



**53-55 CHALTON STREET
LONDON
NW1 1HY**

**ENERGY STATEMENT
TECHNICAL NOTE**

AUGUST 2019

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DOCUMENT CONTROL SHEET

Original Report Ref	ES/CS/201809-BC
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Report Prepared for:	Divine Ideas
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This Report has been produced to support a Planning Application and is not to be used 'For Construction', for Building Control compliance or for a Planning Condition on an approved scheme.

The information contained within this Report is based on Drawings and Specifications provided by the Design Team along with information assumed by NRG Consulting for the purposes of compliance where no other information was available. Any budget costs or plant sizing contained within this document are based upon available information and are to be taken as an estimation and guideline only.

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1. EXECUTIVE SUMMARY

- 1.1.0 NRG Consulting have been appointed to undertake an Energy Statement Addendum on a proposed development in Camden. The addendum is to address comments made by the London Borough of Camden.
- 1.2 The proposed scheme is for (current reference: 2016/5266/P)
- Erection of part 4 part 2 storey plus basement building, comprising 46 room hotel (C1 Use Class) fronting Chalton Street and Churchway (following demolition of existing building); in association with application 2016/3174/P [70 Churchway] erection of 3 storey building plus basement with rear garden and roof terrace at 1st floor level, comprising 4x Residential units (1x2 bed & 2x1bed unit) (C3 Use Class) to allow for offsetting of residential accommodation (following demolition of existing building). REVISED DRAWINGS: The key changes are: height reduced by 1 storey, design alterations, reduction in number of bedrooms.*
- 1.3 Following updated SBEM calculations, this document illustrates a reduction of 26.49% in CO₂ emissions over that of the baseline of Part L of the regulated CO₂ emissions achieved via:

“Be Lean”

- No change to previously proposed scheme. Current fabric values have been maximised as well as ventilation and lighting.
- The improvement in the Be Lean figure is due to the change from CHP to ASHP on the TER.

“Be Clean”

- The scheme retains a future District Heat Network connection as originally proposed.
- The proposed CHP has now been removed.

“Be Green”

- A maximum possible PV array of 130m² (using 345w panels) will be installed across the scheme.
- To confirm, ASHPs are being proposed to provide Heating and Cooling to the Hotel rooms.

“Carbon Offsetting”

- 1.4 Following the on-site measures, it is proposed to offset the remainder of the carbon emissions for the required 35% target via off-site measures in the form of a carbon offset payment. According to the Mayor’s *Sustainable Design and Construction SPG (2015)*, the nationally recognised price for carbon dioxide include:
- The Zero Carbon Hub price, currently at £60 per tonne;
 - The non-trading price of carbon.

The overall contribution should be calculated over 30 years. For example, using the Zero Carbon Hub price it equates to £60 x 30 years = £1,800 per tonne of carbon dioxide to be off-set.”

- 1.5 In Camden, the Council follow the GLA methodology and pricing for the Zero Carbon Policy.
- 1.6 As the GLA sets the price of carbon at £1,800 per tonne of CO₂, the resulting contribution for the remaining regulated CO₂ will be: **£1,800 x 8.459 tonnes of CO₂ = £15,226**
- 1.7 The Carbon Emissions table on the next page highlights the changes in proposed CO₂ emissions to the scheme.

UPDATED CARBON EMISSIONS			
	ORIGINAL REPORT	CO ₂ Emissions (Tonnes per Annum) – Updated Calculations	
	Regulated	Regulated	
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	87.7	96.9	Regulated CO ₂ Savings at 'Be Lean' over Part L 2013 8.44%
Be Lean: Energy Demand Reduction	82.2	88.7	
Be Clean: Supply Energy Efficiently	58	88.7	
Be Green: Renewable Energy	55.6	71.2	
Regulated CO ₂ Savings at 'Be Green' over Part L 2013	36.66%	26.49%	
Cumulative on-site savings	32.1	25.7	
Carbon Shortfall	0	8.46	
	(Tonnes CO ₂)		
Cumulative savings for offset payment	8,459		
Cash-in-lieu contribution	£15,226		

2. PLANNING HISTORY

2.1 The proposed development has a current Planning Application ref: 2016/5266/P

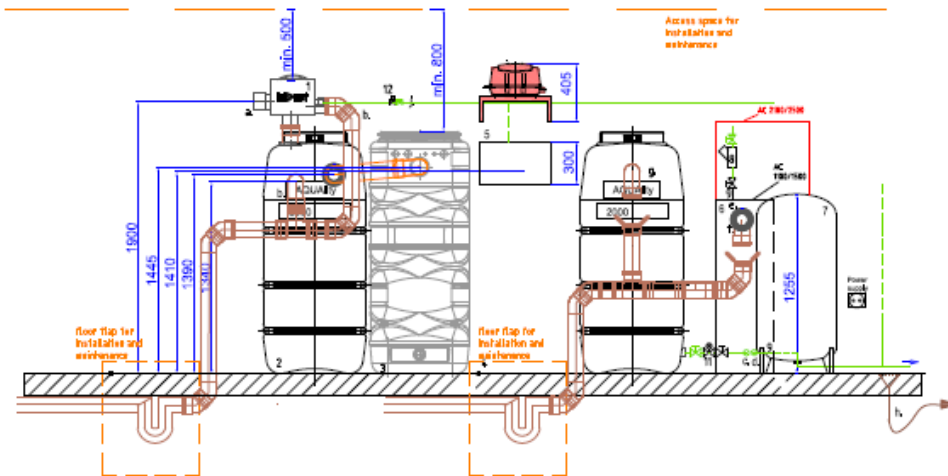
2.2 This report is intended to address the following comments:

NO.	ELEMENT	COMMENT	WHERE
1	ASHPs	<p>Further information required including:</p> <ul style="list-style-type: none"> · Air-air/ air-water system · Details of COP and Energy Efficiency ratio (EER) · Calculation of CO2 savings and demonstrate that ASHP is lower in terms of CO2 emissions than other heating/cooling systems. · Noise/visual impacts should be considered. Including consideration of 'quieter' options. · System should comply with minimum performance standards as set out in the ECA and MGS certification requirements. 	Section 5
2	Overheating	<p>Overheating – As the room data sheets have not yet been finalised and the Plant Selection is TBC, it is suggested that a CIBSE TM52 Overheating Analysis be made a Pre-Commencement Condition. The cooling hierarchy requires measures to be incorporated into the design to minimise internal heat therefore the analysis should be undertaken at the design stage. ACTION: Further information required</p>	Section 4
3	Recycled Materials	<p>Recycled Materials – A Contractor is not on-board for the project yet so this information is not known but it would be anticipated that Recycled Aggregates would be used for the Concrete. ACTION: A target should be included in the revised Energy Statement.</p>	Section 6

NO.	ELEMENT	COMMENT	WHERE
4	Greywater Recycling	<p>Due to the Roof Layout and use, it is not viable to provide Rainwater Harvesting to the scheme and Greywater Recycling would be impractical given the use as a Hotel. As stated previously major developments and high or intense water use developments, such as hotels, hostels and student housing, should include a grey water and rainwater harvesting system. Where such a system is not feasible or practical, developers must demonstrate to the Council's satisfaction that this is the case. ACTION:</p> <p>A feasibility assessment for greywater harvesting which should consider the following:</p> <ul style="list-style-type: none"> · the cost of the system; · cost savings for owner/occupier over a 10 year period; · projected grey water generation; · projected demand for use of grey water; · water savings as a result of the grey water system; and · payback for the system. 	Section 3

3. GREYWATER RECYCLING

- 3.1 Following comments made by Camden, further feasibility into Greywater Recycling has been made via a specialist provider (Aquality).
- 3.2 A review of the scheme can be found on the following page and indicates that the provision of such a system would have a payback of 12 years. This is not a great payback period, especially when based on a high occupancy level and due to the small size of the hotel, would have a limited water saving.
- 3.3 Further to this, the provision of Greywater Recycling would also require a Plant Room, illustrated below (and with a full drawing in the Appendices). This would require the loss of a Hotel Room and an estimated £50,000 of revenue an annum, reducing the viability of the scheme. Coupled with the high payback without this loss, it is not deemed feasible to incorporate Greywater Recycling into this scheme.



