



ENERGY & SUSTAINABILITY STATEMENT

**Golden Cross
Hayes
UB3**

**MARCH 2014
REPORT REF: ESS/GC/20140314 - AT**

Disclaimer

The performances of renewable systems, especially wind and solar, are difficult to predict with any certainty. This is due to the variability of environmental conditions from location to location and from year to year. As such all budget/cost/sizings, which are based upon the best available information, are to be taken as an estimation only and should not be considered as a guarantee. This report relates to pre-planning stage therefore final specification must be provided by an M & E consultant after stage C. NRG Consulting disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report. This report is confidential to the Client and NRG Consulting accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

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DOCUMENT CONTROL SHEET

<u>Rev.</u>	<u>Issue Purpose</u>	<u>Author</u>	<u>Checked</u>	<u>Date</u>
	For Initial Comment	AT	RT	11/09/2013
A	Following Council Comments	AT	RT	12/12/2013
B	Updated Accom. Schedule	AT	RT	14/03/2013

Document Author:

Alex Timperley - NRG Consulting
Studio 7, Third Floor, 138-148 Cambridge Heath Road
London, E1 5QJ **E: alex@nrgconsulting.org**

1. INTRODUCTION

- 1.1 NRG Consulting have been appointed by Kevin Scott Consultancy to undertake an Energy Statement on a proposed development in Hayes comprising 23 dwellings.
- 1.2 The Floor Areas in this report have been taken from the Accommodation Schedule provided by the Architects for the scheme.
- 1.3 This document has been produced to satisfy Policy 5.2 of the London Plan by providing a 40% improvement in CO₂.
- 1.4 Full Code for Sustainable Homes Certification to Level 4 is sought and a Pre-Assessment can be found in the Appendices.
- 1.5 Hillingdon Local Policy EM1 will also be followed.

2. POLICY FRAMEWORK

- 2.1 With 23 residential units proposed the development falls within the Government's "major" category of planning applications.

This report will comply with both the Local Policies of the London Borough of Hillingdon and also the over-arching Regional Policies of the Greater London Authority (as set out in The London Plan (July 2011)).

- 2.2 The London Plan was updated in July 2011. In this update a change of priority was initiated in that a "fabric first" approach was adopted to ensure that a development was as energy efficient as possible before renewable energy was added. This is in contradiction to the previous London Plan, Policy 4A.7 that promoted renewable energy above all else.

- 2.3 Policy 5.2 of The London Plan (2011) states:

- A** Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- 1 Be lean: use less energy
- 2 Be clean: supply energy efficiently
- 3 Be green: use renewable energy

- B** The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016:

Residential buildings:

Improvement on 2010 Building Regulations: 2010 – 2013 - **40 per cent** (as of 1st October 2013)

C Development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.

D As a minimum, energy assessments should include the following details:

a. Calculation of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations.

b Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services

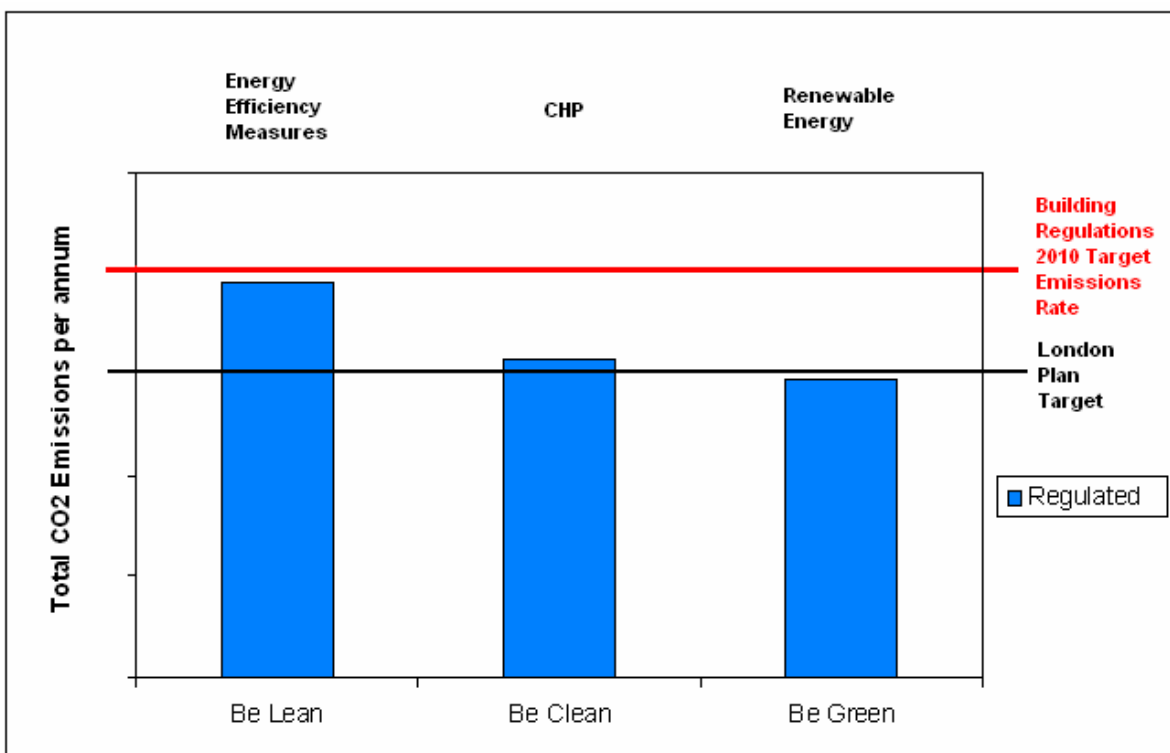
c Proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP)

d Proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

2.4 Carbon dioxide emissions from new development should be reduced by sustainable use of energy in accordance with the Mayor's energy hierarchy. The first step in the hierarchy, to reduce energy demand, should be met through adopting sustainable design principles outlined in Policy 5.3. The second step, to supply energy efficiently,

should be met by prioritising decentralised energy, as outlined in Policies 5.5 and 5.6. The third step, to use renewable energy, is outlined in Policy 5.7.

