5385

12<sup>th</sup> December 2016



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Dear Sir/Madam

# 44 Gloucester Avenue Block E Full Planning Application – Energy and Sustainability Measures

We write to inform you of the Energy and Sustainability measures which have been adopted within the proposed Block E, 44A Gloucester Avenue development, to meet the sustainability and energy requirements set by the London Borough of Camden (LBC).

Block E 44A Gloucester Avenue, is part of the wider 44 Gloucester Avenue (Application Ref. 2015/1243/P) development which was granted full planning permission by LBC, subject to S016 Agreement, on 30th November 2015.

The Permitted wider 44 Gloucester Avenue development comprises of:

"Demolition of existing buildings identified as Number 2 at the northwest corner of the site and Number 4 at the eastern corner of the site to provide a new ground plus 5 upper storey building along the north west part of the site and a ground plus 2 storey building at the eastern corner and refurbishment of existing building on site to create 40 residential units, employment floor area (Class B1a), car parking and landscaping within the courtyard with ancillary works."

The Permitted development includes the refurbishment of the existing Block E to provide a two storey residential dwelling. However, this proposal seeks permissions for;

- Extension at the rear of the property;
- Roof extension;
- Refurbishment and;
- Amended basement design to the basement approved under Ref: 2015/1243/P

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metropolis architectural studio Ilp Registered in England No OC325242 metropolis green Ilp Registered in England No OC331434 **partners and directors** Greg Cooper DiP TP DiP UD MRTPI Paul O'Neill MA (Hons) MRTPI Miranda Pennington BA

The existing building at 44A Gloucester Avenue is a two storey, over basement, detached dwelling, facing onto Gloucester Avenue. It is built of stock brick, however the front elevation appears to have later been stuccoed and painted. The aesthetic of this building is completely different to the rest of the site, and the majority of the surrounding area.

As the proposed development is part of the wider 44 Gloucester Avenue development, all energy and sustainability methods and measures incorporated within the Permitted scheme have been incorporated into the proposed Block E design and construction.

# Policy Requirements

This letter confirms the sustainability and energy measures adopted by the proposed development to address the policy requirements set at national, regional and local level, which are as follows:

- The National Planning Policy Framework, March 2012
- The Building Regulations, Approved Document Part L2A and L2B, 2013 Editions
- London Borough of Camden Core Strategy, Adopted November 2010
- London Borough of Camden Development Policies, Adopted November 2010

# Sustainability Measures

Sustainable development is the core principle underpinning planning, and has a key role to play in the creation of sustainable communities. In order to ensure the implementation of sustainable development 44 Gloucester Avenue development has introduced measures which satisfy the aims and objectives of LB Camden's strategic policies scheme, and the assessment criteria within the BREEAM Domestic Refurbishment scheme.

The measures have been approved by LBC, and are established within the Sustainability Statement prepared by XCO2 (October 2015) and the S106 Sustainability Plan prepared by Metropolis Green (October 2016), appended to this letter.

The table below shows the sustainability measures to be introduced into the proposed Block E development.

	Sustainability Commitments
Phase ility	A Construction Management Plan can be prepared to outline the management of the impacts arising from demolition and construction processes.
struction ustainabi	A Site Waste Management Plan (SWMP) can be prepared to outline the best practice commitments and procedures for sorting, reusing, recycling and diverting waste from landfill, as required by CPG3 criteria.
Cons	To prevent pollution, prevention measures and following best practice guidance will be adopted, as required by the Mayor's SPG.

	Sustainability Commitments
	The contractor will operate under the Considerate Constructors Scheme's Code of Considerate Practice (CCP) and will be required to achieve a score representing beyond best practice. Construction site impacts (energy and water consumption and the use of site timber) will be monitored and reported, to enable the site to be managed in a manner that mitigates environmental impacts.
	The London Plan's energy hierarchy has been applied to the development to ensure the improvement of Dwelling Emission Rate (DER) over Target Emission Rate (TER), when calculated according to Building Regulations. The design and specification is for high quality construction standards, high quality windows, energy efficient pumps, fans and ventilation equipment, high levels of insulation, individual gas fired boiler. To meet the requirements of Building Regulation's Part F ventilation requirement, all windows will be openable to provide a suitable level of
m Sustainability Measures	<ul> <li>Internal water consumption will be reduced through specifying water efficient fixtures and fittings (WCs, taps, baths, showers, dishwashers and washing machines) throughout the development, in compliance with Policy DP22, DP23 and CPG3 and BREEAM's water standards. A water consumption rate of 105 litres or less/person/day will be targeted, in line with the Mayor's Priorities set out in his SPG.</li> <li>A water meter will be installed, as recommended in the Mayor's SPG water criteria.</li> <li>The materials used in the new building elements (roof, walls, floors, windows and floor finishes) will be specified to have a low environmental impact and high environmental performance, achieving an A+ - D rating in the BRE's Green Guide.</li> <li>At least 10% of the total value of materials used across the site will be derived from recycled and reused sources, required in Section 8 of CPG3.</li> <li>As required the Mayor's SPG, all timber and timber products will be sourced from an accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) source, as set out in.</li> <li>To address surface water run-off, the risk of localised flooding caused by</li> </ul>
Fabric and System (	new development and wider issues of flood risk associated with climate change, it is noted that the site currently contains only existing buildings and hardstanding surfaces. The redevelopment proposals include green roofs on both the main building and ground floor reception extension as required by Policy DP22. As such, the development will efficiently manage its run-off, as required by Policy DP23 and the Mayor's SPG. The site is located in a zone with low annual probability of flooding, as noted by the Environment Agency flood risk map tool. All new insulation materials will be specified with a Global Warming Potential (GWP) or less than 2.5.
	Based on the layout and location of assessed rooms and the size and location of windows, it is considered that good daylighting will improve quality of life and reduce the need for energy to lighting within the dwelling.
	A home office will be provided, minimising the need to travel by car, required by Policy CS13. The site currently contains only existing buildings and hardstanding surfaces and is of low ecological value. Energy efficient internal and external lighting will be provided, to reduce the CO2 emissions associated with the development. To provide sustainable transport solutions, cycle storage spaces will be provided for the dwelling.
	standards set out in the Building Regulations Approved Document Part E

	Sustainability Commitments
	will be achieved. These targets will be evidenced in pre completion sound testing reports.
cupation isures	External waste, recycling and composting facilities will be provided for the development in dedicated bin stores at the ground floor level. Dedicated internal storage containers for recyclable waste and composting will be provided, in line with the Mayor's SPG.
nt and Oc ability Mea	Meters will be provided that inform occupants of their energy consumption, enabling them to make decisions and manage the development in a way that reduces energy consumption, as recommended in the Mayor's SPG's energy metering requirements.
jeme staina	Energy efficient white goods will be provided to the dwellings, thus reducing the CO <sub>2</sub> emissions from appliance use.
Manaç Sus	A Home User Guide will be developed to provide the occupants of the dwelling with information relating to the operation and environmental performance of the building, and wider sustainability issues.

For more information on the sustainability measures adopted within Block E 44A Gloucester Avenue development please review the Sustainability Statement prepare by XCO2 and Sustainability Plan prepared by Metropolis Green for the 44 Gloucester Avenue development, appended to this letter.

# Energy Measures

In line with the aims and objectives of the Council's strategic policies on energy contained within the Development Plan, the Permitted 44 Gloucester Avenue development incorporated all possible energy efficiency measures to achieve an overall 41.4% improvement in carbon emissions for the entire site against Part L 2013 Building Regulations.

The energy measures are shown in the table below and are discussed in detail within the revised Energy Strategy prepared by Metropolis Green (October 2016), appended to this letter.

a vidual house to be provided via of 89.5% SEDBUK 2009.
elivered via ceiling mounted 4 pipe g south-southwest with total output
ed/Upgraded
etained/Upgraded

A sub-metering system to allow monitoring of plant Achieving a 41.4% reduction

As mentioned previously, the proposed Block E will adopt the energy commitments of the permitted 44 Gloucester Avenue development, were feasible.

The energy efficiency measures specified in the following table, will be incorporated into the refurbished and new build elements of the proposed dwelling in Block E 44A Gloucester Avenue.

Specifications	Refurbished Elements	New Build Elements				
FABRIC DETAILS						
External Wall U-value	2.10	0.20				
Ground Floor / Exposed Floor U-value	0.25	NA				
Roof U-value	NA	0.20				
Windows U-values	2.00	2.00				
Thermal bridging	Accredited construction details, Lintels with line thermal conductivity (Psi) of 0.08 W/mK or low (e.g. Keystone Hi-therm lintel or similar) 10.00					
Air Permeability 10.00						
M&E SYSTEMS						
Space Heating System (House)	Gas boiler, 89.5% SEDBUK 2009 efficiency, radiators, time and temperature zone control, weather compensator					
DHW System	Indirect cylinder 210 L,	neat loss 1.9 kWh/24h				
Ventilation System	MVHR Vent Axia	Ninetic Plus E				
Cooling	Individual VRF conde	nser unit (A+ rated)				
Water Consumption	105 litres per perso	on per day or less				
Energy Efficient Lighting	100	%				
Metering	Specified to all main M&E technol	systems and renewable ogies				
Sub-metering	Specified to allow n	nonitoring of plant				

Energy and carbon figures have been calculated using approved Standard Assessment Procedure (SAP) software, used to demonstrate compliance with Approved Documents Part L1B 2013 edition requirements.

