

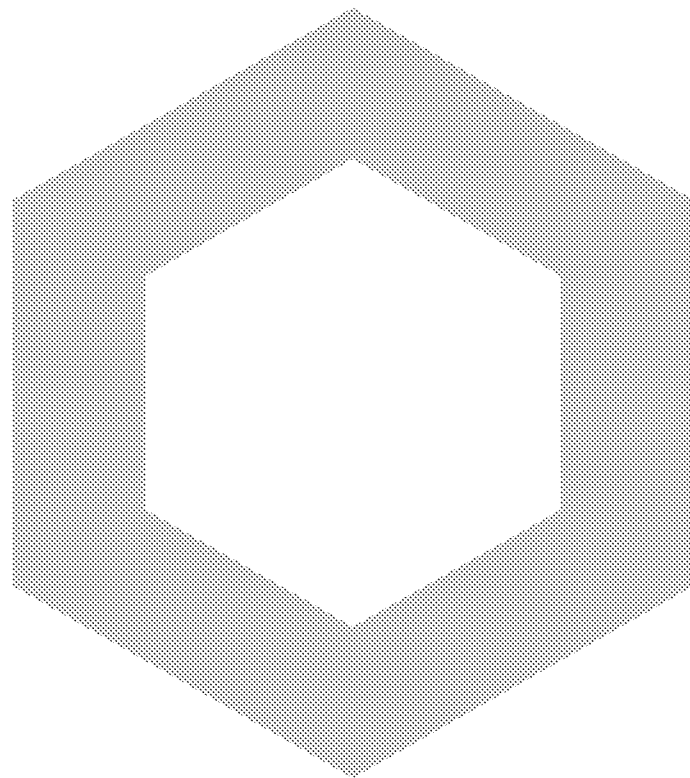
Development of Waitrose Site, East Street, Littlehampton. Littlehampton. Ropemaker Properties Ltd.

SUSTAINABILITY

ENERGY AND RENEWABLE STRATEGY REPORT

STAGE 2

REVISION REV 02 – 29 NOVEMBER 2018



STAGE 2

Audit sheet.

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DRAFT	25/10/2018	Stage 2 - DRAFT	J.Pugh	GK
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Executive Summary

This report presents Building Regulations Part L 2013 assessments which have been carried out for the proposed Residential Redevelopment of the Former Waitrose Site at Littlehampton, based on Stage 2 design.

Areas assessed include the proposed dwellings of Building 1 and Building 2. The analysis of the residential areas has been conducted to assess compliance with Building Regulations Part L1A 2013 (conservation of fuel and power).

The residential buildings have also been assessed to achieve compliance with the Adopted Arun Local Plan (2018) which requires 10% of the total predicted energy requirements from renewable or low carbon energy generation on-site.

Energy Strategy

The energy strategy for the proposed development is based on low energy passive design measures and efficient building services to reduce carbon emissions. Measures include:

- Glazing g-value specified to control solar heat gain. The final glazing selection should be chosen to maximise access to daylight within the limit of the given maximum g-value allowed, thereby reducing the use of electric lighting, and instances of high internal temperatures in summer.
- Building fabric specifications have adopted low U-values, with a high resistance to heat transfer, reducing space heating requirements
- High efficiency gas-fed community heating system for space heating and domestic hot water
- High efficiency mechanical ventilation systems with heat recovery (MVHR)
- Low energy electric lighting systems
- Photovoltaic panels – connected to landlord supply

Results – Dwellings

A sample of apartments across the two buildings have been modelled to determine the Criterion 1 (annual regulated carbon emissions and fabric energy efficiency standards) and Criterion 3 (limiting the effects of heat gains in summer) performance against Part L1A of the Building Regulations 2013, and demonstrate how compliance can be achieved. Based on the modelled sample units, an area-weighted average for compliance with Criterion 1 has been calculated for each building.

Part L1A 2013 Criterion 1 – Carbon Emissions

Area weighted average results for each building are summarised below. As each building must be assessed individually for Part L compliance, area weighted results for Target Emission Ratio (TER), Dwelling Emissions Ratio (DER) and Fabric Energy Efficiency are required per block / building. Individual building results are provided within this report (Section 1.4.1)

The Criterion 1 emission pass rate results for each building are show in Table 1.

