

Detailed Energy Assessment

Pursuant to Condition 5, 74891/APP/2020/1614

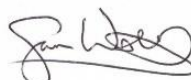
Barton Buildings

Prepared for Cyril Leonard
25th February 2021



envision

Revision	Date
A	25 / 02 / 2021

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EXECUTIVE SUMMARY

1. This Energy Statement has been prepared on behalf of Cyril Leonard to discharge Condition 5 (Ref: 74891/APP/2020/1614) in relation to the demolition of the existing buildings and redevelopment of the site to provide two industrial units (Use Class B1, B2 and B8). The scheme is located at Barton Buildings, Uxbridge Industrial Estate, Arundel Road, Uxbridge.
2. Condition 5 of the planning permission requires:

“Prior to above ground works, a detailed energy assessment shall be submitted to and approved in writing by the Local Planning Authority. The energy assessment shall demonstrate how the development will achieve a minimum 35% reduction in CO₂ through the application of the London Plan energy hierarchy, Be Clean, Be Lean and Be Green in combination. The assessment shall provide full details of the measures to be incorporated into the development and their impact on the baseline development (2013 building regulation compliance) in terms of energy (KwHr) and CO₂ (KgCO₂).

The assessment shall provide full details of the plans and specifications of any low and zero carbon technology to be used including, for example, roof plans and elevations if PVs are selected. The assessment shall clearly set out any shortfall in emissions below the 35% target. Thereafter, the development must proceed and be operated in accordance with the approved plans and specifications”.
3. This statement satisfies the above requirements and demonstrates how the scheme has met a minimum 35% reduction in CO₂ through the application of the London Plan hierarchy.

Table A.1 – Final Site-Wide CO₂ reductions Chart

Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)		
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	11.29	8.91
After energy demand reduction	10.13	8.91
After heat network / CHP	-	-
After renewable energy	6.93	8.91
Regulated domestic carbon dioxide savings		
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	1.16	10.26%
Savings from heat network / CHP	-	-
Savings from renewable energy	3.21	28.39%
Cumulative on-site savings	4.46	39.49%

1 ENERGY STATEMENT

- 1.1 This Energy Statement has been prepared by Envision on behalf of Cyril Leonard to discharge Condition 5 (Ref: 74891/APP/2020/1614) in relation to the demolition of the existing Barton Buildings, Uxbridge Industrial Estate to provide two industrial units (Use Class B1, B2 and B8).
- 1.2 In pursuing compliance with Condition 5, Envision has followed guidance from the Borough's Local Plan and London Plan. Policy DMEI 2: Reducing Carbon Emissions requires development to make the fullest contribution to minimising carbon dioxide emissions in accordance with London Plan targets and the energy hierarchy:
- Step 1 – Reducing Energy Requirements;
 - Step 2 – Supplying the energy that is required more efficiently;
 - Step 3 – Meeting remaining energy requirements through renewable and low carbon energy.

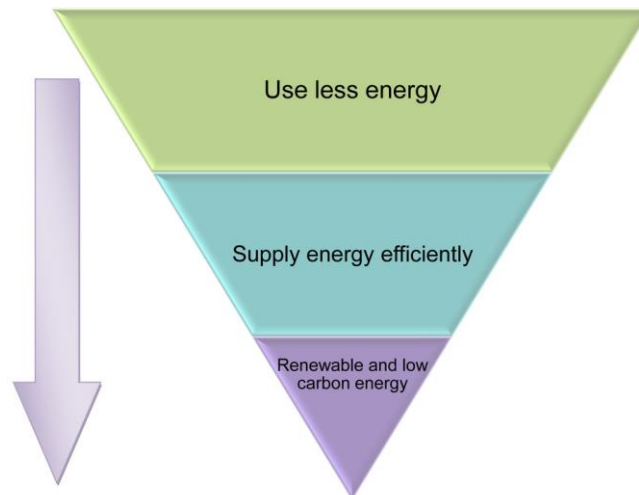


Fig 1.1 - 'Energy Hierarchy'

- 1.3 In line with the requirements of the October 2018 update to the 'GLA Guidance on preparing Energy Assessments', the predicted CO₂ emissions and energy demand presented in this report have been calculated using SAP 10 figures.

Methodology

- 1.4 The appropriate methodology for calculating the development's energy performance and compliance with Part L of the Building Regulations is through a Simplified Building Energy Model (SBEM). The SBEM was produced using DesignBuilder software version 6.1.0.006, which is a DCLG approved software and methodology for undertaking SBEM.

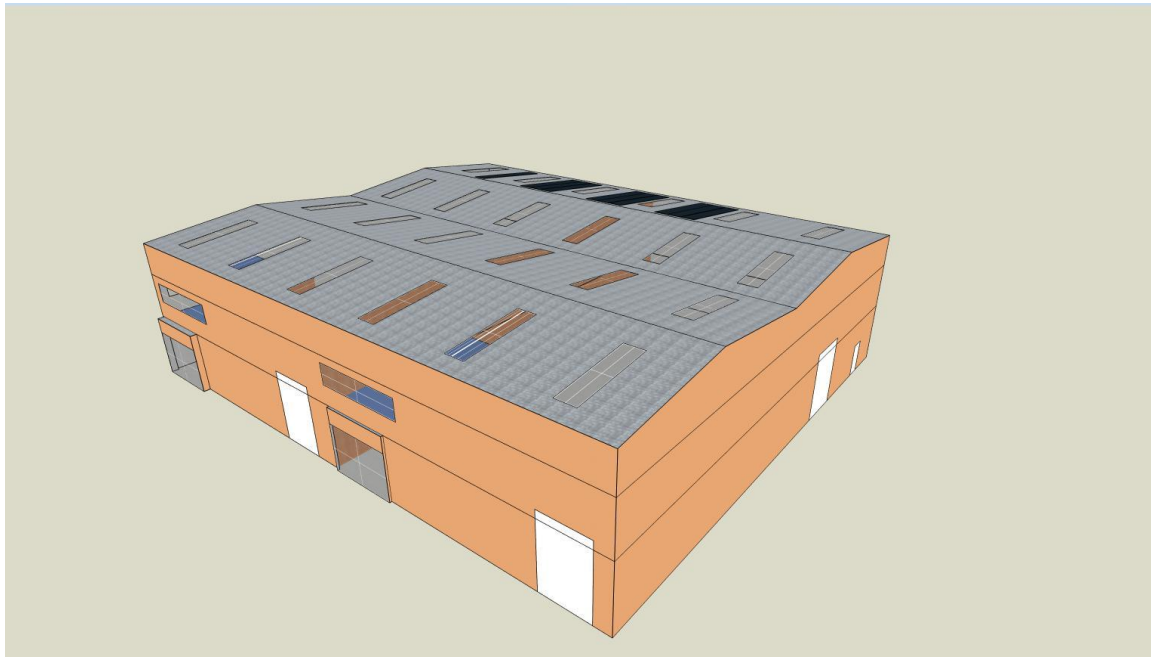


Fig 1.2 DesignBuilder Model of Development (not aesthetic representation)

Establishing the Target Emission Rate (TER)

- 1.5 The total emissions savings calculated in this report are expressed against a Building Regulation 2013 Target Emission Rate. This is the Baseline against which the measures implemented must show an improvement.
- 1.6 The Target Emission Rates for the development has been established using CLG approved methodology and software.
- 1.7 The calculated carbon emissions for the Target Emission Rates are illustrated below. The calculated figures demonstrate a Building Regulations 2013 (Part L2a) compliant model.

Table 1.1 – Target CO₂ emissions for Development

	Target Regulated Emissions (Tonnes.CO ₂ .yr)	Target Energy Demand (kWh.yr)
Unit 1 & 2	11.29	51,235

- 1.8 The figure of **11.29 tonnes.CO₂.year**, calculated using SAP 10 emission factors is the target that must be reached and improved upon by the proposals for the proposals in this Energy Assessment in order to comply with Condition 5. This will be achieved through the implementation of fabric efficiency, energy-reduction and carbon-saving measures as outlined in the ensuing sections.

