

Waterfront Square. Reading. Packaged Living Ltd.

SUSTAINABILITY

ENERGY STATEMENT

(TO FULFIL THE REQUIREMENTS OF READING SUSTAINABLE DESIGN AND CONSTRUCTION SUPPLEMENTARY PLANNING DOCUMENT ADOPTED
DECEMBER 2019)

REVISION P02 – 13.12.2024



STAGE 2

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
P01	19.07.2024	Stage 2 Issue	S. Hunt	R. Palmer	J. Nuttall
P02	13.12.2024	Stage 2 Update	S. Hunt	R. Palmer	J. Nuttall

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Executive summary.

This Energy Statement has been prepared on the behalf of Packaged Living Ltd for the proposed residential-led development at Waterfront Square, Reading.

This report demonstrates a proposed route to compliance with Approved Document Part L Conservation of Fuel and Power. The approach follows the requirements of Reading Sustainable Design and Construction Supplementary Planning Document (adopted December 2019) and is based upon the performance parameters stated within this report.

The Proposed Development.

The Proposed Scheme at Waterfront Square will involve the:

“Demolition of the former Covea Insurance building and construction of residential-led development, access from Waterfront Square and associated car parking, infrastructure and landscaping”.

The Proposed Development seeks to deliver 254 studio, one, two and three bedroom residential dwellings (Use Class C3), together with 365m² (GEA) of flexible Class E floorspace at ground floor level. A series of internal and external amenity spaces feature within the layout. New pedestrian accesses are proposed from Vastern Road and Waterfront Square and a vehicular access to a ground floor undercroft car parking area is proposed from Waterfront Square. Substantial public realm surrounds the development, providing significant visual improvement to Vastern Road, Waterfront Square and the River Thames frontage.

Assessment Drivers.

The Proposed Development is seeking to achieve compliance with national policy as stated within Building Regulations Part L (2021).

Local policy as set out within the Reading Borough Local Plan 2019.

Part L1&L2 Assessment Results.

Residential Results Summary

- Be Lean: Overall reduction in Building Emissions Rates of 10.9% over current Part L 2021 building regulations target.
- Be Green: Overall reduction in in Building Emission Rate of 71.5% over current Part L 2021 building regulations target.

Non-Residential Results Summary

- Be Lean: Overall reduction in Building Emissions Rates of 1.5% over current Part L 2021 building regulations target.
- Be Green: Overall reduction in in Building Emission Rate of 35.6% over current Part L 2021 building regulations target.

Site-wide Results Summary

- Be Lean: Overall reduction in Building Emissions Rates of **10.8%** over current Part L 2021 building regulations target.
- Be Green: Overall reduction in in Building Emission Rate of **70.9%** over current Part L 2021 building regulations target.

It is important to ensure that the performance parameters stated within this report are achieved as any deviation could reduce the regulated carbon emission performance and impact the betterment over Part L (2021).

Local Policies CC2, CC3, CC4 and H5 have been addressed throughout the report and compliance shown where applicable.

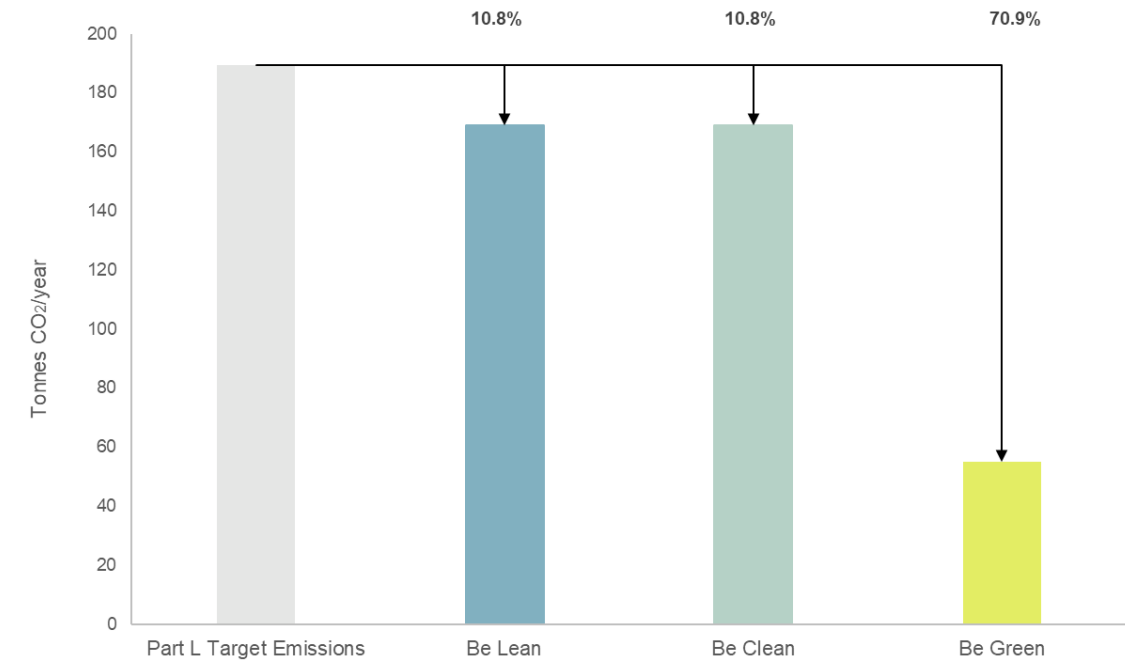


Figure 0.1: Sitewide carbon reduction summary.