4. OVERHEATING

- 4.1 Overheating is an increasing issue in modern, well-insulated buildings. However, recently, there has been a focus in mitigating the potential for Overheating through passive design, adequate ventilation and mitigation measures such as low G-Values on Windows.

This development should have no issues with overheating due to all stages of the cooling hierarchy being followed, with the lack of communal heat distribution, provision of MVHR and openable windows (with blinds) being major factors in mitigating any potential risks.

It is expected that there will be a Planning Condition for a CIBSE TM52 Analysis for the scheme to highlight that after following the Cooling Hierarchy (as per the table on the right hand side of this page) there will be no risk of overheating to the Hotel Rooms and other occupied spaces.

Cooling Hierarchy	Measures Undertaken
1. Minimising internal heat generation through energy efficient design	<ul style="list-style-type: none"> As the rooms will be heated by VRF, there will not be any communal heat distribution within the building. Hot Water will be supplied centrally so there will be pipework associated with this. This pipework will be insulated beyond the requirements of the Non-Domestic Building Services guide in-order to reduce the heat losses to the minimum feasible.
2. Reducing the amount of heat entering the building in summer	<ul style="list-style-type: none"> Carefully designed shading measures have been considered, including: <ol style="list-style-type: none"> specification of Internal Blinds designing in the stack-effect inclusion of Solar Film to reduce the G-Value of the Windows
3. Use of thermal mass and high ceilings to manage the heat within the building	<ul style="list-style-type: none"> Level of exposed thermal mass has been maximised where possible, but it must be noted that in high buildings the internal partitions are built to minimize its weight so increasing thermal mass of internal partitions is not feasible for this scheme The Floor to Ceiling Height complies with statutory requirements.
4. Passive Ventilation	<ul style="list-style-type: none"> Openable Windows
5. Mechanical Ventilation	<ul style="list-style-type: none"> MVHR will be installed. Mechanical Ventilation will make use of 'free cooling' (when the outside air temperature is below that in the building during summer months). This will be achieved via a by-pass mode on the heat recovery system for summer mode operation. The AOVs in the corridors will also be timed to open when the temperature reaches a certain point therefore providing ventilation to cool the corridors.

Table 4: Cooling Hierarchy

5. RENEWABLE ENERGY (“Be Green”)

5.1 Following comments from Camden and a review of the scheme in terms of renewable energy, the following has been proposed:

- Provide PV to the maximum available roof area using high efficiency modules.
- Provide Heating and Cooling to the Hotel Rooms (and other relevant areas) using a Heat Pump System (VRF)

5.2 Details of the proposed Heat Pump system is:

ASHP System Details	
System Type	Air to Air
Efficiency (COP) - Heating	4.5
Efficiency (COP) - Cooling	6
CO ₂ Saving over Gas System	6.7 tonnes
System to meet ECA / MCS	Yes
Noise / Visual Impacts	<p>The system will be located in an unobtrusive location (the exact location on Roof to be determined by the appointed Contractor – it is expected an Acoustic Condition related to the Heat Pump is present on the approved permission and this will tie-in with the final location)</p> <p>In terms of noise, plant selection will occur during RIBA Stage 4 but the system will be designed with as few units as possible to avoid cumulative noise issues in-line with best practice as in controlling the noise at source i.e. quieter equipment and/or containment of that equipment</p> <p>These units will most likely be contained in a contained plant area i.e. a louvred enclosure. If required, an acoustic enclosure will be considered i.e. enclosure manufacturers such as Environ claim some 25 dB reduction from their systems. http://www.environ.co.uk/products/commercial-equipment.html</p>

PV System Details	
PV Proposed	130m ²
Module Output	345 Watts (Datasheet in Appendices)
Module Efficiency and Size	21.5% and 1.63m ²
Number of Panels	79
Panel Orientation	Horizontal
Tilt of Collectors	10 degrees
Over-Shading Factor	<20%
CO ₂ Saving	10.7 tonnes

Table 3: Proposed PV Specification

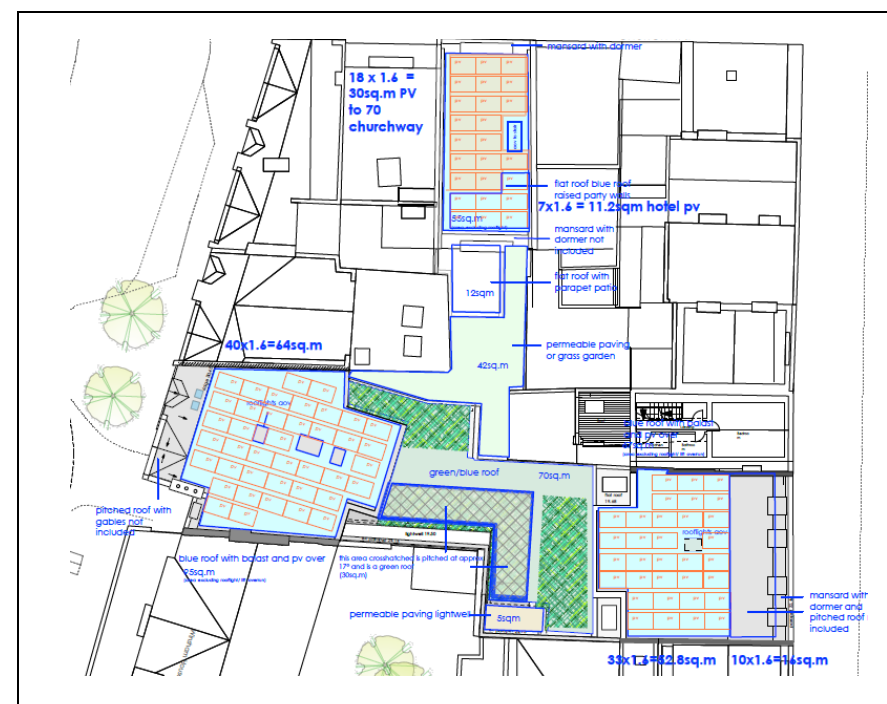


Figure 2: Proposed PV Drawing (for illustration only – not for Construction)

6. MATERIALS

- 6.1 When considering minimising the environmental impact of materials this requires the specification of materials with a low environmental impact across their lifetime. The BRE's Green Guide rating system focuses on the major building element build ups of the roof, external walls, internal walls, upper and ground floor and windows and rates each element from A+ to E across a range of environmental factors.
- 6.2 Note that any Retained Elements, including Hard Landscaping and Boundary Details achieve A+ under the Green Guide to Specification by default due to the low embodied carbon impact.

TIMBER SPECIFICATION

- 6.3 All timber products used on the project, including site as well as construction timber, will be legally harvested and traded timber. No products used in the development should be included on the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) list.

Additionally, all timber and timber-based products should be procured from suppliers and manufacturers who can provide full Chain of Custody certification for their corresponding products. Certifications that demonstrate full Chain of Custody certification include Forest Stewardship Council (FSC) or Programme for Endorsement of Forest Certification (PEFC).

INSULATION SPECIFICATION

- 6.4 The insulation for the scheme has been generally specified as mineral based insulation. This has the benefits of:
- ✓ Offers high performance and fire safety
 - ✓ Achieves an A+ rating when compared to the BRE Green Guide.
 - ✓ Has zero ozone depletion potential (zero ODP) and zero global warming potential (GWP).
 - ✓ Having BBA certification.

