0624	326.5266	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0500	19.6403	0.6300	0.7000	0.7700	18.3071	(76)
South	0.4900	46.7521	0.6300	0.7000	0.7700	7.0011	(78)
West	7.3100	19.6403	0.6300	0.7000	0.7700	43.8770	(80)

Solar gains	69.1852	133.1112	214.9380	308.6803	375.2705	383.1015	365.1424	315.4660	248.2521	156.7095	85.8349	57.1868	(83)
Total gains	405.9459	468.4515	538.4643	612.8588	659.0768	647.9560	618.1436	572.3354	515.4781	443.4170	394.8973	383.7134	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8351	60.0251	60.2126	61.1089	61.2795	62.0867	62.0867	62.2385	61.7733	61.2795	60.9353	60.5795	
alpha	4.9890	5.0017	5.0142	5.0739	5.0853	5.1391	5.1391	5.1492	5.1182	5.0853	5.0624	5.0386	
util living area	0.9989	0.9976	0.9929	0.9736	0.9114	0.7666	0.5969	0.6592	0.8940	0.9869	0.9978	0.9992	(86)
MIT	19.6731	19.8177	20.0770	20.4293	20.7364	20.9285	20.9842	20.9744	20.8284	20.4210	19.9873	19.6545	(87)
Th 2	19.9517	19.9546	19.9575	19.9712	19.9738	19.9857	19.9857	19.9880	19.9811	19.9738	19.9686	19.9632	(88)
util rest of house	0.9986	0.9967	0.9902	0.9627	0.8741	0.6781	0.4699	0.5319	0.8346	0.9798	0.9969	0.9989	(89)
MIT 2	18.7386	18.8853	19.1456	19.5025	19.7898	19.9515	19.9816	19.9803	19.8804	19.5005	19.0660	18.7292	(90)
Living area fraction									fLA = Living area / (4) =			0.2829	(91)
MIT	19.0029	19.1491	19.4091	19.7647	20.0576	20.2279	20.2652	20.2615	20.1486	19.7609	19.3266	18.9909	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0029	19.1491	19.4091	19.7647	20.0576	20.2279	20.2652	20.2615	20.1486	19.7609	19.3266	18.9909	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9883	0.9600	0.8776	0.7011	0.5063	0.5684	0.8462	0.9778	0.9961	0.9986	(94)
Useful gains	405.1730	466.4949	532.1457	588.3539	578.4276	454.2987	312.9553	325.2870	436.1775	433.5861	393.3643	383.1663	(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	1324.1779	1279.2413	1155.3331	958.1027	734.9612	488.4777	318.1253	334.3494	527.6552	805.6011	1081.2746	1315.7363	(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	683.7396	546.1656	463.6514	266.2191	116.4610	0.0000	0.0000	0.0000	0.0000	276.7792	495.2954	693.8321	(98)
Space heating												3542.1434	(98)
Space heating per m2											(98) / (4) =	45.6462	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	815.8841	642.2917	658.0419	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8528	0.9176	0.8910	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	695.7651	589.3921	586.3128	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	847.8817	811.2338	759.3824	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	109.5240	165.0503	128.7638	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												403.3381	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	27.3810	41.2626	32.1910	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												100.8345	(107)
Space cooling per m2												1.2994	(108)
Energy for space heating												45.6462	(99)
Energy for space cooling												1.2994	(108)
Total												46.9456	(109)
Target Fabric Energy Efficiency (TFEE)												54.0	(109)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.8000 (1b)	x	2.3900 (2b)	=	92.7320 (1b) - (3b)	
First floor	38.8000 (1c)	x	2.7600 (2c)	=	107.0880 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.8200	(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) =	0.2002	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.4502	(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) =	0.4164	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.5309	0.4893	0.4789	0.4476	0.4476	0.4164	0.4164	0.4060	0.4164	0.4685	0.4581	0.4893	(22b)
Effective ac	0.6409	0.6197	0.6147	0.6002	0.6002	0.5867	0.5867	0.5824	0.5867	0.6097	0.6049	0.6197	(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	
New Dwelling Glazed Door			2.0100	1.4000	2.8140			(26a)
New Dwelling Windows (Uw = 1.40)			10.8500	1.3258	14.3845			(27)
Ground Floor			38.8000	0.1200	4.6560			(28a)
External Cavity Walls	90.6900	12.8600	77.8300	0.2000	15.5660			(29a)
External Roof	38.8000		38.8000	0.1100	4.2680			(30)
Total net area of external elements Aum(A, m2)			168.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6885			(33)
Party Wall			46.2500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0847	(36)
Total fabric heat loss					(33) + (36) =		49.7732	(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	42.2642	40.8635	40.5312	39.5772	39.5772	38.6874	38.6874	38.4052	38.6874	40.2061	39.8880	40.8635	(38)
Heat transfer coeff	92.0374	90.6367	90.3044	89.3503	89.3503	88.4606	88.4606	88.1783	88.4606	89.9792	89.6612	90.6367	(39)
Average = Sum(39)m / 12 =												89.6264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1860	1.1680	1.1637	1.1514	1.1514	1.1400	1.1400	1.1363	1.1400	1.1595	1.1554	1.1680	(40)
HLP (average)												1.1550	(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		2.4157 (42)
Average daily hot water use (litres/day)		91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(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	44.6781	47.5984	44.2566	43.8652	40.6438	41.9986	43.8652	44.2566	47.5984	47.8693	50.9589	(61)
Total heat required for water heating calculated for each month	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(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	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(64)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Total per year (kWh/year) = Sum(64)m = 1989.3627 (64)

RHI water heating demand 1989 (64)

Heat gains from water heating, kWh/month

62.4091 54.6107 56.7270 50.1458 48.4660 42.5204 40.4854 45.3754 45.8842 52.4790 56.2630 60.8419 (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	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	(66)

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

51.2671 45.5350 37.0315 28.0352 20.9567 17.6925 19.1174 24.8495 33.3529 42.3492 49.4278 52.6920 (67)

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

319.9277 323.2475 314.8816 297.0716 274.5896 253.4597 239.3437 236.0238 244.3897 262.1998 284.6817 305.8116 (68)

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

51.9102 51.9102 51.9102 51.9102 51.9102 51.9102 51.9102 51.9102 51.9102 51.9102 51.9102 51.9102 (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)

-96.6298 -96.6298 -96.6298 -96.6298 -96.6298 -96.6298 -96.6298 -96.6298 -96.6298 -96.6298 -96.6298 -96.6298 (71)

Water heating gains (Table 5)

83.8832 81.2659 76.2460 69.6469 65.1425 59.0561 54.4159 60.9884 63.7281 70.5363 78.1430 81.7767 (72)

Total internal gains

555.3031 550.2735 528.3842 494.9788 460.9139 430.4334 413.1021 422.0869 441.6959 475.3104 512.4776 540.5054 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0500	25.9136	0.7100	0.7000	0.7700	27.2219	(76)
South	0.4900	58.2505	0.7100	0.7000	0.7700	9.8307	(78)
West	7.3100	25.9136	0.7100	0.7000	0.7700	65.2432	(80)

Solar gains	102.2958	168.1608	269.4369	392.5013	454.6340	501.8520	467.0390	412.8574	329.4617	209.2443	125.7609	80.7277	(83)
Total gains	657.5990	718.4344	797.8212	887.4801	915.5479	932.2855	880.1411	834.9443	771.1576	684.5547	638.2385	621.2331	(84)