- 2.5 A visual representation of the GLA Target in relation to Building Regulations where feasible is:



HILLINGDON LOCAL POLICIES

2.6 **Hillingdon Local Policy EM1: Climate Change Adaptation and Mitigation** states that:

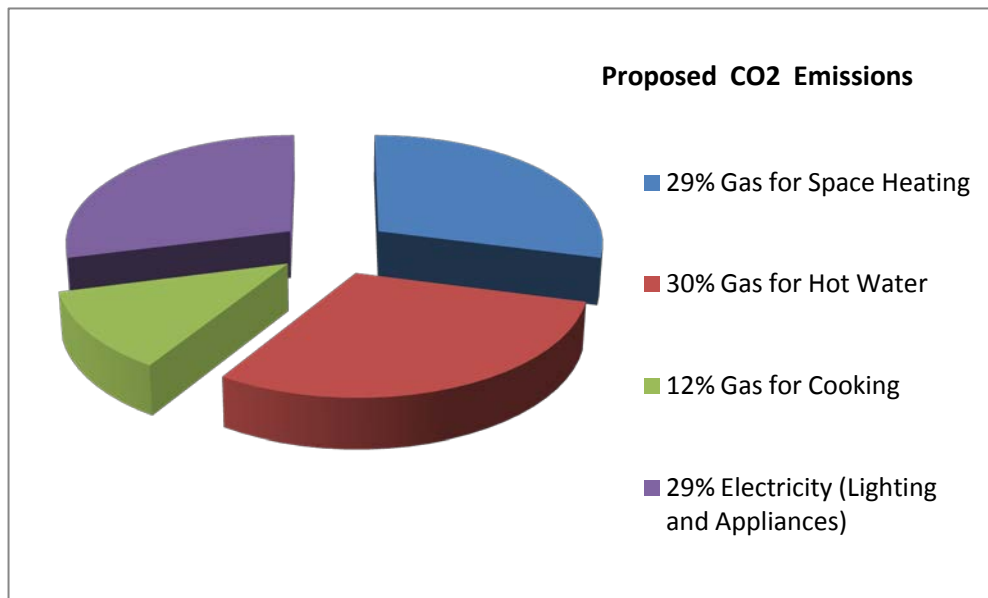
The Council will ensure that climate change mitigation is addressed at every stage of the development process by [...] encouraging the installation of renewable energy for all new developments in meeting the carbon reduction targets set out in the London Plan.

Therefore, a 40% improvement over the Part L (2010) Baseline shall be achieved in order to satisfy both the Regional and Local Policies.

3. **PREDICTED ANNUAL CARBON DIOXIDE EMISSIONS**

3.1 Sample SAP calculations have been carried out on 5 property types using the NHER Plan Assessor Version 5.4.2 (SAP v9.90) to gain the regulated emissions for the site. A licensed and OCDEA accredited SAP Assessor has carried out the calculations.

3.2 Typical CO₂ emissions for housing developments is broken down as follows



3.3 In addition to and in accordance with potential planning requirements, compliance is to be achieved on the unit in order to reach Level 4 of the Government's Code for Sustainable Homes scheme (November 2010).

3.4 A table can be found in the Appendices which sets out the floor area of the dwelling, the Target Emission Rate (TER) and Dwelling Emission Rate (DER) in terms of kg/m²/year and the percentage reduction of the DER over the TER. In addition, another column shows the CO₂ saved through the proposed use of energy efficient measures.

3.5 Based upon the figures as set out in the Appendices, with a total gross internal floor area of **1499m²**, the development has a baseline production of **28.6 tonnes CO₂/year**.

3.6

	Carbon Dioxide Emissions (tonnes per Annum)
	Regulated
Building Regulations 2010 Part L Compliant Development	28.6
After proposed construction details	
After CHP	
After renewable energy	

4. **ENERGY EFFICIENT DESIGN MEASURES**

- 4.1 Area weighted average U-values have been selected to ensure that all fabric U-values exceed the requirements of Part L of the Building Regulations (2010).

A full SAP Data Input Sheet is provided in the Appendices.

- 4.2 The U-values and general construction details for the development are as follows:

Elements	U Value	Further information
Ground Floor	0.15 w/m ² /k	Solid, Over Basement
Main External Walls	0.20 w/m ² /k	
Party Walls	0 w/m ² /k	Fully Filled Cavity
Flat Roof	0.13 w/m ² /k	
Windows	1.3 w/m ² /k	
Doors	1.0 w/m ² /k	
Air Permeability	5m ³ /hm ² @50Pa	
Ventilation	System 1 - Trickle Ventilation	
Heating	Gas Heating – Condensing Boiler	89 % SEDBUK 2009 efficiency
Controls	Full Zone Control	
Compensator	Weather Compensator	
Emitters	Radiators	
Cylinder	210ltr	
Secondary Heating	No	
Thermal Bridging	0.10 w/m ² /k	Accredited Details
Lighting	100%	Low Energy <u>Bulbs</u>

- 4.3 The Dwelling Emission Rate is based upon this form of design and construction with the internal lighting (100%) having dedicated low energy light bulbs that have a luminous efficacy of over 45 lumens/circuit/watt.
- 4.4 A highly efficient Gas Boiler is being installed to the scheme. This will be 89% efficient (SEDBUK 2009 rating) - a big improvement over the 86% assumed as the minimum for Part L1a of the Building Regulations. In addition, modern controls (Full Zone Control) will be installed so each area can be independently zoned.
- 4.5 The development has been designed to be airtight. For this, an Air Permeability of 5m³/hm²@50PA has been targeted: this represents a great improvement over the Building Regulations Part L target of 10m³/hm²@50PA.
- 4.6 The U-Values of all glazed elements will exceed Building Regulations standards, and incorporate low emissivity coating, resulting in an efficient balance between passive solar gain and the thermal losses from each room.

Daylight levels are high throughout and are supplemented with low energy light bulbs. The orientation of the building reduces peak solar gain while ensuring optimum levels of daylight both morning and evening.

- 4.7 When taking into account proposed construction details and U Values, but excluding the imposition of renewable energy technologies gives the development emissions of **29.3 tonnes CO₂/year**; a **2.34%** increase in CO₂ emissions over the Part L 2010 baseline.

