77-79 CHARLOTTE STREET

ENERGY STATEMENT ADDENDUM

1 BACKGROUND

This document forms an addendum to the consented Energy Statement dated February 2015 prepared by Scotch Partners. It should be read in conjunction with the consented Energy Statement and all other documents forming part of the section 73 application.

The energy strategy has been updated in line with changes to the proposed development. The revised strategy follows the same energy reduction hierarchy in line with guidance produced by Camden Council. The following sections describe the revisions to the energy strategy and provides a summary of the overall CO_2 emissions reduction predicted for the proposed development.

1.1 S73 DEVELOPMENT OVERVIEW

The S73 Development includes the erection of a new six storey building and double basement. The development includes a single dwelling located over the 4th and 5th floors, and non-domestic office space from the basement to the 3rd floor.

2 REVISED STRATEGY

The energy strategy for the proposed development continues to follow the same energy hierarchy as the consented Energy statement and has been developed in line with Camden Council Policy CPG 3 section 2. At each stage of the hierarchy the proposed development's CO_2 emissions are evaluated and the percentage reduction achieved reported.

Regulated energy use and the associated CO_2 emissions have been calculated using Part L energy assessment software Stroma FSAP 2012 v1.0.4.7 for the domestic elements, and DesignBuilder 5.0.3.007 SBEM engine version 5.2.g.3 for the non-domestic elements.

All total development CO_2 emissions reported are based on the outputs from the SBEM BRUKL reports and SAP worksheets using the Building Emissions Rate (BER), Dwelling Emissions Rate (DER) and Target Emission Rate (TER). Where the TER from the 'Be Lean' scenario is used to represent the energy use of the Building Regulations Part L compliant development baseline, hereafter referred to as the 'notional development'. Total development figures are then calculated as an area weighted average.

Unregulated emissions for the domestic units have been estimated using the BREDEM 2012 Domestic Energy Model Version 1.0 calculations for 'Appliance' and 'Cooking' energy consumption. Notional unregulated emissions for the non-domestic elements have been taken from the SBEM BRUKL report as the 'equipment' load.

2.1 BE LEAN – REDUCE ENERGY DEMAND

The Development continues to use high efficiency HVAC systems and lighting as per the consented scheme as given in appendix 1. The fabric performance of the Development continues to match or improve upon the Part L notional building values as shown in Table 2.1 below.

Through the application of these measures a CO_2 emissions reduction of 7.1% could be achieved over the notional development baseline.

Table 2.1 –Development Fabric Performance

Model	Commercial	Residential
Air Permeability	$10m^3/hm^2@50Pa$	$3m^3/hm^2@50Pa$
Roof U-value	$0.18W/m^2K$	$0.13W/m^2K$
Floor over commercial U-value	-	$0.065W/m^2K$
Basement Floor U-value	$0.22W/m^2K$	-
External Wall U-value	$0.26W/m^2K$	$0.18W/m^2K$
Basement Wall U-value	$0.26W/m^2K$	-
Window U-value	$1.4 W/m^2K$	$1.4 W/m^2K$
Frame Fraction/Factor	0.17 to 0.3	0.17 to 0.3
G-value T Solar	0.40	0.63
L Solar	0.71	-
Roof light U-value	-	$1.1 W/m^2K$
Frame Fraction	-	0.83
T Solar	-	0.63
L Solar	-	-

2.2 BE CLEAN – SUPPLY ENERGY EFFICIENTLY

No changes have been made to the "Be Clean" strategy, clean measures are therefore as per the consented Energy Statement.

2.3 BE GREEN – USE RENEWABLE ENERGY

The Development continues to use air source heat pumps (ASHPs) to supply heating and cooling to the development. Where the consented scheme included 6no. solar thermal panels, these have been replaced with 6no. solar photovoltaic (PV) panels to reflect the reduction in domestic hot water demand.

Table 2.2 provides a summary of the final area weighting CO_2 emissions including energy efficient measures as per the consented Energy Statement and the changes described above. The domestic element has improved from $15.57kgCO_2/m^2$ to 12.80 $57kgCO_2/m^2$. The non-domestic elements were not modelled within the original energy strategy.

Table 2.2 –Development Total Regulated and Unregulated CO_2 Emissions

	Total Floor Area (m^2)	Area Weighted DER/BER ($kgCO_2/m^2$)	Total Regulated CO_2 Emissions ($kgCO_2$/annum)	Total Unregulated CO_2 Emissions ($kgCO_2$/annum)
Domestic	167	12.80	2,132	3,882
Non-Domestic	1,004	14.80	14,859	18,378
Site Total	1,171	14.52	16,992	22,260

2.4 DEVELOPMENT ENERGY HIERARCHY CO_2 EMISSIONS SAVINGS

2.4.1 BREAKDOWN OF DOMESTIC AND NON-DOMESTIC EMISSIONS SAVINGS

Table 2.3 lists the domestic and non-domestic CO_2 emission reductions after each stage of the energy hierarchy following the changes in energy reduction measures described above. Through measures applied the dwelling achieves a 21.9% reduction in CO_2 and the non-domestic elements show 19.6% reduction over the notional development baseline.

Table 2.3 – Domestic and Non-Domestic Regulated CO_2 Emissions and Savings

	Domestic		Non-Domestic	
	CO_2 Emissions (tCO_2/annum)	Percentage CO_2 Emissions Savings	CO_2 Emissions (tCO_2/annum)	Percentage CO_2 Emissions Savings
Building Regulations 2013 Part L Compliant Development	2.731		18.474	
Savings from Energy Demand Reduction	0.003	0.1%	1.506	8.2%
Savings from clean measures	0.000	0.0%	0.000	0.0%
Savings from Renewable Energy	0.595	21.8%	2.108	11.4%
Cumulative On-Site Savings	**0.598**	**21.9%**	**3.614**	**19.6%**

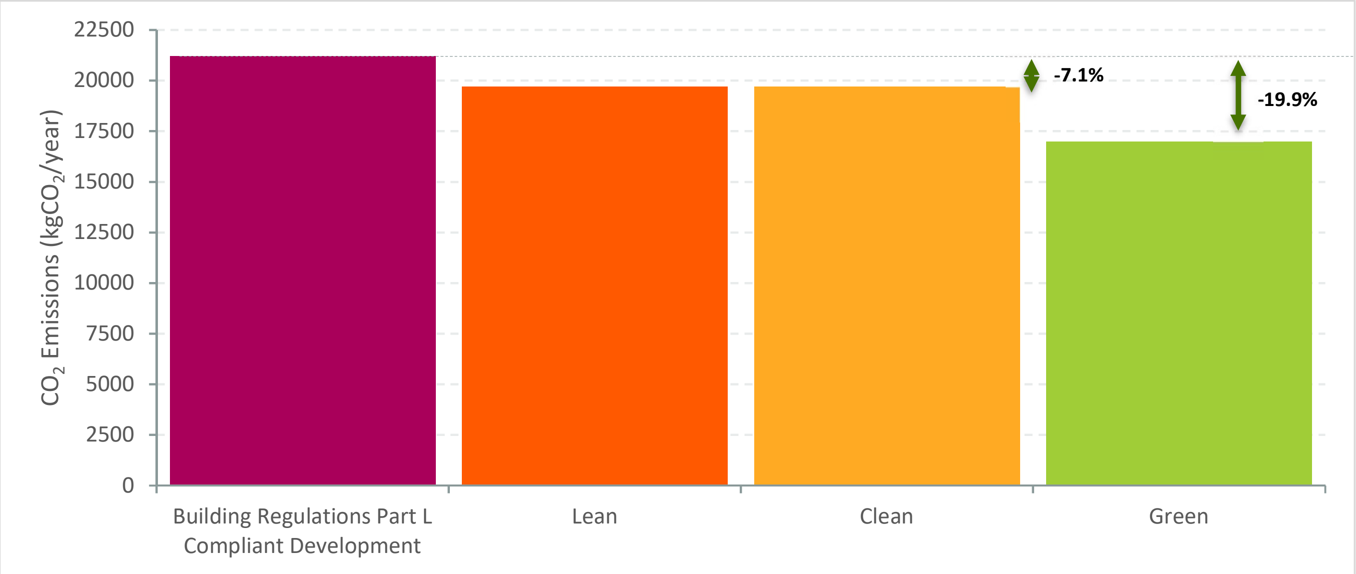
2.4.2 TOTAL DEVELOPMENT EMISSIONS SAVINGS

Table 2.4 and Figure 2.1 gives the total development regulated CO_2 emissions at each stage of the energy hierarchy. The table shows that there is 7.1% CO_2 emission reduction after the "Be Lean" energy efficiency measures and a 12.7% CO_2 emission reduction after the renewable energy measures.

Table 2.4– Development Total Regulated CO_2 Emissions and Savings

Stages of the Energy Hierarchy	CO2 Emissions (kgCO2/annum)	Percentage CO_2 Emissions Savings
Building Regulations 2013 Part L Compliant Development	21.204	
After energy efficiency measures savings	19.695	7.1%
After clean measures savings	19.695	0.0%
After renewable measures savings	16.992	12.7%
Total site savings		19.9%

Figure 2.1 – Site Wide Regulated CO_2 Emissions and Savings



3 CONCLUSION

Scotch Partners have prepared this energy strategy addendum for the S73 planning submission for the proposed development at 77 Charlotte Street in accordance with the Camden councils planning policy.

Through a range of 'Be Lean', 'Be Clean' and 'Be Green' measures the Development achieves an overall 19.9% reduction in CO_2 over a Building Regulations Part L 2013 compliant development. It has been estimated that the proposed development could produce 22.8% of its energy demand through renewable heating from the ASHPs and electricity produced from the PV Panels.