---

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.5511	59.4559	59.6747	60.3119	60.3119	60.9185	60.9185	61.1135	60.9185	59.8904	60.1028	59.4559	
alpha	4.9034	4.9637	4.9783	5.0208	5.0208	5.0612	5.0612	5.0742	5.0612	4.9927	5.0069	4.9637	
util living area	0.9881	0.9812	0.9569	0.8857	0.7417	0.5210	0.3703	0.3887	0.6521	0.9014	0.9742	0.9902	(86)
MIT	20.0549	20.1775	20.4281	20.7186	20.9135	20.9883	20.9983	20.9979	20.9662	20.7454	20.3859	20.0474	(87)
Th 2	19.9312	19.9457	19.9491	19.9591	19.9591	19.9683	19.9683	19.9713	19.9683	19.9525	19.9558	19.9457	(88)
util rest of house	0.9841	0.9751	0.9428	0.8509	0.6737	0.4299	0.2679	0.2818	0.5552	0.8606	0.9641	0.9869	(89)
MIT 2	18.7156	18.9021	19.2594	19.6571	19.8869	19.9624	19.9679	19.9708	19.9482	19.6969	19.2107	18.7156	(90)
Living area fraction									fLA = Living area / (4) =			0.2829	(91)
MIT	19.0944	19.2629	19.5900	19.9574	20.1773	20.2526	20.2594	20.2613	20.2361	19.9935	19.5431	19.0923	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9444	19.1129	19.4400	19.8074	20.0273	20.1026	20.1094	20.1113	20.0861	19.8435	19.3931	18.9423	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9686	0.9342	0.8451	0.6785	0.4420	0.2820	0.2965	0.5669	0.8554	0.9568	0.9824	(94)
Useful gains	643.7815	695.8652	745.3238	749.9872	621.2296	412.0845	248.2247	247.5311	437.1766	585.5912	610.6798	610.2825	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1246.5958	1215.6994	1096.2915	912.0303	663.6318	415.9922	248.5211	247.8988	449.9222	723.7450	985.6541	1218.3639	(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	448.4938	349.3286	261.1199	116.6710	31.5472	0.0000	0.0000	0.0000	0.0000	102.7864	269.9815	452.4125	(98)

Space heating 2032.3410 (98)

RHI space heating demand 2032 (98)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.8000 (1b)	x	2.3900 (2b)	=	92.7320 (1b) - (3b)	
First floor	38.8000 (1c)	x	2.7600 (2c)	=	107.0880 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.8200	(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) =	0.2002	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.4502	(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) =	0.4164	(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	0.5309	0.5205	0.5101	0.4581	0.4476	0.3956	0.3956	0.3852	0.4164	0.4476	0.4685	0.4893	(22b)
Effective ac	0.6409	0.6355	0.6301	0.6049	0.6002	0.5782	0.5782	0.5742	0.5867	0.6002	0.6097	0.6197	(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	
New Dwelling Glazed Door			2.0100	1.4000	2.8140			(26a)
New Dwelling Windows (Uw = 1.40)			10.8500	1.3258	14.3845			(27)
Ground Floor			38.8000	0.1200	4.6560			(28a)
External Cavity Walls	90.6900	12.8600	77.8300	0.2000	15.5660			(29a)
External Roof	38.8000		38.8000	0.1100	4.2680			(30)
Total net area of external elements Aum(A, m2)			168.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6885			(33)
Party Wall			46.2500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0847	(36)
Total fabric heat loss					(33) + (36) =		49.7732	(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	42.2642	41.9033	41.5496	39.8880	39.5772	38.1300	38.1300	37.8620	38.6874	39.5772	40.2061	40.8635	(38)
Heat transfer coeff	92.0374	91.6765	91.3228	89.6612	89.3503	87.9032	87.9032	87.6352	88.4606	89.3503	89.9792	90.6367	(39)
Average = Sum(39)m / 12 =												89.6597	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1860	1.1814	1.1768	1.1554	1.1514	1.1328	1.1328	1.1293	1.1400	1.1514	1.1595	1.1680	(40)
HLP (average)												1.1554	(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		2.4157 (42)
Average daily hot water use (litres/day)		91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(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	44.6781	47.5984	44.2566	43.8652	40.6438	41.9986	43.8652	44.2566	47.5984	47.8693	50.9589	(61)
Total heat required for water heating calculated for each month	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(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	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(64)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Total per year (kWh/year) = Sum(64)m = 1989.3627 (64)

Heat gains from water heating, kWh/month

	62.4091	54.6107	56.7270	50.1458	48.4660	42.5204	40.4854	45.3754	45.8842	52.4790	56.2630	60.8419 (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	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	(66)

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

	51.2671	45.5350	37.0315	28.0352	20.9567	17.6925	19.1174	24.8495	33.3529	42.3492	49.4278	52.6920	(67)

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

	319.9277	323.2475	314.8816	297.0716	274.5896	253.4597	239.3437	236.0238	244.3897	262.1998	284.6817	305.8116	(68)

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

	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	(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)

	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)

Water heating gains (Table 5)

	83.8832	81.2659	76.2460	69.6469	65.1425	59.0561	54.4159	60.9884	63.7281	70.5363	78.1430	81.7767	(72)

Total internal gains

	555.3031	550.2735	528.3842	494.9788	460.9139	430.4334	413.1021	422.0869	441.6959	475.3104	512.4776	540.5054	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0500	19.6403	0.7100	0.7000	0.7700	20.6318	(76)
South	0.4900	46.7521	0.7100	0.7000	0.7700	7.8902	(78)
West	7.3100	19.6403	0.7100	0.7000	0.7700	49.4486	(80)

Solar gains	77.9706	150.0142	242.2317	347.8778	422.9239	431.7493	411.5097	355.5252	279.7762	176.6091	96.7346	64.4486	(83)
Total gains	633.2737	700.2878	770.6159	842.8566	883.8379	862.1827	824.6117	777.6120	721.4720	651.9195	609.2122	604.9540	(84)

---

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.5511	58.7816	59.0093	60.1028	60.3119	61.3048	61.3048	61.4923	60.9185	60.3119	59.8904	59.4559	
alpha	4.9034	4.9188	4.9340	5.0069	5.0208	5.0870	5.0870	5.0995	5.0612	5.0208	4.9927	4.9637	
util living area	0.9924	0.9864	0.9699	0.9192	0.8072	0.6246	0.4637	0.5095	0.7583	0.9429	0.9857	0.9938	(86)
MIT	19.9075	20.0551	20.3053	20.6251	20.8578	20.9708	20.9946	20.9916	20.9233	20.6194	20.2144	19.8884	(87)
Th 2	19.9312	19.9349	19.9386	19.9558	19.9591	19.9742	19.9742	19.9770	19.9683	19.9591	19.9525	19.9457	(88)
util rest of house	0.9899	0.9821	0.9600	0.8932	0.7508	0.5360	0.3584	0.4008	0.6754	0.9187	0.9803	0.9918	(89)
MIT 2	18.5016	18.7177	19.0787	19.5336	19.8273	19.9559	19.9723	19.9737	19.9118	19.5385	18.9629	18.4843	(90)
Living area fraction										fLA = Living area / (4) =		0.2829	(91)
MIT	18.8993	19.0960	19.4257	19.8424	20.1188	20.2430	20.2615	20.2616	20.1979	19.8442	19.3169	18.8815	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7493	18.9460	19.2757	19.6924	19.9688	20.0930	20.1115	20.1116	20.0479	19.6942	19.1669	18.7315	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9860	0.9766	0.9520	0.8854	0.7514	0.5467	0.3727	0.4154	0.6824	0.9109	0.9747	0.9885	(94)
Useful gains	624.4375	683.8748	733.6600	746.2625	664.1407	471.3854	307.3638	323.0363	492.3438	593.8600	593.7967	598.0088	(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	1329.8758	1287.6874	1166.7115	967.6554	738.8209	482.8490	308.6701	325.2689	526.1535	812.5743	1085.7706	1317.0842	(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	524.8461	405.7621	322.1903	159.4029	55.5621	0.0000	0.0000	0.0000	0.0000	162.7234	354.2213	534.9921	(98)
Space heating												2519.7002	(98)
Space heating per m2											(98) / (4) =	32.4704	(99)