RECYCLED AGGREGATES

- 6.5 As there is not yet a Contractor on-board, there are no datapoints available on the potential for the use of recycled aggregates in the build. However, with a proposed Concrete Frame building, there is large potential for the use of recycled and sustainable aggregate in the build. For the scheme, the following brief shall apply:

Aim

To encourage the use of more sustainably sourced aggregates, encourage reuse where appropriate and avoid waste and pollution arising from disposal of demolition and other forms of waste.

Value

Encourages the specification of more sustainable aggregate sourcing options. Considers a broad range of factors influencing aggregates' selection, i.e. regional aggregate availability, environmental and social impacts of transportation and the overall carbon footprint.

Types and Uses of Aggregate:

Aggregate Types	Aggregate Uses
Hard rock (including limestone and granite)	Engineered Fill
Land-based sand or gravel	Concrete Coarse Aggregate
Marine-dredged sand or gravel	Concrete Fine Aggregate
Recycled	Asphalt Aggregate
Secondary	Granular Bedding

Targets

The use of secondary and recycled aggregate in higher value situations should be rewarded as a means to discourage their devaluation as a material resource or their disposal to landfill.

For this scheme, there is a target to use recycled aggregate for 10% of the projects requirement.

Appendix 1



53-55 Chalton Street & 60 Churchway
REDUCTION OF CARBON EMISSIONS - ADDENDUM

AREA	TER <i>Baseline Emissions</i>	Total Part L Baseline CO ₂	BER <i>'Be Lean'</i>	Total BER <i>'Be Lean'</i>	BER <i>'Be Clean'</i>	Total BER <i>'Be Clean'</i>	BER <i>'Be Green'</i> (ASHP and No PV)	Total BER <i>'Be Green'</i> (no PV)	BER <i>'Be Green'</i> (ASHP and PV)	Total BER <i>'Be Green'</i>
m ²	kg CO ₂ /m ² /yr	kg CO ₂ /yr	kg CO ₂ /m ² /yr	kg CO ₂ /yr	kg CO ₂ /m ² /yr	kg CO ₂ /yr	kg CO ₂ /m ² /yr	kg CO ₂ /yr	kg CO ₂ /yr	kg CO ₂ /yr
1410.1	68.7	96,874	62.9	88,695	62.9	88,695	58.1	81,927	50.5	71,210

CO ₂ Reduction at <i>'Be Lean'</i>	8.44%
Cumulative CO ₂ Reduction at <i>'Be Clean'</i>	8.44%
Cumulative CO ₂ Reduction at <i>'Be Green'</i>	26.49%
CO ₂ Reduction via Renewable Energy	19.71%

Appendix 2



Project name

Chalton Street - BE LEAN

As designed

Date: Wed Aug 07 17:23:17 2019

Administrative information

Building Details

Address: 53-55 Charlton Street, London, NW1 1HY

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , , Postcode

Certifier details

Name: NRG Consulting Ltd

Telephone number:

Address: PB219, The Pillbox, 115 Coventry Road, London, E2 6GG

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	70.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	70.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	62.9
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 -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	1K000000:Surf[1]
Floor	0.25	0.18	0.18	1K000000:Surf[0]
Roof	0.25	0.16	0.16	1R000000:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.49	1.71	0R000001:Surf[0]
Personnel doors	2.2	1.8	1.8	0R000001:Surf[6]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* 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	5

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	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Gass boiler with cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	6	0	0	0.9
Standard value	0.91*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- Gas Boiler bathrooms/stores + AHU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	7	0	0	0.9
Standard value	0.91*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.005
Standard value	0.8	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	
-1 refuse store	-	0.1	0	-	-	-	-	-	-	-	N/A	
-1 plant/store room	-	0.1	0	-	-	-	-	-	-	-	N/A	
-1 linen store	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 bathroom	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 WC	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 bike store	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 luggage store	-	0.1	0	-	-	-	-	-	-	-	N/A	
1 bathroom	-	0.1	0	-	-	-	-	-	-	-	N/A	

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
1 bathroom	-	0.1	0	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
-1 kitchen		-	120	-	285
-1 kitchen		-	120	-	36
-1 kitchen		-	120	-	42
-1 refuse store		120	-	-	15
-1 plant/store room		120	-	-	13
-1 stair		-	120	-	15
-1 corridor		-	120	-	91
-1 linen store		120	-	-	2
-1 stair		-	120	-	22
0 restaurant		-	120	35	128
0 private dining		-	120	35	117
0 bar		-	120	35	37
0 store/chiller		120	-	-	10
0 bathroom		-	120	-	23
0 stair		-	120	-	19
0 corridor		-	120	-	38
0 reception		-	120	35	331
0 WC		-	120	-	49
0 bike store		120	-	-	6
0 back office		120	-	-	130
0 luggage store		120	-	-	9
0 stair		-	120	-	32
1 corridor		-	120	-	14
1 stair		-	120	-	15
1 corridor		-	120	-	10
1 corridor		-	120	-	83
1 stair		-	120	-	21
1 bathroom		-	120	-	13
1 bedroom		-	120	-	10
2 corridor		-	120	-	14
2 corridor		-	120	-	10
2 corridor		-	120	-	8
2 stair		-	120	-	15
2 stair		-	120	-	21
2 corridor		-	120	-	17
3 corridor		-	120	-	12
3 corridor		-	120	-	10
3 corridor		-	120	-	8

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
3 stair		-	120	-	15
3 stair		-	120	-	21
3 corridor		-	120	-	17
-1 bedroom		-	120	-	20
-1 bedroom		-	120	-	20
-1 bedroom		-	120	-	23
-1 bedroom		-	120	-	19
-1 bedroom		-	120	-	19
-1 bedroom		-	120	-	31
-1 bedroom		-	120	-	18
-1 bedroom		-	120	-	20
-1 bedroom		-	120	-	23
-1 bedroom		-	120	-	26
-1 bedroom		-	120	-	24
-1 bedroom		-	120	-	27
1 bedroom		-	120	-	22
1 bedroom		-	120	-	19
1 bedroom		-	120	-	19
1 bedroom		-	120	-	23
1 bedroom		-	120	-	32
1 bedroom		-	120	-	15
1 bedroom		-	120	-	15
1 bedroom		-	120	-	22
1 bedroom		-	120	-	23
1 bedroom		-	120	-	20
1 bedroom		-	120	-	29
1 bedroom		-	120	-	25
1 bathroom		-	120	-	36
1 bedroom		-	120	-	20
2 bedroom		-	120	-	23
2 bedroom		-	120	-	20
2 bedroom		-	120	-	30
2 bedroom		-	120	-	23
2 bedroom		-	120	-	25
2 bedroom		-	120	-	22
2 bedroom		-	120	-	19
2 bedroom		-	120	-	19
2 bedroom		-	120	-	17
2 bedroom		-	120	-	25
3 bedroom		-	120	-	21
3 bedroom		-	120	-	17
3 bedroom		-	120	-	18
3 bedroom		-	120	-	17

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
3 bedroom		-	120	-	25
3 bedroom		-	120	-	25
3 bedroom		-	120	-	36
3 bedroom		-	120	-	26
3 bedroom		-	120	-	23