APPENDIX 1 – SBEM & SAP MODEL INPUTS

FABRIC PERFORMANCE

Model	Commercial	Residential
Air Permeability	$10m^3/hm^2$@50Pa	$3m^3/hm^2$@50Pa
Roof U-value	$0.18W/m^2K$	$0.13W/m^2K$
Floor over commercial U-value	-	$0.065W/m^2K$
Basement Floor U-value	$0.22W/m^2K$	-
External Wall U-value	$0.26W/m^2K$	$0.18W/m^2K$
Basement Wall U-value	$0.26W/m^2K$	-
Window U-value	1.4 W/m^2K	1.4 W/m^2K
Frame Fraction/Factor	0.17 to 0.3	0.17 to 0.3
G-value T Solar	0.40	0.63
L Solar	0.71	-
Roof light U-value	-	1.1 W/m^2K
Frame Fraction	-	0.83
T Solar	-	0.63
L Solar	-	-

LIGHTING

Model	Office	Reception	Circulation	Garage/Store
Lamp & Ballast Efficacy	LED 113lm/W	LED 113lm/W	LED 78lm/W	LED 80lm/W
Light Output Ratio	1	-	1	1
Photoelectric Control	PH Dimming	PH Dimming	-	-
Occupancy Sensing	Throughout	Throughout	Throughout	Throughout
Display Lighting	-	Yes 60lm/W	-	-

VENTILATION

Model	Office	Dwelling
Main Areas & Toilet	Mechanical SFP 1.6W/l/s Heat Recovery Efficiency 85%	Natural & Nuaire MVHR

HEATING & COOLING

Model	Office	Dwelling
Primary areas	Multi Split ASHP Grid Supplied Electricity SCOP 3.69 EER 4.48 SEER 5.62	Daikin ASHP ERLQ0006CAV3 + EHBH08CB3V
Stairs	Electric Panel Grid Supplied Electricity SCOP 1	

DOMESTIC HOT WATER

Model	Office	Dwelling
DHW Throughout	Instant Electric	From Heating System

APPENDIX 2 – DATA SOURCES

MODEL GEOMETRY INPUTS

	Comment	
Architect	MR Partnership	
SBEM Site Location	London	
Plans/GIA's	3108A_201 - B	S73 Proposed Basement Plan
	3108A_202 - B	S73 Proposed Lower Ground Floor Plan
	3108A_203 - B	S73 Proposed Ground Floor Plan
	3108A_204 - B	S73 Proposed First Floor Plan
	3108A_205 - C	S73 Proposed Second Floor Plan
	3108A_206 - C	S73 Proposed Third Floor Plan
	3108A_207 - A	S73 Proposed Fourth Floor Plan
	3108A_208 - C	S73 Proposed Fifth Floor Plan
Elevations & Sections	3108A_351 - C	S73 Proposed Main Elevation
	3108A_352 - C	S73 Proposed Main Elevation 2
	3108A_353 - B	S73 Proposed Rear Elevation
	3108A_301 - B	S73 Proposed Sections A-A
	3108A_302 - C	S73 Proposed Sections B-B
	3108A_303 - B	S73 Proposed Sections C-C
	3108A_304 - B	S73 Proposed Sections D-D

MODEL HVAC INPUTS

	Comment	
M&E Consultant	Scotch Partners LLP	

REFERENCE DOCUMENTATION

	Comment
Local Planning Policy	CPG 3 Planning Guidance on Sustainability
Building Regulations	Approved Document L2A
Building Regulations	Approved Document L1A

APPENDIX 3 – SBEM BRUKL LEAN & BASELINE

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

77-79 Charlotte Street

As designed

Date: Thu Jul 20 14:58:17 2017

Administrative information

Building Details

Address: London, W1

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Scotch Partners LLP

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	18.4
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	18.4
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	16.9
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.26	-02 Basement - Stairs_W_7
Floor	0.25	0.13	0.22	-02 Basement - Office_F_19
Roof	0.25	0.18	0.18	-02 Basement - Office_R_4
Windows***, roof windows, and rooflights	2.2	1.4	1.4	-02 Basement - Stairs_G_12
Personnel doors	2.2	1.5	1.5	00 Grd Floor Garage - Store_D_9
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	10

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Elec Panel

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

2- VRF Split

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4.48	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- Instant Electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
-02 Basement - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
00 Grd Floor Garage - Store	-	-	-	-	-	-	-	-	-	-	N/A
00 Ground Office Level - Reception	-	-	-	1.6	-	-	-	-	-	0.85	0.5
-02 Basement - Office	-	-	-	1.6	-	-	-	-	-	0.85	0.5
-02 Basement - WC	-	-	-	1.6	-	-	-	-	-	0.85	0.5

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
-02 Basement - Stairs	-	78	-	234

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Grd Floor Garage - Store	80	-	-	50
00 Ground Office Level - Reception	-	113	60	66
-02 Basement - Office	113	-	-	4499
-02 Basement - WC	-	78	-	366

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Grd Floor Garage - Store	N/A	N/A
00 Ground Office Level - Reception	NO (-4.5%)	NO
-02 Basement - Office	NO (-43.9%)	NO
-02 Basement - WC	NO (-73.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	1004	1004
External area [m^2]	767.3	767.3
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	10	3
Average conductance [W/K]	355.74	453.92
Average U-value [W/m^2K]	0.46	0.59
Alpha value* [%]	23.63	19.54

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	6.82	3.96
Cooling	6.23	8.42
Auxiliary	5.53	2.37
Lighting	11.77	20.82
Hot water	2.31	2.67
Equipment*	35.27	35.27
TOTAL**	**32.66**	**38.24**

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	116.59	134.76
Primary energy* [kWh/m^2]	100.25	104.7
Total emissions [kg/m^2]	16.9	18.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Other local room heater - unfanned, [HS] Room heater, [HFT] Electricity, [CFT] Natural Gas										
	Actual	99.7	11.7	32.9	0	0	0.84	0	1	0
	Notional	86.9	64.2	29.5	0	0	0.82	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	14.2	102.9	4.4	6.8	6	0.89	4.2	0.91	5.62
	Notional	14.1	119.2	1.6	9.2	2.6	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	**$U_{i\text{-}Typ}$**	**$U_{i\text{-}Min}$**	**Surface where the minimum value occurs***
Wall	0.23	0.26	-02 Basement - Stairs_W_7
Floor	0.2	0.1	00 Grd Floor Garage - Store_S_3
Roof	0.15	0.18	-02 Basement - Office_R_4
Windows, roof windows, and rooflights	1.5	1.4	-02 Basement - Stairs_G_12
Personnel doors	1.5	1.5	00 Grd Floor Garage - Store_D_9
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	**Typical value**	**This building**
$m^3/(h.m^2)$ at 50 Pa	5	10

APPENDIX 4 – SBEM BRUKL GREEN

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

77-79 Charlotte Street

As designed

Date: Thu Jul 27 10:38:37 2017

Administrative information

Building Details

Address: London, W1

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Scotch Partners LLP

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	18.4
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	18.4
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	14.8
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.26	-02 Basement - Stairs_W_7
Floor	0.25	0.13	0.22	-02 Basement - Office_F_19
Roof	0.25	0.18	0.18	-02 Basement - Office_R_4
Windows***, roof windows, and rooflights	2.2	1.4	1.4	-02 Basement - Stairs_G_12
Personnel doors	2.2	1.5	1.5	00 Grd Floor Garage - Store_D_9
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	10

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Elec Panel

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

2- VRF Split

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.69	4.48	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Instant Electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
-02 Basement - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
00 Grd Floor Garage - Store	-	-	-	-	-	-	-	-	-	-	N/A
00 Ground Office Level - Reception	-	-	-	1.6	-	-	-	-	-	0.85	0.5
-02 Basement - Office	-	-	-	1.6	-	-	-	-	-	0.85	0.5
-02 Basement - WC	-	-	-	1.6	-	-	-	-	-	0.85	0.5

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
-02 Basement - Stairs	-	78	-	234

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Grd Floor Garage - Store	80	-	-	50
00 Ground Office Level - Reception	-	113	60	66
-02 Basement - Office	113	-	-	4499
-02 Basement - WC	-	78	-	366

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Grd Floor Garage - Store	N/A	N/A
00 Ground Office Level - Reception	NO (-4.5%)	NO
-02 Basement - Office	NO (-43.9%)	NO
-02 Basement - WC	NO (-73.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	1004	1004
External area [m^2]	767.3	767.3
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	10	3
Average conductance [W/K]	355.74	453.92
Average U-value [W/m^2K]	0.46	0.59
Alpha value* [%]	23.63	19.54

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	3.78	3.96
Cooling	6.23	8.42
Auxiliary	5.53	2.37
Lighting	11.77	20.82
Hot water	2.31	2.67
Equipment*	35.27	35.27
TOTAL**	**29.61**	**38.24**

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	1.12	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	116.59	134.76
Primary energy* [kWh/m^2]	90.91	104.7
Total emissions [kg/m^2]	14.8	18.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Other local room heater - unfanned, [HS] Room heater, [HFT] Electricity, [CFT] Natural Gas										
	Actual	99.7	11.7	32.9	0	0	0.84	0	1	0
	Notional	86.9	64.2	29.5	0	0	0.82	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	14.2	102.9	1.1	6.8	6	3.62	4.2	3.69	5.62
	Notional	14.1	119.2	1.6	9.2	2.6	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.26	-02 Basement - Stairs_W_7
Floor	0.2	0.1	00 Grd Floor Garage - Store_S_3
Roof	0.15	0.18	-02 Basement - Office_R_4
Windows, roof windows, and rooflights	1.5	1.4	-02 Basement - Stairs_G_12
Personnel doors	1.5	1.5	00 Grd Floor Garage - Store_D_9
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	10

APPENDIX 5 – SAP WORKSHEETS BASELINE

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.7

Property Address: Charlotte Street - Lean

Address : 77-79 Charlotte Street, London, W1

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	116	(1a)	x	2.55	(2a)	=	295.8	(3a)
First floor	50.6	(1b)	x	2.76	(2b)	=	139.66	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	166.6	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	435.46	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.09	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.29	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 2			1.23	x1/[1/(1.4)+ 0.04]		=	1.63			(27)
Windows Type 3			0.64	x1/[1/(1.4)+ 0.04]		=	0.85			(27)
Windows Type 4			5.11	x1/[1/(1.4)+ 0.04]		=	6.77			(27)
Windows Type 5			4.65	x1/[1/(1.4)+ 0.04]		=	6.16			(27)
Windows Type 6			1.28	x1/[1/(1.4)+ 0.04]		=	1.7			(27)
Windows Type 7			6.83	x1/[1/(1.4)+ 0.04]		=	9.05			(27)
Windows Type 8			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 9			2.28	x1/[1/(1.4)+ 0.04]		=	3.02			(27)
Windows Type 10			6.83	x1/[1/(1.4)+ 0.04]		=	9.05			(27)
Rooflights			0.7938528	x1/[1/(1.7) + 0.04]		=	1.34955			(27b)
Floor			116.16	x	0.13	=	15.1008			(28)
Walls Type1	29.73	8.64	21.09	x	0.18	=	3.8			(29)
Walls Type2	15.58	4.65	10.93	x	0.18	=	1.97			(29)
Walls Type3	22.89	7.62	15.27	x	0.18	=	2.75			(29)
Walls Type4	16.96	0.64	16.32	x	0.18	=	2.94			(29)
Walls Type5	12.56	0	12.56	x	0.18	=	2.26			(29)

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Walls Type6	26.16	6.83	19.33	x	0.18	=	3.48			(29)
Walls Type7	30.59	11.7	18.89	x	0.18	=	3.4			(29)
Walls Type8	39.55	0	39.55	x	0.18	=	7.12			(29)
Walls Type9	11.51	0	11.51	x	0.18	=	2.07			(29)
Roof Type1	50.6	1.59	49.01	x	0.13	=	6.37			(30)
Roof Type2	26.96	0	26.96	x	0.13	=	3.5			(30)
Total area of elements, m²			399.25							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	110.42	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		19.96	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	130.38	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	81.71	81.33	80.95	79.19	78.86	77.33	77.33	77.04	77.92	78.86	79.53	80.23		(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(39)m=	212.1	211.71	211.34	209.58	209.25	207.71	207.71	207.43	208.3	209.25	209.91	210.61		
										Average = Sum(39)$_{1…12}$ /12=			209.57	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(40)m=	1.27	1.27	1.27	1.26	1.26	1.25	1.25	1.25	1.25	1.26	1.26	1.26		
										Average = Sum(40)$_{1…12}$ /12=			1.26	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.96 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 104.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(44)m=	114.9	110.72	106.54	102.36	98.19	94.01	94.01	98.19	102.36	106.54	110.72	114.9		
										Total = Sum(44)$_{1…12}$ =			1253.43	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(45)m=	170.39	149.02	153.78	134.07	128.64	111.01	102.87	118.04	119.45	139.21	151.96	165.01		
										Total = Sum(45)$_{1…12}$ =			1643.44	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	25.56	22.35	23.07	20.11	19.3	16.65	15.43	17.71	17.92	20.88	22.79	24.75	(46)