Energy calculations undertaken for the proposed Block E application have shown that by incorporating the above energy efficiency measures and improvements to the existing and new build elements of building, a significant carbon reduction of 43.19% against Part L1B 2013 can be achieved. As such,

the proposed development is considered acceptable in line with the London Borough of Camden's Sustainability and Energy requirements. Please refer to the appended SAP worksheets for detailed results.

Yours sincerely Metropolis PDG Ltd

Adam Duff Sustainability Consultant

Rohan Shiram Senior Energy Consultant

Miranda Pennington Director

# **SAP WORKSHEETS**

**Project Information** Building type Semi-detached house

Reference 9 December 2016 Date Project NW1

# SAP 2012 worksheet for New dwelling as designed - calculation of energy ratings

## 1. Overall dwelling dimensions

	Area (m²)	Av. Storey height (m)	Volume (m³)	
Ground floor (1)	115.63	3.50	404.70	(3a)
First floor	61.66	3.00	184.98	(3b)
Second floor	61.66	3.00	184.98	(3c)
Third floor	61.66	3.69	227.53	(3d)
Total floor area	300.61			(4)
Dwelling volume (m <sup>3</sup> )			1002.19	(5)

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#### 2. Ventilation rate

											m <sup>3</sup> per ho	ur
						1	nain + s neating	eondar	y + othe	r	·	
Numbe	er of chim	neys				(	) + 0 + 0	)	<b>‹</b> 40		0.00	(6a)
Numbe	er of open	flues				(	0 + 0 + 0	)	< 20		0.00	(6b)
Numbe	er of interr	nittent fa	ins				0	>	< 10		0.00	(7a)
Numbe	er of pass	ive vents	;				0	)	< 10		0.00	(7b)
Number of chimneys Number of open flues Number of intermittent fans Number of passive vents Number of flueless gas fires Infiltration due to chimneys, fans and flues Pressure test, result q50 Air permeability Number of sides on which sheltered Shelter factor Infiltration rate incorporating shelter factor Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun 5.10 5.00 4.90 4.40 4.30 3.80 Wind Factor 1.27 1.25 1.23 1.10 1.07 0.95 Adjusted infiltration rate (allowing for shelter and w							0	>	c 40		0.00	(7c)
											Air chang	es per hou
Infiltrat	ion due to	o chimne	ys, fans	and flues	S						0.00	(8)
Pressu	ire test, re	esult q50							12.00			(17)
Air per	meability										0.60	(18)
Numbe	er of sides	s on whic	h shelte	red							2.00	(19)
Shelter	factor										0.85	(20)
Infiltrat Infiltrat	ion rate ir ion rate m	ncorporation field f	ting shelf	ter factor	, speed						0.51	(21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
		1	1			1	1000				52.50	(22)
Wind F	actor		1	1		1	1			-1		
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
Adjuste	ed infiltrat	ion rate (	allowing	for shelf	ter and v	vind spe	ed)				13.13	(22a)
0.65	0.64	0.62	0.56	0.55	0.48	0.48	0.47	0.51	0.55	0.57	0.60	
											6.69	(22b)
air ch	ange rate	through	system				0.50					(23a)
effici	ency in %	allowing	for in-u	se factor	· 		79.90					(23c)
Ventila Effectiv	tion : bala /e air cha	anced wh nge rate	ole hous	se mecha	anical wi	th heat r	ecovery					
0.75	0.74	0.73	0.66	0.65	0.59	0.59	0.57	0.61	0.65	0.67	0.70	(25)

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3. Heat losses	and heat los	ss paramete	r				
Element	Gross	Openings	Net area	U-value	AxU	kappa-value A x K	
	area, m <sup>2</sup>	m²	A, m <sup>2</sup>	W/m <sup>2</sup> K	W/K	kJ/m²K kJ/K	
Window - Triple	e-glazed,		2.106	1.80 (1.94)	3.79		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	h)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - GF Living	)					( <b>- -</b> )
Window - Triple	e-glazed,		1.620	1.80 (1.94)	2.92		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	h)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - GF Living	9			(		
Window - Triple	e-glazed,		0.900	1.80 (1.94)	1.62		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	h)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - SF						
Window - Triple	e-glazed,		1.656	1.80 (1.94)	2.98		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	h)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - SF						(07)
Window - Triple	e-glazed,		1.656	1.80 (1.94)	2.98		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	n) Livita da Dat						
2013 External	window Ref	urb Resi _					
Comm, Block	E - GF Living	9	4 050		0.00		(07)
window - Triple	e-glazed,		1.656	1.80 (1.94)	2.98		(27)
air-filled, IOW-E,	En=0.2,						
nard coat (North	n) L Müsselerin Dief						
2013 External	window Ret	urd Resi _					
Comm, Block			4 050	1 00 (1 0 1)	0.00		(07)
window - Triple	-glazed,		1.656	1.80 (1.94)	2.98		(27)
air-Illied, IOW-E,	EN=0.2,						
naro coal (Norti	[])   Mindow Dof	urb Dooi					
2013 External							
Window Triple			0 100	1 00 (1 04)	2 70		(07)
air filled low E	En_0.2		2.100	1.60 (1.94)	3.79		(27)
bord cost (North	EII=0.2,						
2012 Extornal	II) Mindow Dof	urb Dooi					
Comm Plack							
Window Trials			0 106	1 00 /1 04	2 70		(07)
air filled low 5	Fylazeu,		2.100	1.00 (1.94)	3.19		(27)
air-Iiieu, IOW-E,	⊏II=U.∠, b)						
2012 External	II) Mindow Dof	urb Dooi					
COMIN, BIOCK	E - 3F						

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3. Heat losses a	and heat los	ss paramete	r					
Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-valı kJ/m²K	ue A x K kJ/K	
Window - Triple-	glazed,		1.656	1.80 (1.94)	2.98			(27)
air-filled, low-E, I	Ēn=0.2,							
hard coat (North)	)							
2013 External	Window Ref	urb Resi _						
Comm, Block E	E - SF							
Window - Triple-	glazed,		2.106	1.80 (1.94)	3.79			(27)
air-filled, low-E, I	Ĕn=0.2,			. ,				. ,
hard coat (North)	)							
2013 External	Window Ref	urb Resi _						
Comm, Block E	E - GF Living	2						
Window - Triple-	glazed,	-	2.106	1.80 (1.94)	3.79			(27)
air-filled, low-E, E	Ĕn=0.2,			· · · ·				( )
hard coat (North)	)							
2013 External	, Window Ref	urb Resi _						
Comm, Block E	E - GF Living	a						
Window - Triple-	alazed.		2.106	1.80 (1.94)	3.79			(27)
air-filled, low-E, E	Ĕn=0.2,							( )
hard coat (North)	)							
2013 External	, Window Ref	urb Resi _						
Comm. Block E	E - FF							
Window - Triple-	alazed.		1.620	1.80 (1.94)	2.92			(27)
air-filled, low-E, E	Ĕn=0.2,			· · · ·				( )
hard coat (North)	)							
2013 External	Window Ref	urb Resi _						
Comm, Block E	E - FF							
Window - Triple-	glazed,		2.106	1.80 (1.94)	3.79			(27)
air-filled, low-E, I	Ĕn=0.2,			· · ·				( )
hard coat (North)	)							
2013 External	Window Ref	urb Resi _						
Comm, Block E	E - FF							
Window - Triple-	glazed,		2.106	1.80 (1.94)	3.79			(27)
air-filled, low-E, I	Ēn=0.2,							
hard coat (North)	)							
2013 External	Window Ref	urb Resi _						
Comm, Block E	E - FF							
Pitched roofs ins	ulated betw	een joists	60.87	0.20	12.13	98.75	6011.05	(30)
2013 Roof New	v, Block E -							
Basement								
Pitched roofs ins	ulated betw	een joists	81.92	0.20	16.33	98.75	8089.70	(30)
2013 Roof New	v, Block E -	SF						
Walls			56.17	0.20	11.22	21.95	1232.94	(29)
2013 Block E N	lew Externa	l Wall,						
Block E - SF				_				
Walls			63.20	2.07	130.77	8.75	552.98	(29)
2013 External	Wall Refurbi	ished						
Resi, Block E -	GF Living							