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?
-1 kitchen	N/A	N/A
-1 kitchen	N/A	N/A
-1 kitchen	N/A	N/A
-1 refuse store	N/A	N/A
-1 plant/store room	N/A	N/A
-1 stair	N/A	N/A
-1 corridor	NO (-93.6%)	NO
-1 linen store	N/A	N/A
-1 stair	N/A	N/A
0 restaurant	NO (-23.4%)	NO
0 private dining	NO (-91.9%)	NO
0 bar	NO (-43.9%)	NO
0 store/chiller	N/A	N/A
0 bathroom	N/A	N/A
0 stair	N/A	N/A
0 corridor	N/A	N/A
0 reception	NO (-38.4%)	NO
0 WC	NO (-89.1%)	NO
0 bike store	N/A	N/A
0 back office	NO (-54.4%)	NO
0 luggage store	N/A	N/A
0 stair	N/A	N/A
1 corridor	N/A	N/A
1 stair	N/A	N/A
1 corridor	N/A	N/A
1 corridor	NO (-79.6%)	NO
1 stair	NO (-71.1%)	NO
1 bathroom	N/A	N/A
1 bedroom	NO (-60.4%)	NO
2 corridor	N/A	N/A
2 corridor	N/A	N/A
2 corridor	N/A	N/A
2 stair	N/A	N/A
2 stair	NO (-63.9%)	NO
2 corridor	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3 corridor	YES (+46.4%)	NO
3 corridor	YES (+257.4%)	NO
3 corridor	YES (+248.5%)	NO
3 stair	N/A	N/A
3 stair	NO (-61.7%)	NO
3 corridor	YES (+150.3%)	NO
-1 bedroom	NO (-77.7%)	NO
-1 bedroom	NO (-55.5%)	NO
-1 bedroom	NO (-77.2%)	NO
-1 bedroom	NO (-17.2%)	NO
-1 bedroom	NO (-42.1%)	NO
-1 bedroom	NO (-76.8%)	NO
-1 bedroom	NO (-73.4%)	NO
-1 bedroom	N/A	N/A
-1 bedroom	NO (-84.4%)	NO
-1 bedroom	NO (-92.6%)	NO
-1 bedroom	NO (-79.8%)	NO
-1 bedroom	NO (-68.6%)	NO
1 bedroom	NO (-38.3%)	NO
1 bedroom	NO (-55.6%)	NO
1 bedroom	NO (-57.1%)	NO
1 bedroom	NO (-77.9%)	NO
1 bedroom	NO (-84.8%)	NO
1 bedroom	NO (-45.5%)	NO
1 bedroom	NO (-62.6%)	NO
1 bedroom	NO (-80.9%)	NO
1 bedroom	NO (-71.3%)	NO
1 bedroom	NO (-58.4%)	NO
1 bedroom	NO (-8.3%)	NO
1 bedroom	NO (-87.5%)	NO
1 bathroom	NO (-70.6%)	NO
1 bedroom	N/A	N/A
2 bedroom	N/A	N/A
2 bedroom	NO (-76.2%)	NO
2 bedroom	NO (-65%)	NO
2 bedroom	NO (-68.2%)	NO
2 bedroom	NO (-66.7%)	NO
2 bedroom	NO (-52.2%)	NO
2 bedroom	NO (-65.7%)	NO
2 bedroom	NO (-66.9%)	NO
2 bedroom	NO (-57.8%)	NO
2 bedroom	NO (-67.5%)	NO
3 bedroom	NO (-82%)	NO
3 bedroom	NO (-73.9%)	NO
3 bedroom	NO (-89.6%)	NO
3 bedroom	NO (-82.7%)	NO
3 bedroom	NO (-64.6%)	NO
3 bedroom	NO (-76.4%)	NO
3 bedroom	NO (-92%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3 bedroom	NO (-78.1%)	NO
3 bedroom	NO (-68.1%)	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]	1447.3	1447.3
External area [m ²]	1874.9	1874.9
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	633.51	891.46
Average U-value [W/m ² K]	0.34	0.48
Alpha value* [%]	10.08	10

* 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
B1 Offices and Workshop businesses
B2 to B7 General Industrial and Special Industrial Groups
B8 Storage or Distribution
100 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/m²]

	Actual	Notional
Heating	42.1	47.24
Cooling	3.42	4.51
Auxiliary	0.1	0.59
Lighting	8.38	20.35
Hot water	221.07	220.93
Equipment*	27.59	27.59
TOTAL **	275.07	293.61

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	186.03	208.1
Primary energy* [kWh/m ²]	356.68	403.32
Total emissions [kg/m ²]	62.9	70.8

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
Actual	124.9	53	38.9	3.6	0	0.89	4.11	0.91	5.5	
Notional	0	0	0	0	0	0	0	----	----	
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
Actual	287.8	16.7	89.6	1	1.6	0.89	4.86	0.91	6.5	
Notional	133.9	64.3	43.1	4.7	0	0.86	3.79	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	334.4	19.4	107.8	1.4	9.2	0.86	3.79	----	----	

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-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	1K000000:Surf[1]
Floor	0.2	0.18	1K000000:Surf[0]
Roof	0.15	0.16	1R000000:Surf[1]
Windows, roof windows, and rooflights	1.5	1.45	1C000000:Surf[2]
Personnel doors	1.5	1.8	0R000001:Surf[6]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-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
m³/(h.m²) at 50 Pa	5	5

Project name

Chalton Street - BE GREEN NO PV

As designed

Date: Wed Aug 07 16:49:57 2019

Administrative information

Building Details

Address: 53-55 Charlton Street, London, NW1 1HY

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , , Postcode

Certifier details

Name: NRG Consulting Ltd

Telephone number:

Address: PB219, The Pillbox, 115 Coventry Road, London, E2 6GG

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	68.7
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	68.7
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	58.1
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 -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	1K000000:Surf[1]
Floor	0.25	0.18	0.18	1K000000:Surf[0]
Roof	0.25	0.16	0.16	1R000000:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.49	1.71	0R000001:Surf[0]
Personnel doors	2.2	1.8	1.8	0R000001:Surf[6]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* 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	5

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	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Main system VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	6	0	0	0.9
Standard value	2.5*	3.2	N/A	N/A	0.5
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.					

2- Main system bathrooms/stores

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	7	0	0	0.9
Standard value	2.5*	3.2	N/A	N/A	0.5
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- DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.005
Standard value	0.8	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	
-1 refuse store	-	0.1	0	-	-	-	-	-	-	-	N/A	
-1 plant/store room	-	0.1	0	-	-	-	-	-	-	-	N/A	
-1 linen store	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 bathroom	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 WC	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 bike store	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 luggage store	-	0.1	0	-	-	-	-	-	-	-	N/A	
1 bathroom	-	0.1	0	-	-	-	-	-	-	-	N/A	

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
1 bathroom	-	0.1	0	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
-1 kitchen		-	120	-	285
-1 kitchen		-	120	-	36
-1 kitchen		-	120	-	42
-1 refuse store		120	-	-	15
-1 plant/store room		120	-	-	13
-1 stair		-	120	-	15
-1 corridor		-	120	-	91
-1 linen store		120	-	-	2
-1 stair		-	120	-	22
0 restaurant		-	120	35	128
0 private dining		-	120	35	117
0 bar		-	120	35	37
0 store/chiller		120	-	-	10
0 bathroom		-	120	-	23
0 stair		-	120	-	19
0 corridor		-	120	-	38
0 reception		-	120	35	331
0 WC		-	120	-	49
0 bike store		120	-	-	6
0 back office		120	-	-	130
0 luggage store		120	-	-	9
0 stair		-	120	-	32
1 corridor		-	120	-	14
1 stair		-	120	-	15
1 corridor		-	120	-	10
1 corridor		-	120	-	83
1 stair		-	120	-	21
1 bathroom		-	120	-	13
1 bedroom		-	120	-	10
2 corridor		-	120	-	14
2 corridor		-	120	-	10
2 corridor		-	120	-	8
2 stair		-	120	-	15
2 stair		-	120	-	21
2 corridor		-	120	-	17
3 corridor		-	120	-	12
3 corridor		-	120	-	10
3 corridor		-	120	-	8