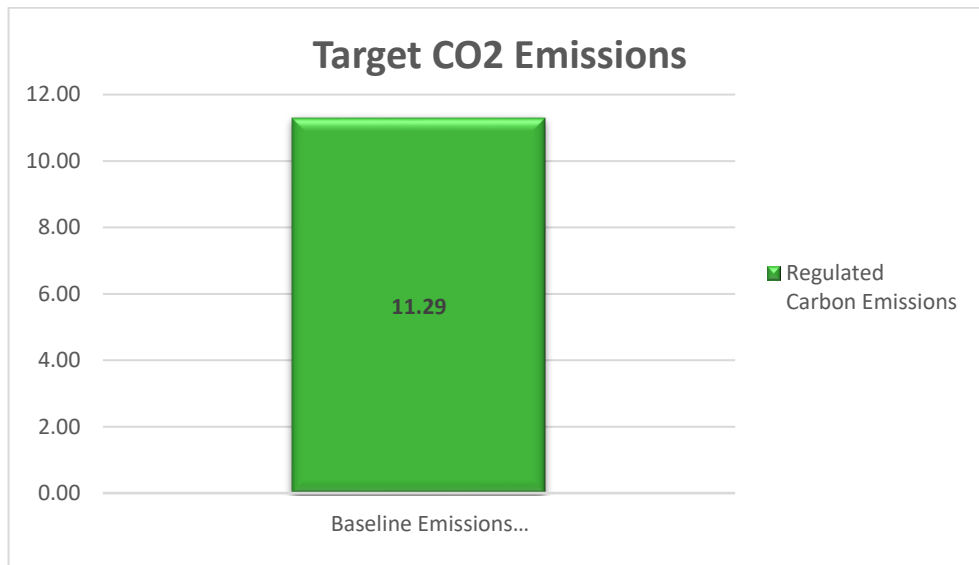


Fig 1.3 – Target CO₂ emissions for Development

Applying the London Plan Energy Hierarchy: Stage 1 – Be Lean

- 1.9 The Greater London Authority seeks a ‘fabric first’ approach to reducing the carbon footprint of London’s built environment. This is achieved through buildings using less energy by improving u-values, air-tightness and lighting efficiency amongst others. This is the first step to consider in reducing a building’s carbon emissions before the efficient delivery of power, heat or renewables are considered by a design-team.

Fabric Efficiency

- 1.10 U-Values, are used to measure how effective elements of a building’s fabric are as insulators. That is, how effective they are at preventing heat from transmitting between the inside and the outside of a building. The lower the U-value of an element of a building's fabric, the more slowly heat is able to transmit through it, and so the better it performs as an insulator. Very broadly, the better (i.e. lower) the U-value of a buildings fabric, the less energy is required to maintain comfortable conditions inside the building. Therefore, the following U-Values are being applied for the development:

Table 1.2 Proposed U-Values

Elements	New Thermal Elements: U-Values – W/m ² K	Comment
External Wall	0.15	n/a
Spandrel Panel Window Infill	0.35	
Ground Floor	0.12	n/a
Exposed Roof	0.16	n/a
Windows/Glazing	1.5	Double-glazed with a G-value of 0.4 and Light Transmittance value of 0.744
Rooflights	1.4	Double-glazed with a G-value of 0.4 and Light Transmittance value of 0.744
External Solid Doors/Roller Shutter Doors	1.5	-

Air Permeability

- 1.11 The designed Air Permeability Rate (APR) has been set at 4 m³/h.m² @ 50Pa for each unit. This will be validated through air test.

Lighting Strategy¹

- 1.12 The strategy proposes to reduce lighting loads in areas which benefit from large amounts of natural light. Particular focus has been given to the warehouse areas, where lighting would typically represent a large energy load. This energy demand will be limited by the application of more efficient lighting and use of occupancy sensors throughout. The following lighting design requirements are therefore recommended:

Table 1.3 –Lighting Datasheet

Lighting zone	Luminaire Lumens / Circuit Watt	Light Output Ratio	Photocell Dimming (Parasitic Power – W/m ²)	Occupancy Sensing – On/Off (Parasitic Power – w/m ²)
Reception/Office Areas	105	1	No	Yes (0.3 W/m ²)
WC Areas	105	1	No	Yes (0.3 W/m ²)
Warehouse Areas	115	1	No ²	No

Space & Water Heating

- 1.13 It is the market expectation that the main warehouse floor areas will be unheated, save for frost protection, with all ancillary accommodation being heated. In line with the GLA's Energy Hierarchy, the heating system proposed for these areas at the 'Be-Lean' stage is a gas-fired Low-Temperature Hot Water (LTHW) system with radiator outlets and a minimum efficiency of 91%.
- 1.14 WCs will be heated via electric panel radiators.
- 1.15 The hot water demand is anticipated to be low in a building such as this. Instantaneous electric hot water systems will be used for each unit.

Ventilation Strategy

- 1.16 The only mechanical ventilation proposed is in the WC's, which will be served via a basic extract fan (remote from zone) with an SFP of 0.5 W/l-s.

¹ The development is being brought forward as shell & core, with all HVAC and Lighting systems installed by tenants. Therefore, the inputs laid out for M&E are assumptions and will be passed through to prospective tenants for satisfaction.

Be Lean Stage CO₂ Reductions

- 1.17 The following tables and graphs represent the lean stage improvements for the development over the Target Emission Rate (TER) baseline emissions:

Table 1.4 –Lean Stage CO₂ Reductions

	Be-Lean Regulated Emissions (Tonnes.CO ₂ .yr)	Be-Lean Energy Demand (kWh.yr)
Unit 1 & 2	10.13	44,799
Difference over Baseline	1.16	6,436
% Difference	10.26%	12.56%

- 1.18 As detailed above, the measures as taken at 'Be-Lean' stage would result in a **10.26%** reduction in the sitewide regulated CO₂ emissions over the Building Regulations Part L 2013 Target Emission Rate – arrived at using SAP 10 emission factors.

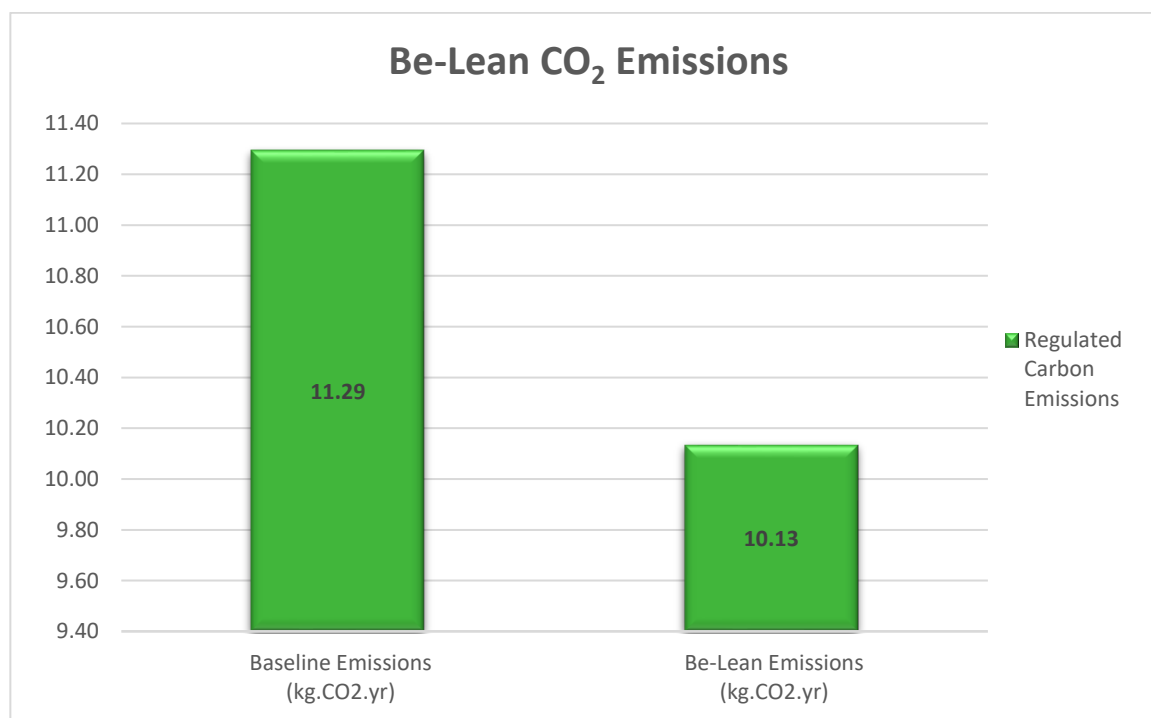


Fig 1.4 Graph of Lean Stage CO₂ reductions

Applying the Energy Hierarchy: Stage 2 – Be Clean

1.19 In accordance with the 'GLA guidance on preparing Energy Assessments', the 'Be-Clean' stage requires that any energy supplied to major developments should be as efficient as possible by selecting energy systems in accordance with the following hierarchy:

1. Connection to an area wide heat network;
2. Communal heating system (site-wide or building-level); and
3. Individual heating systems.

Connection to an area wide heat network

1.20 At the planning application stage, the Energy Statement referenced the London Heat Map. There is clearly no existing or proposed networks in the vicinity of the site. There is a 'proposed' network identified 1,339 meters to the east of the site, outside the 500-metre threshold stipulated by Policy DMEI 3.