Table 1: Building area-weighted average Part L1A Criterion 1 Results.

Ref	Reduction in CO ₂ emissions over Part L target:	Overall pass for CO ₂ emissions?	Reduction in Fabric Energy Efficiency (FEES)	Overall pass for FEES?
Building 1	22%	Pass	6.7%	Pass
Building 2	24%	Pass	7.0%	Pass
Both Buildings combined	23%	Pass	N/A*	N/A*

*Fabric Energy Efficiency Standards must be met for each thermal envelope (i.e. each building) separately

Part L1A 2013 Criterion 3 – Passive Control of Heat Gains

Criterion 3 requires each dwelling to demonstrate that it is not expected to have a high risk of summer overheating, using the SAP 2012 Appendix P methodology. This assesses the predicted balance between thermal gains and losses within each dwelling based on its geographical location, and calculates whether it has a ‘low’, ‘medium’ or ‘high’ risk of summer overheating based on heat gains within the dwellings. It should be noted that the assessment is part of the Part L compliance methodology, but is not always a robust method for assessing the likely risk of overheating in practise.

All apartments in the sample modelled meet the Criterion 3 overheating requirements by passive measures and on the basis of openable windows for summertime ventilation. This is via the selection of ‘windows fully open, all of the time’ within the SAP methodology, which is equivalent to an Air Change Rate of 4 ACH. The windows fully open, half the time has a reduced air change rate of 2.

The openable window type required to achieve compliance with the heat gain criteria are detailed for the apartments tested in Table 2.

Table 2 Ventilation requirements for assessed apartments to achieve compliance with Criterion 3.

Building 1	Orientation	Type	Natural Ventilation
Ref			Window opening type
B1 Ground Floor 03	North Facing	2 bed	Full open, half the time
B1 Ground Floor 08	South Facing	1 bed	Full open, half the time
B1 Ground Floor 10	South Facing	2 bed	Full open, all the time
B1 First Floor 14	North facing	2 bed	Full open, all the time
B1 First Floor 19	South Facing	1 bed	Full open, all the time
B1 First Floor 21	South Facing	2 bed	Full open, all the time
B1 Roof Floor 30	South Facing	1 bed	Full open, half the time
Building 2	Orientation	Type	Natural Ventilation
Ref			Window opening type
B2 Ground Floor 39	South Facing	1 bed	Full open all the time
B2 Ground Floor 42	South Facing	1 bed	Full open all the time
B2 Ground Floor 47	North Facing	2 bed	Full open half the time
B2 First Floor 52	South Facing	1 bed	Full open, all the time
B2 First Floor 55	South Facing	1 bed	Full open, all the time
B2 First Floor 64	North Facing	2 bed	Full open, all the time
B2 Roof Floor 72	South Facing	1 bed	Full open, half the time

Arun Local Plan (2018) – Renewable Energy Generation On-Site

The sampled apartments have been assessed to calculate the percentage of energy that can be generated from on-site renewable technology to meet the Arun Local Plan Policy ECC SP2. The most appropriate technology is considered to be Photovoltaics (PV) and based upon the SAP calculations, it is estimated that the following PV provision will meet the 10% on-site energy generation requirement for to meet compliance with Arun Local Plan (2018).

Table 3 PV specification requirements

Building	Output (kWh/yr)	Orientation	Approximate Area (m²)
Building 1	9639	South/ South West	50 – 60
Building 2	13892	South/ South West	80 – 90

1. Dwellings

1.1 Building Regulations: Part L1A 2013

Under the current Part L1A (2013) requirements there are five key criteria that must be satisfied:

- Criterion 1 - Achieving the TER and TFEE rate
- Criterion 2 - Limits of Design Flexibility
- Criterion 3 - Limiting the Effects of Heat Gains in Summer
- Criterion 4 - Building Performance Consistent with DER and DFEE Rate
- Criterion 5 - Provisions for Energy-Efficient Operation of the Building

} Design Stage

} Post Construction Stage

This report focuses on Criteria 1 and 3.