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 %)	90.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2771.9474 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	524.8461	405.7621	322.1903	159.4029	55.5621	0.0000	0.0000	0.0000	0.0000	162.7234	354.2213	534.9921	(98)
Space heating efficiency (main heating system 1)	90.9000	90.9000	90.9000	90.9000	90.9000	0.0000	0.0000	0.0000	0.0000	90.9000	90.9000	90.9000	(210)
Space heating fuel (main heating system)	577.3885	446.3829	354.4448	175.3607	61.1244	0.0000	0.0000	0.0000	0.0000	179.0137	389.6824	588.5501	(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)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Water heating
Water heating requirement

200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271 (64)
Efficiency of water heater											80.8000 (216)
(217)m	87.8658	87.5963	86.9700	85.5155	83.2211	80.8000	80.8000	80.8000	80.8000	85.4483	87.2121	87.9562 (217)
Fuel for water heating, kWh/month											
228.0076	200.1549	209.7478	189.2000	188.2292	170.7492	163.5908	182.3654	184.3794	198.5314	207.6422	222.4143 (219)
Water heating fuel used											2345.0122 (219)

Annual totals kWh/year	
Space heating fuel - main system	2771.9474 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	45.0000 (231)
Electricity for lighting (calculated in Appendix L)	362.1571 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.93 * 1080 * 0.80) = -642.5331	-642.5331 (233)
Total delivered energy for all uses	4881.5836 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2771.9474	3.4800	96.4638 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2345.0122	3.4800	81.6064 (247)
Pumps and fans for heating	45.0000	13.1900	5.9355 (249)
Energy for lighting	362.1571	13.1900	47.7685 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-642.5331	13.1900	-84.7501 (252)
Total energy cost			267.0241 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9148 (257)
SAP value		87.2390
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2771.9474	0.2160	598.7406 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2345.0122	0.2160	506.5226 (264)
Space and water heating			1105.2633 (265)
Pumps and fans	45.0000	0.5190	23.3550 (267)
Energy for lighting	362.1571	0.5190	187.9595 (268)
Energy saving/generation technologies			
PV Unit	-642.5331	0.5190	-333.4747 (269)
Total kg/year			983.1031 (272)
CO2 emissions per m2			12.6700 (273)
EI value			89.2548
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9090 = 3.828, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9090 = 0.2376, stars = 4
Water heating energy efficiency	3.48 / 0.8458 = 4.114, stars = 4
Water heating environmental impact	0.216 / 0.8458 = 0.2554, stars = 4

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.8000 (1b)	x	2.3900 (2b)	=	92.7320 (1b) - (3b)	
First floor	38.8000 (1c)	x	2.7600 (2c)	=	107.0880 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.8200	(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) =	0.2002	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.4502	(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) =	0.4164	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.5309	0.4893	0.4789	0.4476	0.4476	0.4164	0.4164	0.4060	0.4164	0.4685	0.4581	0.4893	(22b)
Effective ac	0.6409	0.6197	0.6147	0.6002	0.6002	0.5867	0.5867	0.5824	0.5867	0.6097	0.6049	0.6197	(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	
New Dwelling Glazed Door			2.0100	1.4000	2.8140			(26a)
New Dwelling Windows (Uw = 1.40)			10.8500	1.3258	14.3845			(27)
Ground Floor			38.8000	0.1200	4.6560			(28a)
External Cavity Walls	90.6900	12.8600	77.8300	0.2000	15.5660			(29a)
External Roof	38.8000		38.8000	0.1100	4.2680			(30)
Total net area of external elements Aum(A, m2)			168.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6885			(33)
Party Wall			46.2500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.0847 (36)
Total fabric heat loss	(33) + (36) =	49.7732 (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	42.2642	40.8635	40.5312	39.5772	39.5772	38.6874	38.6874	38.4052	38.6874	40.2061	39.8880	40.8635	(38)
Heat transfer coeff	92.0374	90.6367	90.3044	89.3503	89.3503	88.4606	88.4606	88.1783	88.4606	89.9792	89.6612	90.6367	(39)
Average = Sum(39)m / 12 =												89.6264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1860	1.1680	1.1637	1.1514	1.1514	1.1400	1.1400	1.1363	1.1400	1.1595	1.1554	1.1680	(40)
HLP (average)												1.1550	(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	2.4157 (42)
Average daily hot water use (litres/day)	91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(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	44.6781	47.5984	44.2566	43.8652	40.6438	41.9986	43.8652	44.2566	47.5984	47.8693	50.9589	(61)
Total heat required for water heating calculated for each month	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(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	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(64)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Total per year (kWh/year) = Sum(64)m = 1989.3627 (64)

Heat gains from water heating, kWh/month

62.4091	54.6107	56.7270	50.1458	48.4660	42.5204	40.4854	45.3754	45.8842	52.4790	56.2630	60.8419 (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	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	(66)

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

51.2671	45.5350	37.0315	28.0352	20.9567	17.6925	19.1174	24.8495	33.3529	42.3492	49.4278	52.6920 (67)

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

319.9277	323.2475	314.8816	297.0716	274.5896	253.4597	239.3437	236.0238	244.3897	262.1998	284.6817	305.8116 (68)

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

51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102 (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)

-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298 (71)

Water heating gains (Table 5)

83.8832	81.2659	76.2460	69.6469	65.1425	59.0561	54.4159	60.9884	63.7281	70.5363	78.1430	81.7767 (72)

Total internal gains

555.3031	550.2735	528.3842	494.9788	460.9139	430.4334	413.1021	422.0869	441.6959	475.3104	512.4776	540.5054 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0500	25.9136	0.7100	0.7000	0.7700	27.2219	(76)
South	0.4900	58.2505	0.7100	0.7000	0.7700	9.8307	(78)
West	7.3100	25.9136	0.7100	0.7000	0.7700	65.2432	(80)

Solar gains	102.2958	168.1608	269.4369	392.5013	454.6340	501.8520	467.0390	412.8574	329.4617	209.2443	125.7609	80.7277 (83)
Total gains	657.5990	718.4344	797.8212	887.4801	915.5479	932.2855	880.1411	834.9443	771.1576	684.5547	638.2385	621.2331 (84)