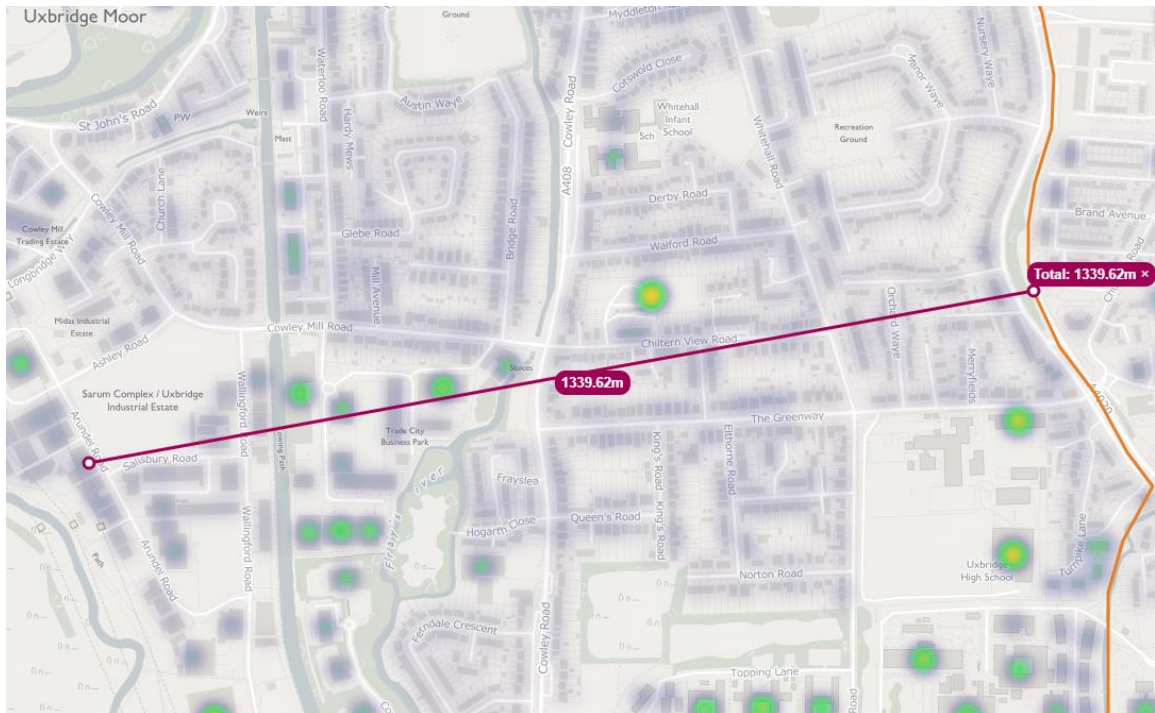


Fig 1.5 – London Heat Map

Communal heating system (site-wide or building level)

1.21 The development at Barton Buildings will deliver two industrial units, with a majority of the floor area not provided with any heating or cooling. The only areas to be heated are the ancillary office and WC areas. In this instance, as the heat load of the new buildings is determined to be low, it is deemed the implications of installing the infrastructure and provision of a communal heating system would not be suitable for a development of this nature.

- 1.22 Therefore, the development's energy strategy follows guidance by maximising carbon savings from additional on-site measures, including fabric energy efficiency and renewable technologies.

Individual heating system

- 1.23 As detailed in the next section, the small heating and cooling demand to the office and reception areas will be met by individual air source heat pumps, installed by the tenants.

Applying the Energy Hierarchy: Stage 3 – Be Green

- 1.24 During the design-development period for this scheme, multiple low carbon/renewable systems were examined for both their feasibility and ability to lower carbon emissions insofar as possible. As per the analysis contained in Appendix II, two systems were deemed to be viable for the scheme:

- Air-Source Heat Pumps providing heating and cooling to office and receptions areas.
- Photovoltaic Arrays (serving all of the development).

Low-Carbon/Renewable Technology System 1 – Air-Source Heat Pumps to ancillary areas

- 1.25 The first low-carbon/renewable energy proposed for the units is an air-source heat pump (ASHP). ASHPs with the following specifications have been assumed for each commercial unit;
- The proposed ASHP for the ancillary areas is a conventional VRF air source heat pump system³.
 - Cooling plant will have a minimum Energy Efficiency Ratio (EER) of 4 and SEER of 5.
 - The ASHP will have a minimum COP of 4 for heating.
 - HVAC system controls installed will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values as well as local time and temperature control.

Low-Carbon/Renewable Technology System 2 – Photovoltaic Array

- 1.26 The low-carbon/renewable energy proposed for the development is a Photovoltaic (PV) array. The proposed PV will be mounted on the south-east facing roof of Unit(s) 1 and 2. The building design will provide service riser accommodation to allow the roof mounted inverter to be wired back to a distribution board and G59 intake meter arrangement.
- 1.27 The carbon offset from the installation will contribute towards an overall developments CO₂ reduction. In order to achieve the necessary carbon reduction to achieve compliance with the

³ This will be subject to tenant design, however the parameters applied are considered reasonable and will be passed to the tenants.

planning stage energy targets, a scheme able to generate circa 9,316 kwh annum is required. The scheme proposed will generate in excess of this (9,754 kWh annum).

Table 1.6 – PV Array Details

PV Energy Generation (kWh.annum) Target Established at Planning	PV Energy Generation (kWh.annum) Target Established at Planning
9,316.6 kWh	9,754 kWh

- 1.28 Further details on the PV analysis, specification of the panels and inverters are provided in Appendix IV, V and VI..

Be Green Stage CO₂ Reductions

- 1.29 The following tables and graphs represent the ‘Be-Green’ improvements for the development;

Table 1.7 – Green Stage CO₂ Reductions

	Be-Green Regulated Emissions (Tonnes.CO ₂ .yr)	Be-Green Energy Demand (kWh.annum)
Unit 1 & 2	6.83	29,326
Difference over Baseline	3.3	15,472
% Difference	39.49%	42.76%

- 1.30 As detailed above, the measures as taken at ‘Be-Green’ stage would result in a **39.49%** reduction in sitewide regulated CO₂ emissions over the Baseline emissions – calculated using SAP 10 emission factors. This is in full compliance with Condition 18.

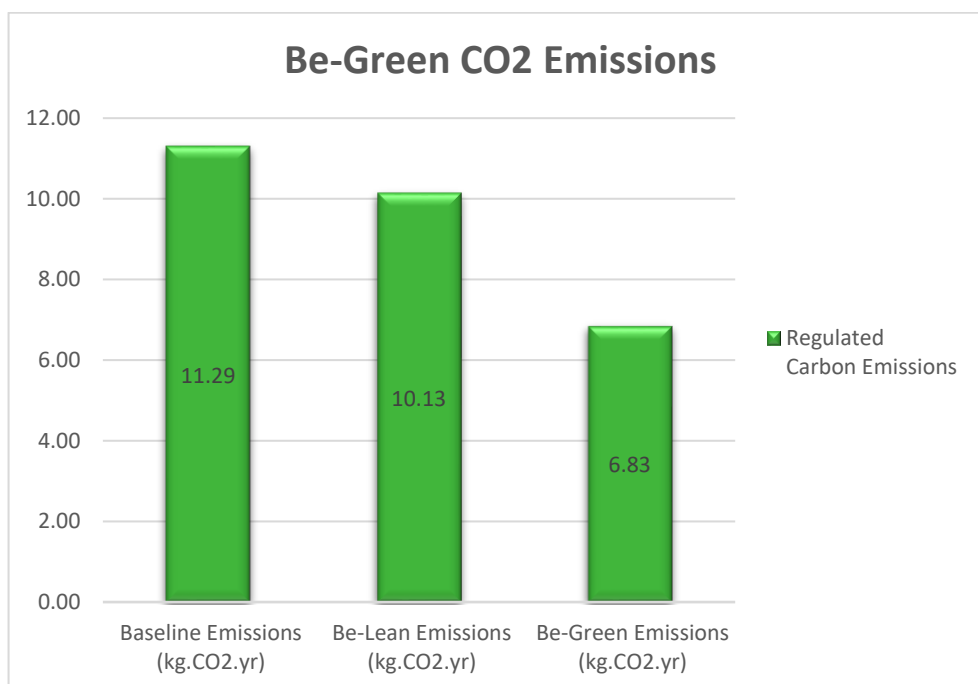


Fig 1.6 Graph of Green Stage CO₂ reduction over Baseline

CO₂ Reduction Charts

- 1.31 In accordance with the 'GLA guidance on preparing energy assessments', the final carbon emissions and predicted savings are presented below for the entire development.

Table 1.8 – Sitewide Unregulated and Regulated CO₂ emissions and savings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	11.29	8.91
After energy demand reduction	10.13	8.91
After heat network / CHP	-	-
After renewable energy	6.83	8.91
	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	1.16	10.26%
Savings from heat network / CHP	-	-
Savings from renewable energy	3.30	29.23%
Cumulative on-site savings	4.46	39.49%

- 1.32 As seen in the charts above, the cumulative on-site savings for the development is 39.49%, in line with the London Borough of Hillingdon and GLA energy policy for minimum CO₂ reductions in

major non-residential developments and in full accord with Condition 5 of planning permission 74891/APP/2020/1614.