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<i>3. Heat losses</i> Element	and heat los Gross	<b>s paramete</b> Openings	r Net area	U-value	A x U	kappa-value	e A x K	
	alea, m-	111-	A, III-		1 70			(00)
			8.62	0.20	1.72	21.95	189.11	(29)
2013 BIOCK E	New Externa	i wali,						
BIOCK E - SF								()
Walls			3.11	2.07	6.43	8.75	27.18	(29)
2013 External	Wall Refurbl	shed						
Resi, Block E	- GF Living							
Walls			182.45	2.07	377.52	8.75	1596.43	(29)
2013 External	Wall Refurbi	shed						
Resi, Block E	- Basement							
Walls			2.12	0.20	0.42	21.95	46.52	(29)
2013 Block E	New External	l Wall,						( )
Block E - SF								
Walls			61.39	2 07	127 04	8 75	537 20	(29)
2013 External	Wall Refurbi	shed	01.00	2.07	127.04	0.70	007.20	(20)
Bosi Block E		Shea						
Walle	- 1 1		20.12	0.20	1 02	21.05	441 55	(20)
2012 Plack E	Now Extornal		20.12	0.20	4.02	21.95	441.55	(29)
	New Externa	i wali,						
			00.07	0.07	55.00	0.75	005 00	(00)
waiis			26.97	2.07	55.80	8.75	235.98	(29)
2013 External	Wall Refurbl	shed						
Resi, Block E	- GF Living							
Walls			4.91	2.07	10.16	8.75	42.95	(29)
2013 External	Wall Refurbi	shed						
Resi, Block E	- FF							
Walls			26.97	2.07	55.80	8.75	235.98	(29)
2013 External	Wall Refurbi	shed						. ,
Resi, Block E	- FF							
Ground floors			6.90	0.25	1.75	85.00	586.41	(28)
2013 Exposed	d Floor Refurt	o Resi						( - )
Comm. Block	E - GF Livino	1						
Ground floors		)	115.63	0 10	11 62	85.00	9828 52	(28)
2013 Exposed	d Floor New F	Block E -	110.00	0.10	11.02	00.00	0020.02	(20)
Basement								
Internal floor			61.66	0.00	0.00	05.00	E0E7 11	
	Cailing/Elear	Diack E	01.00	0.00	0.00	95.00	3637.44	
	Celling/Floor,							
- SF			~~~~			05.00		
Internal floor	o		92.93	0.00	0.00	95.00	8828.60	
2013 Internal	Ceiling/Floor,	Block E						
- GF Living								
Internal floor			123.31	0.00	0.00	95.00	11714.89	
2013 Internal	Ceiling/Floor,	Block E						
- FF								
Internal ceiling			54.76	0.00	0.00	95.00	5202.04	
2013 Internal	Ceiling/Floor,	Block E						
- Basement								

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3. Heat	losses a	and heat	loss pa	rameter								
Element	t	Gross area, m <sup>2</sup>	Ópe ² m²	enings	Net are A, m <sup>2</sup>	a U-v W/	/alue m²K	A x U W/K	ka kJ	ppa-valu /m²K	e A x K kJ/K	
Internal 2013 I - GF L	ceiling nternal C iving	Ceiling/Fl	oor, Bloc	kΕ	23.48	3	0.00	0.0	0	95.00	2230.8	9
Total and Fabric h Therma Effect of Total fal Ventilati	ea of ext leat loss, l mass pa f thermal bric heat on heat l	ernal ele W/K aramete bridges loss oss calc	ments S r, kJ/m²k ulated m	igma A, K (user-s onthlv	m² pecified	TMP)					750.6 875.4 250.0 0.0 875.5	0 (31) 4 (33) 0 (35) 8 (36) 2 (37)
248.29	244.07	239.86	218.77	214.56	193.47	193.47	189.26	201.91	214.56	222.99	231.42	(38)
Heat tra	nsfer coe	efficient,	W/K	<u> </u>				1				
1123.8	1 1119.59	1115.37	1094.29	1090.07	1068.99	1068.99	1064.77	1077.42	1090.07	1098.51	1106.94	
Heat los	s param	eter (HL	P), W/m²	²K			1				1093.2	4 (39)
3.74	3.72	3.71	3.64	3.63	3.56	3.56	3.54	3.58	3.63	3.65	3.68	
HLP (av	verage)		( <b>T</b> ) )			•				•	3.6	4 (40)
Number	of days	in month	I (I able	1a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	

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4. Wate Assume	er heating ed occupa	<b>g energy</b> ancy, N	/ require	ements							<b>kWh/yea</b> r 3.13	(42
Annual a	average	hot wate	r usage i	in litres p	er day V	d,avera	ge				114.32	(43
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wate	er usage	in litres	per day f	or each	month							
125.75	121.18	116.60	112.03	107.46	102.89	102.89	107.46	112.03	116.60	121.18	125.75	(44
Energy	content c	of hot wa	ter used									
186.48	163.10	168.30	146.73	140.79	121.49	112.58	129.19	130.73	152.36	166.31	180.60	
Energy of Distribut	content ( tion loss	annual)				1	1	I	1		1798.67	(45
27.97	24.46	25.25	22.01	21.12	18.22	16.89	19.38	19.61	22.85	24.95	27.09	(46
Manufac Temper Energy Total sto	cturer's d ature Fac lost from prage los	I leclared ctor hot wate s	cylinder er cylinde	loss fact er (kWh/o	or (kWh/ day)	′day)	1.94 0.5400				1.05	(47 (48 (49 (55
32.48	29.33	32.48	31.43	32.48	31.43	32.48	32.48	31.43	32.48	31.43	32.48	(56
Net stor	age loss	•										
32.48	29.33	32.48	31.43	32.48	31.43	32.48	32.48	31.43	32.48	31.43	32.48	(57
Primary	loss			1	Į			ł			I]	
37.30	33.69	37.30	36.09	37.30	36.09	37.30	37.30	36.09	37.30	36.09	37.30	(59
Total he	at requir	ed for wa	ater heat	ing calcu	lated for	r each m	onth		I	1	I]	
256.26	226.12	238.08	214.25	210.57	189.02	182.35	198.96	198.25	222.13	233.83	250.37	(62
Output f	rom wate	er heater	for each	n month,	kWh/mo	onth			1		I]	
256.26	226.12	238.08	214.25	210.57	189.02	182.35	198.96	198.25	222.13	233.83	250.37	(64
Heat ga	ins from	water he	eating, kV	Nh/mont	h		00 77	07.40			2620.20	(64
117.82	104.65	111./8	102.81	102.63	94.41	93.25	98.77	97.49	106.48	109.32	115.87	(65

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#### 5. Internal gains

	-										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabol	ic gains,	Watts									
187.96	187.96	187.96	187.96	187.96	187.96	187.96	187.96	187.96	187.96	187.96	187.96
Lighting	gains										
118.73	105.45	85.76	64.93	48.53	40.97	44.27	57.55	77.24	98.08	114.47	122.03
Applianc	ces gains	5									
684.71	691.82	673.91	635.80	587.68	542.46	512.25	505.14	523.05	561.16	609.28	654.50
Cooking	gains			1							
56.93	56.93	56.93	56.93	56.93	56.93	56.93	56.93	56.93	56.93	56.93	56.93
Pumps a	and fans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g. evap	oration	negative	values)							
-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31
Water h	eating ga	ains									
158.37	155.73	150.24	142.79	137.95	131.13	125.34	132.76	135.40	143.11	151.83	155.74
Total int	ernal gai	ns	,	,	ļ.		1	ļ	ı.		
1084.39	1075.58	1032.50	966.09	896.74	837.15	804.44	818.03	858.27	924.94	998.16	1054.85

#### 6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading (	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - GF Living	g		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.620 10.63	0.64 x 0.80	0.77	6.1121
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - GF Living	g		
Window - Triple-glazed, air-filled, low-E,	0.9 x 0.900 10.63	0.64 x 0.80	0.77	3.3956
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.656 10.63	0.64 x 0.80	0.77	6.2479
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.656 10.63	0.64 x 0.80	0.77	6.2479
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - GF Living	g		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.656 10.63	0.64 x 0.80	0.77	6.2479
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.656 10.63	0.64 x 0.80	0.77	6.2479
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - SF			

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6. Solar gains (calculation for January)				
	Area & Flux	g & FF	Shading	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.656 10.63	0.64 x 0.80	0.77	6.2479
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - GF Living	a		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - GF Living	q		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.620 10.63	0.64 x 0.80	0.77	6.1121
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm.	Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm.	Block E - FF			
Total solar gains, January				110.43 (83-1)
Solor going				( , , , , , , , , , , , , , , , , , , ,
				(00)
110.43 211.03 358.59 575.98 775.90 830	0.63   775.50   615.2	6 431.14 251.2	20   136.22   92	2.06 (83)
Total gains				
1194.82 1286.61 1391.09 1542.08 1672.65 166	67.78 1579.94 1433.	29 1289.41 1176	.14 1134.38 1 <sup>.</sup>	146.91 (84)
Linkting extendetions				
Lighting calculations	Aree	~		~
Window Triple glazad air filled low E	Area	g 0.70		y 0.89
Fr. 0.2 hard cost (North)	0.9 X 2.11	0.70	0.00 X 0.03	0.00
CII=0.2, Haro Coal (North)	Plack F OF Livin	~		
2013 External Window Reluid Resi Commi,		y 0.70	0.00 × 0.00	0.00
window - Tripie-glazed, air-filied, low-E,	0.9 X 1.62	0.70	0.80 x 0.83	0.68
En=0.2, naro coat (North)				
2013 External Window Refurb Resi _Comm,		J		0.00
vvinuow - Triple-glazed, air-filled, Iow-E,	0.9 X 0.90	0.70	0.80 x 0.83	0.38
EII=U.2, IIard Coat (INOrIII)				
2013 External Window Returb Resi Comm,		0.70	0.00.000	0.00
vvindow - Triple-glazed, air-filled, low-E,	U.9 X 1.66	0.70	0.80 x 0.83	0.69
En=0.2, hard coat (North)				