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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.96	49.32	50.03	46.36	47.91	50.03	49.32	50.96	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	221.35	195.05	204.74	183.38	178.68	157.37	150.77	168.07	168.76	190.17	201.27	215.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	221.35	195.05	204.74	183.38	178.68	157.37	150.77	168.07	168.76	190.17	201.27	215.97

Output from water heater (annual)1…12 — 2235.58 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	69.39	61.06	63.87	56.91	55.28	48.5	46.18	51.76	52.05	59.03	62.85	67.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	(66)

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

(67)m=	30.14	26.77	21.77	16.48	12.32	10.4	11.24	14.61	19.61	24.9	29.06	30.98	(67)

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

(68)m=	338.07	341.57	332.73	313.91	290.16	267.83	252.91	249.41	258.25	277.07	300.82	323.15	(68)

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

(69)m=	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	(71)

Water heating gains (Table 5)

(72)m=	93.27	90.86	85.85	79.04	74.3	67.36	62.07	69.57	72.29	79.34	87.3	90.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	531.85	529.57	510.72	479.8	447.15	415.96	396.59	403.95	420.51	451.67	487.55	515.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	1.44	x	11.28	x	0.63	x	0.7	=	29.79	(75)
Northeast 0.9x	0.77	x	6.83	x	11.28	x	0.63	x	0.7	=	23.55	(75)
Northeast 0.9x	0.77	x	1.44	x	22.97	x	0.63	x	0.7	=	60.64	(75)
Northeast 0.9x	0.77	x	6.83	x	22.97	x	0.63	x	0.7	=	47.94	(75)
Northeast 0.9x	0.77	x	1.44	x	41.38	x	0.63	x	0.7	=	109.26	(75)
Northeast 0.9x	0.77	x	6.83	x	41.38	x	0.63	x	0.7	=	86.37	(75)
Northeast 0.9x	0.77	x	1.44	x	67.96	x	0.63	x	0.7	=	179.44	(75)
Northeast 0.9x	0.77	x	6.83	x	67.96	x	0.63	x	0.7	=	141.85	(75)
Northeast 0.9x	0.77	x	1.44	x	91.35	x	0.63	x	0.7	=	241.2	(75)
Northeast 0.9x	0.77	x	6.83	x	91.35	x	0.63	x	0.7	=	190.67	(75)
Northeast 0.9x	0.77	x	1.44	x	97.38	x	0.63	x	0.7	=	257.14	(75)
Northeast 0.9x	0.77	x	6.83	x	97.38	x	0.63	x	0.7	=	203.27	(75)
Northeast 0.9x	0.77	x	1.44	x	91.1	x	0.63	x	0.7	=	240.55	(75)
Northeast 0.9x	0.77	x	6.83	x	91.1	x	0.63	x	0.7	=	190.16	(75)
Northeast 0.9x	0.77	x	1.44	x	72.63	x	0.63	x	0.7	=	191.77	(75)
Northeast 0.9x	0.77	x	6.83	x	72.63	x	0.63	x	0.7	=	151.6	(75)
Northeast 0.9x	0.77	x	1.44	x	50.42	x	0.63	x	0.7	=	133.14	(75)
Northeast 0.9x	0.77	x	6.83	x	50.42	x	0.63	x	0.7	=	105.24	(75)
Northeast 0.9x	0.77	x	1.44	x	28.07	x	0.63	x	0.7	=	74.11	(75)
Northeast 0.9x	0.77	x	6.83	x	28.07	x	0.63	x	0.7	=	58.59	(75)
Northeast 0.9x	0.77	x	1.44	x	14.2	x	0.63	x	0.7	=	37.49	(75)
Northeast 0.9x	0.77	x	6.83	x	14.2	x	0.63	x	0.7	=	29.63	(75)
Northeast 0.9x	0.77	x	1.44	x	9.21	x	0.63	x	0.7	=	24.33	(75)
Northeast 0.9x	0.77	x	6.83	x	9.21	x	0.63	x	0.7	=	19.23	(75)
Southeast 0.9x	0.54	x	0.64	x	36.79	x	0.63	x	0.7	=	5.05	(77)
Southeast 0.9x	0.54	x	0.64	x	62.67	x	0.63	x	0.7	=	8.6	(77)

Southeast	0.9x	0.54	x	0.64	x	85.75	x	0.63	x	0.7	=	11.76	(77)
Southeast	0.9x	0.54	x	0.64	x	106.25	x	0.63	x	0.7	=	14.57	(77)
Southeast	0.9x	0.54	x	0.64	x	119.01	x	0.63	x	0.7	=	16.32	(77)
Southeast	0.9x	0.54	x	0.64	x	118.15	x	0.63	x	0.7	=	16.21	(77)
Southeast	0.9x	0.54	x	0.64	x	113.91	x	0.63	x	0.7	=	15.62	(77)
Southeast	0.9x	0.54	x	0.64	x	104.39	x	0.63	x	0.7	=	14.32	(77)
Southeast	0.9x	0.54	x	0.64	x	92.85	x	0.63	x	0.7	=	12.74	(77)
Southeast	0.9x	0.54	x	0.64	x	69.27	x	0.63	x	0.7	=	9.5	(77)
Southeast	0.9x	0.54	x	0.64	x	44.07	x	0.63	x	0.7	=	6.05	(77)
Southeast	0.9x	0.54	x	0.64	x	31.49	x	0.63	x	0.7	=	4.32	(77)
Southwest	0.9x	0.54	x	1.23	x	36.79		0.63	x	0.7	=	9.7	(79)
Southwest	0.9x	0.54	x	5.11	x	36.79		0.63	x	0.7	=	40.3	(79)
Southwest	0.9x	0.54	x	1.28	x	36.79		0.63	x	0.7	=	10.09	(79)
Southwest	0.9x	0.77	x	2.59	x	36.79		0.63	x	0.7	=	29.12	(79)
Southwest	0.9x	0.77	x	2.28	x	36.79		0.63	x	0.7	=	25.64	(79)
Southwest	0.9x	0.77	x	6.83	x	36.79		0.63	x	0.7	=	76.8	(79)
Southwest	0.9x	0.54	x	1.23	x	62.67		0.63	x	0.7	=	16.52	(79)
Southwest	0.9x	0.54	x	5.11	x	62.67		0.63	x	0.7	=	68.64	(79)
Southwest	0.9x	0.54	x	1.28	x	62.67		0.63	x	0.7	=	17.19	(79)
Southwest	0.9x	0.77	x	2.59	x	62.67		0.63	x	0.7	=	49.61	(79)
Southwest	0.9x	0.77	x	2.28	x	62.67		0.63	x	0.7	=	43.67	(79)
Southwest	0.9x	0.77	x	6.83	x	62.67		0.63	x	0.7	=	130.82	(79)
Southwest	0.9x	0.54	x	1.23	x	85.75		0.63	x	0.7	=	22.61	(79)
Southwest	0.9x	0.54	x	5.11	x	85.75		0.63	x	0.7	=	93.92	(79)
Southwest	0.9x	0.54	x	1.28	x	85.75		0.63	x	0.7	=	23.53	(79)
Southwest	0.9x	0.77	x	2.59	x	85.75		0.63	x	0.7	=	67.88	(79)
Southwest	0.9x	0.77	x	2.28	x	85.75		0.63	x	0.7	=	59.75	(79)
Southwest	0.9x	0.77	x	6.83	x	85.75		0.63	x	0.7	=	178.99	(79)
Southwest	0.9x	0.54	x	1.23	x	106.25		0.63	x	0.7	=	28.01	(79)
Southwest	0.9x	0.54	x	5.11	x	106.25		0.63	x	0.7	=	116.37	(79)
Southwest	0.9x	0.54	x	1.28	x	106.25		0.63	x	0.7	=	29.15	(79)
Southwest	0.9x	0.77	x	2.59	x	106.25		0.63	x	0.7	=	84.1	(79)
Southwest	0.9x	0.77	x	2.28	x	106.25		0.63	x	0.7	=	74.04	(79)
Southwest	0.9x	0.77	x	6.83	x	106.25		0.63	x	0.7	=	221.78	(79)
Southwest	0.9x	0.54	x	1.23	x	119.01		0.63	x	0.7	=	31.37	(79)
Southwest	0.9x	0.54	x	5.11	x	119.01		0.63	x	0.7	=	130.34	(79)
Southwest	0.9x	0.54	x	1.28	x	119.01		0.63	x	0.7	=	32.65	(79)
Southwest	0.9x	0.77	x	2.59	x	119.01		0.63	x	0.7	=	94.2	(79)
Southwest	0.9x	0.77	x	2.28	x	119.01		0.63	x	0.7	=	82.93	(79)
Southwest	0.9x	0.77	x	6.83	x	119.01		0.63	x	0.7	=	248.42	(79)
Southwest	0.9x	0.54	x	1.23	x	118.15		0.63	x	0.7	=	31.15	(79)