APPENDIX I – GLA SAP 10 CALCULATION SHEET

SAP 2012 CO2 PERFORMANCE

SAP10 CO2 PERFORMANCE

DEMAND

NON-DOMESTIC ENERGY CONSUMPTION AND CO₂ ANALYSIS

[illegible]

SAP 2012 CO2 PERFORMANCE

NON-DOMESTIC ENERGY CONSUMPTION AND CO₂ ANALYSIS

SITE-WIDE ENERGY CONSUMPTION AND CO₂ ANALYSIS

Use	Total Area (m²)	Calculated BER 2012 (kgCO2 / m2)	-	Space Heating (kWh p.a.)	REGULATED ENERGY CONSUMPTION						REGULATED CO2 EMISSIONS		REGULATED CO2 EMISSIONS		N/A	REGULATED ENERGY DEMAND PER UNIT PER ANNUM (kWh p.a.)				
					N/A	Domestic Hot Water (kWh p.a.)	N/A	Lighting (p.a.)	Auxiliary (p.a.)	Cooling (kWh p.a.)	2012 CO2 emissions (kgCO2 p.a.)	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated BER SAP10 (kgCO2 / m2)	N/A		Space Heating (kWh p.a.)	Domestic Hot Water (kWh p.a.)	Lighting (p.a.)	Auxiliary (p.a.)	Cooling (kWh p.a.)
Sum	1,275	15.1	-	7,456	5,761	N/A	30,078	76	1,427	19,250	10,134	8.0	0	0	0	0	0			

SAP 2012 PERFORMANCE

SAP10 PERFORMANCE

DOMESTIC

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	0	n/a
After energy demand reduction	0	n/a
After heat network / CHP	0	n/a
After renewable energy	0	n/a

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	0	#DIV/0!
Savings from heat network / CHP	0	#DIV/0!
Savings from renewable energy	0	#DIV/0!
Cumulative on site savings	0	#DIV/0!
Annual savings from off-set payment	0	-
	(Tonnes CO ₂)	
Cumulative savings for off-set payment	0	-
Cash in-lieu contribution (£)	0	

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	0	n/a
After energy demand reduction	0	n/a
After heat network / CHP	0	n/a
After renewable energy	0	n/a

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	0	#DIV/0!
Savings from heat network / CHP	0	#DIV/0!
Savings from renewable energy	0	#DIV/0!
Cumulative on site savings	0	#DIV/0!
Annual savings from off-set payment	0	-
	(Tonnes CO ₂)	
Cumulative savings for off-set payment	0	-
Cash in-lieu contribution (£)	0	

NON-DOMESTIC

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	20	20
After energy demand reduction	19	20
After heat network / CHP	19	20
After renewable energy	15	20

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	11	9
After energy demand reduction	10	9
After heat network / CHP	10	9
After renewable energy	7	9

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	1	4%
Savings from heat network / CHP	0	0%
Savings from renewable energy	4	20%
Total Cumulative Savings	5	24%

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO ₂)	Cumulative Shortfall (Tonnes CO ₂)
Total Target Savings	7	-
Shortfall	2	64
Cash in-lieu contribution (£)	3,856	-

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	1	10%
Savings from heat network / CHP	0	0%
Savings from renewable energy	3	29%
Total Cumulative Savings	4	39%

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO ₂)	Cumulative Shortfall (Tonnes CO ₂)
Total Target Savings	4	-
Shortfall	-1	-15
Cash in-lieu contribution (£)	-913	-

SITE-WIDE

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	20		
Be lean	19	1	4%
Be clean	19	0	0%
Be green	15	4	20%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	64	-

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	11		
Be lean	10	1	10%
Be clean	10	0	0%
Be green	7	3	29%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	-15	-

Building use	Energy demand following energy efficiency measures (MWh/year)						
	Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Unregulated electricity	Unregulated gas
Domestic	0	0	0	0	0	n/a	n/a
Non-domestic	0	0	0	0	0	8.91	0

	Target Fabric Energy Efficiency (kWh/m ²)	Dwelling Fabric Energy Efficiency (kWh/m ²)	Improvement (%)
Development total			

	Area weighted average non-domestic cooling demand (MJ/m ²)	Total area weighted non-domestic cooling demand (MJ/year)
Actual		
Notional		

DOMESTIC ENERGY CONSUMPTION AND CO₂ ANALYSIS

NON-DOMESTIC ENERGY CONSUMPTION AND CO₂ ANALYSIS

	VALIDATION CHECK	REGULATED ENERGY CONSUMPTION BY FND USE (kWh/m ² p.a.) 'B5 GREEN' BER - SOURCE: BRUKL OUTPUT	REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m ² p.a.) 'B5 GREEN' BER - SOURCE: BRUKL INP or 'SIM.CSV FILE	REGULATED CO2 EMISSIONS PER UNIT
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SITE-WIDE ENERGY CONSUMPTION AND CO₂ ANALYSIS

			REGULATED CO2 EMISSIONS	REGULATED CO2 EMISSIONS	REGULATED CO2 EMISSIONS PER UNIT
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APPENDIX II – BASELINE & BE-LEAN BRUKL REPORT

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name

Shell and Core

Unit 1 & 2 (Be-Lean)

As designed

Date: Mon Mar 16 13:44:29 2020

Administrative information

Building Details

Address: Barton Buildings Site, Uxbridge Industrial Estate,
London, UB8 2SN

Owner Details

Name: Cyril Leonard
Telephone number:
Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Certifier details

Interface to calculation engine: DesignBuilder SBEM
Interface to calculation engine version: v6.1.0
Name: Claran Dority
Telephone number: 01908062819
Address: Unit 2 Lodge Farm Business Centre,
Castlethorpe, MK19 7ES

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

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

CO ₂ emission rate from the notional building, kg CO ₂ /m ² .annum	15.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	15.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	15.1
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 _f -Limit	U _f -Calc	U _f -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	Lower Block - Unit 1 Toilet_P_5
Floor	0.25	0.12	0.12	Lower Block - Unit 1 Toilet_S_3
Roof	0.25	0.16	0.16	Lower Block - Unit 2 Reception_R_5
Windows***, roof windows, and rooflights	2.2	1.5	1.5	Lower Block - Unit 2 Reception_G_9
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_f-Limit = Limiting area-weighted average U-values [W/(m²K)]
U_f-Calc = Calculated area-weighted average U-values [W/(m²K)]
U_c-Calc = Calculated maximum individual element U-values [W/(m²K)]

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

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	4

Building services

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

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

1- BOH Heating (LTDH)

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

2- Be-Lean Split ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				
* Standard shown is for gas 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- Instantaneous Water Heaters (Be-Lean)

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

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	ID of system type	SFP [W/(l/s)]									HR efficiency	
		A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	-	-
Lower Block - Unit 1 Toilet		-	-	0.4	-	-	-	-	-	-	-	N/A
Lower Block - Unit 2 WC		-	-	0.4	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Lower Block - Unit 1 Warehouse	NO
Lower Block - Unit 2 Warehouse	NO
Lower Block - Unit 1 Stair Up	NO
Lower Block - Unit 2 Stair Up	NO
Lower Block - Unit 1 Toilet	NO
Lower Block - Unit 2 WC	NO

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 _{typ}	U _{min}	Surface where the minimum value occurs*
Wall	0.23	0.15	Lower Block - Unit 1 Toilet_P_5
Floor	0.2	0.12	Lower Block - Unit 1 Toilet_S_3
Roof	0.15	0.16	Lower Block - Unit 2 Reception_R_5
Windows, roof windows, and rooflights	1.5	1.5	Lower Block - Unit 2 Reception_G_9
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{typ} = Typical individual element U-values [W/(m²K)]			U _{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	4

Shell and core configuration

Zone	Assumed shell?
Lower Block - Unit 2 Reception	NO
Lower Block - Unit 1 Reception	NO
Upper Block - Unit 2 Office	NO
Upper Block - Unit 1 Office	NO

General lighting and display lighting

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name	Standard value	Luminaire	Lamp	Display lamp	
		60	60	22	
Lower Block - Unit 1 Warehouse		115	-	-	2222
Lower Block - Unit 2 Warehouse		115	-	-	2220
Lower Block - Unit 1 Stair Up		-	105	-	29
Lower Block - Unit 2 Stair Up		-	105	-	29
Lower Block - Unit 1 Toilet		-	105	-	32
Lower Block - Unit 2 WC		-	105	-	32
Lower Block - Unit 2 Reception		-	105	105	131
Lower Block - Unit 1 Reception		-	105	105	134
Upper Block - Unit 2 Office		105	-	-	326
Upper Block - Unit 1 Office		105	-	-	323

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?
Lower Block - Unit 1 Warehouse	NO (-47.1%)	NO
Lower Block - Unit 2 Warehouse	NO (-47%)	NO
Lower Block - Unit 2 Reception	NO (-15.9%)	NO
Lower Block - Unit 1 Reception	NO (-57.4%)	NO
Upper Block - Unit 2 Office	NO (-64.7%)	NO
Upper Block - Unit 1 Office	NO (-58.5%)	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				Building Use	
		Actual	Notional	% Area	Building Type
Area [m²]		1274.5	1274.5	A1/A2 Retail/Financial and Professional services	
External area [m²]		4674.2	4674.2	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways	
Weather		LON	LON	B1 Offices and Workshop businesses	
Infiltration [m³/hm²@ 50Pa]	4		7	B2 to B7 General Industrial and Special Industrial Groups	
Average conductance [W/K]	1084.56		1580.35	B8 Storage or Distribution	
Average U-value [W/m²K]	0.23		0.34	C1 Hotels	
Alpha value* [%]	8.27		28.1	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	
				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	

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

Energy Consumption by End Use [kWh/m ²]		
	Actual	Notional
Heating	5.85	10.94
Cooling	1.12	1.31
Auxiliary	0.06	0.08
Lighting	23.6	23.12
Hot water	4.52	4.75
Equipment*	30.01	30.01
TOTAL**	35.15	40.2