---

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.5511	59.4559	59.6747	60.3119	60.3119	60.9185	60.9185	61.1135	60.9185	59.8904	60.1028	59.4559	
alpha	4.9034	4.9637	4.9783	5.0208	5.0208	5.0612	5.0612	5.0742	5.0612	4.9927	5.0069	4.9637	
util living area	0.9881	0.9812	0.9569	0.8857	0.7417	0.5210	0.3703	0.3887	0.6521	0.9014	0.9742	0.9902	(86)
MIT	20.0549	20.1775	20.4281	20.7186	20.9135	20.9883	20.9983	20.9979	20.9662	20.7454	20.3859	20.0474	(87)
Th 2	19.9312	19.9457	19.9491	19.9591	19.9591	19.9683	19.9683	19.9713	19.9683	19.9525	19.9558	19.9457	(88)
util rest of house	0.9841	0.9751	0.9428	0.8509	0.6737	0.4299	0.2679	0.2818	0.5552	0.8606	0.9641	0.9869	(89)
MIT 2	18.7156	18.9021	19.2594	19.6571	19.8869	19.9624	19.9679	19.9708	19.9482	19.6969	19.2107	18.7156	(90)
Living area fraction										fLA = Living area / (4) =		0.2829	(91)
MIT	19.0944	19.2629	19.5900	19.9574	20.1773	20.2526	20.2594	20.2613	20.2361	19.9935	19.5431	19.0923	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9444	19.1129	19.4400	19.8074	20.0273	20.1026	20.1094	20.1113	20.0861	19.8435	19.3931	18.9423	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9686	0.9342	0.8451	0.6785	0.4420	0.2820	0.2965	0.5669	0.8554	0.9568	0.9824	(94)
Useful gains	643.7815	695.8652	745.3238	749.9872	621.2296	412.0845	248.2247	247.5311	437.1766	585.5912	610.6798	610.2825	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1246.5958	1215.6994	1096.2915	912.0303	663.6318	415.9922	248.5211	247.8988	449.9222	723.7450	985.6541	1218.3639	(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	448.4938	349.3286	261.1199	116.6710	31.5472	0.0000	0.0000	0.0000	0.0000	102.7864	269.9815	452.4125	(98)
Space heating												2032.3410	(98)
Space heating per m2											(98) / (4) =	26.1900	(99)

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 %) 90.9000 (206)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

Space heating requirement 2235.7987 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	448.4938	349.3286	261.1199	116.6710	31.5472	0.0000	0.0000	0.0000	0.0000	102.7864	269.9815	452.4125	(98)
Space heating efficiency (main heating system 1)	90.9000	90.9000	90.9000	90.9000	90.9000	0.0000	0.0000	0.0000	0.0000	90.9000	90.9000	90.9000	(210)
Space heating fuel (main heating system)	493.3925	384.2999	287.2607	128.3510	34.7054	0.0000	0.0000	0.0000	0.0000	113.0764	297.0093	497.7036	(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)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Water heating
Water heating requirement
200.3406 175.3282 182.4177 161.7953 156.6464 137.9654 132.1813 147.3512 148.9786 169.6418 181.0892 195.6271 (64)
Efficiency of water heater 80.8000 (216)
(217)m 87.5220 87.2552 86.4553 84.7451 82.3335 80.8000 80.8000 80.8000 80.8000 84.3355 86.5563 87.5947 (217)
Fuel for water heating, kWh/month
228.9032 200.9374 210.9964 190.9198 190.2583 170.7492 163.5908 182.3654 184.3794 201.1511 209.2155 223.3322 (219)
Water heating fuel used 2356.7985 (219)
Annual totals kWh/year
Space heating fuel - main system 2235.7987 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 45.0000 (231)
Electricity for lighting (calculated in Appendix L) 362.1571 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.93 * 1234 * 0.80) = -734.7535 -734.7535 (233)
Total delivered energy for all uses 4265.0008 (238)

10a. Fuel costs - using BEDF prices (395)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2235.7987	4.2800	95.6922 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2356.7985	4.2800	100.8710 (247)
Pumps and fans for heating	45.0000	15.4400	6.9480 (249)
Energy for lighting	362.1571	15.4400	55.9171 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit	-734.7535	15.4400	-113.4459 (252)
Total energy cost			237.9823 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2235.7987	0.2160	482.9325 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2356.7985	0.2160	509.0685 (264)
Space and water heating			992.0010 (265)
Pumps and fans	45.0000	0.5190	23.3550 (267)
Energy for lighting	362.1571	0.5190	187.9595 (268)
Energy saving/generation technologies			
PV Unit	-734.7535	0.5190	-381.3371 (269)
Total kg/year			821.9785 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2235.7987	1.2200	2727.6744 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2356.7985	1.2200	2875.2942 (264)
Space and water heating			5602.9686 (265)
Pumps and fans	45.0000	3.0700	138.1500 (267)
Energy for lighting	362.1571	3.0700	1111.8222 (268)
Energy saving/generation technologies			
PV Unit	-734.7535	3.0700	-2255.6932 (269)
Primary energy kWh/year			4597.2476 (272)
Primary energy kWh/m2/year			59.2429 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 38	-205 kg (24.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£38	2.64 kg/m²	B 89	B 91
Total Savings	£38	2.64 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 395 TEST (24 Jun 2016)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£63	£71	-£8
Mains gas	£289	£243	£46
Space heating	£195	£195	£0
Water heating	£101	£63	£38
Lighting	£56	£56	£0
Generated (PV)	-£113	-£113	£0
Total cost of fuels	£239	£201	£38
Total cost of uses	£239	£201	£38
Delivered energy	55 kWh/m²	42 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	59 kWh/m²	44 kWh/m²	15 kWh/m²

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.8000 (1b)	x	2.3900 (2b)	=	92.7320 (1b) - (3b)	
First floor	38.8000 (1c)	x	2.7600 (2c)	=	107.0880 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.8200	(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) =	0.2002	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.4502	(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) =	0.4164	(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	0.5309	0.5205	0.5101	0.4581	0.4476	0.3956	0.3956	0.3852	0.4164	0.4476	0.4685	0.4893	(22b)
Effective ac	0.6409	0.6355	0.6301	0.6049	0.6002	0.5782	0.5782	0.5742	0.5867	0.6002	0.6097	0.6197	(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	
New Dwelling Glazed Door			2.0100	1.4000	2.8140			(26a)
New Dwelling Windows (Uw = 1.40)			10.8500	1.3258	14.3845			(27)
Ground Floor			38.8000	0.1200	4.6560			(28a)
External Cavity Walls	90.6900	12.8600	77.8300	0.2000	15.5660			(29a)
External Roof	38.8000		38.8000	0.1100	4.2680			(30)
Total net area of external elements Aum(A, m2)			168.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6885			(33)
Party Wall			46.2500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.0847	(36)
Total fabric heat loss (33) + (36) =	49.7732	(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	42.2642	41.9033	41.5496	39.8880	39.5772	38.1300	38.1300	37.8620	38.6874	39.5772	40.2061	40.8635	(38)
Heat transfer coeff	92.0374	91.6765	91.3228	89.6612	89.3503	87.9032	87.9032	87.6352	88.4606	89.3503	89.9792	90.6367	(39)
Average = Sum(39)m / 12 =												89.6597	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1860	1.1814	1.1768	1.1554	1.1514	1.1328	1.1328	1.1293	1.1400	1.1514	1.1595	1.1680	(40)
HLP (average)												1.1554	(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	2.4157 (42)
Average daily hot water use (litres/day)	91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(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	44.6781	47.5984	44.2566	43.8652	40.6438	41.9986	43.8652	44.2566	47.5984	47.8693	50.9589	(61)
Total heat required for water heating calculated for each month	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(62)

Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.7000	(H2)
Collector heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0050	(H3a)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

```
Collector effective heat loss coefficient                                                                    1.8063 (H3b)
Collector performance ratio                                                                                  2.5804 (H4)
Annual solar radiation per m2                                                                             1079.5246 (H5)
Overshading factor                                                                                           0.8000 (H6)
Solar energy available                                                                                    1813.6014 (H7)
Adjustment factor for showers                                                                                1.0000 (H7a)
Solar-to-load ratio                                                                                          1.2587 (H8)
Utilisation factor                                                                                           0.5482 (H9)
Collector performance factor                                                                                 0.8793 (H10)
Dedicated solar storage volume                                                                              75.0000 (H11)
Effective solar volume                                                                                      75.0000 (H13)
Daily hot water demand                                                                                      91.5740 (H14)
Volume ratio Veff/V                                                                                          0.8190 (H15)
Solar storage volume factor                                                                                  0.9601 (H16)
Solar input                                                                                               -839.2535 (H17)
Solar input    -24.3367   -40.6109   -69.1650   -92.6948  -114.5166  -112.5881  -111.1002   -97.0688   -76.0243   -51.9157   -28.8668   -20.3656 (63)
                                                                    Solar input (sum of months) = Sum(63)m =   -839.2535 (63)
Output from w/h
             176.0039   134.7173   113.2526    69.1005    42.1298    25.3773    21.0812    50.2824    72.9542   117.7261   152.2224   175.2614 (64)
                                                                     Total per year (kWh/year) = Sum(64)m =   1150.1092 (64)
Heat gains from water heating, kWh/month
              62.4091    54.6107    56.7270    50.1458    48.4660    42.5204    40.4854    45.3754    45.8842    52.4790    56.2630    60.8419 (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         144.9447   144.9447   144.9447   144.9447   144.9447   144.9447   144.9447   144.9447   144.9447   144.9447   144.9447   144.9447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              51.2671    45.5350    37.0315    28.0352    20.9567    17.6925    19.1174    24.8495    33.3529    42.3492    49.4278    52.6920 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             319.9277   323.2475   314.8816   297.0716   274.5896   253.4597   239.3437   236.0238   244.3897   262.1998   284.6817   305.8116 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              51.9102    51.9102    51.9102    51.9102    51.9102    51.9102    51.9102    51.9102    51.9102    51.9102    51.9102    51.9102 (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)
             -96.6298   -96.6298   -96.6298   -96.6298   -96.6298   -96.6298   -96.6298   -96.6298   -96.6298   -96.6298   -96.6298   -96.6298 (71)
Water heating gains (Table 5)
              83.8832    81.2659    76.2460    69.6469    65.1425    59.0561    54.4159    60.9884    63.7281    70.5363    78.1430    81.7767 (72)
Total internal gains
             555.3031   550.2735   528.3842   494.9788   460.9139   430.4334   413.1021   422.0869   441.6959   475.3104   512.4776   540.5054 (73)
```

---

6. Solar gains

```
[Jan]                                    Area         Solar flux                 g                FF             Access              Gains
                                          m2          Table 6a       Specific data      Specific data          factor                 W
                                                         W/m2          or Table 6b        or Table 6c          Table 6d
-------------------------------------------------------------------------------------------------------------------------------------------
East                                   3.0500            19.6403            0.7100             0.7000            0.7700            20.6318 (76)
South                                  0.4900            46.7521            0.7100             0.7000            0.7700             7.8902 (78)
West                                   7.3100            19.6403            0.7100             0.7000            0.7700            49.4486 (80)
-------------------------------------------------------------------------------------------------------------------------------------------

Solar gains    77.9706   150.0142   242.2317   347.8778   422.9239   431.7493   411.5097   355.5252   279.7762   176.6091    96.7346    64.4486 (83)
Total gains   633.2737   700.2878   770.6159   842.8566   883.8379   862.1827   824.6117   777.6120   721.4720   651.9195   609.2122   604.9540 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            58.5511    58.7816    59.0093    60.1028    60.3119    61.3048    61.3048    61.4923    60.9185    60.3119    59.8904    59.4559
alpha           4.9034     4.9188     4.9340     5.0069     5.0208     5.0870     5.0870     5.0995     5.0612     5.0208     4.9927     4.9637
util living area
                0.9924     0.9864     0.9699     0.9192     0.8072     0.6246     0.4637     0.5095     0.7583     0.9429     0.9857     0.9938 (86)

MIT            19.9075    20.0551    20.3053    20.6251    20.8578    20.9708    20.9946    20.9916    20.9233    20.6194    20.2144    19.8884 (87)
Th 2           19.9312    19.9349    19.9386    19.9558    19.9591    19.9742    19.9742    19.9770    19.9683    19.9591    19.9525    19.9457 (88)
util rest of house
                0.9899     0.9821     0.9600     0.8932     0.7508     0.5360     0.3584     0.4008     0.6754     0.9187     0.9803     0.9918 (89)
MIT 2          18.5016    18.7177    19.0787    19.5336    19.8273    19.9559    19.9723    19.9737    19.9118    19.5385    18.9629    18.4843 (90)
Living area fraction                                                                        fLA = Living area / (4) =     0.2829 (91)
MIT            18.8993    19.0960    19.4257    19.8424    20.1188    20.2430    20.2615    20.2616    20.1979    19.8442    19.3169    18.8815 (92)
Temperature adjustment                                                                                       -0.1500
adjusted MIT   18.7493    18.9460    19.2757    19.6924    19.9688    20.0930    20.1115    20.1116    20.0479    19.6942    19.1669    18.7315 (93)
```