4.8

	Carbon Dioxide Emissions (tonnes per Annum)
	Regulated
Building Regulations 2010 Part L Compliant Development	28.6
After proposed construction details	29.3
After CHP	
After renewable energy	

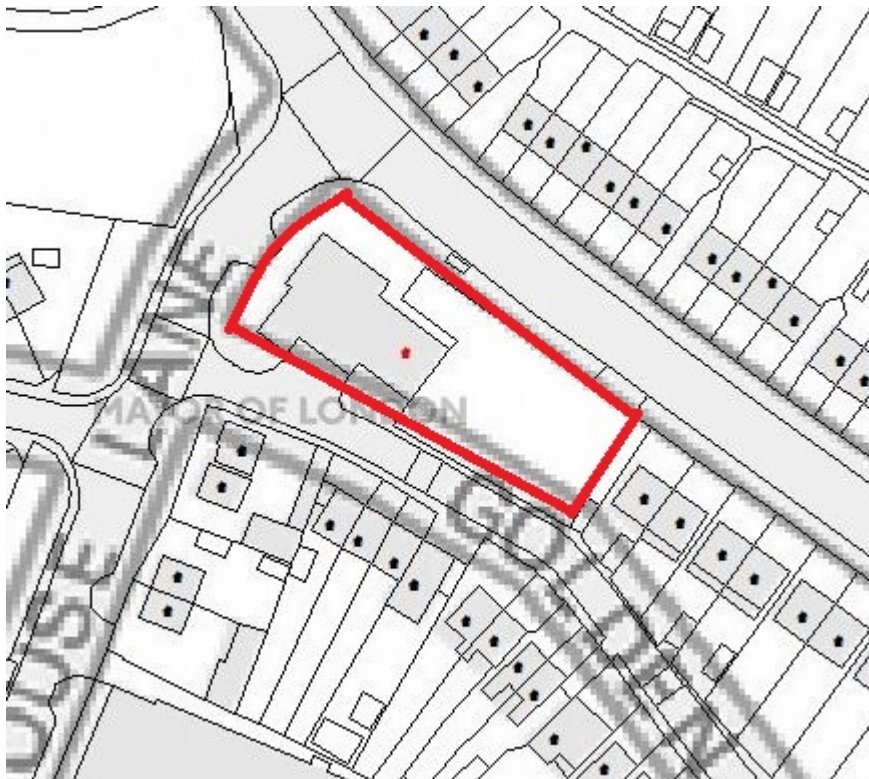
5. **FEASIBILITY OF RENEWABLE ENERGY**

Communal Heat and Power

5.1.1 Pursuant to Policy 5.5 of the London Plan, to the knowledge of the authors, there are no existing large scale CCHP/CHP distribution networks to connect into and the use of site wide CCHP/CHP powered by renewable energy or mains gas would not be possible on this site due to the tiny summer heating demand, maintenance issues and payback over 20 years.

5.1.2 The London Heat Map has been checked and no viable local connections are available. The red dot in the image is part of the existing building and will be cleared when the building is demolished. The red shape in the centre of the Picture is the Site.

The Map picture is:



5.2 The potential renewable energy applicable to this development is:

- Solar PV
- Solar Hot Water
- Ground Source Heat Pump
- Air Source Heat Pump
- Biomass Boilers

The feasibility of these items is investigated below:

5.3 Photovoltaic Panels

Advantages	Disadvantages	Feasibility
Can have significant impact on carbon by offsetting electricity which has a high carbon footprint. Low maintenance No noise issues associated with PV No additional land use from the installation of PV panels	High capital investment required Needs unobstructed space on roof	The development incorporates a flat roof which is perfectly suited to PV. PV would be feasible as it can contribute to meet the on-site electrical demand and any unused electricity can be sent back to the grid.

5.4 Solar Thermal Collectors

Advantages	Disadvantages	Feasibility
No noise issues associated with Solar thermal collectors No additional land use from the installation of solar thermal collectors Low maintenance and easy to manage Low capital cost	The hot water cylinder will need to be larger than a traditional cylinder. Consideration will need to be given to the space required especially as combination boilers are planned. Needs unobstructed space on roof.	Solar thermal collectors are feasible for the development, although it is not possible to meet a 25% carbon saving as the maximum demand that solar thermal collectors can be designed to meet can be no greater than 50% of the hot water demand. Solar thermal collectors have therefore not been investigated further.

5.5 Biomass Heating

Advantages	Disadvantages	Feasibility
Potential to reduce large component of the total CO₂ A biomass boiler would replace a standard gas heating system so some of the cost may be offset through money saved on a traditional boiler.	Regular maintenance will be required Reliability of fuel may become a problem, therefore limited cost saving for residents A plant room and fuel store will be required which may take additional land from the proposed development or surroundings The fuel will need to be delivered, which can cause issues with access etc. Biomass is often not a favoured technology in new development due to the potential local impacts of NO_x emissions and delivery vehicles.	This is a small tight site in an urban area. Biomass is not considered feasible for such a development due to the need for space to accommodate fuel storages, access for delivery vehicles and local NO_x emissions.

5.6 Ground Source Heat Pumps

Advantages	Disadvantages	Feasibility
Low maintenance and easy to manage Optimum efficiency with under-floor heating systems As heat pumps would replace standard heating systems, some of the cost may offset through money saved on a traditional boiler.	The heat pump has a noise level around 45-60dB so some attenuation may be required and it should be sensibly located Relatively high capital cost Requires electricity to run the pump, therefore limited carbon savings in most cases For communal systems plant room required which may take additional land from the proposed development/surroundings High payback.	Limited Space on site and large communal infrastructure needed would remove and reduce amenity space. As PV offers a much simpler installation offering equal/greater savings, GSHP has not been investigated further.

5.7 Air Source Heat Pumps

Advantages	Disadvantages	Feasibility
ASHP systems are generally cheaper than ground source as there is no requirement for long lengths of buried piping. Low maintenance and easy to manage Optimum efficiency with under-floor heating systems As heat pumps would replace standard heating systems, some of the cost may offset through money saved on a traditional boiler.	The heat pump has a noise level around 50-60dB so some attenuation may be required and it should be sensibly located. The potential noise from the external unit may mean there is local opposition to their installation. Requires electricity to run the pump, therefore limited carbon savings in most cases For communal systems plant room required which may take additional land from the proposed development/surroundings Potential noise issues	The use of conventional air source heat pumps would not be preferable for a site with mains gas available. With the cost of electricity increasing, the payback of ASHPs may further increase.

6. **RENEWABLE ENERGY MEASURES**

- 6.1 Following the above feasibility, the chosen technology, Solar PV, will be implemented.
- 6.1.1 With regulated CO₂ emissions of **29.3 tonnes** CO₂/yr after proposed construction details, the 40% reduction i.e. **12.1 tonnes** CO₂/yr will be met through the use of Solar PV to each dwelling. This comprises of a reduction of **0.7 tonnes** CO₂/yr to reach the Part L Baseline of **28.6 tonnes** CO₂/yr, and a further reduction of **11.5 tonnes** CO₂/yr to achieve the 40% reduction required to satisfy Local and Regional Policies.
- 6.2.1 The amount of CO₂ reduction required will be through generating electricity from photovoltaic cells. This effectively off-sets the consumption of mains grid electricity, most of which is generated by coal fired power stations, which has an emission factor of 0.529.
- 6.2.2 Assuming the use of optimally orientated monocrystalline modules producing **858.4kWh** per kWp (SAP v9.90) for all plots; 1kWp of PV array offsets **454.09** kg/CO₂/year. The orientation of the panels will be orientated between 15 and 30 degrees on a South orientation.
- 6.2.3 Based on the above figure, **26.71 kWp** of PV is required. This is equivalent to **82 panels** (327w) for a total of **26.81 kWp**.
- 6.3 For confirmation of this, please see the Appendices that contain an Architectural drawing showing a sketch of the proposed PV provision to the Site. A Manufacturer Datasheet for a typical PV Panel is also provided in the Appendices.