1.1.1 Criterion 1 - Achieving the TER and TFEE rate

Criterion 1 requires that the annual regulated CO₂ emissions rate (Dwelling Emission Rate (DER)) of the dwelling and the Dwelling Fabric Energy Efficiency (DFEE) to be lower than that of the notional dwelling (Target Emission Rate (TER) and Target Fabric Energy Efficiency (TFEE)), which is of set specifications and of the same size and shape as the designed dwelling.

1.1.2 Criterion 3 - Limiting the Effects of Heat Gains in the Summer

Criterion 3 requires each dwelling to demonstrate that it is not expected to have a high risk of summer overheating, using the SAP 2012 Appendix P methodology. This assesses the predicted balance between thermal gains and losses within each dwelling based on its geographical location, and calculates whether it has a 'low', 'medium' or 'high' risk of summer overheating based on heat gains within the dwellings. It should be noted that the assessment is part of the Part L compliance methodology, but is not always a robust method for assessing the likely risk of overheating in practise.

1.1.3 Software

The software used to model and calculate the proposed apartment Criterion 1 and 3 performances is NES NHER Plan Assessor 6.3.4 (SAP 2012).

1.2 Model Inputs and Assumptions

The following details have been used in the modelling to determine the energy and carbon performance of the proposed building design and compare it to that of the Part L1A 2013 'Notional' building.

1.2.1 Building Form

The analysis undertaken within this report utilised drawings and 3D models provided by POD Architects (October 2018) to determine the geometry inputs required by the SAP 2012 assessment.

1.2.2 Selected Sample

14 individual SAP calculation types have been undertaken for the sitewide development consisting of ground-floor, mid-floor and top-floor apartments from both buildings. These calculations have been extrapolated to provide SAP calculation types (accounting for varying orientation, mid floor, top floor and ground floor apartments)) to provide a weighted average Dwelling Emission Rate (DER) for each domestic building.

It should be noted that the sampling does not cover every individual unit type.

Figure 1 shows the location of Building 1 and Building 2.