---

8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9860     0.9766     0.9520     0.8854     0.7514     0.5467     0.3727     0.4154     0.6824     0.9109     0.9747     0.9885 (94)
Useful gains  624.4375   683.8748   733.6600   746.2625   664.1407   471.3854   307.3638   323.0363   492.3438   593.8600   593.7967   598.0088 (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
            1329.8758  1287.6874  1166.7115   967.6554   738.8209   482.8490   308.6701   325.2689   526.1535   812.5743  1085.7706  1317.0842 (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
             524.8461   405.7621   322.1903   159.4029    55.5621     0.0000     0.0000     0.0000     0.0000   162.7234   354.2213   534.9921 (98)
Space heating                                                                                                                 2519.7002 (98)
Space heating per m2                                                                                    (98) / (4) =     32.4704 (99)
```

8c. Space cooling requirement

Not applicable

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

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 %)	90.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2771.9474 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	524.8461	405.7621	322.1903	159.4029	55.5621	0.0000	0.0000	0.0000	0.0000	162.7234	354.2213	534.9921	(98)
Space heating efficiency (main heating system 1)													
	90.9000	90.9000	90.9000	90.9000	0.0000	0.0000	0.0000	0.0000	0.0000	90.9000	90.9000	90.9000	(210)
Space heating fuel (main heating system)													
	577.3885	446.3829	354.4448	175.3607	61.1244	0.0000	0.0000	0.0000	0.0000	179.0137	389.6824	588.5501	(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													
	176.0039	134.7173	113.2526	69.1005	42.1298	25.3773	21.0812	50.2824	72.9542	117.7261	152.2224	175.2614	(64)
Efficiency of water heater												80.8000	(216)
(217)m	88.1334	88.1534	88.0378	87.5891	86.2505	80.8000	80.8000	80.8000	80.8000	86.3681	87.6084	88.1801	(217)
Fuel for water heating, kWh/month													
	199.7017	152.8214	128.6409	78.8917	48.8458	31.4076	26.0906	62.2307	90.2899	136.3074	173.7532	198.7540	(219)
Water heating fuel used												1327.7348	(219)
Annual totals kWh/year													
Space heating fuel - main system												2771.9474	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:	
main heating flue fan	45.0000 (230e)
pump for solar water heating	50.0000 (230g)
Total electricity for the above, kWh/year	95.0000 (231)
Electricity for lighting (calculated in Appendix L)	362.1571 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.93 * 1080 * 0.80) =	-642.5331	-642.5331 (233)
Total delivered energy for all uses		3914.3062 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2771.9474	3.4800	96.4638	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1327.7348	3.4800	46.2052	(247)
Pumps and fans for heating	45.0000	13.1900	5.9355	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	362.1571	13.1900	47.7685	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-642.5331	13.1900	-84.7501	(252)
Total energy cost			238.2178	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8161 (257)
SAP value		88.6157
SAP rating (Section 12)		89 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2771.9474	0.2160	598.7406	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1327.7348	0.2160	286.7907	(264)
Space and water heating			885.5313	(265)
Pumps and fans	95.0000	0.5190	49.3050	(267)
Energy for lighting	362.1571	0.5190	187.9595	(268)
Energy saving/generation technologies				
PV Unit	-642.5331	0.5190	-333.4747	(269)
Total kg/year			789.3212	(272)
CO2 emissions per m2			10.1700	(273)
EI value			91.3728	
EI rating			91	(274)
EI band			B	

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.8000 (1b)	x	2.3900 (2b)	=	92.7320 (1b) - (3b)	
First floor	38.8000 (1c)	x	2.7600 (2c)	=	107.0880 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		199.8200	(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) =	0.2002	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.4502	(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) =	0.4164	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.5309	0.4893	0.4789	0.4476	0.4476	0.4164	0.4164	0.4060	0.4164	0.4685	0.4581	0.4893	(22b)
Effective ac	0.6409	0.6197	0.6147	0.6002	0.6002	0.5867	0.5867	0.5824	0.5867	0.6097	0.6049	0.6197	(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	
New Dwelling Glazed Door			2.0100	1.4000	2.8140			(26a)
New Dwelling Windows (Uw = 1.40)			10.8500	1.3258	14.3845			(27)
Ground Floor			38.8000	0.1200	4.6560			(28a)
External Cavity Walls	90.6900	12.8600	77.8300	0.2000	15.5660			(29a)
External Roof	38.8000		38.8000	0.1100	4.2680			(30)
Total net area of external elements Aum(A, m2)			168.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6885			(33)
Party Wall			46.2500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0847	(36)
Total fabric heat loss					(33) + (36) =		49.7732	(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	42.2642	40.8635	40.5312	39.5772	39.5772	38.6874	38.6874	38.4052	38.6874	40.2061	39.8880	40.8635	(38)
Heat transfer coeff	92.0374	90.6367	90.3044	89.3503	89.3503	88.4606	88.4606	88.1783	88.4606	89.9792	89.6612	90.6367	(39)
Average = Sum(39)m / 12 =												89.6264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1860	1.1680	1.1637	1.1514	1.1514	1.1400	1.1400	1.1363	1.1400	1.1595	1.1554	1.1680	(40)
HLP (average)												1.1550	(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		2.4157 (42)
Average daily hot water use (litres/day)		91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(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	44.6781	47.5984	44.2566	43.8652	40.6438	41.9986	43.8652	44.2566	47.5984	47.8693	50.9589	(61)
Total heat required for water heating calculated for each month	200.3406	175.3282	182.4177	161.7953	156.6464	137.9654	132.1813	147.3512	148.9786	169.6418	181.0892	195.6271	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1234.4649 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													2073.9010 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.4394 (H8)
Utilisation factor													0.5008 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													91.5740 (H14)
Volume ratio Veff/V													0.8190 (H15)
Solar storage volume factor													0.9601 (H16)
Solar input													-876.7648 (H17)
Solar input	-28.7726	-41.0737	-69.6129	-94.9912	-112.1103	-119.3066	-114.9019	-102.5076	-81.1287	-55.5487	-33.8279	-22.9828 (63)	
								Solar input (sum of months) = Sum(63)m =				-876.7648 (63)	
Output from w/h													
	171.5680	134.2545	112.8047	66.8041	44.5360	18.6588	17.2795	44.8436	67.8498	114.0931	147.2613	172.6442 (64)	
								Total per year (kWh/year) = Sum(64)m =				1112.5978 (64)	
Heat gains from water heating, kWh/month													
	62.4091	54.6107	56.7270	50.1458	48.4660	42.5204	40.4854	45.3754	45.8842	52.4790	56.2630	60.8419 (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	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.2671	45.5350	37.0315	28.0352	20.9567	17.6925	19.1174	24.8495	33.3529	42.3492	49.4278	52.6920	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	319.9277	323.2475	314.8816	297.0716	274.5896	253.4597	239.3437	236.0238	244.3897	262.1998	284.6817	305.8116	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	(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)													