*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 & CO ₂ Emissions Summary			
	Actual	Notional	
Heating + cooling demand [MJ/m ²]	210.24	343.36	
Primary energy* [kWh/m ²]	88.75	92.49	
Total emissions [kg/m ²]	15.1	15.8	

*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	Aux con kWh/m2	Heat SSEE	Cool SSEE	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling								
Actual	97.3	110.6	0	0	0	0	0	0
Notional	220.3	126	0	0	0	0		
[ST] Other local room heater - fanned, [HS] Room heater, [HFT] Natural Gas, [CFT] Natural Gas								
Actual	285.7	5.4	103.6	0	10.8	0.77	0	0.91
Notional	321.2	12.4	109	0	13.1	0.82	0	
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity								
Actual	116.2	104.3	36.2	7.7	0	0.89	0.91	5
Notional	209.5	117	71.1	9	0	0.82	3.6	

Key to terms

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

APPENDIX III – BE-GREEN BRUKL REPORT

Date: Thu Feb 25 09:03:41 2021

Administrative information

Building Details

Address: Barton Buildings Site, Uxbridge Industrial Estate,
London, UB8 2SN

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.8

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Claran Dornity

Telephone number: 01908062819

Address: Unit 2 Lodge Farm Business Centre,
Castlethorpe, MK19 7ES

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

CO ₂ emission rate from the notional building, kg CO ₂ /m ² .annum	15.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	15.9
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	11.9
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 _f -Limit	U _f -Calc	U _f -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	"Lower Block - Unit 1 Toilet_P_5"
Floor	0.25	0.12	0.12	"Lower Block - Unit 1 Toilet_S_3"
Roof	0.25	0.16	0.16	"Lower Block - Unit 2 Reception_R_5"
Windows***, roof windows, and rooflights	2.2	1.5	1.5	"Lower Block - Unit 2 Reception_G_9"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_f-Limit = Limiting area-weighted average U-values [W/(m²K)]
U_f-Calc = Calculated area-weighted average U-values [W/(m²K)]
U_c-calc = Calculated maximum individual element U-values [W/(m²K)]

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

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	4

Building services

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

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

1- BOH Heating (Electric - Be-Green)

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

2- Be-Green Split ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

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

1- Instantaneous Water Heaters (Be-Green)

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	ID of system type	SFP [W/(l/s)]									HR efficiency	
		A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	-	-
Lower Block - Unit 1 Toilet	-	-	-	0.4	-	-	-	-	-	-	-	N/A
Lower Block - Unit 2 WC	-	-	-	0.4	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Lower Block - Unit 1 Warehouse	NO
Lower Block - Unit 2 Warehouse	NO
Lower Block - Unit 1 Stair Up	NO
Lower Block - Unit 2 Stair Up	NO
Lower Block - Unit 1 Toilet	NO
Lower Block - Unit 2 WC	NO
Lower Block - Unit 2 Reception	NO

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 _{typ}	U _{min}	Surface where the minimum value occurs*
Wall	0.23	0.15	"Lower Block - Unit 1 Toilet_P_5"
Floor	0.2	0.12	"Lower Block - Unit 1 Toilet_S_3"
Roof	0.15	0.16	"Lower Block - Unit 2 Reception_R_5"
Windows, roof windows, and rooflights	1.5	1.5	"Lower Block - Unit 2 Reception_G_9"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{typ} = Typical individual element U-values [W/(m²K)]			U _{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	4

Shell and core configuration

Zone	Assumed shell?
Lower Block - Unit 1 Reception	NO
Upper Block - Unit 2 Office	NO
Upper Block - Unit 1 Office	NO

General lighting and display lighting

General lighting and display lighting				General lighting [W]
Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	
Standard value				
Lower Block - Unit 1 Warehouse	115	-	-	2222
Lower Block - Unit 2 Warehouse	115	-	-	2220
Lower Block - Unit 1 Stair Up	-	105	-	29
Lower Block - Unit 2 Stair Up	-	105	-	29
Lower Block - Unit 1 Toilet	-	105	-	32
Lower Block - Unit 2 WC	-	105	-	32
Lower Block - Unit 2 Reception	-	105	105	131
Lower Block - Unit 1 Reception	-	105	105	134
Upper Block - Unit 2 Office	105	-	-	326
Upper Block - Unit 1 Office	105	-	-	323

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?
Lower Block - Unit 1 Warehouse	NO (-47.1%)	NO
Lower Block - Unit 2 Warehouse	NO (-47%)	NO
Lower Block - Unit 2 Reception	NO (-15.9%)	NO
Lower Block - Unit 1 Reception	NO (-57.4%)	NO
Upper Block - Unit 2 Office	NO (-64.7%)	NO
Upper Block - Unit 1 Office	NO (-58.5%)	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

Building Use

		% Area Building Type	
Actual	Notional		
Area [m ²]	1274.5	1274.5	A1/A2 Retail/Financial and Professional services
External area [m ²]	4674.2	4674.2	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	LON	LON	B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	4	7	B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	1084.56	1580.35	100 B8 Storage or Distribution
Average U-value [W/m ² K]	0.23	0.34	C1 Hotels
Alpha value* [%]	8.27	28.1	C2 Residential Institutions: Hospitals and Care Homes
C2 Residential Institutions: Residential schools			
C2 Residential Institutions: Universities and colleges			
C2A Secure Residential Institutions			
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging			

- 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	1.74	4.11
Cooling	1.12	1.31
Auxiliary	0.06	0.08
Lighting	23.6	23.12
Hot water	4.11	4.75
Equipment*	30.01	30.01
TOTAL**	30.64	33.36

*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	7.63	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	210.24	343.36
Primary energy* [kWh/m²]	94.07	89.66
Total emissions [kg/m³]	11.9	15.9

*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 kWh/m2	Heat con kWh/m2	Aux con kWh/m2	Heat SSEE	Cool SSEE	Heat gen SEFF	Cool gen SEER	
[ST] No Heating or Cooling									
Actual	97.3	110.6	0	0	0	0	0	0	
Notional	220.3	126	0	0	0	0	----	----	
[ST] Other local room heater - fanned, [HS] Room heater, [HFT] Electricity, [CFT] Natural Gas									
Actual	285.7	5.4	94.2	0	0.84	0	1	0	
Notional	321.2	12.4	109	0	0.82	0	----	----	
[ST] Split or multi-split system, [HS] Heat pump (electric); air source, [HFT] Electricity, [CFT] Electricity									
Actual	116.2	104.3	8.2	7.7	0	3.92	4	5	
Notional	209.5	117	23.9	9	2.43	3.6	----	----	

Key to terms

- 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 SSEFF
- Cool gen SSEER
- ST
- HS
- HFT
- CFT
- = Heating energy demand
- = Cooling energy demand
- = Heating energy consumption
- = Cooling energy consumption
- = Auxiliary energy consumption
- = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
- = Cooling system seasonal efficiency ratio
- = Heating generator seasonal efficiency
- = Cooling generator seasonal efficiency ratio
- = System type
- = Heat source
- = Heating fuel type
- = Cooling fuel type

APPENDIX IV – PV PROPOSAL



11.25 kWp Solar PV Grid-connected as 2 x 5.625kWp Systems Proposal & Quotation



For	Client:	Chris Emm Sigma Building Services Ltd
	Site Address:	Barton Buildings Uxbridge Industrial Estate Middx UB8 2SN
Prepared by	Surveyor: Engineer:	Guy Hewitt Peter Cross
Job No	TL3578	
Date	05/02/2021	Doc Ref.: 041 Rev. 3.2



SUMMARY

Client	Chris Emm Sigma Building Services Ltd		
Installation address	Barton Buildings Uxbridge Industrial Estate Middx UB8 2SN		
Date:	05/02/2021		
Job / Ref No:	TL3578	Quotation No:	TL3578/1

Solar PV Proposal

Investing in a Solar PV system for this property will allow the owners to benefit from a saving off their annual electricity bill and help the environment by reducing their annual CO2 emissions. This represents a return on investment with highlight figures as follows:

System Performance Expectation

System Size	11.25 kWp (2 x 5.625kWp)
Solar Panels & wattage	30 x 375W
Estimated Annual System Generation	9,754 kWh
Fully Installed System Cost ex vat	
Annual Benefit Year 1	
Annual Return On Investment (ROI) *	
Payback Period *	
Total Benefit over a 20 year term *	
Annual CO ₂ saving	5.06t

* Using an annual fuel inflation of 3.60%.