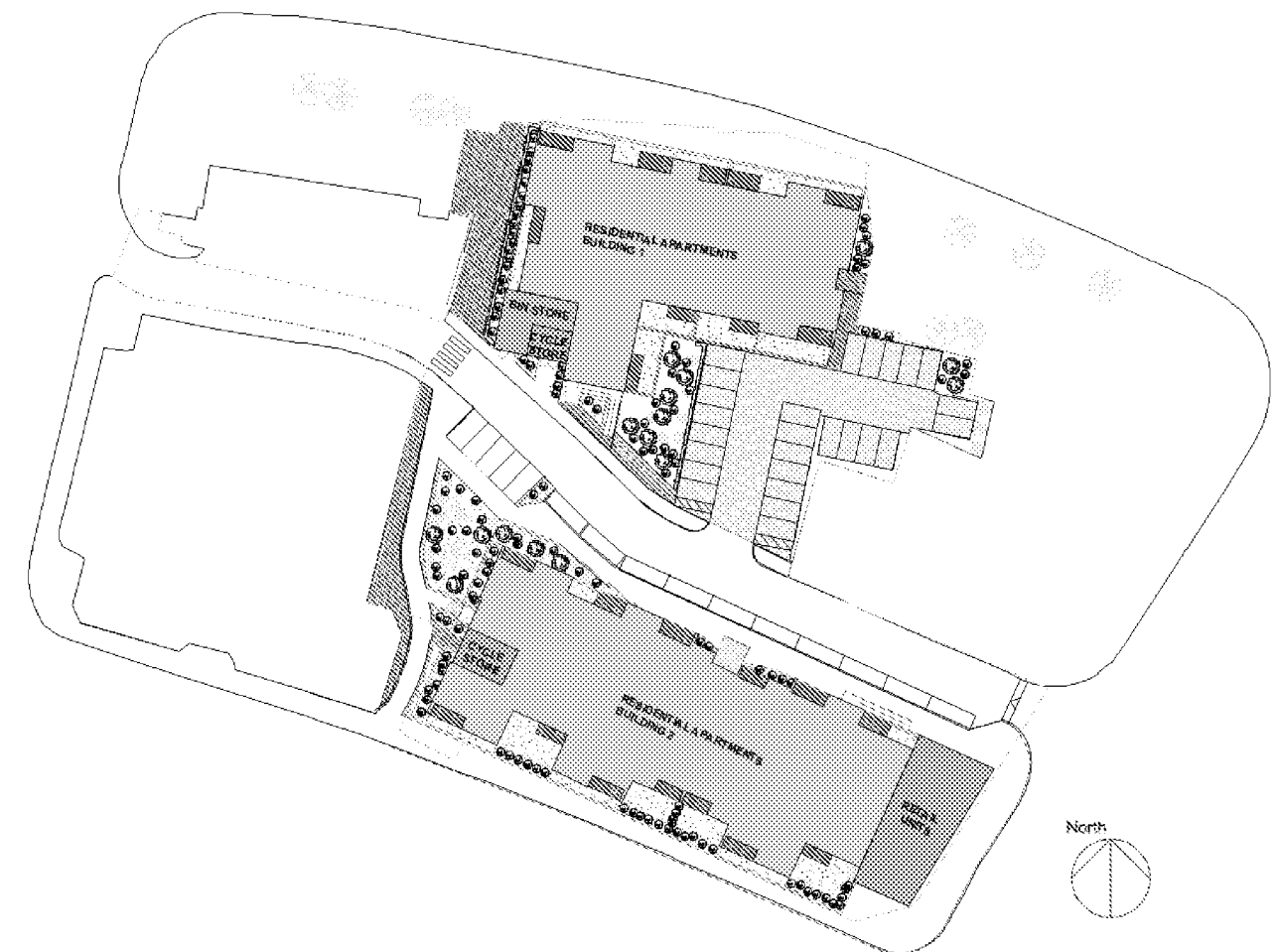


Figure 1 Site-wide Building Plan

1.2.3 Fabric Properties

Table 4: Opaque Building Fabric Thermal Performance

Building Element	Design U-value (W/m²K)	Notes
External wall	0.18	Lightweight thermal mass
Internal wall to communal corridors and cores	0	All sheltered walls to be fully filled with insulation, and to have sealed edges
Party wall	0	All party walls to be fully filled with insulation, and to have sealed edges
Ground floor	0.15	-
Exposed floor	0.20	-
Roof	0.15	Low thermal mass ceilings
Solid (opaque) doors	0	Doors placed in sheltered walls where no heat transfer is expected between corridor and apartment

Table 5: Glazed Building Fabric Thermal Performance

Building Element	Window U-value	Glazing g-value	Frame Factor
Windows	1.2	0.4	20%
Glazed doors	1.4	0.4	20%

Thermal Bridging

As the details are developed at the next stage of design, the thermal performance should be calculated and optimised to ensure minimal heat loss. Key details and Ψ value inputs used at this stage are as follows:

To facilitate overall block/building weighted average for both Building 1 and 2, approved Ψ values are required. These final design details will need to be reviewed against these values at the next stage of design.

Table 6: Key thermal bridging Ψ value inputs

Code	Thermal bridge	Ψ value (W/m. K)	Note
E2	Other lintels (incl. other steel lintels)	0.3	'approved value'
E3	Sills	0.04	'approved value'
E4	Jambs	0.05	'approved value'
E5	Ground Floor (normal)	0.16	'approved value'
E7	Party floors between dwellings	0.07	'approved Value'
E9	Balcony connection to slab	0.02	'approved value'
E11	Eaves (insulation at rafter level)	0.04	'approved value'
E13	Gable (insulation at rafter level)	0.04	'approved value'
E14	Flat Roof	0.04	'approved value'
E16	Corner (normal)	0.09	'approved value'
E17	Corner (inverted)	-0.09	'approved value'
E18	Party wall between dwellings	0.06	'approved value'
E25	Staggered party wall between dwellings	0.12	'default' value
P1	Ground floor (party)	0.16	'default' value
P3	Intermediate floor between dwellings	0	'default' value
P4	Roof (Insulation ceiling level)	0.12	'approved value'
P5	Roof (insulation at rafter level)	0.08	'default' value
P7	Exposed Floor	0.16	'default' value
R4	Ridge (vaulted ceiling)	0.08	'default' value
R5	Ridge (inverted)	0.04	'default' value
R7	Flat ceiling (inverted)	0.04	'default' value

Infiltration / Air Leakage Rate

The new building will require to be air pressure tested upon completion. The maximum allowable air permeability for Part L compliance is 10 m³/(hm²) measured at 50Pa.