	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)
Water heating gains (Table 5)													
	83.8832	81.2659	76.2460	69.6469	65.1425	59.0561	54.4159	60.9884	63.7281	70.5363	78.1430	81.7767	(72)
Total internal gains													
	555.3031	550.2735	528.3842	494.9788	460.9139	430.4334	413.1021	422.0869	441.6959	475.3104	512.4776	540.5054	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0500	25.9136	0.7100	0.7000	0.7700	27.2219	(76)
South	0.4900	58.2505	0.7100	0.7000	0.7700	9.8307	(78)
West	7.3100	25.9136	0.7100	0.7000	0.7700	65.2432	(80)

Solar gains	102.2958	168.1608	269.4369	392.5013	454.6340	501.8520	467.0390	412.8574	329.4617	209.2443	125.7609	80.7277	(83)
Total gains	657.5990	718.4344	797.8212	887.4801	915.5479	932.2855	880.1411	834.9443	771.1576	684.5547	638.2385	621.2331	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.5511	59.4559	59.6747	60.3119	60.3119	60.9185	60.9185	61.1135	60.9185	59.8904	60.1028	59.4559	
alpha	4.9034	4.9637	4.9783	5.0208	5.0208	5.0612	5.0612	5.0742	5.0612	4.9927	5.0069	4.9637	
util living area													
	0.9881	0.9812	0.9569	0.8857	0.7417	0.5210	0.3703	0.3887	0.6521	0.9014	0.9742	0.9902	(86)
MIT	20.0549	20.1775	20.4281	20.7186	20.9135	20.9883	20.9983	20.9979	20.9662	20.7454	20.3859	20.0474	(87)
Th 2	19.9312	19.9457	19.9491	19.9591	19.9591	19.9683	19.9683	19.9713	19.9683	19.9525	19.9558	19.9457	(88)
util rest of house													
	0.9841	0.9751	0.9428	0.8509	0.6737	0.4299	0.2679	0.2818	0.5552	0.8606	0.9641	0.9869	(89)
MIT 2	18.7156	18.9021	19.2594	19.6571	19.8869	19.9624	19.9679	19.9708	19.9482	19.6969	19.2107	18.7156	(90)
Living area fraction										fLA = Living area / (4) =		0.2829	(91)
MIT	19.0944	19.2629	19.5900	19.9574	20.1773	20.2526	20.2594	20.2613	20.2361	19.9935	19.5431	19.0923	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9444	19.1129	19.4400	19.8074	20.0273	20.1026	20.1094	20.1113	20.0861	19.8435	19.3931	18.9423	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9686	0.9342	0.8451	0.6785	0.4420	0.2820	0.2965	0.5669	0.8554	0.9568	0.9824	(94)
Useful gains	643.7815	695.8652	745.3238	749.9872	621.2296	412.0845	248.2247	247.5311	437.1766	585.5912	610.6798	610.2825	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W													
	1246.5958	1215.6994	1096.2915	912.0303	663.6318	415.9922	248.5211	247.8988	449.9222	723.7450	985.6541	1218.3639	(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													
	448.4938	349.3286	261.1199	116.6710	31.5472	0.0000	0.0000	0.0000	0.0000	102.7864	269.9815	452.4125	(98)
Space heating												2032.3410	(98)
Space heating per m2											(98) / (4) =	26.1900	(99)

8c. Space cooling requirement

Not applicable

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

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 %)	90.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2235.7987 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	448.4938	349.3286	261.1199	116.6710	31.5472	0.0000	0.0000	0.0000	0.0000	102.7864	269.9815	452.4125	(98)
Space heating efficiency (main heating system 1)													
	90.9000	90.9000	90.9000	90.9000	0.0000	0.0000	0.0000	0.0000	0.0000	90.9000	90.9000	90.9000	(210)
Space heating fuel (main heating system)													
	493.3925	384.2999	287.2607	128.3510	34.7054	0.0000	0.0000	0.0000	0.0000	113.0764	297.0093	497.7036	(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													
	171.5680	134.2545	112.8047	66.8041	44.5360	18.6588	17.2795	44.8436	67.8498	114.0931	147.2613	172.6442	(64)
Efficiency of water heater												80.8000	(216)
(217)m	87.8612	87.8513	87.5968	86.9430	84.7023	80.8000	80.8000	80.8000	80.8000	85.2914	87.0592	87.8664	(217)
Fuel for water heating, kWh/month													
	195.2717	152.8202	128.7773	76.8367	52.5795	23.0926	21.3855	55.4995	83.9725	133.7686	169.1509	196.4850	(219)
Water heating fuel used												1289.6401	(219)
Annual totals kWh/year													
Space heating fuel - main system												2235.7987	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												95.0000	(231)
Electricity for lighting (calculated in Appendix L)												362.1571	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.93 * 1234 * 0.80) =										-734.7535		-734.7535	(233)
Total delivered energy for all uses												3247.8424	(238)

10a. Fuel costs - using BEDF prices (395)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2235.7987	4.2800	95.6922	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1289.6401	4.2800	55.1966	(247)
Pumps and fans for heating	45.0000	15.4400	6.9480	(249)
Pump for solar water heating	50.0000	15.4400	7.7200	(249)
Energy for lighting	362.1571	15.4400	55.9171	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit	-734.7535	15.4400	-113.4459	(252)
Total energy cost			200.0279	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2235.7987	0.2160	482.9325	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1289.6401	0.2160	278.5623	(264)
Space and water heating			761.4948	(265)
Pumps and fans	95.0000	0.5190	49.3050	(267)
Energy for lighting	362.1571	0.5190	187.9595	(268)
Energy saving/generation technologies				
PV Unit	-734.7535	0.5190	-381.3371	(269)
Total kg/year			617.4222	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2235.7987	1.2200	2727.6744	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1289.6401	1.2200	1573.3609	(264)
Space and water heating			4301.0353	(265)
Pumps and fans	95.0000	3.0700	291.6500	(267)
Energy for lighting	362.1571	3.0700	1111.8222	(268)
Energy saving/generation technologies				
PV Unit	-734.7535	3.0700	-2255.6932	(269)
Primary energy kWh/year			3448.8143	(272)
Primary energy kWh/m2/year			44.4435	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	263.76 (P1)
Transmission heat loss coefficient	49.77 (37)
Summer heat loss coefficient	313.54 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
East	1.000	0.610	Normal overhang
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	0.610	0.510 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.0500	125.2818	0.7100	0.7000	0.9000	153.8258
South	0.4900	118.5567	0.7100	0.7000	0.9000	23.3864
West	7.3100	125.2818	0.7100	0.7000	0.9000	368.6776
total:						545.8898

	Jun	Jul	Aug	
Solar gains	587	546	483	(P3)
Internal gains	430	413	422	
Total summer gains	1017	959	905	(P5)
Summer gain/loss ratio	3.24	3.06	2.89	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.89	20.61	20.44	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	

Assessment of likelihood of high internal temperature: Slight

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Predicted Energy Assessment

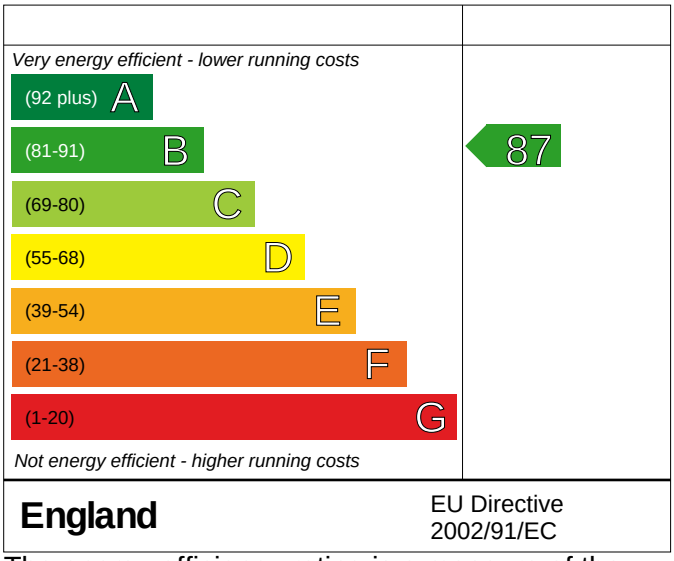
Plot 1, 23 & 23a, Meadow Grove,
Eastleigh,
Hampshire

Dwelling type:	House, Semi-Detached
Date of assessment:	19.Jul.2016
Produced by:	Surecalc Ltd
Total floor area:	77.6 m^2

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

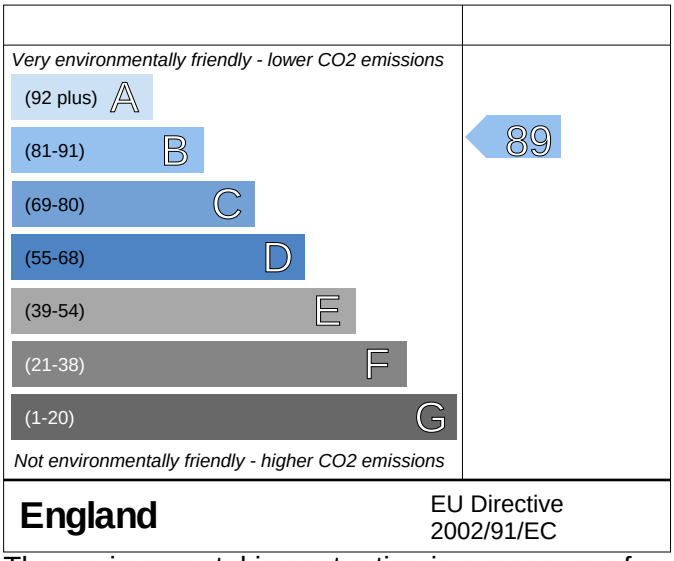
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Property Reference: sc120305
Survey Reference: 002 With PV

Issued on Date: 19.Jul.2016
Prop Type Ref: New Dwelling

Property: Plot 1, 23 & 23a, Meadow Grove, Eastleigh, Hampshire

SAP Rating: 87 B **CO2 Emissions (t/year):** 0.82 **DER:** 14.65 Pass **TER:** 19.07 **Percentage DER<TER:** 23.20 %
Environmental: 89 B **General Requirements Compliance:** Pass **DFEE:** 46.05 Pass **TFEE:** 53.99 **Percentage DFEE<TFEE:** 14.70 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 3.3 **ENE2 Credits:** 7.0 **ENE7 Credits:** 1 **CfSH Level:** 4