Southwest0.9x	0.54	x	5.11	x	118.15	0.63	x	0.7	=	129.4	(79)
Southwest0.9x	0.54	x	1.28	x	118.15	0.63	x	0.7	=	32.41	(79)
Southwest0.9x	0.77	x	2.59	x	118.15	0.63	x	0.7	=	93.52	(79)
Southwest0.9x	0.77	x	2.28	x	118.15	0.63	x	0.7	=	82.33	(79)
Southwest0.9x	0.77	x	6.83	x	118.15	0.63	x	0.7	=	246.62	(79)
Southwest0.9x	0.54	x	1.23	x	113.91	0.63	x	0.7	=	30.03	(79)
Southwest0.9x	0.54	x	5.11	x	113.91	0.63	x	0.7	=	124.75	(79)
Southwest0.9x	0.54	x	1.28	x	113.91	0.63	x	0.7	=	31.25	(79)
Southwest0.9x	0.77	x	2.59	x	113.91	0.63	x	0.7	=	90.16	(79)
Southwest0.9x	0.77	x	2.28	x	113.91	0.63	x	0.7	=	79.37	(79)
Southwest0.9x	0.77	x	6.83	x	113.91	0.63	x	0.7	=	237.77	(79)
Southwest0.9x	0.54	x	1.23	x	104.39	0.63	x	0.7	=	27.52	(79)
Southwest0.9x	0.54	x	5.11	x	104.39	0.63	x	0.7	=	114.33	(79)
Southwest0.9x	0.54	x	1.28	x	104.39	0.63	x	0.7	=	28.64	(79)
Southwest0.9x	0.77	x	2.59	x	104.39	0.63	x	0.7	=	82.63	(79)
Southwest0.9x	0.77	x	2.28	x	104.39	0.63	x	0.7	=	72.74	(79)
Southwest0.9x	0.77	x	6.83	x	104.39	0.63	x	0.7	=	217.9	(79)
Southwest0.9x	0.54	x	1.23	x	92.85	0.63	x	0.7	=	24.48	(79)
Southwest0.9x	0.54	x	5.11	x	92.85	0.63	x	0.7	=	101.69	(79)
Southwest0.9x	0.54	x	1.28	x	92.85	0.63	x	0.7	=	25.47	(79)
Southwest0.9x	0.77	x	2.59	x	92.85	0.63	x	0.7	=	73.5	(79)
Southwest0.9x	0.77	x	2.28	x	92.85	0.63	x	0.7	=	64.7	(79)
Southwest0.9x	0.77	x	6.83	x	92.85	0.63	x	0.7	=	193.81	(79)
Southwest0.9x	0.54	x	1.23	x	69.27	0.63	x	0.7	=	18.26	(79)
Southwest0.9x	0.54	x	5.11	x	69.27	0.63	x	0.7	=	75.86	(79)
Southwest0.9x	0.54	x	1.28	x	69.27	0.63	x	0.7	=	19	(79)
Southwest0.9x	0.77	x	2.59	x	69.27	0.63	x	0.7	=	54.83	(79)
Southwest0.9x	0.77	x	2.28	x	69.27	0.63	x	0.7	=	48.27	(79)
Southwest0.9x	0.77	x	6.83	x	69.27	0.63	x	0.7	=	144.58	(79)
Southwest0.9x	0.54	x	1.23	x	44.07	0.63	x	0.7	=	11.62	(79)
Southwest0.9x	0.54	x	5.11	x	44.07	0.63	x	0.7	=	48.27	(79)
Southwest0.9x	0.54	x	1.28	x	44.07	0.63	x	0.7	=	12.09	(79)
Southwest0.9x	0.77	x	2.59	x	44.07	0.63	x	0.7	=	34.88	(79)
Southwest0.9x	0.77	x	2.28	x	44.07	0.63	x	0.7	=	30.71	(79)
Southwest0.9x	0.77	x	6.83	x	44.07	0.63	x	0.7	=	91.99	(79)
Southwest0.9x	0.54	x	1.23	x	31.49	0.63	x	0.7	=	8.3	(79)
Southwest0.9x	0.54	x	5.11	x	31.49	0.63	x	0.7	=	34.49	(79)
Southwest0.9x	0.54	x	1.28	x	31.49	0.63	x	0.7	=	8.64	(79)
Southwest0.9x	0.77	x	2.59	x	31.49	0.63	x	0.7	=	24.92	(79)
Southwest0.9x	0.77	x	2.28	x	31.49	0.63	x	0.7	=	21.94	(79)
Southwest0.9x	0.77	x	6.83	x	31.49	0.63	x	0.7	=	65.73	(79)

Northwest	0.9x	0.54	x	4.65	x	11.28	x	0.63	x	0.7	=	11.24	(81)
Northwest	0.9x	0.54	x	4.65	x	22.97	x	0.63	x	0.7	=	22.89	(81)
Northwest	0.9x	0.54	x	4.65	x	41.38	x	0.63	x	0.7	=	41.24	(81)
Northwest	0.9x	0.54	x	4.65	x	67.96	x	0.63	x	0.7	=	67.73	(81)
Northwest	0.9x	0.54	x	4.65	x	91.35	x	0.63	x	0.7	=	91.04	(81)
Northwest	0.9x	0.54	x	4.65	x	97.38	x	0.63	x	0.7	=	97.05	(81)
Northwest	0.9x	0.54	x	4.65	x	91.1	x	0.63	x	0.7	=	90.79	(81)
Northwest	0.9x	0.54	x	4.65	x	72.63	x	0.63	x	0.7	=	72.38	(81)
Northwest	0.9x	0.54	x	4.65	x	50.42	x	0.63	x	0.7	=	50.25	(81)
Northwest	0.9x	0.54	x	4.65	x	28.07	x	0.63	x	0.7	=	27.97	(81)
Northwest	0.9x	0.54	x	4.65	x	14.2	x	0.63	x	0.7	=	14.15	(81)
Northwest	0.9x	0.54	x	4.65	x	9.21	x	0.63	x	0.7	=	9.18	(81)
Rooflights	0.9x	1	x	0.79	x	37.03	x	0.63	x	0.7	=	23.34	(82)
Rooflights	0.9x	1	x	0.79	x	70.28	x	0.63	x	0.7	=	44.29	(82)
Rooflights	0.9x	1	x	0.79	x	111.87	x	0.63	x	0.7	=	70.5	(82)
Rooflights	0.9x	1	x	0.79	x	159.33	x	0.63	x	0.7	=	100.4	(82)
Rooflights	0.9x	1	x	0.79	x	193.3	x	0.63	x	0.7	=	121.81	(82)
Rooflights	0.9x	1	x	0.79	x	197.35	x	0.63	x	0.7	=	124.36	(82)
Rooflights	0.9x	1	x	0.79	x	188.08	x	0.63	x	0.7	=	118.52	(82)
Rooflights	0.9x	1	x	0.79	x	162.62	x	0.63	x	0.7	=	102.47	(82)
Rooflights	0.9x	1	x	0.79	x	128.66	x	0.63	x	0.7	=	81.08	(82)
Rooflights	0.9x	1	x	0.79	x	82.24	x	0.63	x	0.7	=	51.83	(82)
Rooflights	0.9x	1	x	0.79	x	45.75	x	0.63	x	0.7	=	28.83	(82)
Rooflights	0.9x	1	x	0.79	x	30.74	x	0.63	x	0.7	=	19.37	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	284.62	510.81	765.8	1057.43	1280.95	1313.46	1248.98	1076.29	866.1	582.8	345.7	240.45	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	816.47	1040.39	1276.52	1537.23	1728.1	1729.42	1645.57	1480.24	1286.6	1034.47	833.25	755.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.87	0.7	0.54	0.61	0.87	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.5	19.69	20.01	20.41	20.75	20.94	20.99	20.97	20.82	20.36	19.85	19.46	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.86	19.86	19.87	19.87	19.88	19.88	19.88	19.88	19.88	19.88	19.87	19.87	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.82	0.61	0.41	0.48	0.8	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.86	18.14	18.6	19.19	19.64	19.84	19.88	19.87	19.73	19.12	18.37	17.81	(90)

fLA = Living area ÷ (4) = 0.21 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.2	18.47	18.9	19.45	19.87	20.07	20.11	20.11	19.96	19.38	18.68	18.16	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.2	18.47	18.9	19.45	19.87	20.07	20.11	20.11	19.96	19.38	18.68	18.16	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.82	0.62	0.44	0.51	0.8	0.97	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	814.94	1034.43	1252.99	1439.19	1416.7	1077.38	720.44	751.47	1032.54	1002.63	829.57	754.82	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2948.38	2872.62	2619.85	2210.03	1710.15	1136.66	729.29	768.65	1221.38	1837.45	2431.83	2939.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1587.28	1235.27	1016.94	555.01	218.33	0	0	0	0	621.11	1153.62	1625.69	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 8013.25 (98)

Space heating requirement in kWh/m²/year 48.1 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	1587.28	1235.27	1016.94	555.01	218.33	0	0	0	0	621.11	1153.62	1625.69		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1699.45	1322.56	1088.81	594.22	233.76	0	0	0	0	665	1235.14	1740.57		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													8579.5	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	221.35	195.05	204.74	183.38	178.68	157.37	150.77	168.07	168.76	190.17	201.27	215.97		
Efficiency of water heater													80.3	(216)

(217)m=	89.03	88.88	88.53	87.66	85.56	80.3	80.3	80.3	80.3	87.81	88.74	89.09	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	248.62	219.47	231.25	209.19	208.84	195.98	187.76	209.31	210.17	216.56	226.8	242.43	

Total = Sum(219a)$_{1...12}$ = 2606.39 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			8579.5	
Water heating fuel used			2606.39	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			532.26	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1853.17	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	562.98	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2416.15	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	276.24	(268)
Total CO2, kg/year			sum of (265)…(271) =		2731.32	(272)

TER = 16.39 (273)

APPENDIX 6 – SAP WORKSHEETS LEAN

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.7

Property Address: Charlotte Street - Lean

Address : 77-79 Charlotte Street, London, W1

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	116	(1a)	x	2.55	(2a)	=	295.8	(3a)
First floor	50.6	(1b)	x	2.76	(2b)	=	139.66	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	166.6	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	435.46	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.37	x1/[1/(1.4)+ 0.04]		=	3.14			(27)
Windows Type 2			2.03	x1/[1/(1.4)+ 0.04]		=	2.69			(27)
Windows Type 3			1.05	x1/[1/(1.4)+ 0.04]		=	1.39			(27)
Windows Type 4			8.44	x1/[1/(1.4)+ 0.04]		=	11.19			(27)
Windows Type 5			7.68	x1/[1/(1.4)+ 0.04]		=	10.18			(27)
Windows Type 6			2.11	x1/[1/(1.4)+ 0.04]		=	2.8			(27)
Windows Type 7			11.27	x1/[1/(1.4)+ 0.04]		=	14.94			(27)
Windows Type 8			4.28	x1/[1/(1.4)+ 0.04]		=	5.67			(27)
Windows Type 9			3.76	x1/[1/(1.4)+ 0.04]		=	4.98			(27)
Windows Type 10			11.27	x1/[1/(1.4)+ 0.04]		=	14.94			(27)
Rooflights			1.31	x1/[1/(1.1) + 0.04]		=	1.441			(27b)
Floor			116.16	x	0.065	=	7.5504			(28)
Walls Type1	29.73	14.22	15.51	x	0.18	=	2.79			(29)
Walls Type2	15.58	7.68	7.9	x	0.18	=	1.42			(29)
Walls Type3	22.89	12.58	10.31	x	0.18	=	1.86			(29)
Walls Type4	16.96	1.05	15.91	x	0.18	=	2.86			(29)
Walls Type5	12.56	0	12.56	x	0.18	=	2.26			(29)

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Walls Type6	26.16	11.27	14.89	x	0.18	=	2.68			(29)
Walls Type7	30.59	19.31	11.28	x	0.18	=	2.03			(29)
Walls Type8	39.55	0	39.55	x	0.09	=	3.56			(29)
Walls Type9	11.51	0	11.51	x	0.09	=	1.04			(29)
Roof Type1	50.6	2.62	47.98	x	0.13	=	6.24			(30)
Roof Type2	26.96	0	26.96	x	0.13	=	3.5			(30)
Total area of elements, m²			399.25							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	128.2	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		59.89	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	188.09	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.86	40.4	39.94	37.65	37.19	34.9	34.9	34.44	35.82	37.19	38.11	39.02	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	228.94	228.48	228.03	225.74	225.28	222.99	222.99	222.53	223.9	225.28	226.19	227.11	
									Average = Sum(39)$_{1…12}$ /12=			225.62	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.37	1.37	1.37	1.35	1.35	1.34	1.34	1.34	1.34	1.35	1.36	1.36	
									Average = Sum(40)$_{1…12}$ /12=			1.35	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.96 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 104.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	114.9	110.72	106.54	102.36	98.19	94.01	94.01	98.19	102.36	106.54	110.72	114.9	
									Total = Sum(44)$_{1…12}$ =			1253.43	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	170.39	149.02	153.78	134.07	128.64	111.01	102.87	118.04	119.45	139.21	151.96	165.01	
									Total = Sum(45)$_{1…12}$ =			1643.44	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.56	22.35	23.07	20.11	19.3	16.65	15.43	17.71	17.92	20.88	22.79	24.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = | 0 | (54)