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
3 stair		-	120	-	15
3 stair		-	120	-	21
3 corridor		-	120	-	17
-1 bedroom		-	120	-	20
-1 bedroom		-	120	-	20
-1 bedroom		-	120	-	23
-1 bedroom		-	120	-	19
-1 bedroom		-	120	-	19
-1 bedroom		-	120	-	31
-1 bedroom		-	120	-	18
-1 bedroom		-	120	-	20
-1 bedroom		-	120	-	23
-1 bedroom		-	120	-	26
-1 bedroom		-	120	-	24
-1 bedroom		-	120	-	27
1 bedroom		-	120	-	22
1 bedroom		-	120	-	19
1 bedroom		-	120	-	19
1 bedroom		-	120	-	23
1 bedroom		-	120	-	32
1 bedroom		-	120	-	15
1 bedroom		-	120	-	15
1 bedroom		-	120	-	22
1 bedroom		-	120	-	23
1 bedroom		-	120	-	20
1 bedroom		-	120	-	29
1 bedroom		-	120	-	25
1 bathroom		-	120	-	36
1 bedroom		-	120	-	20
2 bedroom		-	120	-	23
2 bedroom		-	120	-	20
2 bedroom		-	120	-	30
2 bedroom		-	120	-	23
2 bedroom		-	120	-	25
2 bedroom		-	120	-	22
2 bedroom		-	120	-	19
2 bedroom		-	120	-	19
2 bedroom		-	120	-	17
2 bedroom		-	120	-	25
3 bedroom		-	120	-	21
3 bedroom		-	120	-	17
3 bedroom		-	120	-	18
3 bedroom		-	120	-	17

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
3 bedroom		-	120	-	25
3 bedroom		-	120	-	25
3 bedroom		-	120	-	36
3 bedroom		-	120	-	26
3 bedroom		-	120	-	23

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?
-1 kitchen	N/A	N/A
-1 kitchen	N/A	N/A
-1 kitchen	N/A	N/A
-1 refuse store	N/A	N/A
-1 plant/store room	N/A	N/A
-1 stair	N/A	N/A
-1 corridor	NO (-93.6%)	NO
-1 linen store	N/A	N/A
-1 stair	N/A	N/A
0 restaurant	NO (-23.4%)	NO
0 private dining	NO (-91.9%)	NO
0 bar	NO (-43.9%)	NO
0 store/chiller	N/A	N/A
0 bathroom	N/A	N/A
0 stair	N/A	N/A
0 corridor	N/A	N/A
0 reception	NO (-38.4%)	NO
0 WC	NO (-89.1%)	NO
0 bike store	N/A	N/A
0 back office	NO (-54.4%)	NO
0 luggage store	N/A	N/A
0 stair	N/A	N/A
1 corridor	N/A	N/A
1 stair	N/A	N/A
1 corridor	N/A	N/A
1 corridor	NO (-79.6%)	NO
1 stair	NO (-71.1%)	NO
1 bathroom	N/A	N/A
1 bedroom	NO (-60.4%)	NO
2 corridor	N/A	N/A
2 corridor	N/A	N/A
2 corridor	N/A	N/A
2 stair	N/A	N/A
2 stair	NO (-63.9%)	NO
2 corridor	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3 corridor	YES (+46.4%)	NO
3 corridor	YES (+257.4%)	NO
3 corridor	YES (+248.5%)	NO
3 stair	N/A	N/A
3 stair	NO (-61.7%)	NO
3 corridor	YES (+150.3%)	NO
-1 bedroom	NO (-77.7%)	NO
-1 bedroom	NO (-55.5%)	NO
-1 bedroom	NO (-77.2%)	NO
-1 bedroom	NO (-17.2%)	NO
-1 bedroom	NO (-42.1%)	NO
-1 bedroom	NO (-76.8%)	NO
-1 bedroom	NO (-73.4%)	NO
-1 bedroom	N/A	N/A
-1 bedroom	NO (-84.4%)	NO
-1 bedroom	NO (-92.6%)	NO
-1 bedroom	NO (-79.8%)	NO
-1 bedroom	NO (-68.6%)	NO
1 bedroom	NO (-38.3%)	NO
1 bedroom	NO (-55.6%)	NO
1 bedroom	NO (-57.1%)	NO
1 bedroom	NO (-77.9%)	NO
1 bedroom	NO (-84.8%)	NO
1 bedroom	NO (-45.5%)	NO
1 bedroom	NO (-62.6%)	NO
1 bedroom	NO (-80.9%)	NO
1 bedroom	NO (-71.3%)	NO
1 bedroom	NO (-58.4%)	NO
1 bedroom	NO (-8.3%)	NO
1 bedroom	NO (-87.5%)	NO
1 bathroom	NO (-70.6%)	NO
1 bedroom	N/A	N/A
2 bedroom	N/A	N/A
2 bedroom	NO (-76.2%)	NO
2 bedroom	NO (-65%)	NO
2 bedroom	NO (-68.2%)	NO
2 bedroom	NO (-66.7%)	NO
2 bedroom	NO (-52.2%)	NO
2 bedroom	NO (-65.7%)	NO
2 bedroom	NO (-66.9%)	NO
2 bedroom	NO (-57.8%)	NO
2 bedroom	NO (-67.5%)	NO
3 bedroom	NO (-82%)	NO
3 bedroom	NO (-73.9%)	NO
3 bedroom	NO (-89.6%)	NO
3 bedroom	NO (-82.7%)	NO
3 bedroom	NO (-64.6%)	NO
3 bedroom	NO (-76.4%)	NO
3 bedroom	NO (-92%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3 bedroom	NO (-78.1%)	NO
3 bedroom	NO (-68.1%)	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]	1447.3	1447.3
External area [m ²]	1874.9	1874.9
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	633.51	891.46
Average U-value [W/m ² K]	0.34	0.48
Alpha value* [%]	10.08	10

* 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
B1 Offices and Workshop businesses
B2 to B7 General Industrial and Special Industrial Groups
B8 Storage or Distribution

100 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/m²]

	Actual	Notional
Heating	8.51	15.92
Cooling	3.42	4.51
Auxiliary	0.1	0.59
Lighting	8.38	20.35
Hot water	221.07	220.93
Equipment*	27.59	27.59
TOTAL **	241.48	262.29

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	186.03	208.1
Primary energy* [kWh/m ²]	356.28	441
Total emissions [kg/m ²]	58.1	68.7

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	124.9	53	7.9	3.6	0	4.41	4.11	4.5	5.5
	Notional	0	0	0	0	0	0	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	287.8	16.7	18.1	1	1.6	4.41	4.86	4.5	6.5
	Notional	133.9	64.3	14.5	4.7	0	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	334.4	19.4	36.3	1.4	9.2	2.56	3.79	----	----

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-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	1K000000:Surf[1]
Floor	0.2	0.18	1K000000:Surf[0]
Roof	0.15	0.16	1R000000:Surf[1]
Windows, roof windows, and rooflights	1.5	1.45	1C000000:Surf[2]
Personnel doors	1.5	1.8	0R000001:Surf[6]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-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
m³/(h.m²) at 50 Pa	5	5

Project name

Chalton Street - BE GREEN

As designed

Date: Wed May 08 13:14:04 2019

Administrative information

Building Details

Address: 53-55 Charlton Street, London, NW1 1HY

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.10

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.10

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , , Postcode

Certifier details

Name: NRG Consulting Ltd

Telephone number:

Address: PB219, The Pillbox, 115 Coventry Road, London, E2 6GG

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	68.7
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	68.7
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	50.5
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 -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	1K000000:Surf[1]
Floor	0.25	0.18	0.18	1K000000:Surf[0]
Roof	0.25	0.16	0.16	1R000000:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.49	1.71	0R000001:Surf[0]
Personnel doors	2.2	1.8	1.8	0R000001:Surf[6]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* 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	5

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	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Main system VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	6	0	0	0.9
Standard value	2.5*	3.2	N/A	N/A	0.5
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.					