The assessments have been carried out with a lower air permeability rating than the Part L minimum standard, to benefit from lower space heating demand and reduced carbon emissions. The design air permeability target is as follows:

- Target air permeability rating = 3 m³/h.m² @ 50Pa

It should be noted that upon completion, if air test results are to be re-used in SAP calculations for untested apartments of the same dwelling type, a 'confidence' factor needs to be applied, which adds 2m³/(h.m²) to the test result. This means that in reality the test results would need to be 2m³/h.m² at 50Pa better than the design air permeability used in the SAP calculation. In other words, as the target air permeability for the dwelling type in SAP is 3m³/h.m² @ 50Pa, the tested apartment would need to achieve 1m³/h.m² @ 50Pa for the result to be re-used in untested apartments.

Alternatively, every single apartment can be tested individually and the actual tested values applied.

For large residential developments it is sometimes possible to negotiate the approach to air tightness testing with Building Control, for example to offer to test one apartment of each unique type (rather than every single unit), and employ best practice air tightness procedures during construction works (e.g. airtightness champion on site, and specific training of site workforce with regards to achieving air tight construction), and thus potentially forego the 'confidence factor' addition without having to test every single apartment.

1.2.4 Mechanical and Electrical Services

Table 7: Mechanical and electrical services

System	Description	Note
Space heating	– Heat source: Gas Boiler – Efficiency: 95% – Heat emitter: Radiator – Controls: Programmer and room thermostats	
Domestic Hot Water	– Heat source: Same as heating system – Type: Heat Interface Unit (HIU) – Water use <125 litres/person/day – Heat loss source: Manufacturer data – Declared loss factor: – 1 litre: 0.2 kWh/day	No waste water heat recovery included.
Background ventilation	– Target performance: – SFP = 0.6 – HR = 91% – Ductwork to be rigid and insulated – MVHR to be installed by an approved installer	SFPs to be aligned to the following extracts in each apartment: – 1No extract in the Kitchen – 1No extract in each bathroom – 1No extract in the MVHR cupboard
Cooling	None	The apartments will not include active cooling systems
Lighting	All fixed lighting installed in apartments to be low energy lamps	

1.3 Treatment of Walls in SAP

Sheltered Wall U-Value

Assumptions within the current version of, and proposed amendments to SAP (SAP v9.92 2012 & 2016) relating to heat loss from a dwelling to landlord areas, within an apartment building, are limited in their appraisal. The omission of likely internal gains within landlord areas has led to a notable underestimation of the internal temperatures in these areas and therefore an overestimation of heat loss from adjacent dwellings.

Heat flow across a sheltered wall occurs in two ways; directly through the element and via the junctions which connect the wall to the surrounding construction elements.

If the stairwell or access corridor is unheated, then it might initially be assumed that the temperature within the stair well or access corridor would be lower than if it were heated. It could also be assumed however, that the air temperature on the within the corridor or stairwell could still be expected to be higher than if the stairwell or corridor wasn't present at all (due to being contained within a common thermal envelope). The stairwell or access corridor provides a 'buffer' to the external environment and as a result, less heat loss would occur across the separating wall as the temperature difference across the wall is less than across an equivalent external wall.

Therefore, in a development where landlord areas are contained within the thermal envelope and without the use of fixed heat emitters, it would be reasonable to assume that on aggregate no heat loss will occur across the separating 'sheltered' wall between a dwelling and adjacent landlord areas.

As a result, the sheltered walls have been assigned a U-value of 0 W/m².K, and the associated sheltered wall thermal bridging have a Ψ (Psi) value of 0 W/m.K. This approach would be required to be confirmed by building control prior to design stage submission of SAP calculations.