Enter (50) or (54) in (55) | 0 | (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.96	49.32	50.03	46.36	47.91	50.03	49.32	50.96	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	221.35	195.05	204.74	183.38	178.68	157.37	150.77	168.07	168.76	190.17	201.27	215.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	221.35	195.05	204.74	183.38	178.68	157.37	150.77	168.07	168.76	190.17	201.27	215.97

Output from water heater (annual)$_{1...12}$ | 2235.58 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	69.39	61.06	63.87	56.91	55.28	48.5	46.18	51.76	52.05	59.03	62.85	67.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	(66)

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

(67)m=	30.14	26.77	21.77	16.48	12.32	10.4	11.24	14.61	19.61	24.9	29.06	30.98	(67)

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

(68)m=	338.07	341.57	332.73	313.91	290.16	267.83	252.91	249.41	258.25	277.07	300.82	323.15	(68)

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

(69)m=	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	(71)

Water heating gains (Table 5)

(72)m=	93.27	90.86	85.85	79.04	74.3	67.36	62.07	69.57	72.29	79.34	87.3	90.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	531.85	529.57	510.72	479.8	447.15	415.96	396.59	403.95	420.51	451.67	487.55	515.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	2.37	x	11.28	x	0.63	x	0.72	=	50.43	(75)
Northeast	0.9x	0.77	x	11.27	x	11.28	x	0.63	x	0.78	=	43.3	(75)
Northeast	0.9x	0.77	x	2.37	x	22.97	x	0.63	x	0.72	=	102.66	(75)
Northeast	0.9x	0.77	x	11.27	x	22.97	x	0.63	x	0.78	=	88.14	(75)
Northeast	0.9x	0.77	x	2.37	x	41.38	x	0.63	x	0.72	=	184.96	(75)
Northeast	0.9x	0.77	x	11.27	x	41.38	x	0.63	x	0.78	=	158.81	(75)
Northeast	0.9x	0.77	x	2.37	x	67.96	x	0.63	x	0.72	=	303.76	(75)
Northeast	0.9x	0.77	x	11.27	x	67.96	x	0.63	x	0.78	=	260.81	(75)
Northeast	0.9x	0.77	x	2.37	x	91.35	x	0.63	x	0.72	=	408.31	(75)
Northeast	0.9x	0.77	x	11.27	x	91.35	x	0.63	x	0.78	=	350.58	(75)
Northeast	0.9x	0.77	x	2.37	x	97.38	x	0.63	x	0.72	=	435.31	(75)
Northeast	0.9x	0.77	x	11.27	x	97.38	x	0.63	x	0.78	=	373.75	(75)
Northeast	0.9x	0.77	x	2.37	x	91.1	x	0.63	x	0.72	=	407.22	(75)
Northeast	0.9x	0.77	x	11.27	x	91.1	x	0.63	x	0.78	=	349.64	(75)
Northeast	0.9x	0.77	x	2.37	x	72.63	x	0.63	x	0.72	=	324.64	(75)
Northeast	0.9x	0.77	x	11.27	x	72.63	x	0.63	x	0.78	=	278.73	(75)
Northeast	0.9x	0.77	x	2.37	x	50.42	x	0.63	x	0.72	=	225.38	(75)
Northeast	0.9x	0.77	x	11.27	x	50.42	x	0.63	x	0.78	=	193.51	(75)
Northeast	0.9x	0.77	x	2.37	x	28.07	x	0.63	x	0.72	=	125.46	(75)
Northeast	0.9x	0.77	x	11.27	x	28.07	x	0.63	x	0.78	=	107.72	(75)
Northeast	0.9x	0.77	x	2.37	x	14.2	x	0.63	x	0.72	=	63.46	(75)
Northeast	0.9x	0.77	x	11.27	x	14.2	x	0.63	x	0.78	=	54.49	(75)
Northeast	0.9x	0.77	x	2.37	x	9.21	x	0.63	x	0.72	=	41.19	(75)
Northeast	0.9x	0.77	x	11.27	x	9.21	x	0.63	x	0.78	=	35.36	(75)
Southeast	0.9x	0.54	x	1.05	x	36.79	x	0.63	x	0.82	=	9.7	(77)
Southeast	0.9x	0.54	x	1.05	x	62.67	x	0.63	x	0.82	=	16.52	(77)

Southeast	0.9x	0.54	x	1.05	x	85.75	x	0.63	x	0.82	=	22.61	(77)
Southeast	0.9x	0.54	x	1.05	x	106.25	x	0.63	x	0.82	=	28.01	(77)
Southeast	0.9x	0.54	x	1.05	x	119.01	x	0.63	x	0.82	=	31.37	(77)
Southeast	0.9x	0.54	x	1.05	x	118.15	x	0.63	x	0.82	=	31.15	(77)
Southeast	0.9x	0.54	x	1.05	x	113.91	x	0.63	x	0.82	=	30.03	(77)
Southeast	0.9x	0.54	x	1.05	x	104.39	x	0.63	x	0.82	=	27.52	(77)
Southeast	0.9x	0.54	x	1.05	x	92.85	x	0.63	x	0.82	=	24.48	(77)
Southeast	0.9x	0.54	x	1.05	x	69.27	x	0.63	x	0.82	=	18.26	(77)
Southeast	0.9x	0.54	x	1.05	x	44.07	x	0.63	x	0.82	=	11.62	(77)
Southeast	0.9x	0.54	x	1.05	x	31.49	x	0.63	x	0.82	=	8.3	(77)
Southwest	0.9x	0.54	x	2.03	x	36.79		0.63	x	0.83	=	18.98	(79)
Southwest	0.9x	0.54	x	8.44	x	36.79		0.63	x	0.78	=	74.16	(79)
Southwest	0.9x	0.54	x	2.11	x	36.79		0.63	x	0.82	=	19.49	(79)
Southwest	0.9x	0.77	x	4.28	x	36.79		0.63	x	0.84	=	57.75	(79)
Southwest	0.9x	0.77	x	3.76	x	36.79		0.63	x	0.83	=	50.13	(79)
Southwest	0.9x	0.77	x	11.27	x	36.79		0.63	x	0.78	=	141.21	(79)
Southwest	0.9x	0.54	x	2.03	x	62.67		0.63	x	0.83	=	32.33	(79)
Southwest	0.9x	0.54	x	8.44	x	62.67		0.63	x	0.78	=	126.33	(79)
Southwest	0.9x	0.54	x	2.11	x	62.67		0.63	x	0.82	=	33.2	(79)
Southwest	0.9x	0.77	x	4.28	x	62.67		0.63	x	0.84	=	98.37	(79)
Southwest	0.9x	0.77	x	3.76	x	62.67		0.63	x	0.83	=	85.39	(79)
Southwest	0.9x	0.77	x	11.27	x	62.67		0.63	x	0.78	=	240.53	(79)
Southwest	0.9x	0.54	x	2.03	x	85.75		0.63	x	0.83	=	44.24	(79)
Southwest	0.9x	0.54	x	8.44	x	85.75		0.63	x	0.78	=	172.85	(79)
Southwest	0.9x	0.54	x	2.11	x	85.75		0.63	x	0.82	=	45.43	(79)
Southwest	0.9x	0.77	x	4.28	x	85.75		0.63	x	0.84	=	134.6	(79)
Southwest	0.9x	0.77	x	3.76	x	85.75		0.63	x	0.83	=	116.84	(79)
Southwest	0.9x	0.77	x	11.27	x	85.75		0.63	x	0.78	=	329.11	(79)
Southwest	0.9x	0.54	x	2.03	x	106.25		0.63	x	0.83	=	54.81	(79)
Southwest	0.9x	0.54	x	8.44	x	106.25		0.63	x	0.78	=	214.17	(79)
Southwest	0.9x	0.54	x	2.11	x	106.25		0.63	x	0.82	=	56.29	(79)
Southwest	0.9x	0.77	x	4.28	x	106.25		0.63	x	0.84	=	166.78	(79)
Southwest	0.9x	0.77	x	3.76	x	106.25		0.63	x	0.83	=	144.77	(79)
Southwest	0.9x	0.77	x	11.27	x	106.25		0.63	x	0.78	=	407.78	(79)
Southwest	0.9x	0.54	x	2.03	x	119.01		0.63	x	0.83	=	61.4	(79)
Southwest	0.9x	0.54	x	8.44	x	119.01		0.63	x	0.78	=	239.88	(79)
Southwest	0.9x	0.54	x	2.11	x	119.01		0.63	x	0.82	=	63.05	(79)
Southwest	0.9x	0.77	x	4.28	x	119.01		0.63	x	0.84	=	186.8	(79)
Southwest	0.9x	0.77	x	3.76	x	119.01		0.63	x	0.83	=	162.15	(79)
Southwest	0.9x	0.77	x	11.27	x	119.01		0.63	x	0.78	=	456.75	(79)
Southwest	0.9x	0.54	x	2.03	x	118.15		0.63	x	0.83	=	60.95	(79)

Southwest0.9x	0.54	x	8.44	x	118.15	0.63	x	0.78	=	238.15	(79)
Southwest0.9x	0.54	x	2.11	x	118.15	0.63	x	0.82	=	62.59	(79)
Southwest0.9x	0.77	x	4.28	x	118.15	0.63	x	0.84	=	185.45	(79)
Southwest0.9x	0.77	x	3.76	x	118.15	0.63	x	0.83	=	160.98	(79)
Southwest0.9x	0.77	x	11.27	x	118.15	0.63	x	0.78	=	453.45	(79)
Southwest0.9x	0.54	x	2.03	x	113.91	0.63	x	0.83	=	58.76	(79)
Southwest0.9x	0.54	x	8.44	x	113.91	0.63	x	0.78	=	229.6	(79)
Southwest0.9x	0.54	x	2.11	x	113.91	0.63	x	0.82	=	60.34	(79)
Southwest0.9x	0.77	x	4.28	x	113.91	0.63	x	0.84	=	178.8	(79)
Southwest0.9x	0.77	x	3.76	x	113.91	0.63	x	0.83	=	155.2	(79)
Southwest0.9x	0.77	x	11.27	x	113.91	0.63	x	0.78	=	437.17	(79)
Southwest0.9x	0.54	x	2.03	x	104.39	0.63	x	0.83	=	53.85	(79)
Southwest0.9x	0.54	x	8.44	x	104.39	0.63	x	0.78	=	210.41	(79)
Southwest0.9x	0.54	x	2.11	x	104.39	0.63	x	0.82	=	55.3	(79)
Southwest0.9x	0.77	x	4.28	x	104.39	0.63	x	0.84	=	163.85	(79)
Southwest0.9x	0.77	x	3.76	x	104.39	0.63	x	0.83	=	142.23	(79)
Southwest0.9x	0.77	x	11.27	x	104.39	0.63	x	0.78	=	400.64	(79)
Southwest0.9x	0.54	x	2.03	x	92.85	0.63	x	0.83	=	47.9	(79)
Southwest0.9x	0.54	x	8.44	x	92.85	0.63	x	0.78	=	187.16	(79)
Southwest0.9x	0.54	x	2.11	x	92.85	0.63	x	0.82	=	49.19	(79)
Southwest0.9x	0.77	x	4.28	x	92.85	0.63	x	0.84	=	145.74	(79)
Southwest0.9x	0.77	x	3.76	x	92.85	0.63	x	0.83	=	126.51	(79)
Southwest0.9x	0.77	x	11.27	x	92.85	0.63	x	0.78	=	356.36	(79)
Southwest0.9x	0.54	x	2.03	x	69.27	0.63	x	0.83	=	35.73	(79)
Southwest0.9x	0.54	x	8.44	x	69.27	0.63	x	0.78	=	139.62	(79)
Southwest0.9x	0.54	x	2.11	x	69.27	0.63	x	0.82	=	36.69	(79)
Southwest0.9x	0.77	x	4.28	x	69.27	0.63	x	0.84	=	108.72	(79)
Southwest0.9x	0.77	x	3.76	x	69.27	0.63	x	0.83	=	94.38	(79)
Southwest0.9x	0.77	x	11.27	x	69.27	0.63	x	0.78	=	265.84	(79)
Southwest0.9x	0.54	x	2.03	x	44.07	0.63	x	0.83	=	22.74	(79)
Southwest0.9x	0.54	x	8.44	x	44.07	0.63	x	0.78	=	88.83	(79)
Southwest0.9x	0.54	x	2.11	x	44.07	0.63	x	0.82	=	23.35	(79)
Southwest0.9x	0.77	x	4.28	x	44.07	0.63	x	0.84	=	69.17	(79)
Southwest0.9x	0.77	x	3.76	x	44.07	0.63	x	0.83	=	60.05	(79)
Southwest0.9x	0.77	x	11.27	x	44.07	0.63	x	0.78	=	169.14	(79)
Southwest0.9x	0.54	x	2.03	x	31.49	0.63	x	0.83	=	16.24	(79)
Southwest0.9x	0.54	x	8.44	x	31.49	0.63	x	0.78	=	63.47	(79)
Southwest0.9x	0.54	x	2.11	x	31.49	0.63	x	0.82	=	16.68	(79)
Southwest0.9x	0.77	x	4.28	x	31.49	0.63	x	0.84	=	49.42	(79)
Southwest0.9x	0.77	x	3.76	x	31.49	0.63	x	0.83	=	42.9	(79)
Southwest0.9x	0.77	x	11.27	x	31.49	0.63	x	0.78	=	120.85	(79)