2013 External Window Refurb Resi \_Comm, Block E - SF

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Lighting calculations				
0 0	Area	g	FF x Shading	
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.66	0.70	0.80 x 0.83	0.69
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - GF Living	)		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.66	0.70	0.80 x 0.83	0.69
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.66	0.70	0.80 x 0.83	0.69
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.66	0.70	0.80 x 0.83	0.69
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - GF Living	9		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - GF Living	9		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.62	0.70	0.80 x 0.83	0.68
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - FF			
GL = 12.24 / 300.61 = 0.041				

C1 = 0.500

C2 = 1.115 El = 839

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#### 7. Mean internal temperature

Temper Heating	Femperature during heating periods in the living area, Th1 (°C)21.00Heating system responsiveness1.00											0 (85) 0
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
18.58	18.65	18.72	19.08	19.15	19.53	19.53	19.61	19.38	19.15	19.00	18.86	
alpha												
2.24	2.24	2.25	2.27	2.28	2.30	2.30	2.31	2.29	2.28	2.27	2.26	
Utilisatio	on factor	for gains	for livin	g area								
1.00	1.00	1.00	0.99	0.99	0.97	0.94	0.96	0.99	0.99	1.00	1.00	(86)
Mean internal temperature in living area T1												
17.27	17.44	17.85	18.48	19.17	19.87	20.30	20.23	19.67	18.81	17.97	17.27	(87)
Temper	ature du	ring heat	ing peric	ds in res	st of dwe	lling Th2	2	•	•		<u> </u>	
18.43	18.43	18.44	18.46	18.47	18.50	18.50	18.50	18.49	18.47	18.46	18.45	(88)
Utilisatio	on factor	for gains	s for rest	of dwell	ing						<u> </u>	
1.00	1.00	0.99	0.99	0.97	0.92	0.78	0.83	0.96	0.99	1.00	1.00	(89)
Mean in	ternal ter	mperatu	re in the	rest of d	welling T	2						
13.86	14.11	14.72	15.65	16.66	17.66	18.24	18.17	17.38	16.13	14.89	13.87	(90)
Living a	rea fracti	on (61.6	6 / 300.6	51)							0.2	1 (91)
Mean in	ternal ter	mperatu	re (for th	e whole	dwelling	)						
14.56	14.80	15.36	16.23	17.17	18.11	18.67	18.59	17.85	16.68	15.52	14.57	(92)
Apply ac	djustmen	it to the r	mean inte	ernal ten	nperatur	e, where	appropr	iate				
14.56	14.80	15.36	16.23	17.17	18.11	18.67	18.59	17.85	16.68	15.52	14.57	(93)

### 8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisatio	n factor	for gains	5								
0.99	0.99	0.99	0.98	0.96	0.91	0.80	0.84	0.95	0.98	0.99	1.00
Useful g	ains										
1188.12	1277.52	1376.49	1512.55	1605.04	1514.21	1269.07	1209.21	1223.81	1157.20	1125.83	1141.20
Monthly	average	external	tempera	ature							
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
Heat los	s rate fo	r mean ii	nternal te	emperati	ire						
11532.8	11080.3	9881.2	8022.9	5965.5	3756.5	2208.5	2335.5	4040.6	6629.7	9254.2	11475.6
Fraction	of montl	h for hea	iting								
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space h	eating re	quireme	nt for ea	ch mont	h, kWh/r	nonth					
7696.5	6587.5	6327.5	4687.4	3244.2	-	-	-	-	4071.6	5852.4	7688.8
Total space heating requirement per year (kWh/year) (October to May)4Space heating requirement per m² (kWh/m²/year)										46155.8 153.5	

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#### 8c. Space cooling requirement

		5 1									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Externa	l tempera	aturers	1			L	I	1		1	
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-
Heat los	s rate W	ĺ	1	1	1		1	1	1	1	
-	-	-	-	-	10048.5	7910.5	8092.3	-	-	-	-
Jtilisatio	on factor	for loss	1	1	1		1	1	1		
-	-	-	-	-	0.18	0.21	0.19	-	-	-	-
Useful lo	oss W	1	1				1	1		1	
-	-	-	-	-	1776.46	1668.32	1507.24	-	-	-	-
Internal	gains W			•					•	•	
0.00	0.00	0.00	0.00	0.00	834.15	801.44	815.03	0.00	0.00	0.00	0.00
Solar ga	ains W			•	•				•	•	
0.00	0.00	0.00	0.00	0.00	970.86	906.43	719.13	0.00	0.00	0.00	0.00
Gains W	V									•	
-	-	-	-	-	1805.01	1707.87	1534.17	-	-	-	-
- raction	of mont	h for coo	bling					•		•	
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Space h	eating k	Wh						•	•		
-	-	-	-	-	1094.16	116.51	50.79	-	-	-	-
Space c	cooling k	Wh									
-	-	-	-	-	20.56	29.42	20.03	-	-	-	-
Total	·							•	•		70.01
Cooled 1	traction	tor									0.80
					0.25	0.25	0.25				
- Snaco o	- ooling re		- nt for m	- onth	0.25	0.25	0.25	-	-	-	-
Space C					1 11	E 00	4.01		1		
- <u>Spaas s</u>	-	- luna ta A	-	-	4.11	5.66	4.01	-	-	-	14.00
Space o Space o	cooling (J	auireme	nt per m	<sup>2</sup> (kWh/r	n²/vear)						0.05
				(							0.00

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#### 9a. Energy requirements

	57 1		-								kWh/year	
No seco Fraction Efficien Cooling	ondary he n of space cy of mai system e	eating system the heat from the heating the heating the heating heating the heating heating heating heating heating heating heating heating the heating heat the heating heati	stem sel om main g system fficiency	ected system( ratio	(s)			9 4	1.0000 0.50% .32%			(202) (206) (209)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space I	neating re	equireme	ent									
7696.5	6587.5	6327.5	4687.4	3244.2	-	-	-	-	4071.6	5852.4	7688.8	(98)
Append	lix Q - mo	onthly en	ergy sav	ed (mair	heating	system	1)	•				
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space I	neating fu	iel (main	heating	system	1)						·	
8504.4	7279.0	6991.7	5179.5	3584.7	-	-	-	-	4499.0	6466.8	8495.9	(211)
Append	lix Q - mo	onthly en	ergy sav	ed (mair	heating	system	2)				·	
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space I	heating fu	iel (main	heating	system	2)	•					LI	
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Append	lix Q - mo	onthly en	ergy sav	ed (seco	ndary he	eating sy	stem)	1	1		ļ	
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space I	heating fu	iel (seco	ndary)	I	1		1	1	1		ļ	
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water h Water h	neating neating re	quireme	nt	1		1		1		1		
256.26	226.12	238.08	214.25	210.57	189.02	182.35	198.96	198.25	222.13	233.83	250.37	(64)
Efficien	cy of wat	er heatei	r		1				1		79.80	(216)
90.11	90.10	90.06	89.97	89.77	79.80	79.80	79.80	79.80	89.88	90.04	90.12	(217)
Water h	neating fu	el										
284.38	250.97	264.35	238.13	234.57	236.86	228.51	249.33	248.44	247.15	259.71	277.82	(219)
Annual	totolo											. ,
Space I Space I Water I Space o	neating function neating function neating function cooling function	iel used, iel (seco iel iel used	main sy ndary)	stem 1							51000.96 0.00 3020.23 3.24	(211) (215) (219) (221)
-	-	-	-	-	0.95	1.36	0.93	-	-	-	-	(221)
Electric mecha centra Total el Electric Energy	ity for pur anical ver I heating ectricity f ity for ligh saving/ge	nps, fan htilation - pump or the ab hting (100 eneratior	s and ele balance bove, kW 0.00% fix n technol	ectric kee d, extrac h/year ked LEL) ogies	ep-hot ct or posi	tive inpu	t from ou	utside (S	FP=0.74	20)	907.22 30.00 937.22 838.71	(230a) (230c) (231) (232)
Energ	gy saved () gy used ()	or genera :	ated ():								0.000 0.000	(236a) (237a)
Total de	elivered e	nergy fo	r all uses	6							55800.36	(238)