	Carbon Dioxide Emissions (tonnes per Annum)
	Regulated
Building Regulations 2010 Part L Compliant Development	28.6
After proposed construction details	29.3
After CHP	
After renewable energy	17.2

7. **CONCLUSION**

7.1 Following the above feasibility, the chosen technology, Solar PV, will be implemented. In line with The London Plan (2011), this Strategy has been written and produced to illustrate savings in terms of CO₂ for the proposed development.

7.2 The baseline emissions for the development have been assessed in accordance with Part L of the Building Regulations for the emissions at **28.6 tonnes CO₂/year**.

7.3 Taking into proposed construction details and U-Values to all thermal elements, high levels of energy efficient lighting and a low air permeability rating, the CO₂ savings from energy efficiency measures equate to a **2.34%** increase in CO₂ emissions over the Part L 2010 baseline.

Despite the sample SAP Calculations showing a negligible rise in CO₂ emissions over the Part L 2010 Baseline, it is entirely likely that full Calculations on all plots will show that the development meets Building Regulations before renewable technology is considered.

7.4 The final 2010 baseline equates to **29.3 tonnes CO₂/year** and therefore the chosen renewable energy technology, Solar PV, needs to provide an offset of **12.1 tonnes CO₂/year** in order to meet the 40% reduction requirement. This comprises of a reduction of **0.7 tonnes CO₂/yr** to reach the Part L Baseline of **28.6 tonnes CO₂/yr**, and a further reduction of **11.5 tonnes CO₂/yr**. Therefore, **26.71 kWp** of PV is required based on a South orientation. This is equivalent to **82 panels** across the site for a total of **26.81 kWp**.

7.5 When taking into account the installation of such a system a reduction of CO₂ emissions by **40.15%** is achieved.

7.6 The above therefore is in compliance with the main policy, (5.2) of The London Plan and the Hillingdon Borough Council Policies.

Appendix 1

Golden Cross - 40% Carbon Dioxide Reduction Calculations - Revision B

1	2	3	4	5	6
PLOT	AREA	TER	DER	Multiple	Multiple
				TER	DER
	m2	kg/CO ₂ /m2/yr	kg/CO ₂ /m2/yr	kg/CO ₂ /yr	kg/CO ₂ /yr
4	64.77	18.94	19.47	1227	1261
7	49.49	22.55	22	1116	1089
12	64.77	15.72	16.48	1018	1067
15	49.49	21.79	21.78	1078	1078
20	64.77	18	19.16	1166	1241
Total	293.29			5605	5736
			1m2 figure	19.11	19.56
			kg/Co2/m2/year		
Total Site	1499			28,648	29,317

Multiple TER		<u>28,648</u>	kg/CO₂/yr
Multiple DER		<u>29,317</u>	kg/CO₂/yr
40% Improvement on TER		<u>17,189</u>	kg/CO₂/yr
Needed to Offset		<u>12,129</u>	kg/CO₂/yr
1kWp PV		<u>454.09</u>	kg/CO₂/yr
PV		<u>26.71</u>	kWp

Appendix 2

Data Input Report

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Rothon	Assessor number	4282
Client		Last modified	10/09/2013
Address	12 Golden Cross Botwell Lane, Hayes, UB3		

Dwelling

Development:	House type:		
Property type:	Flat	Year built:	2013
Flat type:	Mid floor	Assess summer overheating:	Yes
Tariff:	Standard	Thermal mass parameter:	250.00
Thermal mass:	Medium	Degree day region:	Thames
Separated heated conservatory:	No	Terrain:	Dense Urban
Sheltered sides:	3		

Storeys:

Name	Area (m ²)	Height (m)
Lowest occupied	64.77	2.40

Floors

Ref - Name	Type	Construction	Storey Location	Living Area (m ²)	Area (m ²)	U-value (W/m ² K)
Living area that has no heat loss:	22.05					

Walls

Ref - Name	Type	Construction	Gross Area (m ²)	U-value (W/m ² K)
Wall 1 - external	External	Cavity	38.11	0.20
Wall 2 - to corridor	Sheltered	Cavity	13.68	0.20
Wall 3 - party	Party	Fully filled cavity with sealed edges	32.31	0.00

Roofs

Ref - Name	Construction	Gross Area (m ²)	U-value (W/m ² K)
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Openings

Opening Ref: 1 Door to corridor, N/A, 'N/A', master: Yes, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	South East
Overshading:	N/A	Width (m):	0.91	Height (m):	2.10
Frame:	u-PVC	Transmittance factor:	N/A	U-value (W/m ² K):	1.00

Opening Ref: 2 Window, Double glazed (low-E), 'N/A', master: Yes, linked to: 0

Location:	Wall 1	Source:	From Manufacturer	Orientation:	North East
Overshading:	Average / Unknown	Width (m):	3.80	Height (m):	2.10
Frame:	u-PVC	Transmittance factor:	0.63	U-value (W/m ² K):	1.30

Opening Ref: 3 Window, Double glazed (low-E), 'N/A', master: No, linked to: 2

Location:	Wall 1	Source:	From Manufacturer	Orientation:	North East
Overshading:	Average / Unknown	Width (m):	1.10	Height (m):	2.10
Frame:	u-PVC	Transmittance factor:	0.63	U-value (W/m ² K):	1.30

Opening Ref: 4 Window, Double glazed (low-E), 'N/A', master: No, linked to: 2

Location:	Wall 1	Source:	From Manufacturer	Orientation:	North East
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Overshading:	Average / Unknown	Width (m):	1.10	Height (m):	2.10
Frame:	u-PVC	Transmittance factor:	0.63	U-value (W/m²K):	1.30
Opening Ref: 5 Window, Double glazed (low-E), ' N/A', master: No, linked to: 2					
Location:	Wall 1	Source:	From Manufacturer	Orientation:	North East
Overshading:	Average / Unknown	Width (m):	1.10	Height (m):	2.10
Frame:	u-PVC	Transmittance factor:	0.63	U-value (W/m²K):	1.30