Please note:

- | | |
|----------------------------|---|
| Financial forecast | - Our figures take into account the future effect any fossil fuel energy cost increases will have as per the Government's current forecasts. As such, your annual benefit will increase year on year. |
| Planning Permission | - The panels will be within 1 meter of the flat roof surface of a commercial building and so can be installed under permitted development rights. |
| MCS | - We are a fully accredited installer (Micro-generation Certification Scheme). An MCS Certificate will be provided upon receipt of final payment. |
| Warranty | - A 2 year warranty on the quality of our workmanship is provided. |
| Guarantees | - Solar panel 25 year output and inverter guarantees pass to the client upon receipt of final payment. |
| Insurance | - We are fully insured and carry £5M Public Liability insurance. |
| Roof access | - Scaffolding, Edge Protection & Lifting Gear (as required) provided by the client |



SYSTEM QUOTATION

Client	Chris Emm Sigma Building Services Ltd		
Installation address	Barton Buildings Uxbridge Industrial Estate Middx UB8 2SN		
Date:	05/02/2021		
Job / Ref No:	TL3578	Quotation No:	TL3578/1

Description

Supply, Install & Certify 11.25 kWp Solar Photovoltaic (PV)

Grid-connected as 2 x 5.625kWp Systems

Equipment

30 Suntech 375W Mono PERC Black Frame, White Backsheet panels
2 Solis 6.00 kW 3 Phase Dual Inverters
2 Solis Data Logging stick -WIFI (WIFI or network data point required)
30 panel K2 inclined metal roof mounting system
2 OFGEM Approved 3 Phase Total Generation Meter
2 Balance of system incl. DC & AC isolators, armoured cable, MC4 connectors, switches
Delivery to site

Installation

Mechanical & Electrical Installation, Testing,
Commissioning, MCS Certification & O&M Documentation.
Allow 3-4 crew days

Sub-Total

VAT @ 20.00%

Total Payable

Quotation valid for: 30 days

Notes:

1. To place an order please complete the attached Order Confirmation and return it to Treadlighter Ltd together with your deposit payment - upon receipt we will contact you to arrange an installation date.
2. A full breakdown of services to be supplied is given on the enclosed "Schedule of Materials & Services to be supplied"
3. For internet monitoring, either a permanent functional WIFI signal at the inverter location, or preferably a network data point (RJ45) within 3 meters of the inverter is required.
4. If Additional Works are required due to exceptional circumstances not reasonably foreseeable or if you request specification changes, a further estimate will be provided.
5. The total installation price is based on a continuous working period. If circumstances beyond our control necessitate a split programme of works we reserve the right to charge for additional time.
6. Please see our attached full Terms & Conditions of Business

Detailed System Performance Expectation

Client	Chris Emm Sigma Building Services Ltd		
Installation address	Barton Buildings Uxbridge Industrial Estate Middx UB8 2SN		
Job / Ref No:	TL3578	Quotation No:	TL3578/1

The UK Microgeneration Certification Scheme (MCS) requires all certified companies to give an assessment of a Solar PV system's performance based on the standard MCS procedure in Microgeneration Installation Standard MIS3002, Issue 3.1¹.

The performance of Solar PV systems is impossible to predict with certainty due to the variability in the amount of solar radiation (sunlight) from location to location and from year to year. This performance estimate is based upon the standard MCS procedure and is given as guidance only. It should not be considered as a guarantee of performance.

In optimal circumstances (a property in the south of the UK with an un-shaded south-facing roof sloping at an angle of 35 degrees) a 10.0kWp PV system typically generates 9,840 kWh per annum.

Your system is predicted to produce, on average, 9,754 kWh per annum.

For your system, where the panels are oriented in two directions / inclinations we take for each orientation:

- The size of the PV array (in kWp)
- How much solar radiation the array is estimated to get (the 'solar radiation input factor' or Kk for short). We use official tables to estimate this which take into account your postcode region, the inclination (or tilt) of your roof and its orientation (which direction it faces), and
- How much shading there is on the panels (the 'shade factor' or SF), such as from surrounding trees, chimneys, shadow from nearby buildings). We have estimated this using the sunpath diagram(s) below.

The calculation we do is: kWp (size of system) x Kk (solar radiation input factor) x SF (shade factor)

A - Installation Data

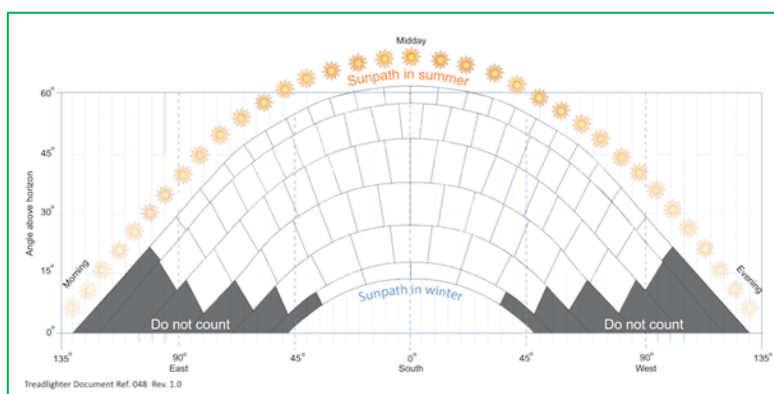
Installed Capacity of the PV System
Postcode Region

11.25 kWp
Zone 1

B - Calculations

Orientation of the PV array - degrees from south
Inclination of the array - degrees from horizontal
kWh/kWp from table (Kk)
Shade Factor (SF)
Estimated annual output (kWp x Kk x SF)

-29 deg
6 deg
867 kWh/kWp
1.00
4,877 kWh



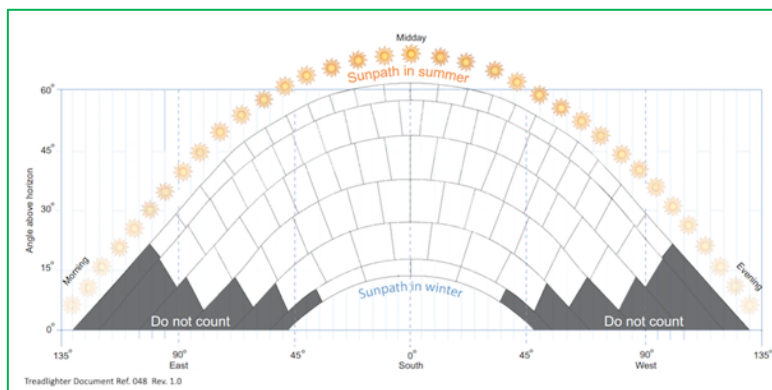
¹ The method is set out in the Guide to the Installation of Photovoltaic Systems, at Section 3.7. The Guide is available on the MCS website



Predicted System Performance Expectation cont'd

Orientation of the PV array - degrees from south
Inclination of the array - degrees from horizontal
kWh/kWp from table (Kk)
Shade Factor (SF)
Estimated annual output (kWp x Kk x SF)

-29 deg
6 deg
867 kWh/kWp
1.00
4,877 kWh



Please note:

Where the shade factor is less than 1

This shade assessment has been undertaken using the standard MCS procedure. It is estimated that this method will yield results within 10% of the actual energy yield for most systems.

If we have not surveyed your property or worked from a set of plans.

This system performance calculation has been undertaken using estimated values for array orientation, inclination and shading. Actual performance may be significantly lower or higher if the characteristics of the installed system vary from the estimated values.

If we have had to estimate or take remotely any of the factors that affect this estimate, we will carry out a full site survey before installation commences. If the survey results in a lower performance estimate than in this quote, we will issue you with a new quotation.

Benefits - Electricity & CO₂ Savings

Proposed System Size	11.25 kWp
Predicted Annual System Output (using standard MCS procedure)	9,754 kWh

Energy Savings

To work out how much you might save, we have estimated how many kWh your system will produce, and have assumed that you will use 73%. [As the system only generates in daylight hours, you can only use its output in daylight hours.]

Electricity generated and used on premises (73% x 9,754 kWh x import Tariff @ UK Average £0.144)

Year 1 Electricity Cost Saving	£1,019
---------------------------------------	---------------

Your savings from using some of the electricity generated will also increase if electricity prices rise.

Year 1 Electricity Export Payment (SEG - Smart Export Guarantee Scheme from 1 Jan 2020)

Estimated Solar Electricity exported to the grid (27% x 9,754 kWh @ 5.24p/kWh)	£140
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Year 1 Estimated Total Benefit	£1,158
---------------------------------------	---------------

Annual CO₂ saving	5.06t
-------------------------------------	--------------

Payback & Return on Investment (ROI)

To estimate how long the system will take to 'pay for itself' ('Payback'), we compare what you pay for the system with our estimate of how much you will get and save each year. We then factor in annual fuel inflation of 3.60%.