Party Wall Between Dwellings

The guidance allows for party walls to have a U-value of zero (i.e. no net heat transfer) for either a solid wall construction or where the construction has full-fill insulation and effective edge sealing. For other construction types, where a cavity is present or edge sealing is not provided, it is understood that an allowance is made in the U-value to account for convective air movements.

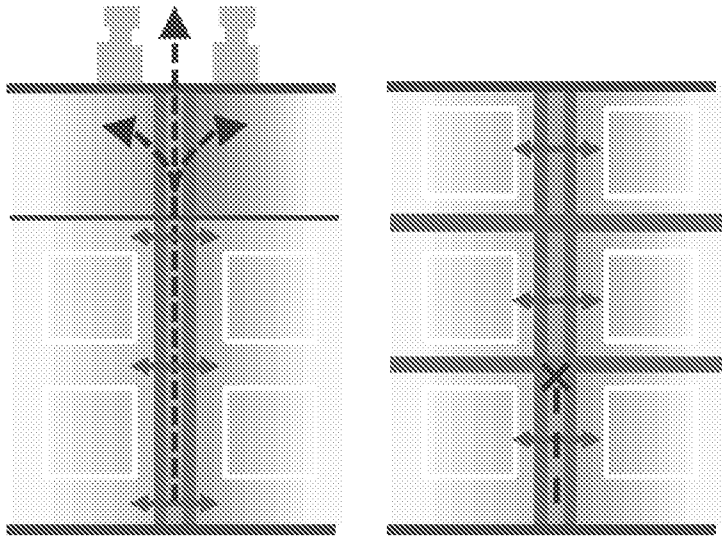


Figure 2: (Left) Heat Loss Routes for Terraced House, (Right) Heat Loss Routes for Apartment Block (red = conductive, purple dashed = convective)

However, in apartment blocks such cavity walls do not exist through the building, as they are bisected by a floor slabs at each level. As a result, the only possible heat loss route is conductive (ignoring radiant effects), this is negated where both sides of a party wall are heated to the same temperature profile.

Therefore all party walls between apartments have a U-Value of 0 W/m².K.

1.4 Part L1A Results

1.4.1 Criterion 1

Results for the block-by-block area-weighted results are shown below in Table 8.

Table 8: Flat-by-flat Part L1A results

Ref	TER kgCO ₂ / kWh	DER kgCO ₂ / kWh	Reduction in CO ₂ emissions	Overall pass for CO ₂ emissions?	TFEE kWh/m ² yr	DFEE kWh/m ² yr	Reduction in FEES	Overall pass for FEES?
Build 1, Flat 03	18.0	14.6	19%	Pass	52.4	46.6	10.9%	Pass
Build 1, Flat 08	17.5	14.2	19%	Pass	41.6	41.7	-0.1%	Fail
Build 1, Flat 10	14.4	11.4	21%	Pass	32.7	32.5	0.6%	Pass
Build 1, Flat 14	15.7	12.0	24%	Pass	40.9	35.9	12.1%	Pass
Build 1, Flat 19	15.5	11.7	25%	Pass	31.3	30.3	1.3%	Pass
Build 1, Flat 21	12.3	9.0	27%	Pass	22.5	21.5	4.5%	Pass
Build 1, Flat 30	21.3	16.8	21%	Pass	61.4	55.7	9.4%	Pass
Building 1 Area Weighted Average	16.1	12.6	22%	Pass	39.8	37.1	6.7%	Pass
Build 2, Flat 39	17.9	14.3	20%	Pass	43.7	42.3	3.2%	Pass
Build 2, Flat 42	16.1	12.5	22%	Pass	33.8	34.4	-1.6%	Fail
Build 2, Flat 47	16.4	12.9	22%	Pass	43.0	38.2	11.0%	Pass
Build 2, Flat 52	15.6	11.7	25%	Pass	32.2	31.0	3.5%	Pass
Build 2, Flat 55	14.1	9.9	30%	Pass	23.2	22.6	2.7%	Pass
Build 2, Flat 64	14.2	10.1	29%	Pass	31.4	26.7	15.2%	Pass
Build 2, Flat 72	18.1	13.5	25%	Pass	44.0	40.2	8.6%	Pass
Building 2 Area Weighted Average	16.0	12.1	25%	Pass	36.0	33.5	7.0%	Pass
Both Buildings combined	-	-	23%	Pass	-	-	N/A*	N/A*

*Fabric Energy Efficiency Standards must be met for each thermal envelope (i.e. each building) separately

On an area-weighted average basis, each building / block is demonstrated to meet Part L Criterion 1 requirement based on Stage 2 proposals.