Ventilation

Air permeability entered:	Yes	Seek exemption (<3 dwellings):	No		
Design air permeability rate:	5.00				
Number of...	Open fireplaces	Open flues	Flueless gas fires	Extract fans	Passive vents
	0	0	0	2	0
Mechanical ventilation:	Not present (natural)				

Space heating

Main heating category:	Individual system/s	Number of systems:	1
Secondary heating:	No	Open flue or chimney:	No
Unconnected gas point:	N/A	Smoke control area:	No
Type:	Boiler	Efficiency source:	Manufacturer declared
Product index:	N/A		
Product details:	N/A N/A N/A		
Boiler type:	Combi	Fuel:	Mains gas
Condensing:	Yes	Flue type:	Balanced
Fan assisted flue:	Yes		
Combi type:	Instantaneous	Uses electricity:	N/A
Keep hot power rating:	N/A		
System:	Condensing combi with automatic ignition (1998 or later)		
Controls:	Time and temperature zone control		
Interlock:	Yes	Delayed start thermostat:	Yes
Compensation:	None	Burner control:	Modulating
Emitter:	Radiators	Pump in heated space:	Yes
Efficiency Type:	2009 SEDBUK	Efficiency (%):	89.00
Manufacturer efficiency description:	a		
FGHRS:	No		

Water heating

Type:	From main	Fuel:	Mains gas
Water separately timed:	N/A	Water use ≤125 litres/person/day:	Yes
Heat pump uses immersion:	N/A	Summer immersion:	N/A
Thermal store type:	N/A		
Store details:			
Cylinder volume (litres):	N/A		
Thermostat:	N/A	In heated space:	N/A
Primary pipework insulated:	N/A		

WWHRS:

WWHRS:	N/A
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Renewables

No renewables present

Other

Thermal Bridging

Thermal bridge specification:	Enter y value	y-value:	0.10
y-value description:	guess		

Internal lighting

Standard fittings:	0	Low energy fittings:	6	Total fittings:	6
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Summer overheating

Thermal mass parameter (TMP):	250.00		
User defined air change rate:	No	Air change rate (ach):	N/A
Cross ventilation on most floors:	No	Window ventilation:	Fully open
Source of user defined values:	N/A		
Curtains closed in daylight hours:	No	Fraction curtains closed:	N/A
Blind/curtain type:	N/A		

Special features (Appendix Q)

No Appendix Q special features present

Cooling details

No space cooling present

DRAFT

L1A 2010 - Regulations Compliance Report

Design - Draft



This design draft submission provides evidence towards compliance with Part L of the Building Regulations, in accordance with Appendix A of AD L1A. It has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the 'as built' property. This report covers only items included within the SAP and is not a complete report of regulations compliance.

Assessor name	Mr Neil Rothon	Assessor number	4282
Client		Last modified	10/09/2013
Address	12 Golden Cross Botwell Lane, Hayes, UB3		

Check	Evidence	Produced by	OK?																		
Criterion 1: predicted carbon dioxide emission from proposed dwelling does not exceed the target																					
TER (kg CO ₂ /m ² .a)	Fuel = Mains gas Fuel factor = 1.00 TER = 15.72	Authorised SAP Assessor																			
DER for dwelling as designed (kg CO ₂ /m ² .a)	DER = 16.48	Authorised SAP Assessor																			
Are emissions from dwelling as designed less than or equal to the target?	DER 16.48 > TER 15.72 Excess emissions = 0.76kg/m ² (4.83%)	Authorised SAP Assessor	Failed																		
Criterion 2: the performance of the building fabric and the heating, hot water and fixed lighting systems should be no worse than the design limits																					
Fabric U-values																					
Are all U-values better than the design limits in Table 2?	<table><thead><tr><th>Element</th><th colspan="2">Weighted average Highest</th></tr></thead><tbody><tr><td>Wall</td><td>0.20 (max 0.30)</td><td>0.20 (max 0.70)</td></tr><tr><td>Party wall</td><td>0.00 (max 0.20)</td><td>N/A</td></tr><tr><td>Floor</td><td>(no floor)</td><td></td></tr><tr><td>Roof</td><td>(no roof)</td><td></td></tr><tr><td>Openings</td><td>1.27 (max 2.00)</td><td>1.30 (max 3.30)</td></tr></tbody></table>	Element	Weighted average Highest		Wall	0.20 (max 0.30)	0.20 (max 0.70)	Party wall	0.00 (max 0.20)	N/A	Floor	(no floor)		Roof	(no roof)		Openings	1.27 (max 2.00)	1.30 (max 3.30)	Authorised SAP Assessor	Passed
Element	Weighted average Highest																				
Wall	0.20 (max 0.30)	0.20 (max 0.70)																			
Party wall	0.00 (max 0.20)	N/A																			
Floor	(no floor)																				
Roof	(no roof)																				
Openings	1.27 (max 2.00)	1.30 (max 3.30)																			
Thermal bridging																					
How has the loss from thermal bridges been calculated?	Thermal bridging calculated using user-specified γ-value of 0.1, with reference: guess	Authorised SAP Assessor																			
Heating and hot water systems																					
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Main heating system: Mains gas, Combi boiler a Data from manufacturer Efficiency = 89.00% 2009 SEDBUK Minimum = 88.00% Secondary heating system: None	Authorised SAP Assessor	Passed																		
Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	No hot water cylinder	Authorised SAP Assessor																			
Do controls meet the minimum controls provision set out in the Domestic Heating Compliance Guide?	Space heating control: Time and temperature zone control Hot water control: No hot water cylinder Boiler interlock (main system 1)	Authorised SAP Assessor	Passed																		

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 6 Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appropriate passive control measures to limit solar gains			
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Slight Overheating risk (August) = Slight Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 4.00 ach Blinds/curtains = None	Authorised SAP Assessor	Passed
Criterion 4: the performance of the dwelling, as designed, is consistent with the DER			
Design air permeability (m ³ /(h.m ²) at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Not applicable	Authorised SAP Assessor	
Have the key features of the design been included (or bettered) in practice?	The following walls/wall have a U-value less than 0.2W/m²K: • party (0.00) The following openings have a U-value less than 1.5W/m²K: • Door to corridor reference 1 (1.00) • Window reference 2 (1.30) • Window reference 3 (1.30) • Window reference 4 (1.30) • Window reference 5 (1.30)	Authorised SAP Assessor	