Surveyor: Mark Rogers MRICS CBuildE FCABE, Tel: 023 9225 4347 Surveyor ID: A320-0001
Address: 2, St Jacques Way, Denmead, Waterlooville, Hampshire, PO7 6LA
Client: Vivid Design Studio, Vivid Design Studio

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.05r04
SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	8.18	0.41	IG Hi Therm Lintels
External wall	E3 Sill	Independently assessed	0.030	7.23	0.22	LABC Construction Detail
External wall	E4 Jamb	Independently assessed	0.032	17.40	0.56	LABC Construction Detail
External wall	E5 Ground floor (normal)	Independently assessed	0.049	17.61	0.86	LABC Construction Detail
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.002	17.61	0.04	LABC Construction Detail
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.089	17.61	1.57	LABC Construction Detail
External wall	E16 Corner (normal)	Independently assessed	0.046	10.30	0.47	LABC Construction Detail
External wall	E18 Party wall between dwellings	Independently assessed	0.036	10.30	0.37	LABC Construction Detail
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.98	1.44	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.98	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	0.240	8.98	2.16	

Total W/mK: 8.08
Y-Value W/m2K: 0.048

Property Reference: sc120305
Survey Reference: 002 With PV

Issued on Date: 19.Jul.2016
Prop Type Ref: New Dwelling

Project: Plot 1, 23 & 23a, Meadow Grove, Eastleigh, Hampshire

Calculation Type: New Build (As Designed)

SAP Rating:	87 B	**CO2 Emissions (t/year):**	0.82	**DER:**	14.65 Pass	**TER:**	19.07	**Percentage DER<TER:**	23.20 %
Environmental:	89 B	**General Requirements Compliance:**	Pass	**DFEE:**	46.05 Pass	**TFEE:**	53.99	**Percentage DFEE<TFEE:**	14.70 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 3.3 **ENE2 Credits:** 7.0 **ENE7 Credits:** 1 **CfSH Level:** 4

Surveyor: Mark Rogers MRICS CBuildE FCABE, Tel: 023 9225 4347 Surveyor ID: A320-0001
Address: 2, St Jacques Way, Denmead, Waterlooville, Hampshire, PO7 6LA
Client: Vivid Design Studio, Vivid Design Studio

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.05r04
SAP version: , Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

Building Elements:

Roof 000002 - Pitched Roof Insulated Ceiling Vivid

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness	Conductivity	Resistance	Fraction
Ext surface				0.0400	
Layer 1	**Roof space**				
	Main construction	0 mm	0.0000	0.0000	100.00 %
Layer 2	**Mineral wool**				
	Main construction	250 mm	0.0440	5.6818	100.00 %
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 3	**Mineral wool quilt**				
	Main construction	150 mm	0.0440	3.4091	91.67 %
	Bridging - Timber	150 mm	0.1300		8.33 %
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 4	**Plasterboard, standard**				
	Main construction	12.5 mm	0.2100	0.0595	100.00 %
Int surface				0.1000	

Total resistance: Upper limit = 9.049 m^2 K/W Lower limit = 8.813 m^2 K/W Average = 8.931 m^2 K/W
U-value (unrounded) = 0.11 W/m^2 K

Unheated space: None

Total thickness: 413 mm **U-value: 0.11 W/m^2 K** **Kappa: n/a**

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Property Reference: sc120305
Survey Reference: 002 With PV

Issued on Date: 19.Jul.2016
Prop Type Ref: New Dwelling

Project: Plot 1, 23 & 23a, Meadow Grove, Eastleigh, Hampshire

Calculation Type: New Build (As Designed)

SAP Rating:	87 B	**CO2 Emissions (t/year):**	0.82	**DER:**	14.65 Pass	**TER:**	19.07	**Percentage DER<TER:**	23.20 %
Environmental:	89 B	**General Requirements Compliance:**	Pass	**DFEE:**	46.05 Pass	**TFEE:**	53.99	**Percentage DFEE<TFEE:**	14.70 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 3.3 **ENE2 Credits:** 7.0 **ENE7 Credits:** 1 **CfSH Level:** 4

Surveyor: Mark Rogers MRICS CBuildE FCABE, Tel: 023 9225 4347 Surveyor ID: A320-0001
Address: 2, St Jacques Way, Denmead, Waterlooville, Hampshire, PO7 6LA
Client: Vivid Design Studio, Vivid Design Studio

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.05r04
SAP version: , Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

Building Elements:

Wall 000001 - Cavity Wall Full Fill Vivid

Wall Type: Standard Wall

Layer	Description	Thickness	Conductivity	Resistance	Fraction
Ext surface				0.0400	
Layer 1	**Brick, outer leaf**				
	Main construction	105 mm	0.7700	0.1364	100.00 %
Layer 2	**Thermabead Diamond**				
	Main construction	125 mm	0.0320	3.9063	100.00 %
	Corrections - Air Gap: Level 0, Fasteners: Wall ties, Cross sectional area: 12.50 mm^2, Lambda: 17.000 W/m.K, per m^2: 2.500				
Layer 3	**Supabloc *4**				
	Main construction	100 mm	0.1600	0.6250	94.04 %
	Bridging - Mortar	100 mm	0.8803		5.96 %
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	**airspace/plaster dabs**				
	Main construction	15 mm	0.1000	0.1500	80.00 %
	Bridging - Mortar	15 mm	0.0882		20.00 %
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 5	**Plasterboard, standard**				
	Main construction	12.5 mm	0.2100	0.0595	100.00 %
Int surface				0.1300	

Total resistance: Upper limit = 5.017 m^2 K/W Lower limit = 4.919 m^2 K/W Average = 4.968 m^2 K/W
U-value (unrounded) = 0.2 W/m^2 K

Unheated space: None

Total thickness: 358 mm **U-value: 0.20 W/m^2 K** **Kappa: n/a**

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB

Property Reference: sc120305
Survey Reference: 002 With PV

Issued on Date: 19.Jul.2016
Prop Type Ref: New Dwelling

Project: Plot 1, 23 & 23a, Meadow Grove, Eastleigh, Hampshire

Calculation Type: New Build (As Designed)

SAP Rating:	87 B	**CO2 Emissions (t/year):**	0.82	**DER:**	14.65 Pass	**TER:**	19.07	**Percentage DER<TER:**	23.20 %
Environmental:	89 B	**General Requirements Compliance:**	Pass	**DFEE:**	46.05 Pass	**TFEE:**	53.99	**Percentage DFEE<TFEE:**	14.70 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 3.3 **ENE2 Credits:** 7.0 **ENE7 Credits:** 1 **CfSH Level:** 4

Surveyor: Mark Rogers MRICS CBuildE FCABE, Tel: 023 9225 4347 Surveyor ID: A320-0001
Address: 2, St Jacques Way, Denmead, Waterlooville, Hampshire, PO7 6LA
Client: Vivid Design Studio, Vivid Design Studio

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.05r04
SAP version: , Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

Building Elements:

Floor 000003 - Ground Floor Beam and Block Vivid

Floor Type: Suspended Floor
Area = 38.80 m^2, Perimeter = 17.61 m, Wall thickness = 300.00 mm, Soil: Unknown
Depth of underfloor space below ground:0.200 m Floor wind shielding: Average (suburban)
Floor height above ground:h = 0.000 m
U-value of walls above ground:Uw = 1.500 m
Ventilation openings per perimeter length:e = 0.0015 %
Mean wind speed:v = 5.000 m/s
Resistance on solum:Rg = 0.000 m^2K/W

Layer	Description	Thickness	Conductivity	Resistance	Fraction
Ext surface				0.1700	
Layer 1	**Blockwork, medium**				
	Main construction	100 mm	0.5700	0.1754	90.91 %
	Bridging - Concrete Beam	100 mm	1.0000		9.09 %
Layer 2	**Thermafloor TF70 zero ODP**				
	Main construction	150 mm	0.0220	6.8182	100.00 %
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	**Screed**				
	Main construction	65 mm	1.1500	0.0565	100.00 %
Int surface				0.1700	

Total resistance: Upper limit = 7.383 m^2 K/W Lower limit = 7.379 m^2 K/W Average = 7.381 m^2 K/W
U-value (unrounded) = 0.12 W/m^2 K

Unheated space: None

Total thickness: 315 mm **U-value: 0.12 W/m^2 K** **Kappa: n/a**

© Elmhurst Energy Systems Limited Registered Office Unit 16, St Johns Business Park, Lutterworth, Leicestershire LE17 4HB