Northwest	0.9x	0.54	x	7.68	x	11.28	x	0.63	x	0.91	=	24.14	(81)
Northwest	0.9x	0.54	x	7.68	x	22.97	x	0.63	x	0.91	=	49.14	(81)
Northwest	0.9x	0.54	x	7.68	x	41.38	x	0.63	x	0.91	=	88.54	(81)
Northwest	0.9x	0.54	x	7.68	x	67.96	x	0.63	x	0.91	=	145.41	(81)
Northwest	0.9x	0.54	x	7.68	x	91.35	x	0.63	x	0.91	=	195.46	(81)
Northwest	0.9x	0.54	x	7.68	x	97.38	x	0.63	x	0.91	=	208.39	(81)
Northwest	0.9x	0.54	x	7.68	x	91.1	x	0.63	x	0.91	=	194.94	(81)
Northwest	0.9x	0.54	x	7.68	x	72.63	x	0.63	x	0.91	=	155.41	(81)
Northwest	0.9x	0.54	x	7.68	x	50.42	x	0.63	x	0.91	=	107.89	(81)
Northwest	0.9x	0.54	x	7.68	x	28.07	x	0.63	x	0.91	=	60.06	(81)
Northwest	0.9x	0.54	x	7.68	x	14.2	x	0.63	x	0.91	=	30.38	(81)
Northwest	0.9x	0.54	x	7.68	x	9.21	x	0.63	x	0.91	=	19.72	(81)
Rooflights	0.9x	1	x	1.31	x	37.03	x	0.63	x	0.83	=	45.66	(82)
Rooflights	0.9x	1	x	1.31	x	70.28	x	0.63	x	0.83	=	86.66	(82)
Rooflights	0.9x	1	x	1.31	x	111.87	x	0.63	x	0.83	=	137.94	(82)
Rooflights	0.9x	1	x	1.31	x	159.33	x	0.63	x	0.83	=	196.45	(82)
Rooflights	0.9x	1	x	1.31	x	193.3	x	0.63	x	0.83	=	238.34	(82)
Rooflights	0.9x	1	x	1.31	x	197.35	x	0.63	x	0.83	=	243.33	(82)
Rooflights	0.9x	1	x	1.31	x	188.08	x	0.63	x	0.83	=	231.9	(82)
Rooflights	0.9x	1	x	1.31	x	162.62	x	0.63	x	0.83	=	200.5	(82)
Rooflights	0.9x	1	x	1.31	x	128.66	x	0.63	x	0.83	=	158.64	(82)
Rooflights	0.9x	1	x	1.31	x	82.24	x	0.63	x	0.83	=	101.41	(82)
Rooflights	0.9x	1	x	1.31	x	45.75	x	0.63	x	0.83	=	56.41	(82)
Rooflights	0.9x	1	x	1.31	x	30.74	x	0.63	x	0.83	=	37.91	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	534.97	959.29	1435.92	1979.03	2394.1	2453.49	2333.6	2013.1	1622.76	1093.9	649.62	452.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1066.82	1488.87	1946.64	2458.83	2841.25	2869.45	2730.19	2417.05	2043.26	1545.56	1137.17	967.41	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.86	0.68	0.49	0.36	0.42	0.69	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.51	19.8	20.22	20.66	20.9	20.98	21	20.99	20.92	20.52	19.91	19.45	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.78	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.98	0.94	0.82	0.61	0.4	0.26	0.31	0.59	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.81	18.25	18.84	19.44	19.72	19.8	19.81	19.81	19.76	19.27	18.41	17.74	(90)

fLA = Living area ÷ (4) = 0.21 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.17	18.58	19.13	19.69	19.97	20.05	20.06	20.06	20	19.54	18.72	18.1	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.17	18.58	19.13	19.69	19.97	20.05	20.06	20.06	20	19.54	18.72	18.1	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.81	0.62	0.42	0.28	0.34	0.61	0.91	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1060.77	1457.89	1817.61	1995.74	1752.56	1199.93	769.52	810.21	1247.21	1399.09	1120.97	963.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	3175.61	3125.03	2879.99	2436.56	1862.85	1215.26	771.5	814.41	1321.38	2012.87	2628.95	3157.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1573.45	1120.32	790.41	317.39	82.06	0	0	0	0	456.65	1085.75	1632.46	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 7058.48 (98)

Space heating requirement in kWh/m²/year 42.37 (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	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	2096.09	1650.11	1691.23	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.96	0.98	0.96	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	2006.03	1613.5	1629.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	3511.24	3344.07	2976.38	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1083.75	1287.54	1001.75	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 3373.04 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.78 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	211.42	251.17	195.42	0	0	0	0

Total = Sum(107)$_{6...8}$ = 658.01 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 3.95 (108)

DER WorkSheet: New dwelling design stage

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		95.8	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		6.05	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	1573.45	1120.32	790.41	317.39	82.06	0	0	0	0	456.65	1085.75	1632.46		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1642.43	1169.43	825.07	331.31	85.66	0	0	0	0	476.67	1133.35	1704.02		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													7367.93	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	221.35	195.05	204.74	183.38	178.68	157.37	150.77	168.07	168.76	190.17	201.27	215.97		
Efficiency of water heater													86.5	(216)
(217)m=	94.55	94.3	93.73	92.17	89.23	86.5	86.5	86.5	86.5	92.86	94.22	94.61		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	234.12	206.85	218.44	198.96	200.25	181.93	174.3	194.31	195.1	204.78	213.63	228.27		
Total = Sum(219a)$_{1...12}$ =													2450.93	(219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
(221)m=	0	0	0	0	0	34.96	41.53	32.31	0	0	0	0		
Total = Sum(221)$_{6...8}$ =													108.8	(221)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			7367.93	
Water heating fuel used			2450.93	
Space cooling fuel used			108.8	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		453.69		(230a)
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		528.69	(231)
Electricity for lighting			532.26	(232)

DER WorkSheet: New dwelling design stage

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1591.47	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	529.4	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2120.88	(265)
Space cooling	(221)	x	0.519	=	56.47	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	274.39	(267)
Electricity for lighting	(232)	x	0.519	=	276.24	(268)
Total CO2, kg/year			sum of (265)…(271) =		2727.98	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		16.37	(273)
EI rating (section 14)					83	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.7

Property Address: Charlotte Street - Green

Address : 77-79 Charlotte Street, London, W1

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	116	(1a)	x	2.55	(2a)	=	295.8	(3a)
First floor	50.6	(1b)	x	2.76	(2b)	=	139.66	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	166.6	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	435.46	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	75.65	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.37	x1/[1/(1.4)+ 0.04]		=	3.14			(27)
Windows Type 2			2.03	x1/[1/(1.4)+ 0.04]		=	2.69			(27)
Windows Type 3			1.05	x1/[1/(1.4)+ 0.04]		=	1.39			(27)
Windows Type 4			8.44	x1/[1/(1.4)+ 0.04]		=	11.19			(27)
Windows Type 5			7.68	x1/[1/(1.4)+ 0.04]		=	10.18			(27)
Windows Type 6			2.11	x1/[1/(1.4)+ 0.04]		=	2.8			(27)
Windows Type 7			11.27	x1/[1/(1.4)+ 0.04]		=	14.94			(27)
Windows Type 8			4.28	x1/[1/(1.4)+ 0.04]		=	5.67			(27)
Windows Type 9			3.76	x1/[1/(1.4)+ 0.04]		=	4.98			(27)
Windows Type 10			11.27	x1/[1/(1.4)+ 0.04]		=	14.94			(27)
Rooflights			1.31	x1/[1/(1.1) + 0.04]		=	1.441			(27b)
Floor			116.16	x	0.065	=	7.5504			(28)
Walls Type1	29.73	14.22	15.51	x	0.18	=	2.79			(29)
Walls Type2	15.58	7.68	7.9	x	0.18	=	1.42			(29)
Walls Type3	22.89	12.58	10.31	x	0.18	=	1.86			(29)
Walls Type4	16.96	1.05	15.91	x	0.18	=	2.86			(29)
Walls Type5	12.56	0	12.56	x	0.18	=	2.26			(29)

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Walls Type6	26.16	11.27	14.89	x	0.18	=	2.68				(29)
Walls Type7	30.59	19.31	11.28	x	0.18	=	2.03				(29)
Walls Type8	39.55	0	39.55	x	0.09	=	3.56				(29)
Walls Type9	11.51	0	11.51	x	0.09	=	1.04				(29)
Roof Type1	50.6	2.62	47.98	x	0.13	=	6.24				(30)
Roof Type2	26.96	0	26.96	x	0.13	=	3.5				(30)
Total area of elements, m²			399.25								(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	128.2	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		59.89	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	188.09	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.86	40.4	39.94	37.65	37.19	34.9	34.9	34.44	35.82	37.19	38.11	39.02	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	228.94	228.48	228.03	225.74	225.28	222.99	222.99	222.53	223.9	225.28	226.19	227.11	
									Average = Sum(39)$_{1\ldots12}$ /12=			225.62	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.37	1.37	1.37	1.35	1.35	1.34	1.34	1.34	1.34	1.35	1.36	1.36	
									Average = Sum(40)$_{1\ldots12}$ /12=			1.35	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	2.96	(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	104.45	(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	114.9	110.72	106.54	102.36	98.19	94.01	94.01	98.19	102.36	106.54	110.72	114.9	
									Total = Sum(44)$_{1\ldots12}$ =			1253.43	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	170.39	149.02	153.78	134.07	128.64	111.01	102.87	118.04	119.45	139.21	151.96	165.01	
									Total = Sum(45)$_{1\ldots12}$ =			1643.44	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.56	22.35	23.07	20.11	19.3	16.65	15.43	17.71	17.92	20.88	22.79	24.75	(46)