Appendix 3

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Section		Credits Awarded	Out of	Current Site Compliance
ENE 1	DER	4.4	10	Gas Heating with PV for a 40.47% improvement over the requirements of Part L 2010. This meets the minimum requirements for Code Level 4. Full SAP Calculations at Design Stage to confirm.
ENE 2	FEE	3	9	3 Credits awarded pending full SAP Calculations at Design Stage. These Credits have currently been assumed based on achieving an average of 48 kWh/m²/year across the Site. Full SAP Calculations at Design Stage to confirm.
ENE 3	DISPLAY ENERGY DEVICES	2	2	A Display Energy Device that shows electricity and gas usage for the dwellings will be installed. The device must be fixed to the mains supply and be capable of displaying the following: • Current mains energy consumption (kilowatts and kilowatt hours) • Current emissions (g/kg CO2) • Current tariff • Current cost (in pounds and pence). • Display account balance information for pre-pay customers (amount in credit or debit) • Visual presentation of data (i.e. non-numeric) • Historical consumption data If E:ON are the utility supplier, free Display Energy Devices which achieve 2 Credits can be obtained from HERE.

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ENE 4	DRYING SPACE	1	1	All Flats will have a Tidy Drier of at least 6m in length installed in the Bathroom.
ENE 5	ECO GOODS	1	2	The developer is supplying an information leaflet concerning the purchase of energy efficient appliances and the EST energy labeled scheme. No white Goods are currently specified as it is an unnecessary cost at this stage. This can be revisited at Design Stage if further Credits become necessary.
ENE 6	EXTERNAL LIGHTS	2	2	All external space lighting is to be dedicated low energy fittings. Any security lighting is to be a maximum of 150w with PIR and dusk to dawn sensors to reduce unnecessary usage.
ENE 7	LOW OR ZERO CARBON TECHNOLOGIES	2	2	2 Credits has been awarded the provision of PV Panels to the development as per the Energy & Sustainability Statement. This is for a 15% reduction in CO2 via renewable energy over the Standard Case. Full SAP Calculations at Design Stage to confirm.

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ENE 8	CYCLE STORAGE	1	2	Cycle storage sufficient for 1 Credit will be supplied to the development in the form of proprietary storage. This is satisfied by the 24 spaces specified on the Basement drawing. All units – 1 space per dwelling Cycle Storage will have a secure fitting, be weatherproof and accessible only to the residents. It also has direct access to the highway. Secure Fixing: A stand which allows both wheel and frame to be locked and must, as a minimum, be of galvanised steel bar construction (with a minimum thickness of 3mm) and have a minimum foundation depth of 300mm with a welded anchor T-bar set in concrete to prevent it being easily removed from the ground
ENE 9	HOME OFFICE	1	1	A Home Office will be present in either the Living Room or Second Bedroom of all units. Preliminary calculations confirm that there will be at least 1.5% daylight. The Living Room/Second Bedroom will be shown to accommodate a desk and bookcase and also a provision of 2 double sockets and 1 telephone points, all to be in close proximity to the wall space so extension cables are not required. Broadband is available to the site

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				4 credits have been assumed for indoor water use of <90 ltrs/person/day. This can be reduced if necessary for more Credits. A sample specification is: <table><tr><td><u><90ltrs/person/day (4 credits)</u></td><td>Option 1</td></tr><tr><td>W/C</td><td>4/2.6</td></tr><tr><td>Basin Taps (Litres Per Min)</td><td>4</td></tr><tr><td>Kitchen Taps (Litres Per Min)</td><td>4</td></tr><tr><td>Shower (Litres Per Min)</td><td>6</td></tr><tr><td>Bath (Litres to Overflow)</td><td>156</td></tr><tr><td></td><td></td></tr><tr><td>TOTAL</td><td>89.7</td></tr></table>	<u><90ltrs/person/day (4 credits)</u>	Option 1	W/C	4/2.6	Basin Taps (Litres Per Min)	4	Kitchen Taps (Litres Per Min)	4	Shower (Litres Per Min)	6	Bath (Litres to Overflow)	156			TOTAL	89.7
<u><90ltrs/person/day (4 credits)</u>	Option 1																			
W/C	4/2.6																			
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Shower (Litres Per Min)	6																			
Bath (Litres to Overflow)	156																			
TOTAL	89.7																			
WAT 1	INTERNAL WATER	4	5																	
				A Water Butt of at least 200ltrs is to be installed on the Rainwater Downpipe of all Ground Floor Flats with Rainwater Downpipes. The system is to have a lid, a tap, and provision for any excess water to be returned to the main supply. Upper Floor Flats have Balconies which qualify for the Credit by default. Therefore, 1 Credit can be awarded to each dwelling.																
WAT 2	EXTERNAL WATER	1	1																	

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MAT 1	ENVIRONMENTAL IMPACT OF MATERIALS	10	15	MAT 1 – Materials – As per the Building Research Establishments “Green Guide to Specification”, 10 credits have been awarded based on a masonry and timber construction. This will be confirmed at Design Stage when full Construction Notes have been provided.
MAT 2	RESPONSIBLE SOURCING: BASICS	0	6	All Timber to be FSC/PEFC certified. Where possible, brick/block/roof tiles to have EMS (ISO:14001) Certification. 0 Credits have preliminarily awarded.
MAT 3	RESPONSIBLE SOURCING: FINISHES	0	3	All timber used in the following sections will be FSC/PEFC where available: - Panelling - Skirting - Internal and external door finishing’s - Staircase finishing’s e.g. handrails (All but staircase) 0 Credits have been preliminarily awarded.
SUR 1	SURFACE RUNOFF	0	2	CfSH Mandatory Requirement to be met by default – i.e. post-impermeable areas less than pre-development areas. No confirmation of SUDS at this point so extra Credits withheld.
SUR 2	FLOOD RISK	2	2	A Flood Risk Assessment to be undertaken. (This is a mandatory element of the CSH Assessment) A preliminary inspection of the location suggests that the development is in a Low Flood Risk Zone and therefore 2 Credits can be awarded.

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WAS 1	RECYCLING FACILITIES	4	<i>4</i>	Internal recycling facilities of 1 bin; minimum total capacity 30Ltrs will be installed. This will be in a fixed location within the kitchen and in addition to a normal waste bin. Hillingdon Local Authority provides a Post-Collection Sorting, Clear bag recycling service.
WAS 2	SWMP	3	<i>3</i>	A full Site Waste Management Plan in line with current best practice will be provided with waste being recycled off-site by a licensed external contractor. Over 85% of the Non-Hazardous Waste will be recycled by the Contractor.
WAS 3	COMPOSTING	1	<i>1</i>	Hillingdon Local Authority will begin to provide a Food Waste Collection Service as of October 2013. Space will be provided in the Kitchen of each Flat for a caddy of at least 7 ltrs in order to gain this credit.
POL 1	ODP / GWP	1	<i>1</i>	All insulation used in the construction will have a Global Warming Potential of less than 5.
POL 2	NOX OUTPUT FROM BOILER	3	<i>3</i>	A boiler which produces less than 40 mg/kWh of NOx should be installed.
HEA 1	DAYLIGHT	3	<i>3</i>	Full calculations will be undertaken at Design Stage; however a preliminary inspection shows that all 3 Credits should be achievable in this section.