System Cost - Fully installed excl VAT

Annual Return On Investment (ROI) *

Payback Period *

Estimated Total value of Electricity Saved over 20 years *

Schedule of materials and services to be supplied

Job No: TL3578

Materials & Services	Supplied by Treadlighter	Not included in quote	Comments
Liaise with District Network Operator (DNO) for connection of system to mains network.	✓		
Project management: Liaise with site & other trades	✓		
HSSE co-ordination; preparation of Risk Assessment & Method statement	✓		
Structural engineers report if required	n/a		
Final design, specification and installation works to provide a PV system to Engineering recommendation G98, G99 and "Guide to the Installation of PV Systems" DTI/pub URN 02/788	✓		
Provision of roof mounting system as per our specification	✓		
Safe access, scaffolding & lifting equipment		✓	Scaffolding, Edge Protection & Lifting Gear (as required) provided by the client
Supply and fit PV Panels as per our specification	✓		
Supply and fit A.C. cable to our specification between inverter location and distribution board		✓	By client's electrician to our specification
Supply and fit isolators, total generation meter and wired or wireless display as per our specification	✓		A wireless display has been specified; no wiring is required
A.C. testing according to current regulations and Part P if applicable	✓		
Waste removal		✓	Use of site facilities
Storage of PV modules, ancillaries & tools	✓		
Provision of welfare facilities (minimum of toilet & hand-washing)		✓	Client to provide
Testing & commissioning PV system	✓		
Documentation including operation and maintenance manuals	✓		
Contact with electricity company to enable payment on generation & export		✓	Treadlighter will advise and assist upon completion
Provision of warranties to include 2 year Treadlighter workmanship guarantee and manufacturer's warranty on all equipment	✓		
25 year solar module output guarantee	✓		
5 year inverter guarantee	✓		

ORDER CONFIRMATION

Client	Chris Emm Sigma Building Services Ltd		
Installation address	Barton Buildings Uxbridge Industrial Estate Middx UB8 2SN		
Date:	05/02/2021		
Job / Ref No:	TL3578	Quotation No:	TL3578/1

Supply, Install & Certify 11.25 kWp Solar Photovoltaic (PV)

Grid-connected as 2 x 5.625kWp Systems

Equipment

30 Suntech 375W Mono PERC Black Frame, White Backsheet panels
2 Solis 6.00 kW 3 Phase Dual Inverters
2 Solis Data Logging stick -WIFI (WIFI or network data point required)
30 panel K2 inclined metal roof mounting system
2 OFGEM Approved 3 Phase Total Generation Meter
2 Balance of system incl. DC & AC isolators, armoured cable, MC4 connectors, switches
Delivery to site

Installation

Mechanical & Electrical Installation, Testing,
Commissioning, MCS Certification & O&M Documentation.
Allow 3-4 crew days

Sub-Total

VAT @ 20.00%

Total Payable

Payment Terms

- 50% deposit payment with order confirmation
- 35% Interim payment upon installation of panels and mounting system to site.
- 15% balance payment upon completion of the installation and prior to commissioning & final certification.

Method of Payment:

Please make cheques payable to Treadlighter Ltd

Bank Transfers - Account Name: Treadlighter Ltd
Sort Code: 40-05-31 Account No: 21503677

Planning Permission:

By signing this contract you are confirming that you have received planning permission for the proposed installation or ascertained that planning permission is not required. Although Treadlighter Ltd will advise, Treadlighter Ltd cannot be held responsible for any installations where planning permission was required but not obtained and no refunds will be offered.

Service and Maintenance:

The Treadlighter Commercial Solar PV Service and Maintenance contract is available at £25.00 p'unit p'm + VAT. It covers all labour for reactive servicing and parts when under warranty.



TREADLIGHTER

ORDER CONFIRMATION

By signing this form, you are confirming the order for the products and installation services specified on the attached quotation. This order will become binding when Treadlighter Ltd notifies you of its acceptance and will be governed by its attached Terms & Conditions of Business.

To proceed with this order please sign, date this form below and return it to Managing Director - Treadlighter Ltd at the above address.

If you prefer you may email your confirmation to guy.hewitt@treadlighter.co.uk.

Customer Name (print)	Customer Signature	Date

APPENDIX V – PV PANEL SPECIFICATION

HI Power Series

120 HALF-CELL MONOFACIAL MODULE

360-380 Watt

STPXXXS - B60/Wnhm



Features



High power output

Compared to 158.75 mm half-cell module, the power output can increase 25 - 30 Wp



High PID resistant

Advanced cell technology and qualified materials lead to high resistance to PID



Excellent weak light performance

More power output in weak light condition, such as haze, cloudy, and morning



Lower operating temperature

Lower operating temperature and temperature coefficient increases the power output



Extended load tests

Module certified to withstand front side maximum static test load (5400 Pascal) and rear side maximum static test loads (3800 Pascal) *



Withstanding harsh environment

Reliable quality leads to a better sustainability even in harsh environment like desert, farm and coastline

Certifications and standards:

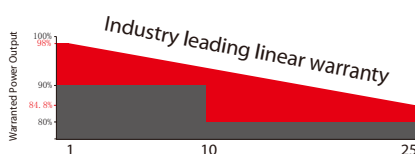
IEC 61215, IEC 61730, conformity to CE



Trust Suntech to Deliver Reliable Performance Over Time

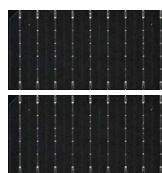
- World-class manufacturer of crystalline silicon photovoltaic modules
- Unrivalled manufacturing capacity and world-class technology
- Rigorous quality control meeting the highest international standards: ISO 9001, ISO 14001 and ISO 17025
- Regular independently checked production process from international accredited institute/company
- Tested for harsh environments (salt mist, ammonia corrosion and sand blowing testing: IEC 61701, IEC 62716, DIN EN 60068-2-68)****
- Long-term reliability tests
- 2 x 100% EL inspection ensuring defect-free modules

Industry-leading Warranty based on nominal power



- 98% in the first year, thereafter, for years two (2) through twenty-five (25), 0.55% maximum decrease from MODULE's nominal power output per year, ending with the 84.8% in the 25th year after the defined WARRANTY STARTING DATE.*****
- 12-year product warranty
- 25-year linear performance warranty

Special Cell Design



The unique cell design leads to reduced electrodes resistance and smaller current, thus enables higher fill factor. Meanwhile, it can reduce losses of mismatch and cell wear, and increase total reflection.

IP68 Rated Junction Box



The Suntech IP68 rated junction box ensures an outstanding waterproof level, supports installations in all orientations and reduces stress on the cables. High reliable performance, low resistance connectors ensure maximum output for the highest energy production.

* Please refer to Suntech Standard Module Installation Manual for details.

** Suntech reserves the right to the final interpretation of the warranty by Munich Re.

***WEEE only for EU market.

**** Please refer to Suntech Product Near-coast Installation Manual for details.

***** Please refer to Suntech Product Warranty for details.

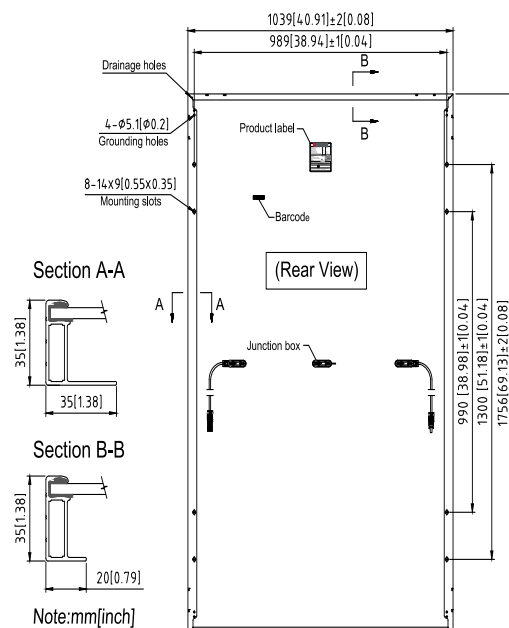
Electrical Characteristics

STC	STPXXS-B60/Wnhm				
Maximum Power at STC (P _{max})	380W	375W	370W	365W	360W
Optimum Operating Voltage (V _{mp})	34.7V	34.5V	34.3V	34.1V	33.9V
Optimum Operating Current (I _{mp})	10.96A	10.87A	10.79A	10.71A	10.62A
Open Circuit Voltage (V _{oc})	41.3V	41.1V	40.9V	40.7V	40.5V
Short Circuit Current (I _{sc})	11.64A	11.57A	11.49A	11.42A	11.35A
Module Efficiency	20.8%	20.6%	20.3%	20.0%	19.7%
Operating Module Temperature	-40 °C to +85 °C				
Maximum System Voltage	1500 V DC (IEC)				
Maximum Series Fuse Rating	20 A				
Power Tolerance	0/+5 W				

STC: Irradiance 1000 W/m², module temperature 25 °C, AM=1.5;
Tolerance of P_{max} is within +/- 3%.

NMOT	STPXXS-B60/Wnhm				
Maximum Power at NMOT (P _{max})	286.3W	281.9W	278.2W	274.3W	270.7W
Optimum Operating Voltage (V _{mp})	32.2V	32.2V	32.0V	31.8V	31.6V
Optimum Operating Current (I _{mp})	8.92A	8.76A	8.69A	8.62A	8.56A
Open Circuit Voltage (V _{oc})	38.9V	38.9V	38.7V	38.5V	38.4V
Short Circuit Current (I _{sc})	9.39A	9.24A	9.17A	9.10A	9.04A

NMOT: Irradiance 800 W/m², ambient temperature 20 °C, AM=1.5, wind speed 1 m/s.