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#### 10a. Fuel costs using Table 12 prices

j i i j i i i j i i i j i i i j i i i i	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	51000.955	3.480	1774.83	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating				
Water heating cost	3020.23	3.480	105.10	(247)
Space cooling	3.241	13.190	0.43	(248)
Mech vent fans cost	907.223	13.190	119.66	(249)
Pump/fan energy cost	30.000	13.190	3.96	(249)
Energy for lighting	838.712	13.190	110.63	(250)
Additional standing charges			120.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			2234.61	(255)
11a. SAP rating			0.40	(050)
Energy cost deflator			0.42	(256)
Energy cost factor (ECF)			2./2	(257)
SAP value			62.12	(050)
SAP rating			62	(258)
SAP band			D	

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#### 12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/ye	s ear
Space heating, main system 1	51000.96	0.216	11016.21	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	3020.23	0.216	652.37	(264)
Space and water heating			11668.57	(265)
Space cooling	3.24	0.519	1.68	(266)
Electricity for pumps and fans	937.22	0.519	486.42	(267)
Electricity for lighting	838.71	0.519	435.29	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				( )
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			12591.97	(272)
			kg/m²/yea	r
CO2 emissions per m <sup>2</sup> El value El rating El band			<b>41.89</b> 51.66 <b>52</b> E	(273) (273a) (274)

#### Calculation of stars for heating and DHW

Main heating energy efficiency Main heating environmental impact Water heating energy efficiency Water heating environmental impact

(3.48 / 0.9050) x (1 + (0.29 x 0.00)) = 3.8453, stars = 4  $(0.2160 / 0.9050) \times (1 + (0.29 \times 0.00)) = 0.2387$ , stars = 4 3.48 / 0.8660 = 4.0183, stars = 4 0.2160 / 0.8660 = 0.2494, stars = 4

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**Project Information** Building type Semi-detached house

Reference 9 December 2016 Date Project NW1

# SAP 2012 worksheet for New dwelling as designed - calculation of dwelling emissions

## 1. Overall dwelling dimensions

	Area (m²)	Av. Storey height (m)	Volume (m³)	
Ground floor (1)	115.63	3.50	404.70	(3a)
First floor	61.66	3.00	184.98	(3b)
Second floor	61.66	3.00	184.98	(3c)
Third floor	61.66	3.69	227.53	(3d)
Total floor area	300.61			(4)
Dwelling volume (m <sup>3</sup> )			1002.19	(5)

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#### 2. Ventilation rate

											m <sup>3</sup> per ho	our
						r ł	nain + s neating	eondar	y + othe	r		
Numbe	r of chim	neys				(	) + 0 + 0	)	<b>‹</b> 40		0.00	(6a)
Numbe	r of open	flues				(	) + 0 + 0	)	< 20		0.00	(6b)
Numbe	er of interr	nittent fa	Ins				0	)	< 10		0.00	(7a)
Numbe	r of pass	ive vents	;				0	)	< 10		0.00	(7b)
Numbe	er of fluele	ess gas fi	ires				0	)	c 40		0.00	(7c)
											Air chanc	ies per hou
Infiltrati	on due to	chimne	ys, fans	and flues	5						0.00	(8)
Pressu	re test, re	esult q50	•						10.00			(17)
Air peri	neability	·									0.60	(18)
Numbe	r of sides	on whic	h shelte	red							2.00	(19)
Shelter	factor										0.85	(20)
Infiltrati	on rate ir	ncorporat	ting shelt	ter factoi	•						0.51	(21)
Infiltrati	on rate m	nodified f	or month	nly wind :	speed							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
Wind F	actor										52.50	(22)
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
Adjuste	d infiltrat	ion rato (		for shalt	for and w	wind snow				-1	13.13	(22a)
			anowing					0 = 1	0 ==			
0.65	0.64	0.62	0.56	0.55	0.48	0.48	0.47	0.51	0.55	0.57	0.60	
											6.69	(22b)
air cha	ange rate	through	system				0.50					(23a)
efficie	ency in %	allowing	for in-u	se factor			79.90					(23c)
Ventila Effectiv	tion : bala ⁄e air cha	anced wh nae rate	ole hous	se mecha	anical wi	th heat r	ecovery					
0.75	0.74	0.73	0.66	0.65	0.59	0.59	0.57	0.61	0.65	0.67	0.70	(25)
L	- 1	1		I	1	1	1	1	1		1	

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3. Heat losses	and heat los	ss paramete	r				
Element	Gross	Openings	Net area	U-value	AxU	kappa-value A x K	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K kJ/K	
Window - Triple	-glazed,		1.620	1.80 (1.94)	2.92		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	ו)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - GF Living	)					
Window - Triple	-glazed,		2.106	1.80 (1.94)	3.79		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	ו)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - GF Living	9					
Window - Triple	-glazed,		1.656	1.80 (1.94)	2.98		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	ו)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - SF						
Window - Triple	-glazed,		0.900	1.80 (1.94)	1.62		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	ו)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - SF						
Window - Triple	-glazed,		1.656	1.80 (1.94)	2.98		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	ו)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - GF Living	9					
Window - Triple	-glazed,		1.656	1.80 (1.94)	2.98		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	ו)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - SF						
Window - Triple	-glazed,		1.656	1.80 (1.94)	2.98		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	ו)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - FF						
Window - Triple	-glazed,		1.656	1.80 (1.94)	2.98		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	ו)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - SF						
Window - Triple	-glazed,		2.106	1.80 (1.94)	3.79		(27)
air-filled, low-E,	En=0.2,						
hard coat (North	ו)						
2013 External	Window Ref	urb Resi _					
Comm, Block	E - SF						

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3. Heat losses	and heat los	ss paramete	r					
Element	Gross	Openings	Net area	U-value	AxU	kappa-valu	ie A x K	
	area, m <sup>2</sup>	m²	A, m²	W/m²K	W/K	KJ/M²K	KJ/K	(07)
Window - Triple	-glazed,		2.106	1.80 (1.94)	3.79			(27)
air-filled, low-E,	En=0.2,							
hard coat (North	1) 							
2013 External	Window Ref	urb Resi _						
Comm, Block	E - SF							
Window - Triple	-glazed,		2.106	1.80 (1.94)	3.79			(27)
air-filled, low-E,	En=0.2,							
hard coat (North	า)							
2013 External	Window Ref	urb Resi _						
Comm, Block	E - GF Living	9						
Window - Triple	-glazed,		2.106	1.80 (1.94)	3.79			(27)
air-filled, low-E,	En=0.2,							
hard coat (North	า)							
2013 External	Window Ref	urb Resi _						
Comm, Block	E - GF Living	9						
Window - Triple	-glazed,		1.620	1.80 (1.94)	2.92			(27)
air-filled, low-E,	Ēn=0.2,							
hard coat (North	า)							
2013 External	Window Ref	urb Resi _						
Comm, Block	E - FF							
Window - Triple	-glazed,		2.106	1.80 (1.94)	3.79			(27)
air-filled, low-E,	Ĕn=0.2,			. ,				( )
hard coat (North	า)							
2013 External	Window Ref	urb Resi						
Comm, Block	E - FF							
Window - Triple	-alazed.		2.106	1.80 (1.94)	3.79			(27)
air-filled. low-E.	En=0.2.							( )
hard coat (North	n)							
2013 External	Window Ref	urb Resi						
Comm. Block	E - FF							
Window - Triple	-alazed.		2,106	1.80 (1.94)	3.79			(27)
air-filled. low-E.	En=0.2.				0110			(=- )
hard coat (North	<u>0</u> , n)							
2013 External	Window Ref	urh Resi						
Comm Block	F - FF							
Pitched roofs in	sulated betw	een ioists	60.87	0.20	12 13	98 75	6011.05	(30)
2013 Boof Ne	w Block F -	oon joioto	00.07	0.20	12.10	00.70	0011.00	(00)
Basement								
Pitched roofs in	sulated betw	een ioists	81 92	0.20	16.33	98 75	8089 70	(30)
2013 Roof Ne	w Block F -	SF	01.02	0.20	10.00	00.70	0000.70	(00)
Walls		0.	56 17	0.20	11 22	21 95	1232 94	(29)
2013 Block E	New Externa	l Wall	00.17	0.20		21.00	1202.01	(20)
Block F - SF								
Walls			63 20	2 07	130 77	8 75	552 98	(29)
2013 External	Wall Refurbi	ished	00.20	2.07	100.11	0.70	002.00	(20)
Resi Block F	- GF Living							
	S. Living							