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HEA 2	SOUND INSULATION	3	<i>4</i>	A 5db improvement over Part E compliance is to be achieved. Post-Construction Sound Testing will be undertaken to confirm this.
HEA 3	PRIVATE SPACE	1	<i>1</i>	All Flats have Private Space which qualifies for this Credit. All Private Space is to be in line with the Inclusive Design Principles Checklist.
HEA 4	LIFETIME HOMES	4	<i>4</i>	All 16 principles of Lifetime Homes (where applicable) will be complied with.
MAN 1	HOME USER GUIDE	3	<i>3</i>	A simple guide that covers information relevant to the 'non technical' occupant on the operation and environmental performance of the dwelling is to be supplied. In addition, information on the site and surrounding area is to be included to achieve all three credits.
MAN 2	CONSIDERATE CONSTRUCTORS	2	<i>2</i>	The Considerate Constructor's Scheme is to be followed and a Beyond Best Practice score is to be achieved. This represents a score of at least 7 points in each section and at least 35 points overall.
MAN 3	CONSTRUCTION SITE IMPACTS	2	<i>2</i>	The following will be undertaken: 1. Adopt best practice policies in respect of air (dust) pollution arising from site 2. Adopt best practice policies in respect of water (ground and surface) pollution occurring on site. 3. All timber for Site Use (Hoarding etc) is either responsibly sourced/re-used/recycled. 4. Monitor Water Consumption from Site activities.

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MAN 4	SECURE BY DESIGN	2	2	A full Secure by Design certificate is to be achieved on this development.
ECO 1	ECOLOGICAL VALUE OF SITE	1	1	The ECO 1 Checklist is to be completed. A preliminary inspection shows that the Site was previously a car park/already built upon so the Credit should be available.
ECO 2	ECOLOGICAL ENHANCEMENT	0	1	This Credit is unavailable without an Ecology Report which, at this stage, is considered an unnecessary cost.
ECO 3	PROTECTION OF ECOLOGICAL FEATURES	1	1	The land looks to be of Low Ecological Value, and there do not seem to be any Ecological Features to protect. ECO 1 Checklist will confirm this Credit at Design Stage.
ECO 4	CHANGE OF SITE USE	2	4	A neutral change in the ecological value of the Site is expected. This is to be confirmed by the ECO 4 Calculator at Design Stage.
ECO 5	BUILDING FOOTPRINT	0	2	0 Credits awarded as the development has a Net Internal Floor Area : Net Internal Ground Floor Area of less than 3:1.

FINAL SCORE: **69.40%**

Code 3 = 57, Code 4 = 68

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<u>Rev.</u>	<u>Issue Purpose</u>	<u>Author</u>	<u>Date</u>
N/A	Initial Issue for Comment	AT	11/09/2013
A	Following Council Comments	AT	12/12/2013

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[illegible]

Appendix 4

20% EFFICIENCY

SunPower E20 panels are the highest efficiency panels on the market today, providing more power in the same amount of space

TRANSFORMERLESS INVERTER COMPATIBILITY

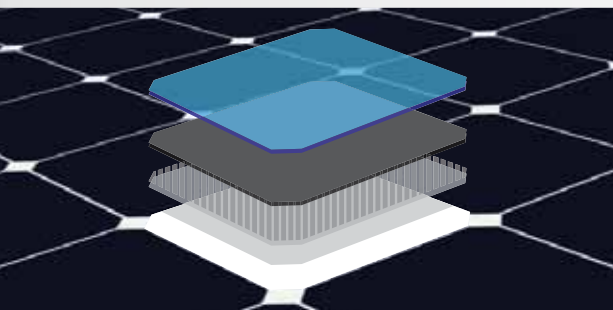
Comprehensive inverter compatibility ensures that customers can pair the highest-efficiency panels with the highest-efficiency inverters, maximizing system output

POSITIVE POWER TOLERANCE

Positive tolerance ensures customers receive the rated power or higher for every panel

RELIABLE AND ROBUST DESIGN

SunPower's unique Maxeon™ cell technology and advanced module design ensure industry-leading reliability



MAXEON™ CELL TECHNOLOGY

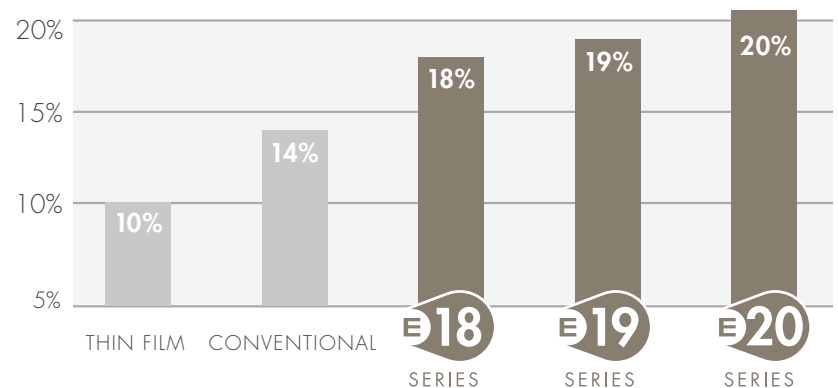
Patented all-back-contact solar cell, providing the industry's highest efficiency and reliability.



THE WORLD'S STANDARD FOR SOLAR™

SunPower™ E20 Solar Panels provide today's highest efficiency and performance. Powered by SunPower Maxeon™ cell technology, the E20 series provides panel conversion efficiencies of up to 20.4%. The E20's low voltage temperature coefficient, anti-reflective glass and exceptional low-light performance attributes provide outstanding energy delivery per peak power watt.