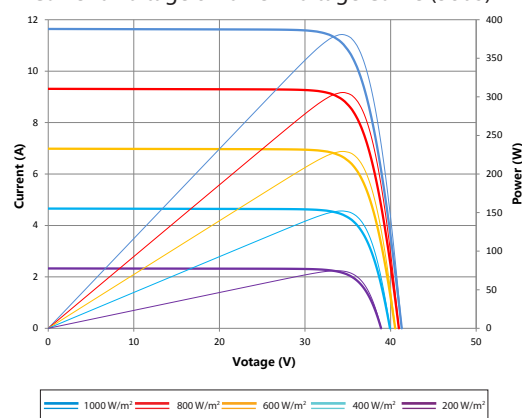
Temperature Characteristics

Nominal Module Operating Temperature (NMOT)	42 ± 2 °C
Temperature Coefficient of P _{max}	-0.36%/°C
Temperature Coefficient of V _{oc}	-0.304%/°C
Temperature Coefficient of I _{sc}	0.050%/°C

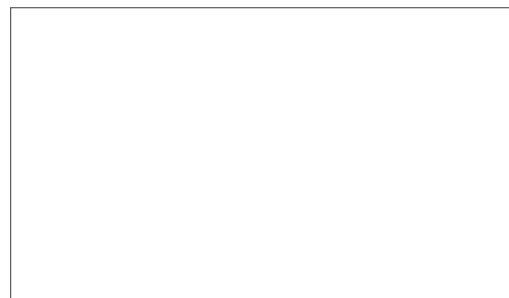
Mechanical Characteristics

Solar Cell	Monocrystalline silicon 166 mm
No. of Cells	120 (6 × 20)
Dimensions	1756 × 1039 × 35 mm (69.1 × 40.9 × 1.4 inches)
Weight	20.3 kgs (44.8 lbs.)
Front Glass	3.2 mm (0.13 inches) tempered glass
Frame	Anodized aluminium alloy
Junction Box	IP68 rated (3 bypass diodes)
Output Cables	4.0 mm ² , Portrait: (-)350 mm and (+)160 mm in length Landscape: (-)1300 mm and (+)1300 mm in length or customized length
Connectors	MC4 EVO2, Cable 015

Current-Voltage & Power-Voltage Curve (380S)



Dealer information



Packing Configuration

Container	20' GP	40' HC
Pieces per pallet	31	31
Pallets per container	6	26
Pieces per container	186	806
Packaging box dimensions	1786 × 1130 × 1203 mm	
Packaging box weight	679 kg	

Information on how to install and operate this product is available in the installation instruction. All values indicated in this data sheet are subject to change without prior announcement. The specifications may vary slightly. All specifications are in accordance with standard EN 50380. Color differences of the modules relative to the figures as well as discolorations of/in the modules which do not impair their proper functioning are possible and do not constitute a deviation from the specification.

APPENDIX VI – INVERTER SPECIFICATION

Three

6kW

Solis Three PV Inverter

- ▶ Three phase output
- ▶ Precise MPPT algorithm
- ▶ Compact and light design, easy installation
- ▶ IP65 rated for outdoor installation
- ▶ RS485, WiFi/GPRS (optional) interface
- ▶ WiFi and monitoring app available
- ▶ Numerous protection functions
- ▶ 5 years standard warranty, 20 years optional upgrade



Model:

Solis-6K

Features:

Fanless
Cooling
Concept

Ultra wide
Voltage
Range

WiFi/GPRS
Real time
monitoring

Available on the iPhone
App Store
Available on the Android
App Store

IP65

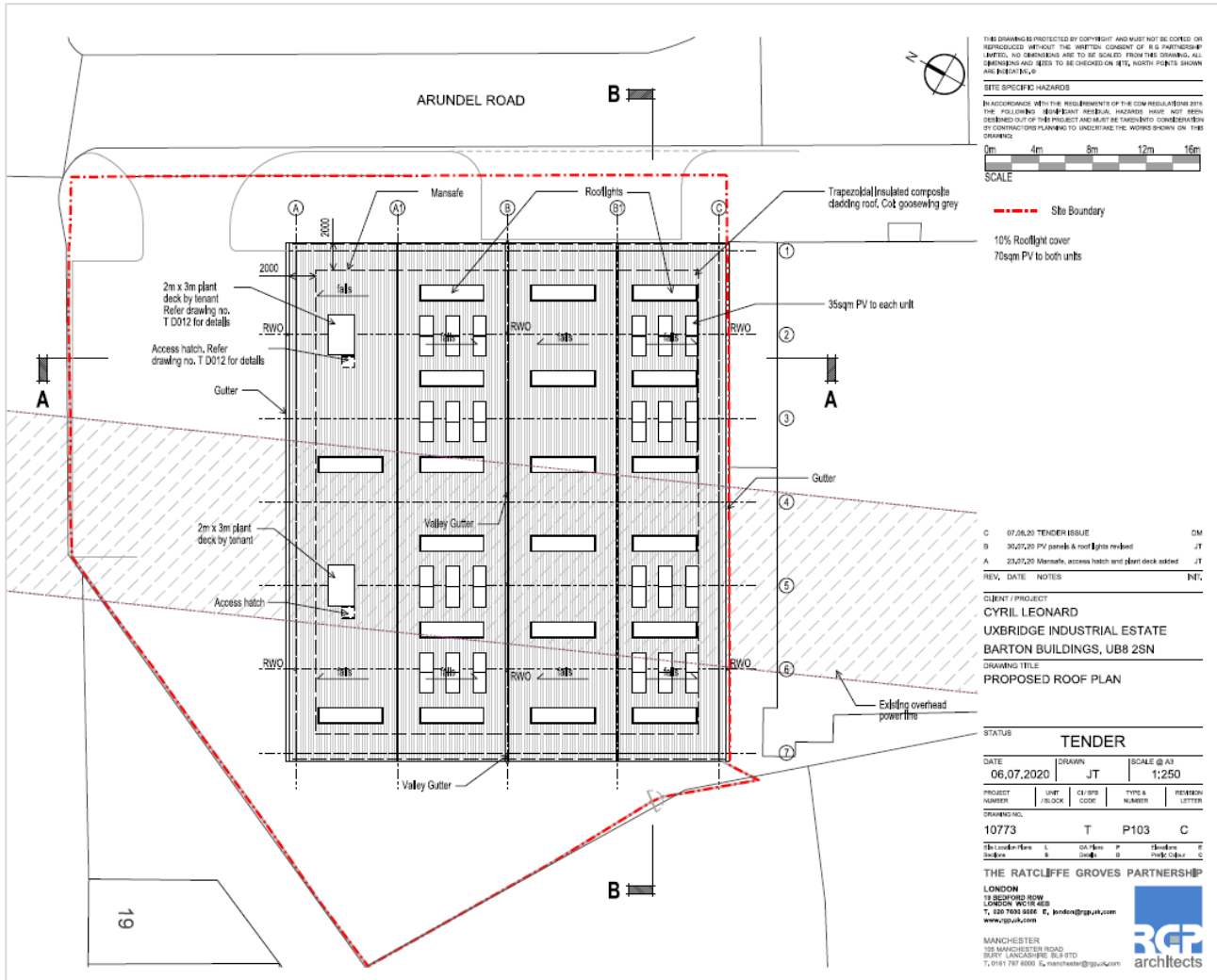
Weight
29kg

Datasheet

Model	Solis-6K
Energy Source	PV
Input Side(DC)	
Max. DC input power(kW)	6.9
Max. DC input voltage(V)	1000
Start-up voltage(V)	250
MPPT voltage range(V)	200-800
Max. input current(A)	15A+15A
MPPT number/Max input strings number	2/2
Output Side (AC)	
Rated output power(kW)	6
Max. apparent output power(kVA)	6.6
Max. output power(kW)	6.6
Rated grid voltage(V)	400
Grid voltage range(V)	313-470
Rated grid frequency(Hz)	50/60
Operation phase	Three
Rated grid output current(A)	8.7
Max. output current(A)	10
Power Factor (at rated output power)	0.8...1...0.8
THDi (at rated output power)	<3%
DC injection current(mA)	<20
Grid frequency range(Hz)	47-52 or 57-62
Efficiency	
Max. efficiency	98.2%
EU efficiency	97.3%
MPPT efficiency	>99%
Protection	
DC reverse-polarity protection	Yes
Short circuit protection	Yes
Output over current protection	Yes
Output over voltage protection	Yes
Insulation resistance monitoring	Yes
Residual current detection	Yes
Surge protection	Yes
Islanding protection	Yes
temperature protection	Yes
Integrated DC switch	Optional
General Data	
Dimensions(mm)	430W*613H*269D (mm)
Weight(kg)	29
Topology	Transformerless
Self consumption (night)	<1W(Night)
Operating ambient temperature range	-25~60°C
Ingress protection	IP65
Noise emission{typical}	<30 dBA
Cooling concept	Natural convection
Max. operation altitude	4000m
Designed lifetime	>20years
Grid connection standard	EN50438, G59/3, AS4777, VDE0126-1-1, IEC61727
Relative humidity	0~100%
Safety/EMC standard	IEC62109-1/-2, AS3100, EN61000-6-1, EN61000-6-3,
Features	
DC connection	MC-4mateable
AC connection	IP67rated plug
Display	LCD,2×20 Z.
Communication connections	4 pins RS485 connector
Warranty	5 years standard (extend to 20 years)

APPENDIX VII – ROOF PLAN

1.33



APPENDIX VIII – ELEVATIONS