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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	200	(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		0.21	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.11	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.11	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	3.52	3.18	3.52	3.4	3.52	3.4	3.52	3.52	3.4	3.52	3.4	3.52	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	3.52	3.18	3.52	3.4	3.52	3.4	3.52	3.52	3.4	3.52	3.4	3.52	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	197.17	173.21	180.56	159.98	155.42	114.41	106.38	121.56	122.85	165.98	177.87	191.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	197.17	173.21	180.56	159.98	155.42	0	0	0	0	165.98	177.87	191.79

Output from water heater (annual)$_{1\ldots12}$ | 1401.98 | (64)

Output immersion

(64)m=	0	0	0	0	0	114.41	106.38	121.56	122.85	0	0	0

Output from immersion (annual)$_{1\ldots12}$ | 465.197923736983 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.08	68.9	72.55	65.31	64.2	39.63	37.02	42.06	42.44	67.71	71.26	76.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	147.9	(66)

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

(67)m=	30.14	26.77	21.77	16.48	12.32	10.4	11.24	14.61	19.61	24.9	29.06	30.98	(67)

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

(68)m=	338.07	341.57	332.73	313.91	290.16	267.83	252.91	249.41	258.25	277.07	300.82	323.15	(68)

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

(69)m=	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	37.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	-118.32	(71)

Water heating gains (Table 5)

(72)m=	104.94	102.53	97.52	90.71	86.28	55.04	49.75	56.53	58.94	91.01	98.97	102.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	540.52	538.24	519.39	488.47	456.13	400.64	381.27	387.92	404.17	460.34	496.22	524.04	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	2.37	x	11.28	x	0.63	x	0.72	=	50.43	(75)
Northeast 0.9x	0.77	x	11.27	x	11.28	x	0.63	x	0.78	=	43.3	(75)
Northeast 0.9x	0.77	x	2.37	x	22.97	x	0.63	x	0.72	=	102.66	(75)
Northeast 0.9x	0.77	x	11.27	x	22.97	x	0.63	x	0.78	=	88.14	(75)
Northeast 0.9x	0.77	x	2.37	x	41.38	x	0.63	x	0.72	=	184.96	(75)
Northeast 0.9x	0.77	x	11.27	x	41.38	x	0.63	x	0.78	=	158.81	(75)
Northeast 0.9x	0.77	x	2.37	x	67.96	x	0.63	x	0.72	=	303.76	(75)
Northeast 0.9x	0.77	x	11.27	x	67.96	x	0.63	x	0.78	=	260.81	(75)
Northeast 0.9x	0.77	x	2.37	x	91.35	x	0.63	x	0.72	=	408.31	(75)
Northeast 0.9x	0.77	x	11.27	x	91.35	x	0.63	x	0.78	=	350.58	(75)
Northeast 0.9x	0.77	x	2.37	x	97.38	x	0.63	x	0.72	=	435.31	(75)
Northeast 0.9x	0.77	x	11.27	x	97.38	x	0.63	x	0.78	=	373.75	(75)
Northeast 0.9x	0.77	x	2.37	x	91.1	x	0.63	x	0.72	=	407.22	(75)
Northeast 0.9x	0.77	x	11.27	x	91.1	x	0.63	x	0.78	=	349.64	(75)
Northeast 0.9x	0.77	x	2.37	x	72.63	x	0.63	x	0.72	=	324.64	(75)
Northeast 0.9x	0.77	x	11.27	x	72.63	x	0.63	x	0.78	=	278.73	(75)
Northeast 0.9x	0.77	x	2.37	x	50.42	x	0.63	x	0.72	=	225.38	(75)
Northeast 0.9x	0.77	x	11.27	x	50.42	x	0.63	x	0.78	=	193.51	(75)
Northeast 0.9x	0.77	x	2.37	x	28.07	x	0.63	x	0.72	=	125.46	(75)
Northeast 0.9x	0.77	x	11.27	x	28.07	x	0.63	x	0.78	=	107.72	(75)
Northeast 0.9x	0.77	x	2.37	x	14.2	x	0.63	x	0.72	=	63.46	(75)
Northeast 0.9x	0.77	x	11.27	x	14.2	x	0.63	x	0.78	=	54.49	(75)

Northeast	0.9x	0.77	x	2.37	x	9.21	x	0.63	x	0.72	=	41.19	(75)
Northeast	0.9x	0.77	x	11.27	x	9.21	x	0.63	x	0.78	=	35.36	(75)
Southeast	0.9x	0.54	x	1.05	x	36.79	x	0.63	x	0.82	=	9.7	(77)
Southeast	0.9x	0.54	x	1.05	x	62.67	x	0.63	x	0.82	=	16.52	(77)
Southeast	0.9x	0.54	x	1.05	x	85.75	x	0.63	x	0.82	=	22.61	(77)
Southeast	0.9x	0.54	x	1.05	x	106.25	x	0.63	x	0.82	=	28.01	(77)
Southeast	0.9x	0.54	x	1.05	x	119.01	x	0.63	x	0.82	=	31.37	(77)
Southeast	0.9x	0.54	x	1.05	x	118.15	x	0.63	x	0.82	=	31.15	(77)
Southeast	0.9x	0.54	x	1.05	x	113.91	x	0.63	x	0.82	=	30.03	(77)
Southeast	0.9x	0.54	x	1.05	x	104.39	x	0.63	x	0.82	=	27.52	(77)
Southeast	0.9x	0.54	x	1.05	x	92.85	x	0.63	x	0.82	=	24.48	(77)
Southeast	0.9x	0.54	x	1.05	x	69.27	x	0.63	x	0.82	=	18.26	(77)
Southeast	0.9x	0.54	x	1.05	x	44.07	x	0.63	x	0.82	=	11.62	(77)
Southeast	0.9x	0.54	x	1.05	x	31.49	x	0.63	x	0.82	=	8.3	(77)
Southwest	0.9x	0.54	x	2.03	x	36.79		0.63	x	0.83	=	18.98	(79)
Southwest	0.9x	0.54	x	8.44	x	36.79		0.63	x	0.78	=	74.16	(79)
Southwest	0.9x	0.54	x	2.11	x	36.79		0.63	x	0.82	=	19.49	(79)
Southwest	0.9x	0.77	x	4.28	x	36.79		0.63	x	0.84	=	57.75	(79)
Southwest	0.9x	0.77	x	3.76	x	36.79		0.63	x	0.83	=	50.13	(79)
Southwest	0.9x	0.77	x	11.27	x	36.79		0.63	x	0.78	=	141.21	(79)
Southwest	0.9x	0.54	x	2.03	x	62.67		0.63	x	0.83	=	32.33	(79)
Southwest	0.9x	0.54	x	8.44	x	62.67		0.63	x	0.78	=	126.33	(79)
Southwest	0.9x	0.54	x	2.11	x	62.67		0.63	x	0.82	=	33.2	(79)
Southwest	0.9x	0.77	x	4.28	x	62.67		0.63	x	0.84	=	98.37	(79)
Southwest	0.9x	0.77	x	3.76	x	62.67		0.63	x	0.83	=	85.39	(79)
Southwest	0.9x	0.77	x	11.27	x	62.67		0.63	x	0.78	=	240.53	(79)
Southwest	0.9x	0.54	x	2.03	x	85.75		0.63	x	0.83	=	44.24	(79)
Southwest	0.9x	0.54	x	8.44	x	85.75		0.63	x	0.78	=	172.85	(79)
Southwest	0.9x	0.54	x	2.11	x	85.75		0.63	x	0.82	=	45.43	(79)
Southwest	0.9x	0.77	x	4.28	x	85.75		0.63	x	0.84	=	134.6	(79)
Southwest	0.9x	0.77	x	3.76	x	85.75		0.63	x	0.83	=	116.84	(79)
Southwest	0.9x	0.77	x	11.27	x	85.75		0.63	x	0.78	=	329.11	(79)
Southwest	0.9x	0.54	x	2.03	x	106.25		0.63	x	0.83	=	54.81	(79)
Southwest	0.9x	0.54	x	8.44	x	106.25		0.63	x	0.78	=	214.17	(79)
Southwest	0.9x	0.54	x	2.11	x	106.25		0.63	x	0.82	=	56.29	(79)
Southwest	0.9x	0.77	x	4.28	x	106.25		0.63	x	0.84	=	166.78	(79)
Southwest	0.9x	0.77	x	3.76	x	106.25		0.63	x	0.83	=	144.77	(79)
Southwest	0.9x	0.77	x	11.27	x	106.25		0.63	x	0.78	=	407.78	(79)
Southwest	0.9x	0.54	x	2.03	x	119.01		0.63	x	0.83	=	61.4	(79)
Southwest	0.9x	0.54	x	8.44	x	119.01		0.63	x	0.78	=	239.88	(79)
Southwest	0.9x	0.54	x	2.11	x	119.01		0.63	x	0.82	=	63.05	(79)