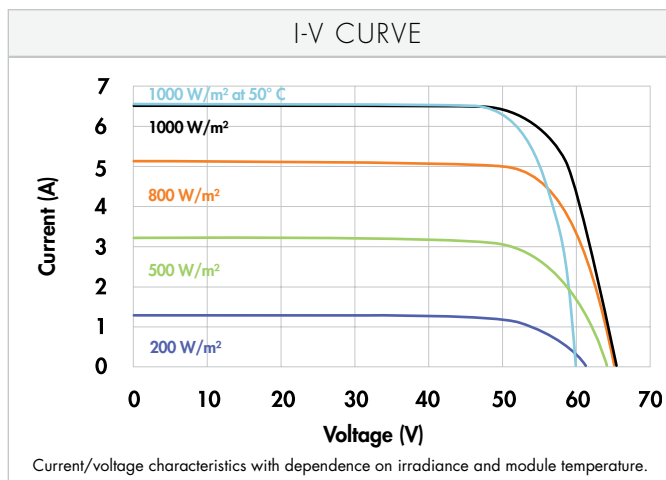
SUNPOWER'S HIGH EFFICIENCY ADVANTAGE



MODELS: SPR-333NE-WHT-D, SPR-327NE-WHT-D

ELECTRICAL DATA			
Measured at Standard Test Conditions (STC): Irradiance 1000W/m², AM 1.5, and cell temperature 25° C			
Nominal Power (+5/-0%)	P _{nom}	333 W	327 W
Cell Efficiency	η	22.9 %	22.5 %
Panel Efficiency	η	20.4 %	20.1 %
Rated Voltage	V _{mpp}	54.7 V	54.7 V
Rated Current	I _{mpp}	6.09 A	5.98 A
Open-Circuit Voltage	V _{oc}	65.3 V	64.9 V
Short-Circuit Current	I _{sc}	6.46 A	6.46 A
Maximum System Voltage	IEC	1000 V	
Temperature Coefficients	Power (P)	− 0.38 %/K	
	Voltage (V _{oc})	− 176.6 mV/K	
	Current (I _{sc})	3.5 mA /K	
NOCT		45° C +/- 2° C	
Series Fuse Rating		20 A	
Limiting Reverse Current (3 strings)	I _r	16.2 A	
Grounding		Positive grounding not required	

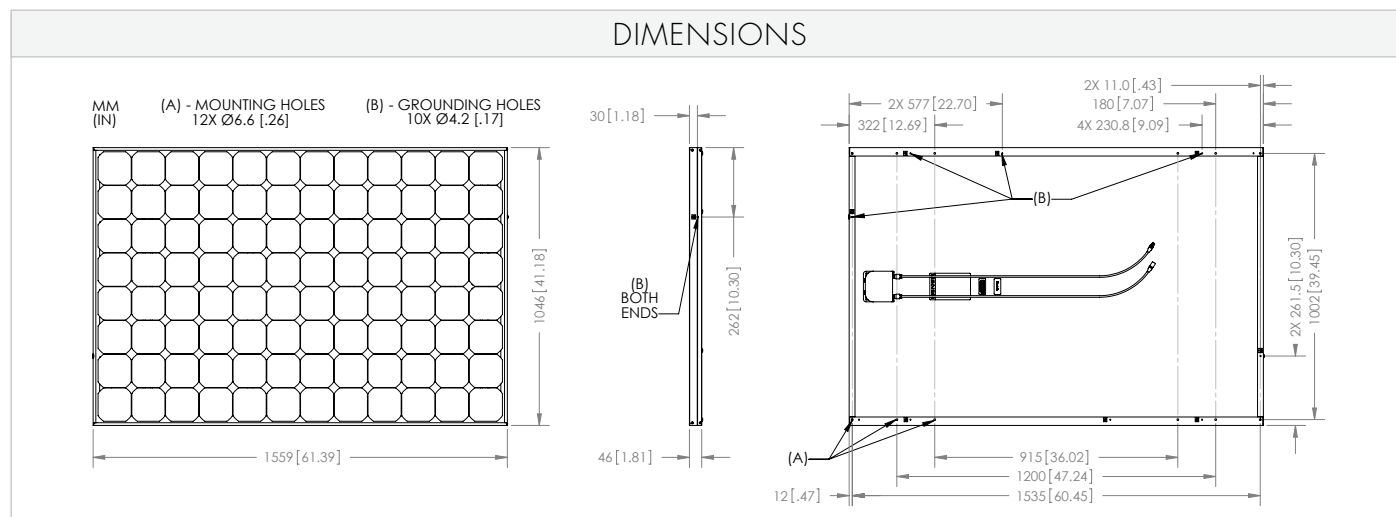
ELECTRICAL DATA			
Measured at Nominal Operating Cell Temperature (NOCT): Irradiance 800W/m ² , 20° C, wind 1 m/s			
Nominal Power	P _{nom}	247 W	243 W
Rated Voltage	V _{mpp}	50.4 V	50.4 V
Rated Current	I _{mpp}	4.91 A	4.82 A
Open-Circuit Voltage	V _{oc}	61.2 V	60.8 V
Short-Circuit Voltage	I _{sc}	5.22 A	5.22 A



TESTED OPERATING CONDITIONS	
Temperature	- 40° C to +85° C
Max load	550 kg/m ² (5400 Pa), front (e.g. snow) w/specified mounting configurations 245 kg/m ² (2400 Pa) front and back (e.g. wind)
Impact Resistance	Hail: 25 mm at 23 m/s

WARRANTIES AND CERTIFICATIONS	
Warranties	25-year limited power warranty 10-year limited product warranty
Certifications	IEC 61215 Ed. 2, IEC 61730 (SCII)

MECHANICAL DATA			
Cells	96 SunPower Maxeon™ cells		
Front Glass	High-transmission tempered glass with anti-reflective (AR) coating		
Junction Box	IP-65 rated with 3 bypass diodes 32 x 155 x 128 mm		
Output Cables	1000 mm cables / Multi-Contact (MC4) connectors		
Frame	Anodised aluminium alloy type 6063 (black)		
Weight	18.6 kg		



Please read safety and installation instructions before using this product, visit sunpowercorp.com for more details.

PRELIMINARY

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DO NOT SCALE THIS DRAWING

NOTES:



82no Sunpower 327W Modules
Mounted at 15°
26.814KWP

REV	DESCRIPTION	DATE	Architect:	PROJECT:		Engineer: PN	Checked: CC	
				GOLDEN CROSS		Date: 13-03-14	PM: MM	
			Client:	Title:	The Despatch House, Noake Mill Lane, Water End Hemel Hempstead, Hertfordshire, HP1 3BG Tel: 01442 264514 Fax: 01442 502120 www.south-facing.co.uk	SCALE: NTS	Drawn: LH	
			NRG CONSULTING	PV SYSTEM PRELIMINARY LAYOUT		Project No 9327	DRAWING No PRE-01	REVISION