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3. Heat losses	and heat lo	oss paramete	er					
Element	Gross area, m²	Openings m <sup>2</sup>	Net area A, m²	U-value W/m²K	A x U W/K	kappa-valı kJ/m²K	ie A x K kJ/K	
Walls 2013 Block E Block E - SF	New Extern	al Wall,	8.62	0.20	1.72	21.95	189.11	(29)
Walls 2013 External Roci Block E	Wall Refur	pished	3.11	2.07	6.43	8.75	27.18	(29)
Walls 2013 External	Wall Refur	pished	182.45	2.07	377.52	8.75	1596.43	(29)
Walls 2013 Block E Block E	New Extern	al Wall,	2.12	0.20	0.42	21.95	46.52	(29)
Walls 2013 External	Wall Refur	pished	61.39	2.07	127.04	8.75	537.20	(29)
Walls 2013 Block E Block E	New Extern	al Wall,	20.12	0.20	4.02	21.95	441.55	(29)
Walls 2013 External	Wall Refur	pished	26.97	2.07	55.80	8.75	235.98	(29)
Walls 2013 External	Wall Refur	pished	4.91	2.07	10.16	8.75	42.95	(29)
Walls 2013 External Besi Block F	- FF Wall Refurl	oished	26.97	2.07	55.80	8.75	235.98	(29)
Ground floors 2013 Exposed Comm Block	l Floor Refu F - GF Livir	rb Resi _	6.90	0.25	1.75	85.00	586.41	(28)
Ground floors 2013 Exposed Basement	d Floor New,	Block E -	115.63	0.10	11.62	85.00	9828.52	(28)
Internal floor 2013 Internal - SF	Ceiling/Floo	r, Block E	61.66	0.00	0.00	95.00	5857.44	
Internal floor 2013 Internal	Ceiling/Floo	r, Block E	92.93	0.00	0.00	95.00	8828.60	
Internal floor 2013 Internal - FF	Ceiling/Floo	r, Block E	123.31	0.00	0.00	95.00	11714.89	
Internal ceiling 2013 Internal - Basement	Ceiling/Floo	r, Block E	54.76	0.00	0.00	95.00	5202.04	

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3. Heat	losses a	and heat	loss pa	rameter								
Element	t	Gross area, m <sup>2</sup>	Öpe ² m²	enings	Net area A, m <sup>2</sup>	a U-v W/i	∕alue m²K	A x U W/K	ka kJ	ppa-valu /m²K	e A x K kJ/K	
Internal 2013 I - GF L	ceiling nternal C iving	Ceiling/Fl	oor, Bloc	kЕ	23.48	3	0.00	0.0	0	95.00	2230.8	9
Total are Fabric h Therma Effect of Total fat Ventilati	ea of ext eat loss, l mass p f thermal oric heat on heat l	ernal ele W/K arameter bridges loss oss calc	ments S r, kJ/m²k ulated m	igma A, (user-s onthly	m² pecified <sup>-</sup>	TMP)					750.6 875.4 250.0 0.0 875.5	0 (31) 4 (33) 0 (35) 8 (36) 2 (37)
248.29	244.07	239.86	218.77	214.56	193.47	193.47	189.26	201.91	214.56	222.99	231.42	(38)
Heat tra	nsfer co	efficient,	W/K					1				
1123.81	11119.59	1115.37	1094.29	1090.07	1068.99	1068.99	1064.77	1077.42	1090.07	1098.51	1106.94	
Heat los	s param	eter (HLI	P), W/m²	²K							1093.2	4 (39)
3.74	3.72	3.71	3.64	3.63	3.56	3.56	3.54	3.58	3.63	3.65	3.68	
HLP (av Number	erage) of days	in month	(Table	1a)							3.6	4 (40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	

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4. Wate Assume	er heating ed occupa	<b>g energy</b> ancy, N	/ require	ements							<b>kWh/yea</b> r 3.13	(42
Annual a	average	hot wate	r usage i	in litres p	oer day V	/d,avera	ge				114.32	(43
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wate	er usage	in litres	per day f	or each	month							
125.75	121.18	116.60	112.03	107.46	102.89	102.89	107.46	112.03	116.60	121.18	125.75	(44
Energy	content c	f hot wa	ter used									
186.48	163.10	168.30	146.73	140.79	121.49	112.58	129.19	130.73	152.36	166.31	180.60	
Energy of Distribut	content ( tion loss	annual)									1798.67	(45
27.97	24.46	25.25	22.01	21.12	18.22	16.89	19.38	19.61	22.85	24.95	27.09	(46
Manufac Temper Energy Total sto	cturer's o ature Fa lost from prage los	I leclared ctor hot wate s	cylinder er cylinde	loss fact er (kWh/e	or (kWh/ day)	/day)	210.00 1.94 0.5400				1.05	(47 (48 (49 (55
32.48	29.33	32.48	31.43	32.48	31.43	32.48	32.48	31.43	32.48	31.43	32.48	(56
Net stor	age loss			•				•			·	
32.48	29.33	32.48	31.43	32.48	31.43	32.48	32.48	31.43	32.48	31.43	32.48	(57
Primary	loss	1	1	1	1		1	1	1		<u> </u>	
37.30	33.69	37.30	36.09	37.30	36.09	37.30	37.30	36.09	37.30	36.09	37.30	(59
Total he	at requir	ed for wa	ater heat	ing calcu	lated fo	r each m	onth	1	1		I]	
256.26	226.12	238.08	214.25	210.57	189.02	182.35	198.96	198.25	222.13	233.83	250.37	(62
Output f	rom wate	er heater	for each	n month,	kWh/mo	onth		1	1			
256.26	226.12	238.08	214.25	210.57	189.02	182.35	198.96	198.25	222.13	233.83	250.37	(64
Heat ga	ins from	water he	ating, k	Nh/mont	h						2620.20	(64
117.82	104.65	111.78	102.81	102.63	94.41	93.25	98.77	97.49	106.48	109.32	115.87	(65

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#### 5. Internal gains

	-										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabol	ic gains,	Watts									
156.64	156.64	156.64	156.64	156.64	156.64	156.64	156.64	156.64	156.64	156.64	156.64
Lighting	gains										
47.49	42.18	34.30	25.97	19.41	16.39	17.71	23.02	30.90	39.23	45.79	48.81
Appliand	ces gains	5									
458.76	463.52	451.52	425.98	393.75	363.45	343.21	338.44	350.44	375.98	408.22	438.52
Cooking	gains							1			
38.66	38.66	38.66	38.66	38.66	38.66	38.66	38.66	38.66	38.66	38.66	38.66
Pumps	and fans	gains						1			
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g. evap	oration	negative	values)	•						
-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31	-125.31
Water h	eating ga	ains									
158.37	155.73	150.24	142.79	137.95	131.13	125.34	132.76	135.40	143.11	151.83	155.74
Total int	ernal gai	ns				•			•	•	
737.61	734.42	709.06	667.73	624.10	583.96	559.24	567.22	589.73	631.31	678.82	716.06

#### 6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading (	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.620 10.63	0.64 x 0.80	0.77	6.1121
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - GF Living	g		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - GF Living	g		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.656 10.63	0.64 x 0.80	0.77	6.2479
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 0.900 10.63	0.64 x 0.80	0.77	3.3956
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.656 10.63	0.64 x 0.80	0.77	6.2479
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - GF Living	g		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.656 10.63	0.64 x 0.80	0.77	6.2479
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.656 10.63	0.64 x 0.80	0.77	6.2479
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm	, Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.656 10.63	0.64 x 0.80	0.77	6.2479
En=0.2, hard coat (North)				
2012 External Window Pofurb Pool Comm	Block E SE			

2013 External Window Refurb Resi \_Comm, Block E - SF

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6. Solar gains (calculation for January)				
	Area & Flux	g & FF	Shading	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm.	Block E - GF Living	a		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.106 10.63	0.64 x 0.80	0.77	7.9457
En=0.2, hard coat (North)				
2013 External Window Refurb Resi Comm.	Block E - GF Living	נ		
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.620 10.63	0.64 x 0.80	0.77	6.1121
En=0.2 hard coat (North)	0.0 //		••••	••••=•
2013 External Window Refurb Resi Comm	Block E - FE			
Window - Triple-glazed air-filled low-F	0.9 x 2 106 10 63	0 64 x 0 80	0 77	7 9457
Fn=0.2 hard coat (North)	0.0 x 2.100 10.00	0.01 × 0.00	0.17	1.0101
2013 External Window Refurb Resi Comm	Block E - FE			
Window - Triple-glazed air-filled low-F	0.9 x 2 106 10 63	0 64 x 0 80	0 77	7 9457
$F_n=0.2$ hard coat (North)	0.0 x 2.100 10.00	0.01 × 0.00	0.17	1.0107
2013 External Window Befurb Besi Comm	Block E - FE			
Window - Triple-glazed air-filled low-F	0 9 y 2 106 10 63	0 64 x 0 80	0 77	7 9457
$E_{n=0.2}$ hard coat (North)	0.5 X 2.100 10.00	0.04 × 0.00	0.77	1.0401
2013 External Window Befurb Besi Comm	Block E - FE			
Lighting calculations				
	Area	a	FF x Shading	a
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.62	0.70	0.80 x 0.83	0.68
En=0.2. hard coat (North)				
2013 External Window Refurb Resi Comm.	Block E - GF Living	נ		
Window - Triple-glazed, air-filled, low-E.	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)		0.1.0		0.00
2013 External Window Refurb Resi Comm	Block E - GE Living	r		
Window - Triple-glazed air-filled low-F	0.9 x 1.66	0 70	0 80 x 0 83	0.69
Fn=0.2 hard coat (North)		0.1.0	0.00 / 0.00	0.00
2013 External Window Refurb Resi Comm	Block E - SE			
Window - Triple-glazed air-filled low-F		0 70	0.80 x 0.83	0.38
$E_{n-0.2}$ hard coat (North)	0.0 × 0.00	0.70	0.00 × 0.00	0.00
2013 External Window Befurb Besi Comm	Block E - SE			
Window - Triple-glazed air-filled low-F	$0.9 \times 1.66$	0 70	0.80 v 0.83	0 69
$E_{n=0.2}$ hard coat (North)	0.5 × 1.00	0.70	0.00 × 0.00	0.00
2013 External Window Refurb Resi Comm	Block E - GE Living	r		
Window - Triplo-glazod air-filled low-E		9 70	0.80 × 0.83	0 60
$F_{n=0.2}$ hard cost (North)	0.3 × 1.00	0.70	0.00 × 0.05	0.03
2012 External Window Defurb Deci Comm	Block E SE			
Window - Triple-glazed air-filled low-		0.70	0 80 v 0 83	0 60
$F_n=0.2$ hard coat (North)	0.0 × 1.00	0.70	0.00 × 0.03	0.09
2013 External Window Pofurb Roci Comm	Block E - EE			
LOTO EXCERNAL WINDOW ITERID ITESI _COMMIN,				