Sitewide, it is expected that an 8% margin over Part L Criterion 1 (Carbon Emissions) can be achieved based on the inputs and approaches detailed in this report.

1.4.2 Criterion 3

All apartments tested are expected to achieve values below the heat gain limit set by the Approved Document and calculated by the Notional Building on the basis that natural ventilation will be provided in line with the specification summary in Table 7. The apartments will have the provision to open the windows during summer months to improve ventilation.

The ventilation air change rates required to achieve compliance with the heat gain criteria are detailed for the apartments tested in Table 2.

1.5 Renewable Strategy

The sampled apartments have been assessed to calculate the percentage of energy that can be generated from on-site renewable technology to meet the Arun Local Plan Policy ECC SP2, detailed below.

'All major developments must produce 10% of the total predicted energy requirements from renewable or low carbon energy generation on site, unless it can be demonstrated that this is unviable. Energy efficiency measures will be taken into consideration when the total predicted energy requirements are calculated. The Council will consider 'allowable solutions' where it is clearly demonstrated that the provision of on-site renewable or low carbon energy generation is unviable or not feasible'.

The most appropriate technology is considered to be PV and based upon the SAP calculations, it is estimated that the following PV provision will meet the 10% on-site energy generation requirement for to meet compliance with Arun Local Plan (2018).

Table 9 PV specification requirements

Building	Output (kWh/yr)	Orientation	Approximate Area (m²)
Building 1	9639	South/ South West	50 – 60
Building 2	13892	South/ South West	80 – 90

The total roof area on Residential Building 1 suitable for PV panels could amount to over 60m² approx. which, allowing for spacing, obstructions and access requirements could allow for 75m² of panels to be installed. Potential roof space has been identified in the red hatched area of Figure 3.

The total roof area on Residential Building 2 suitable for PV panels could amount to over 90m² which, allowing for spacing, obstructions and access requirements could allow for 120m² of panels to be installed. Potential roof space has been identified in the red hatched area of Figure 4.