2- Main system bathrooms/stores

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	7	0	0	0.9
Standard value	2.5*	3.2	N/A	N/A	0.5
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- DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.005
Standard value	0.8	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	
-1 refuse store	-	0.1	0	-	-	-	-	-	-	-	N/A	
-1 plant/store room	-	0.1	0	-	-	-	-	-	-	-	N/A	
-1 linen store	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 bathroom	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 WC	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 bike store	-	0.1	0	-	-	-	-	-	-	-	N/A	
0 luggage store	-	0.1	0	-	-	-	-	-	-	-	N/A	
1 bathroom	-	0.1	0	-	-	-	-	-	-	-	N/A	

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
1 bathroom	-	0.1	0	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
-1 kitchen		-	120	-	285
-1 kitchen		-	120	-	36
-1 kitchen		-	120	-	42
-1 refuse store		120	-	-	15
-1 plant/store room		120	-	-	13
-1 stair		-	120	-	15
-1 corridor		-	120	-	91
-1 linen store		120	-	-	2
-1 stair		-	120	-	22
0 restaurant		-	120	35	128
0 private dining		-	120	35	117
0 bar		-	120	35	37
0 store/chiller		120	-	-	10
0 bathroom		-	120	-	23
0 stair		-	120	-	19
0 corridor		-	120	-	38
0 reception		-	120	35	331
0 WC		-	120	-	49
0 bike store		120	-	-	6
0 back office		120	-	-	130
0 luggage store		120	-	-	9
0 stair		-	120	-	32
1 corridor		-	120	-	14
1 stair		-	120	-	15
1 corridor		-	120	-	10
1 corridor		-	120	-	83
1 stair		-	120	-	21
1 bathroom		-	120	-	13
1 bedroom		-	120	-	10
2 corridor		-	120	-	14
2 corridor		-	120	-	10
2 corridor		-	120	-	8
2 stair		-	120	-	15
2 stair		-	120	-	21
2 corridor		-	120	-	17
3 corridor		-	120	-	12
3 corridor		-	120	-	10
3 corridor		-	120	-	8

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
3 stair		-	120	-	15
3 stair		-	120	-	21
3 corridor		-	120	-	17
-1 bedroom		-	120	-	20
-1 bedroom		-	120	-	20
-1 bedroom		-	120	-	23
-1 bedroom		-	120	-	19
-1 bedroom		-	120	-	19
-1 bedroom		-	120	-	31
-1 bedroom		-	120	-	18
-1 bedroom		-	120	-	20
-1 bedroom		-	120	-	23
-1 bedroom		-	120	-	26
-1 bedroom		-	120	-	24
-1 bedroom		-	120	-	27
1 bedroom		-	120	-	22
1 bedroom		-	120	-	19
1 bedroom		-	120	-	19
1 bedroom		-	120	-	23
1 bedroom		-	120	-	32
1 bedroom		-	120	-	15
1 bedroom		-	120	-	15
1 bedroom		-	120	-	22
1 bedroom		-	120	-	23
1 bedroom		-	120	-	20
1 bedroom		-	120	-	29
1 bedroom		-	120	-	25
1 bathroom		-	120	-	36
1 bedroom		-	120	-	20
2 bedroom		-	120	-	23
2 bedroom		-	120	-	20
2 bedroom		-	120	-	30
2 bedroom		-	120	-	23
2 bedroom		-	120	-	25
2 bedroom		-	120	-	22
2 bedroom		-	120	-	19
2 bedroom		-	120	-	19
2 bedroom		-	120	-	17
2 bedroom		-	120	-	25
3 bedroom		-	120	-	21
3 bedroom		-	120	-	17
3 bedroom		-	120	-	18
3 bedroom		-	120	-	17

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
3 bedroom		-	120	-	25
3 bedroom		-	120	-	25
3 bedroom		-	120	-	36
3 bedroom		-	120	-	26
3 bedroom		-	120	-	23

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?
-1 kitchen	N/A	N/A
-1 kitchen	N/A	N/A
-1 kitchen	N/A	N/A
-1 refuse store	N/A	N/A
-1 plant/store room	N/A	N/A
-1 stair	N/A	N/A
-1 corridor	NO (-93.6%)	NO
-1 linen store	N/A	N/A
-1 stair	N/A	N/A
0 restaurant	NO (-23.4%)	NO
0 private dining	NO (-91.9%)	NO
0 bar	NO (-43.9%)	NO
0 store/chiller	N/A	N/A
0 bathroom	N/A	N/A
0 stair	N/A	N/A
0 corridor	N/A	N/A
0 reception	NO (-38.4%)	NO
0 WC	NO (-89.1%)	NO
0 bike store	N/A	N/A
0 back office	NO (-54.4%)	NO
0 luggage store	N/A	N/A
0 stair	N/A	N/A
1 corridor	N/A	N/A
1 stair	N/A	N/A
1 corridor	N/A	N/A
1 corridor	NO (-79.6%)	NO
1 stair	NO (-71.1%)	NO
1 bathroom	N/A	N/A
1 bedroom	NO (-60.4%)	NO
2 corridor	N/A	N/A
2 corridor	N/A	N/A
2 corridor	N/A	N/A
2 stair	N/A	N/A
2 stair	NO (-63.9%)	NO
2 corridor	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3 corridor	YES (+46.4%)	NO
3 corridor	YES (+257.4%)	NO
3 corridor	YES (+248.5%)	NO
3 stair	N/A	N/A
3 stair	NO (-61.7%)	NO
3 corridor	YES (+150.3%)	NO
-1 bedroom	NO (-77.7%)	NO
-1 bedroom	NO (-55.5%)	NO
-1 bedroom	NO (-77.2%)	NO
-1 bedroom	NO (-17.2%)	NO
-1 bedroom	NO (-42.1%)	NO
-1 bedroom	NO (-76.8%)	NO
-1 bedroom	NO (-73.4%)	NO
-1 bedroom	N/A	N/A
-1 bedroom	NO (-84.4%)	NO
-1 bedroom	NO (-92.6%)	NO
-1 bedroom	NO (-79.8%)	NO
-1 bedroom	NO (-68.6%)	NO
1 bedroom	NO (-38.3%)	NO
1 bedroom	NO (-55.6%)	NO
1 bedroom	NO (-57.1%)	NO
1 bedroom	NO (-77.9%)	NO
1 bedroom	NO (-84.8%)	NO
1 bedroom	NO (-45.5%)	NO
1 bedroom	NO (-62.6%)	NO
1 bedroom	NO (-80.9%)	NO
1 bedroom	NO (-71.3%)	NO
1 bedroom	NO (-58.4%)	NO
1 bedroom	NO (-8.3%)	NO
1 bedroom	NO (-87.5%)	NO
1 bathroom	NO (-70.6%)	NO
1 bedroom	N/A	N/A
2 bedroom	N/A	N/A
2 bedroom	NO (-76.2%)	NO
2 bedroom	NO (-65%)	NO
2 bedroom	NO (-68.2%)	NO
2 bedroom	NO (-66.7%)	NO
2 bedroom	NO (-52.2%)	NO
2 bedroom	NO (-65.7%)	NO
2 bedroom	NO (-66.9%)	NO
2 bedroom	NO (-57.8%)	NO
2 bedroom	NO (-67.5%)	NO
3 bedroom	NO (-82%)	NO
3 bedroom	NO (-73.9%)	NO
3 bedroom	NO (-89.6%)	NO
3 bedroom	NO (-82.7%)	NO
3 bedroom	NO (-64.6%)	NO
3 bedroom	NO (-76.4%)	NO
3 bedroom	NO (-92%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3 bedroom	NO (-78.1%)	NO
3 bedroom	NO (-68.1%)	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]	1447.3	1447.3
External area [m ²]	1874.9	1874.9
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	633.51	891.46
Average U-value [W/m ² K]	0.34	0.48
Alpha value* [%]	10.08	10

* 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
B1 Offices and Workshop businesses
B2 to B7 General Industrial and Special Industrial Groups
B8 Storage or Distribution

100 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/m²]

	Actual	Notional
Heating	8.51	15.92
Cooling	3.42	4.51
Auxiliary	0.1	0.59
Lighting	8.38	20.35
Hot water	221.07	220.93
Equipment*	27.59	27.59
TOTAL **	241.48	262.29