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# Lighting calculations

	Area	g	FF x Shading	
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.66	0.70	0.80 x 0.83	0.69
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - SF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - GF Living	)		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - GF Living	)		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.62	0.70	0.80 x 0.83	0.68
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				
2013 External Window Refurb Resi _Comm,	Block E - FF			
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.11	0.70	0.80 x 0.83	0.88
En=0.2, hard coat (North)				

2013 External Window Refurb Resi \_Comm, Block E - FF

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#### 7. Mean internal temperature

Temper Heating	ature du system	ring heat responsi	ing perio veness	ods in the	e living a	rea, Th1	(°C)				21.00 1.00	) (85) )
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau											<b></b> /	
18.58	18.65	18.72	19.08	19.15	19.53	19.53	19.61	19.38	19.15	19.00	18.86	
alpha											<b></b>	
2.24	2.24	2.25	2.27	2.28	2.30	2.30	2.31	2.29	2.28	2.27	2.26	
Utilisatio	on factor	for gains	for livin	g area								
1.00	1.00	1.00	1.00	0.99	0.98	0.96	0.97	0.99	1.00	1.00	1.00	(86)
Mean in	ternal te	mperatu	re in livin	g area T	1	•	•		•			
17.20	17.37	17.78	18.42	19.12	19.81	20.26	20.18	19.61	18.75	17.90	17.20	(87)
Temper	ature du	ring heat	ing perio	ds in res	st of dwe	lling Th2	2	1		•	<b></b> ]	
18.43	18.43	18.44	18.46	18.47	18.50	18.50	18.50	18.49	18.47	18.46	18.45	(88)
Utilisatio	on factor	for gains	for rest	of dwelli	ing	•		1		•	I	
1.00	1.00	1.00	0.99	0.98	0.94	0.83	0.88	0.98	0.99	1.00	1.00	(89)
Mean in	ternal te	mperatu	re in the	rest of d	welling T	2		1		•	I	
13.76	14.01	14.62	15.56	16.58	17.60	18.20	18.12	17.30	16.04	14.79	13.76	(90)
Living a Mean in	rea fracti ternal te	on (61.6 mperatu	6 / 300.6 re (for th	51) e whole	dwelling)	)	•	1	1	1	0.21	(91)
14.46	14.70	15.27	16.15	17.10	18.05	18.62	18.54	17.78	16.60	15.43	14.47	(92)
Apply a	djustmen	t to the r	nean inte	ernal terr	perature	e, where	appropr	iate	I	1	L]	
14.46	14.70	15.27	16.15	17.10	18.05	18.62	18.54	17.78	16.60	15.43	14.47	(93)

### 8. Space heating requirement

Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec	
Utilisatio	n factor	for gains		, in only								
		lo oo										
1.00	1.00	0.99	0.99	0.97	0.93	0.84	0.88	0.97	0.99	1.00	1.00	(94)
Useful g	ains					•	•			•		
845.70	941.91	1061.09	1228.09	1359.03	1314.38	1123.77	1041.46	986.59	874.51	811.96	806.19	(95)
Monthly	average	external	tempera	ature								
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat los	s rate fo	r mean ii	nternal te	emperati	ire							
11420.3	10970.1	9777.4	7929.3	5883.4	3689.8	2163.9	2282.3	3961.9	6537.3	9152.1	11366.4	(97)
Fraction	of mont	h for hea	ting									
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space h	eating re	quireme	nt for ea	ch mont	h, kWh/r	nonth						
7867.5	6738.9	6484.9	4824.9	3366.2	-	-	-	-	4213.1	6004.9	7856.8	
Total sp	ace heat	ing requi	irement j	ber year	(kWh/ye	ar) (Octo	ber to N	lay)			47357.2	7 (98)
Space h	eating re	quireme	nt per m	² (kŴh/r	n²/year)						157.54	4 (99)

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#### 8c. Space cooling requirement

		5 1									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
External	l tempera	aturers	1		1				•	-	
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-
Heat los	s rate W	ĺ			1					-	
-	-	-	-	-	10048.5	7910.5	8092.3	-	-	-	-
Jtilisatic	on factor	for loss									
-	-	-	-	-	0.18	0.21	0.19	-	-	-	-
Jseful lo	oss W		1		1	1	1			1	
-	-	-	-	-	1776.46	1668.32	1507.24	-	-	-	-
nternal	gains W		1		1	1	1			1	
0.00	0.00	0.00	0.00	0.00	834.15	801.44	815.03	0.00	0.00	0.00	0.00
Solar ga	ains W	•	1			1	1			•	
0.00	0.00	0.00	0.00	0.00	970.86	906.43	719.13	0.00	0.00	0.00	0.00
Gains W	V	•	1		1	1	1			•	
-	-	-	-	-	1805.01	1707.87	1534.17	-	-	-	-
Fraction	of mont	h for coc	bling							•	
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Space h	eating k	Wh	1		1	1	1			1	
-	-	-	-	-	1094.16	116.51	50.79	-	-	-	-
Space c	ooling k	Wh	1		1	1	1			1	
-	-	-	-	-	20.56	29.42	20.03	-	-	-	-
Total	L		1			1	1				70.01
Cooled f	fraction										0.80
ntermitt	tency fac	tor	1	T	1			T	1	1	
-	-	-	-	-	0.25	0.25	0.25	-	-	-	-
Space c	ooling re	quireme	ent for mo	onth	1			1	1		
-	-	-	-	-	4.11	5.88	4.01	-	-	-	-
Space c Space c	ooling (J	lune to A	Nugust)	2 ( <b>kWh</b> /r	m²/vear)						14.00
Space 0	soung ic	999900000		(1.1.1.1/1	, jour)						0.00

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#### 9a. Energy requirements

	. <b>9</b>										kWh/year	
No secondary heating system selected1.0000Fraction of space heat from main system(s)90.50%Efficiency of main heating system90.50%Cooling system energy efficiency ratio4.32%									(202) (206) (209)			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space h	eating re	quireme	ent				•					
7867.5	6738.9	6484.9	4824.9	3366.2	-	-	-	-	4213.1	6004.9	7856.8	(98)
Append	ix Q - mo	onthly en	ergy sav	ed (mair	heating	system	1)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space h	neating fu	iel (main	heating	system	1)							
8693.4	7446.3	7165.6	5331.4	3719.5	-	-	-	-	4655.4	6635.2	8681.6	(211)
Append	ix Q - mo	onthly en	ergy sav	ed (mair	heating	system	2)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space h	eating fu	iel (main	heating	system	2)	•				•		
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Append	ix Q - mo	onthly en	ergy sav	ed (secc	ndary he	eating sy	stem)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space h	eating fu	iel (seco	ndary)									
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
<u>Water h</u> Water h	eating eating re	quireme	nt									
256.26	226.12	238.08	214.25	210.57	189.02	182.35	198.96	198.25	222.13	233.83	250.37	(64)
Efficiend	cy of wate	er heatei							1		79.80	(216)
90.12	90.11	90.07	89.99	89.79	79.80	79.80	79.80	79.80	89.90	90.05	90.13	(217)
Water h	eating fu	el									11	
284.35	250.94	264.32	238.09	234.51	236.86	228.51	249.33	248.44	247.09	259.67	277.80	(219)
Annual t Space h Space h Water h	totals neating function neating function neating function	iel used, iel (seco el	main sy ndary)	stem 1			1	I			kWh/year 52328.48 0.00 3019.93	(211) (215) (219)
Space c		ei usea			0.05		0.00				3.24	(221)
-	-	-	-	-	0.95	1.36	0.93	-	-	-	-	(221)
Electrici mecha central Total ele Electrici Energy	ty for pur inical ver heating ectricity for ty for ligh saving/ge	nps, fan Itilation - pump or the ab Iting (100 eneratior	s and ele balance ove, kW 0.00% fix technol	ectric kee d, extrac h/year (ed LEL) ogies	ep-hot et or posi	tive inpu	it from ou	utside (S	FP=0.74	.20)	907.22 30.00 937.22 838.71	(230a) (230c) (231) (232)
Energ Energ	y saved () y used ()	or genera :	ated ():								0.000 0.000	(236a) (237a)
Total de	livered e	nergy fo	r all uses	6							57127.59	(238)