Southwest0.9x	0.77	x	4.28	x	119.01	0.63	x	0.84	=	186.8	(79)
Southwest0.9x	0.77	x	3.76	x	119.01	0.63	x	0.83	=	162.15	(79)
Southwest0.9x	0.77	x	11.27	x	119.01	0.63	x	0.78	=	456.75	(79)
Southwest0.9x	0.54	x	2.03	x	118.15	0.63	x	0.83	=	60.95	(79)
Southwest0.9x	0.54	x	8.44	x	118.15	0.63	x	0.78	=	238.15	(79)
Southwest0.9x	0.54	x	2.11	x	118.15	0.63	x	0.82	=	62.59	(79)
Southwest0.9x	0.77	x	4.28	x	118.15	0.63	x	0.84	=	185.45	(79)
Southwest0.9x	0.77	x	3.76	x	118.15	0.63	x	0.83	=	160.98	(79)
Southwest0.9x	0.77	x	11.27	x	118.15	0.63	x	0.78	=	453.45	(79)
Southwest0.9x	0.54	x	2.03	x	113.91	0.63	x	0.83	=	58.76	(79)
Southwest0.9x	0.54	x	8.44	x	113.91	0.63	x	0.78	=	229.6	(79)
Southwest0.9x	0.54	x	2.11	x	113.91	0.63	x	0.82	=	60.34	(79)
Southwest0.9x	0.77	x	4.28	x	113.91	0.63	x	0.84	=	178.8	(79)
Southwest0.9x	0.77	x	3.76	x	113.91	0.63	x	0.83	=	155.2	(79)
Southwest0.9x	0.77	x	11.27	x	113.91	0.63	x	0.78	=	437.17	(79)
Southwest0.9x	0.54	x	2.03	x	104.39	0.63	x	0.83	=	53.85	(79)
Southwest0.9x	0.54	x	8.44	x	104.39	0.63	x	0.78	=	210.41	(79)
Southwest0.9x	0.54	x	2.11	x	104.39	0.63	x	0.82	=	55.3	(79)
Southwest0.9x	0.77	x	4.28	x	104.39	0.63	x	0.84	=	163.85	(79)
Southwest0.9x	0.77	x	3.76	x	104.39	0.63	x	0.83	=	142.23	(79)
Southwest0.9x	0.77	x	11.27	x	104.39	0.63	x	0.78	=	400.64	(79)
Southwest0.9x	0.54	x	2.03	x	92.85	0.63	x	0.83	=	47.9	(79)
Southwest0.9x	0.54	x	8.44	x	92.85	0.63	x	0.78	=	187.16	(79)
Southwest0.9x	0.54	x	2.11	x	92.85	0.63	x	0.82	=	49.19	(79)
Southwest0.9x	0.77	x	4.28	x	92.85	0.63	x	0.84	=	145.74	(79)
Southwest0.9x	0.77	x	3.76	x	92.85	0.63	x	0.83	=	126.51	(79)
Southwest0.9x	0.77	x	11.27	x	92.85	0.63	x	0.78	=	356.36	(79)
Southwest0.9x	0.54	x	2.03	x	69.27	0.63	x	0.83	=	35.73	(79)
Southwest0.9x	0.54	x	8.44	x	69.27	0.63	x	0.78	=	139.62	(79)
Southwest0.9x	0.54	x	2.11	x	69.27	0.63	x	0.82	=	36.69	(79)
Southwest0.9x	0.77	x	4.28	x	69.27	0.63	x	0.84	=	108.72	(79)
Southwest0.9x	0.77	x	3.76	x	69.27	0.63	x	0.83	=	94.38	(79)
Southwest0.9x	0.77	x	11.27	x	69.27	0.63	x	0.78	=	265.84	(79)
Southwest0.9x	0.54	x	2.03	x	44.07	0.63	x	0.83	=	22.74	(79)
Southwest0.9x	0.54	x	8.44	x	44.07	0.63	x	0.78	=	88.83	(79)
Southwest0.9x	0.54	x	2.11	x	44.07	0.63	x	0.82	=	23.35	(79)
Southwest0.9x	0.77	x	4.28	x	44.07	0.63	x	0.84	=	69.17	(79)
Southwest0.9x	0.77	x	3.76	x	44.07	0.63	x	0.83	=	60.05	(79)
Southwest0.9x	0.77	x	11.27	x	44.07	0.63	x	0.78	=	169.14	(79)
Southwest0.9x	0.54	x	2.03	x	31.49	0.63	x	0.83	=	16.24	(79)
Southwest0.9x	0.54	x	8.44	x	31.49	0.63	x	0.78	=	63.47	(79)

Southwest	0.9x	0.54	x	2.11	x	31.49		0.63	x	0.82	=	16.68	(79)
Southwest	0.9x	0.77	x	4.28	x	31.49		0.63	x	0.84	=	49.42	(79)
Southwest	0.9x	0.77	x	3.76	x	31.49		0.63	x	0.83	=	42.9	(79)
Southwest	0.9x	0.77	x	11.27	x	31.49		0.63	x	0.78	=	120.85	(79)
Northwest	0.9x	0.54	x	7.68	x	11.28	x	0.63	x	0.91	=	24.14	(81)
Northwest	0.9x	0.54	x	7.68	x	22.97	x	0.63	x	0.91	=	49.14	(81)
Northwest	0.9x	0.54	x	7.68	x	41.38	x	0.63	x	0.91	=	88.54	(81)
Northwest	0.9x	0.54	x	7.68	x	67.96	x	0.63	x	0.91	=	145.41	(81)
Northwest	0.9x	0.54	x	7.68	x	91.35	x	0.63	x	0.91	=	195.46	(81)
Northwest	0.9x	0.54	x	7.68	x	97.38	x	0.63	x	0.91	=	208.39	(81)
Northwest	0.9x	0.54	x	7.68	x	91.1	x	0.63	x	0.91	=	194.94	(81)
Northwest	0.9x	0.54	x	7.68	x	72.63	x	0.63	x	0.91	=	155.41	(81)
Northwest	0.9x	0.54	x	7.68	x	50.42	x	0.63	x	0.91	=	107.89	(81)
Northwest	0.9x	0.54	x	7.68	x	28.07	x	0.63	x	0.91	=	60.06	(81)
Northwest	0.9x	0.54	x	7.68	x	14.2	x	0.63	x	0.91	=	30.38	(81)
Northwest	0.9x	0.54	x	7.68	x	9.21	x	0.63	x	0.91	=	19.72	(81)
Rooflights	0.9x	1	x	1.31	x	37.03	x	0.63	x	0.83	=	45.66	(82)
Rooflights	0.9x	1	x	1.31	x	70.28	x	0.63	x	0.83	=	86.66	(82)
Rooflights	0.9x	1	x	1.31	x	111.87	x	0.63	x	0.83	=	137.94	(82)
Rooflights	0.9x	1	x	1.31	x	159.33	x	0.63	x	0.83	=	196.45	(82)
Rooflights	0.9x	1	x	1.31	x	193.3	x	0.63	x	0.83	=	238.34	(82)
Rooflights	0.9x	1	x	1.31	x	197.35	x	0.63	x	0.83	=	243.33	(82)
Rooflights	0.9x	1	x	1.31	x	188.08	x	0.63	x	0.83	=	231.9	(82)
Rooflights	0.9x	1	x	1.31	x	162.62	x	0.63	x	0.83	=	200.5	(82)
Rooflights	0.9x	1	x	1.31	x	128.66	x	0.63	x	0.83	=	158.64	(82)
Rooflights	0.9x	1	x	1.31	x	82.24	x	0.63	x	0.83	=	101.41	(82)
Rooflights	0.9x	1	x	1.31	x	45.75	x	0.63	x	0.83	=	56.41	(82)
Rooflights	0.9x	1	x	1.31	x	30.74	x	0.63	x	0.83	=	37.91	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	534.97	959.29	1435.92	1979.03	2394.1	2453.49	2333.6	2013.1	1622.76	1093.9	649.62	452.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1075.49	1497.54	1955.31	2467.5	2850.23	2854.13	2714.87	2401.02	2026.92	1554.23	1145.84	976.08	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.85	0.67	0.49	0.36	0.42	0.69	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.78	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(88)

DER WorkSheet: New dwelling design stage

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	1	0.98	0.94	0.81	0.61	0.4	0.26	0.32	0.6	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	19.78	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(90)

fLA = Living area ÷ (4) = 0.21 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	20.04	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	20.04	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.95	0.82	0.62	0.42	0.28	0.34	0.62	0.92	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1071.65	1475.52	1849.47	2031.83	1767.89	1202.03	769.83	810.82	1254.88	1426.91	1134.65	973.78	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	3603.46	3459.55	3088.15	2517.26	1881.75	1217.83	771.86	815.15	1334.04	2129.56	2929.14	3598.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1883.67	1333.27	921.58	349.51	84.71	0	0	0	0	522.77	1292.03	1953.06	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 8340.6 (98)

Space heating requirement in kWh/m²/year 50.06 (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	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	2096.09	1650.11	1691.23	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.96	0.98	0.96	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	2004.97	1613.01	1629.02	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	3498.92	3331.75	2963.34	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1075.65	1278.75	992.74	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 3347.13 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.78 (105)

Intermittency factor (Table 10b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

DER WorkSheet: New dwelling design stage

Space cooling requirement for month = (104)m × (105) × (106)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(107)m=	0	0	0	0	0	209.83	249.46	193.66	0	0	0	0

Total = Sum(107)$_{6..8}$ = 652.95 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 3.92 (108)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		407.16	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		6.05	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	1883.67	1333.27	921.58	349.51	84.71	0	0	0	0	522.77	1292.03	1953.06		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	462.64	327.46	226.34	85.84	20.81	0	0	0	0	128.4	317.33	479.68		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2048.5	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	197.17	173.21	180.56	159.98	155.42	0	0	0	0	165.98	177.87	191.79		
Efficiency of water heater													183.44	(216)
(217)m=	183.44	183.44	183.44	183.44	183.44	183.44	183.44	183.44	183.44	183.44	183.44	183.44		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	107.48	94.42	98.43	87.21	84.72	0	0	0	0	90.48	96.96	104.55		
Total = Sum(219a)$_{1...12}$ =													764.25	(219)
Water heating requirement (immersion)	0	0	0	0	0	114.41	106.38	121.56	122.85	0	0	0		
Efficiency of water heater (Immersion)													100	(216)
(217)m=	0	0	0	0	0	100	100	100	100	0	0	0		(217)
Fuel for water heating (Immersion), kWh/month (219)m = [(64)m + (218) m] x 100 ÷ (217)m														
(219)m=	0	0	0	0	0	114.41	106.38	121.56	122.85	0	0	0		
Total = Sum(219a)$_{1...12}$ =													465.2	(219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
(221)m=	0	0	0	0	0	34.69	41.25	32.02	0	0	0	0		
Total = Sum(221)$_{6...8}$ =													107.96	(221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2048.5

DER WorkSheet: New dwelling design stage

Water heating fuel used		764.25	
Water heating fuel used (Immersion)		465.2	
Space cooling fuel used		107.96	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	453.69		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		453.69	(231)
Electricity for lighting		532.26	(232)
Electricity generated by PVs		-263.47	(233)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	1063.17	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	396.65	(264)
Water heating (Immersion)	(219)	x	0.519	=	241.44	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1701.25	(265)
Space cooling	(221)	x	0.519	=	56.03	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	235.47	(267)
Electricity for lighting	(232)	x	0.519	=	276.24	(268)
Energy saving/generation technologies Item 1			0.519	=	-136.74	(269)
Total CO2, kg/year			sum of (265)…(271) =		2132.25	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		12.8	(273)
EI rating (section 14)					86	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.7
Printed on 28 July 2017 at 11:16:31

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 166.6m²

Site Reference : 77-79 Charlotte Street

Plot Reference: Charlotte Street - Green

Address : 77-79 Charlotte Street, London, W1

Client Details:

Name:

Address :

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 system: Electricity
Fuel factor: 1.47 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.05 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.80 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	61.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.06 (max. 0.25)	0.06 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
Daikin Altherma ERLQ006CAV3 + EHBH08CB3V

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 0.21 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	OK
Primary pipework insulated:	Yes	OK

Regulations Compliance Report

6 Controls

Space heating controls	Programmer and at least two room thermostats	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.61	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Thames valley):	Medium	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	14.22m²	
Windows facing: South West	2.03m²	
Windows facing: South East	1.05m²	
Windows facing: South West	8.44m²	
Windows facing: North West	7.68m²	
Windows facing: South West	2.11m²	
Windows facing: North East	11.27m²	
Windows facing: South West	4.28m²	
Windows facing: South West	3.76m²	
Windows facing: South West	11.27m²	
Roof windows facing: South West	2.62m²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	

DRAFT

10 Key features

Air permeablility	3.0 m³/m²h
External Walls U-value	0.09 W/m²K
Floors U-value	0.06 W/m²K
Photovoltaic array	
Fixed cooling system	

Date Created: July 2017

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