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	14.65	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	186.03	208.1
Primary energy* [kWh/m ²]	356.28	441
Total emissions [kg/m ²]	50.5	68.7

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	124.9	53	7.9	3.6	0	4.41	4.11	4.5	5.5
	Notional	0	0	0	0	0	0	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	287.8	16.7	18.1	1	1.6	4.41	4.86	4.5	6.5
	Notional	133.9	64.3	14.5	4.7	0	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	334.4	19.4	36.3	1.4	9.2	2.56	3.79	----	----

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

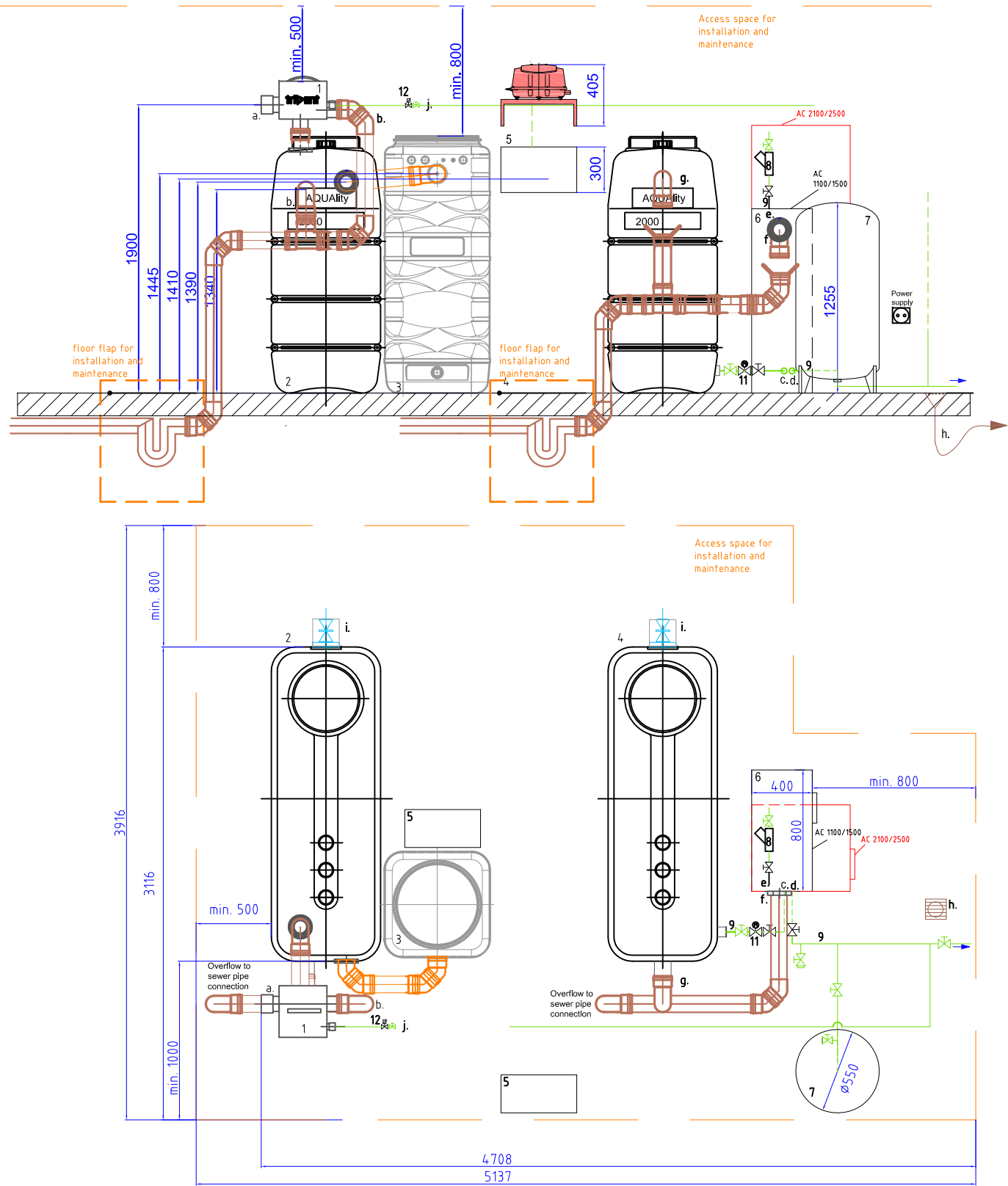
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Floor	0.2	0.18	1K000000:Surf[0]
Roof	0.15	0.16	1R000000:Surf[1]
Windows, roof windows, and rooflights	1.5	1.45	1C000000:Surf[2]
Personnel doors	1.5	1.8	0R000001:Surf[6]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-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
m³/(h.m²) at 50 Pa	5	5

Appendix 3



3) Plant room drawing



Greywater recycling system; general schematic / installation example

Brand: AQUALITY
Type: Aqua-Recycling-Control 80B Plus with Aqua-Control and accessories
Max. treatment capacity: 2,000 litres/day;
Greywater storage volume: 2,000 l
Non-potable water storage volume: 2,000 l
Pore size filter membranes: 38 nanometer
Programmable and fully-automatic; filter cleaning for greywater coarse filter, stagnation prevention for mainswater pipe and non-potable water storage tank, basement tank safety valve
Electrical power supply greywater treatment control: 1x 220V 50Hz 16A (fuse), 400 W
Dimensions total plant: L x W = 5,000 x 3,300 mm
Space requirements (incl. access space): L x W 5,500 x 4,000 mm;
Min. ceiling height for MBR-Tank maintenance: 2,500 mm;
Min. ceiling height for Coarse filter maintenance: 2,600 mm;
Dimension largest tank: L x W x H = 2,230 x 995 x 1,650 mm;
Empty weight total plant: ca. 800 kg;
Empty weight heaviest component: ca. 180 kg;
Standard cable length from control to tanks: 5m, compressor hose to ISB-MBR-tank: 5m, greywater pump hose to ISB-MBR-tank: 3m, hose from ISB-MBR-tank to non-potable water tank: 3m

Please note the drawing shows the standard configuration for this greywater recycling system. Different building types, operating times, applications or usage patterns which affect greywater yield and / or non-potable water demand can require different greywater and / or non-potable water storage tank volumes. Please contact our office or your local sales representative for further advice, project specific dimensions, weights, space requirements or customized tank configurations.

Air ventilation of greywater tanks must be provided via greywater collection pipes. Frost protection and air ventilation of the plant location must be guaranteed. Greywater collection pipes, drainage pipes for overflows from tanks and coarse filter, drainage facilities for Aqua-Control and sludge removal (where required with back flow prevention or sump pump), non-potable water or mainswater pipes, cables for power supplies, BMS or other interfaces are not included in the scope of supply of AQUALITY Trading & Consulting Ltd. These are to be provided by others. GSM SIM Card must be available for remote control.

No liability for printing errors. We reserve the right to make technical changes. All transactions are subject to our general terms and conditions. Please contact our office for further information.