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#### 10a. Does not apply

# 11a. Does not apply

#### 12a. Carbon dioxide emissions

12a. Carbon dioxide eniissions					
	Energy	Emission factor	Emissions		
	kWh/year	kg CO2/kWh	kg CO2/year		
Space heating, main system 1	52328.48	0.216	11302.95	(261)	
Space heating, main system 2	0.00	0.000	0.00	(262)	
Space heating, secondary	0.00	0.519	0.00	(263)	
Water heating	3019.93	0.216	652.31	(264)	
Space and water heating			11955.26	(265)	
Space cooling	3.24	0.519	1.68	(266)	
Electricity for pumps and fans	937.22	0.519	486.42	(267)	
Electricity for lighting	838.71	0.519	435.29	(268)	
Electricity generated - PVs	0.00	0.519	0.00	(269)	
Electricity generated - µCHP	0.00	0.000	0.00	(269)	
Appendix Q -					
Energy saved ():	0.00	0.000	0.00	(270)	
Energy used ():	0.00	0.000	0.00	(271)	
Total CO2, kg/year			12878.65	(272)	

# **Dwelling Carbon Dioxide Emission Rate (DER)**

kg/m<sup>2</sup>/year **42.84** (273)

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**Project Information** Building type Semi-detached house

Reference	
Date	9 December 2016
Project	NW1

# **REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England** assessed by program JPA Designer version 6.03b1, printed on 12/9/2016 at 4:44:00 PM

#### New dwelling as designed

<b>1 TER and DER</b> Fuel for main heating Target Carbon Dioxic Dwelling Carbon Diox Excess emissions = 2	i system: Gas (ma de Emission Rate kide Emission Rat 24.66kg/m² (135.7	ains) (fuel factor = 1.00) te 7%)	TER = 18.18 DER = 42.84	Fail
<b>1b TFEE and DFEE</b> Target Fabric Energy Dwelling Fabric Energy	r Efficiency (TFEE gy Efficiency (DFI	:) EE)	TFEE = 77.6 DFEE = 178.5	Fail
2a Thermal bridging	<b>)</b> Thermal bridgin	g calculated from linear t	hermal transmittances for each junction	
2b Fabric U-values	<u>Element</u> Wall Floor Roof Openings	<u>Average</u> 1.71 (max. 0.30) 0.11 (max. 0.25) 0.20 (max. 0.20) 1.94 (max. 2.00)	<u>Highest</u> 2.07 (max. 0.70) 0.25 (max. 0.70) 0.20 (max. 0.35) 1.94 (max. 3.30)	Fail OK OK OK
3 Air permeability	Air permeability Maximum :	at 50 pascals:	10.00 10.00	ОК
<b>4 Heating efficiency</b> Main heating system Source of efficiency:	Boiler and radia from manufactu	tors, mains gas rer		
		Efficiency: 89.5% SE Minimum: 88.0%	DBUK2009	ОК

Secondary heating system:

None -

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5 Cylinder insulation	I		
Hot water storage	Manufacturer's o	declared cylinder loss factor (kWh/day) 1.94	
Primary pipework insu	Permitted by DB lated	SCG 2.30 Yes	OK OK
6 Controls			
(Also refer to "Domesi Space beating control	ic Building Servic	Time and temperature zone control	OK
Space nealing control	5	Cylindorstat - Vos	OK OK
		Independent timer for DHW - Yes	OK
Boiler Interlock		Yes	OK
7 Low energy lights			
on onorgy ngino		Percentage of fixed lights with low-energy fittings: 100.0%	
		Minimum: 75.0%	OK
8 Mechanical ventila	tion		
		Specific fan power : 0.53 Efficiency : 94.00	
		Maximum : 1.5W/(litre/sec) and efficiency not less than 70%	OK
9 Summertime temp	erature		
Overheating risk (Tha	mes Valley):		OK
		Not significant	OK
Based on:		050.00	
I hermal mass para	neter :	250.00	
Overshading :		Average of unknown (20-60 % sky blocked)	
Vontilation rate :		8 00	
Blinds/curtains :		0.00	
None with blinds/shu	utters closed 0.00	0% of daylight hours	
10 Key features			

Ground floors U-value 0.10 W/m<sup>2</sup>K Fixed cooling system

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## SAP 2012 Overheating Assessment for New dwelling as designed

Dwelling type Number of storeys Cross ventilation possib Region Front of dwelling faces Overshading Overhangs Thermal mass paramet Night ventilation Ventilation rate during h	le er ot weather (ach)	Semi-detached house 4 Yes Thames Valley North Average or unknown (20-60 % sky blocked) (as detailed below) 250.00 (user defined) No 8.00 (Windows fully open)						
Summer ventilation hea Transmission heat loss Summer heat loss coef	t loss coefficient coefficient ficient			2645.78 875.52 3521.30	(P1) (37) (P2)			
Overhangs Orientation North		Ratio - - - - - - - - - - - - - - - - - - -	Z_overhangs 1.00	Overhang None None None None None None None None	type			
Solar shading Orientation North	Z blinds 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.0	Solar access 0.90 0.90 0.90 0.90 0.90 0.90 0.90 0.	Overhangs 1.000	Z summer 0.900 0.900 0.900 0.900 0.900 0.900 0.900 0.900 0.900 0.900 0.900 0.900 0.900 0.900 0.900 0.900 0.900	(P8) (P8) (P8) (P8) (P8) (P8) (P8) (P8)	906		

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responsible for the accuracy of the data. The results of the calculation should not be accepted without first checking the input data.

## SAP 2012 Overheating Assessment for New dwelling as designed

Dwelling type Number of storeys Cross ventilation p Region Front of dwelling fa Overshading Overhangs Thermal mass para Night ventilation Ventilation rate dur	ossible aces ameter ring hot weather (ach)	Semi-detac 4 Yes Thames Va North Average or (as detailed 250.00 (us No 8.00 (Wind	Semi-detached house 4 Yes Thames Valley North Average or unknown (20-60 % sky blocked) (as detailed below) 250.00 (user defined) No 8.00 (Windows fully open)					
Summer ventilatior Transmission heat Summer heat loss	n heat loss coefficient loss coefficient coefficient			26 8 35	45.78 75.52 21.30	(P1) (37) (P2)		
Solar gains (calcul	ation for Julv)							
Orientation	Area	Flux	g & FF	Sh	ading	Gains		
North	0.9 x 2.11	74.68	0.64 x 0.80		0.9Ŏ	6	5	
North	0.9 x 1.62	74.68	0.64 x 0.80		0.90	5	0	
North	0.9 x 0.90	74.68	0.64 x 0.80		0.90	2	8	
North	0.9 x 1.66	74.68	0.64 x 0.80		0.90	5	1	
North	0.9 x 1.66	74.68	0.64 x 0.80		0.90	5	1	
North	0.9 x 1.66	74.68	0.64 x 0.80		0.90	5	1	
North	0.9 x 1.66	74.68	0.64 x 0.80		0.90	5	1	
North	0.9 x 2.11	74.68	0.64 x 0.80		0.90	6	5	
North	0.9 x 2.11	74.68	0.64 x 0.80		0.90	6	5	
North	0.9 x 1.66	74.68	0.64 x 0.80		0.90	5	1	
North	0.9 x 2.11	74.68	0.64 x 0.80		0.90	6	5	
North	0.9 x 2.11	74.68	0.64 x 0.80		0.90	6	5	
North	0.9 x 2.11	74.68	0.64 x 0.80		0.90	6	5	
North	0.9 x 1.62	74.68	0.64 x 0.80		0.90	5	0	
North	0.9 x 2.11	74.68	0.64 x 0.80		0.90	6	5	
North	0.9 x 2.11	74.68	0.64 x 0.80		0.90	6	5	
Total						90	6	
			Jur	า	Jul	Aug		
Solar gains				971	906	719	(P3)	
Internal gains				834	801	815		
Total summer gain	IS			1805	1708	1534	(P5)	
Summer gain/loss ratio				0.51	0.49	0.44	(P6)	
External temperatu	re (Thames Valley)			15.4	17.8	17.8		
Thermal mass tem	perature increment (T	MP=250.0)		0.25	0.25	0.25		
I hreshold tempera	ature			16.16	18.54	18.49	(P7)	
Likelihood of high i	nternal temperature		No	t sig.	Not sig.	Not sig.		
Assessment of like	lihood of high internal	temperature			Not sign	ificant		

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NW1

Dwelling type: Date of assessment: Produced by Total floor area: Semi-detached house 9 December 2016 Metropolis Green (London) 301 m<sup>2</sup>

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO<sub>2</sub>) emissions.



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



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide  $(CO_2)$  emissions. The higher the rating the less impact it has on the environment.