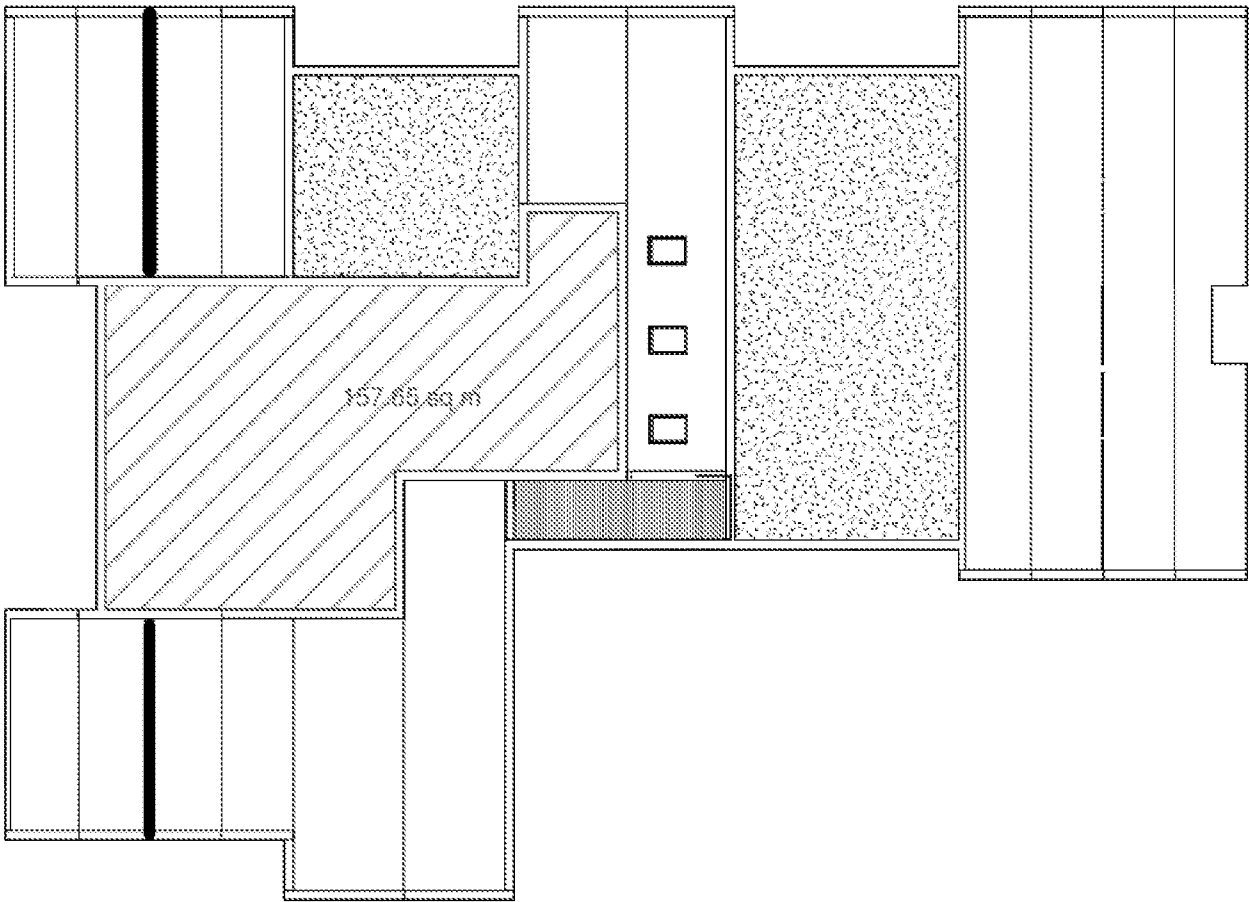


Figure 3 Building 1 – Potential PV area

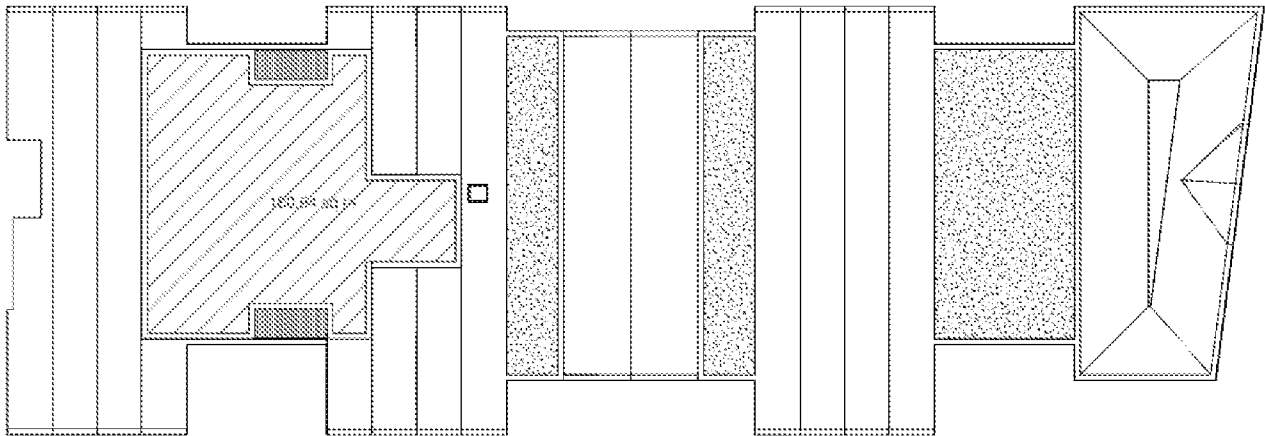


Figure 4 Building 2 – Potential PV area



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