Components:

1. Greywater coarse filter
2. Greywater storage tank
3. Membrane-Bio-Reactor-Tank
4. Non-potable water storage tank
5. GWRS control panel and compressor (for wall mounting)
6. Aqua-Control
7. Expansion vessel (60 – 500 l; depending on flow rate; Drawing shows 200l version)
8. Mainswater filter (s. tbl.)
9. Pipe connection set for suction, pressure and mainswater pipe
10. Non-potable water tank drain down valve (s. tbl.)
11. Basement tank safety valve (s. tbl.)
12. Coarse filter cleaning solenoid valve $\frac{1}{2}$ "

Hydraulic connections:

- a. DN 100 greywater inlet from shower/bath/whb
- b. DN 100 greywater overflow to foul water drain (piped)
- c. Non-potable water suction pipe (s. tbl.)
- d. Non-potable water pressure pipe (s. tbl.)
- e. Mainswater connection for automatic top-up, flow pressure: 1 - 4 bar (s. tbl.)
- f. DN 100 emergency overflow mainswater break tank Aqua-Control
- g. DN 100 emergency overflow non-potable water storage
- h. floor drain points for manual tank drain down and sludge removal
- i. 1" automatic tank drain down via solenoid valve
- j. $\frac{1}{2}$ " automatic coarse filter cleaning; flow pressure: 1 - 2 bar

System:

WATER RECLAMATION SYSTEM
GREYWATER RECYCLING
Aqua-Recycling-Control 120B+
Aqua-Control 1100 / 1500 / 2100 / 2500

Project:

XXX

Title:

Plant room

Date:

XX-XX-2016

Drawing-No:

XXXX-XX

Project-No:

XXX

Drawn by:

M Hessler

Project state:

Drawing

Scale:

A3 nts



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Appendix 4



SunPower® X-Series Commercial Solar Panels | X21-345-COM

More than 21% Efficiency

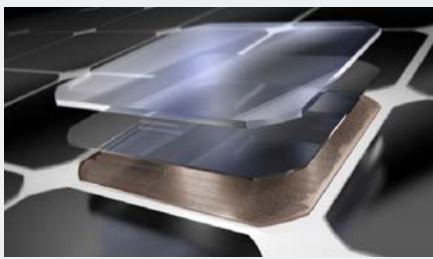
Captures more sunlight and generates more power than conventional panels.

Maximum Performance

Designed to perform in demanding real-world conditions of high temperatures, partial shade from overhead wires, and low light.¹

Commercial Grade

Intended for commercial sites where maximum energy production is critical.



Maxeon® Solar Cells: Fundamentally better

Engineered for performance, designed for reliability.

Engineered for Peace of Mind

Designed to deliver consistent, trouble-free energy over a very long lifetime.²

Designed for Reliability

The SunPower Maxeon solar cell is the only cell built on a solid metal foundation. Virtually impervious to the corrosion and cracking that degrade conventional panels.

Same excellent durability as E-Series panels.
#1 Rank in Fraunhofer durability test.³

High Performance & Excellent Reliability



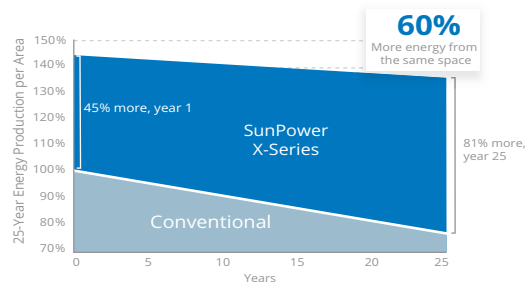
SPR-X21-345-COM



High Efficiency

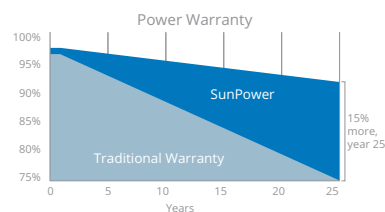
Generate more energy per square foot

More energy to power your operations. X-Series commercial systems convert more sunlight to electricity by producing 45% more energy in the first year. This advantage increases over time, producing 60% more energy over the first 25 years to meet your needs.¹

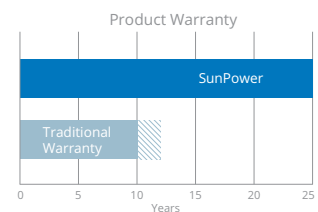


Best Reliability, Best Warranty

A better warranty starts with a better product. Proven performance backs up our industry-best coverage, including our warranted 0.25% per year degradation rate.⁴



More guaranteed power: 98% for first year, -0.25%/yr. to year 25



Combined Power and Product defect 25-year coverage

SunPower® X-Series Commercial Solar Panels | X21-345-COM

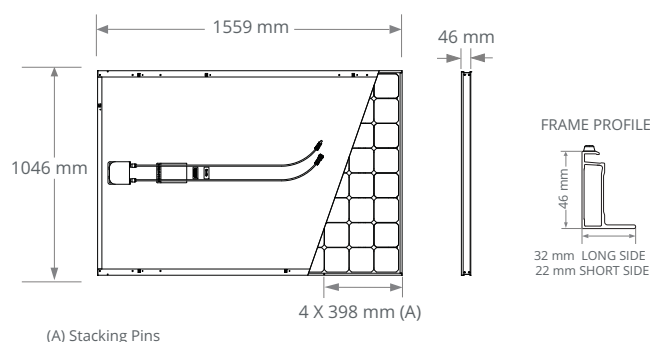
Electrical Data		
	SPR-X21-345-COM	SPR-X20-327-COM
Nominal Power (P _{nom}) ⁵	345 W	327 W
Power Tolerance	+5/-3%	+5/-3%
Avg. Panel Efficiency ⁶	21.5%	20.3%
Rated Voltage (V _{mpp})	57.3 V	57.3 V
Rated Current (I _{mpp})	6.02 A	5.71 A
Open-Circuit Voltage (V _{oc})	68.2 V	67.6 V
Short-Circuit Current (I _{sc})	6.39 A	6.07 A
Max. System Voltage	1000 V UL & 1000 V IEC	
Maximum Series Fuse	15 A	
Power Temp Coef.	-0.29% / ° C	
Voltage Temp Coef.	-167.4 mV / ° C	
Current Temp Coef.	2.9 mA / ° C	

Tests And Certifications	
Standard Tests ⁷	UL1703 (Type 2 Fire Rating), IEC 61215, IEC 61730
Management System Certs	ISO 9001:2015, ISO 14001:2015
EHS Compliance	RoHS, OHSAS 18001:2007, lead free, REACH SVHC-163, PV Cycle
Sustainability	Cradle to Cradle Certified™ Silver (contributes to LEED categories) ⁸
Ammonia Test	IEC 62716
Desert Test	10.1109/PVSC.2013.6744437
Salt Spray Test	IEC 61701 (maximum severity)
PID Test	1000V: IEC62804, PVEL 600hr duration
Available Listings	UL, TUV, CEC

Operating Condition And Mechanical Data	
Temperature	-40° F to +185° F (-40° C to +85° C)
Impact Resistance	1 inch (25 mm) diameter hail at 52 mph (23 m/s)
Appearance	Class B
Solar Cells	96 Monocrystalline Moxeon Gen III
Tempered Glass	High-transmission tempered anti-reflective
Junction Box	IP-65, MC4 Compatible
Weight	41 lbs (18.6 kg)
Max. Load	Wind: 50 psf, 2400 Pa front & back Snow: 112 psf, 5400 Pa front
Frame	Class 2 silver anodized; stacking pins

REFERENCES:

- 1 SunPower 360W compared to a Conventional Panel on same sized arrays (260W, 16% efficient, approx. 1.6 m²), 4% more energy per watt (based on 3pty module characterization and PVSIM), 0.75%/yr slower degradation (Campeau, Z. et al. "SunPower Module Degradation Rate," SunPower white paper, 2013).
- 2 "SunPower Module 40-Year Useful Life" SunPower white paper, May 2015. Useful life is 99 out of 100 panels operating at more than 70% of rated power.
- 3 X-Series same as E-Series, 5 of top 8 panel manufacturers tested in 2013 report, 3 additional panels in 2014. Ferrara, C., et al. "Fraunhofer PV Durability Initiative for Solar Modules: Part 2". Photovoltaics International, 2014.
- 4 See us.sunpower.com/home-solar-system-warranty/ for more details.
- 5 Standard Test Conditions (1000 W/m² irradiance, AM 1.5, 25° C). NREL calibration Standard: SOMS current, LACCS FF and Voltage.
- 6 Based on average of measured power values during production.
- 7 Type 2 fire rating per UL1703:2013, Class C fire rating per UL1703:2002.
- 8 See salesperson for details.



Please read the safety and installation guide.