To achieve net zero regulated emissions in operation, an offset fund cost of **£99,161.96** has been calculated for the residual emissions aligning with Reading's Local Plan paragraph 4.4.46.

1. Introduction.

This report has been produced on behalf of Packaged Living Ltd, in support of the Proposed Development of Waterfront Square, Reading.

1.1 The Proposed Development.

The Proposed Scheme at Waterfront Square will involve the:

“Demolition of the former Covea Insurance building and construction of residential-led development, access from Waterfront Square and associated car parking, infrastructure and landscaping”.

The Proposed Development seeks to deliver 254 studio, one, two and three bedroom residential dwellings (Use Class C3), together with 365m2 (GEA) of flexible Class E floorspace at ground floor level. A series of internal and external amenity spaces feature within the layout. New pedestrian accesses are proposed from Vastern Road and Waterfront Square and a vehicular access to a ground floor undercroft car parking area is proposed from Waterfront Square. Substantial public realm surrounds the development, providing significant visual improvement to Vastern Road, Waterfront Square and the River Thames frontage.

1.2 Approach to Assessment.

The Energy Strategy follows the energy hierarchy: ‘Be Lean, Be Clean, Be Green’.

The residential aspects have been assessed against Approved Documents Part L1 2021 conservation of fuel and power. The commercial aspects have been assessed against Approved Documents Part L2 2021. Both assessments have been completed using approved software packages and the parameters stated in this report.

Although Policy H5 within the Reading Borough Local Plan and Paragraph 3.4 of the Reading SPD references a reduction requirement against Part L 2013, Part L1 2021 has been deemed a more onerous assessment methodology and has therefore been used to assess Waterfront Square. Further, Reading SPD Paragraph 3.4 requires that BREEAM Excellent is achieved, however, this has been deemed not applicable as BREEAM does not apply to new residential development.

1.3 Site Context.

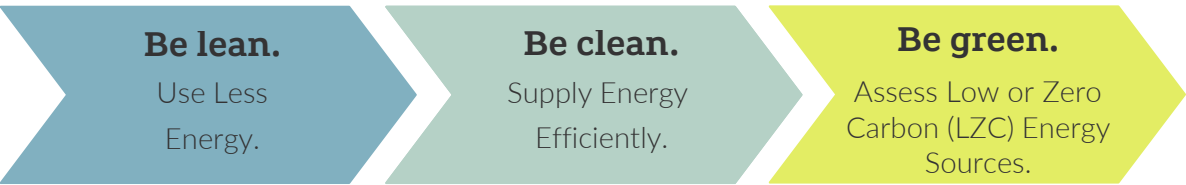


Figure 1.3: First Floor Plan of the Proposed Development provided by Assael Architects.

Figure 1.3 outlines the first-floor layout the proposed development. The Proposed Development has staggered storey heights and the number of apartments per floor reduces through the block.

1.3.1 Passive Design Approach.

The assessment has used the energy hierarchy as part of the design strategy that prioritises passive design in a Be Lean, Be Clean and Be Green approach:



Passive Design measures are those which reduce the demand for energy within buildings, without consuming energy in the process.

These are the most robust and effective measures for reducing CO2 emissions as the performance of the solutions, such as façade insulation, is unlikely to deteriorate significantly with time, or be subject to change by future property owners. In this sense, it is possible to have confidence that the benefits these measures will continue at a similar level for the duration of their installation.

	Fabric performance A ‘fabric first’ approach has been taken in order to reduce the energy demand and CO2 emissions from the Proposed Development. The overriding objective for the façade design of the building will be to achieve the optimum balance between providing natural daylighting benefits to reduce the use of artificial lighting, the provision of passive solar heating to limit the need for space heating in winter and limiting summertime solar gains to reduce space cooling demands.
	Space heating Residential Efficient electric panel heating will be utilised to provide space heating within the dwellings. Non-Residential Heating to the commercial spaces will be supplied through a VRF split system. Shell and core assumptions have been used for the system inputs.
	Space cooling Residential Active Cooling has not been included as part of the development. Trim cooling will be introduced where required for the purposes of overheating mitigation. Non-Residential Active cooling will be supplied via a VRF split system. Shell and core assumptions have been used for the system inputs.
	Ventilation Residential Natural Ventilation will be used where possible. However, acoustic constraints on site restrict the ability to utilise openable windows in a number of locations, therefore reducing reliance on natural ventilation. MVHR units will also be used to ventilate the apartments. Non-Residential The balanced mechanical ventilation to is supplied by an air handling unit.

	Domestic hot water (DHW) system The Proposed Development will feature water efficient fixtures and fittings including WCs with low flush volume and flow reducers in the taps of wash hand basins and on showers to limit overall water consumption. Residential Areas Spaces will be connected to an ASHP to provide hot water in each dwelling. Non-Residential Domestic Hot Water will be supplied to the commercial spaces via a direct electric system.
	Natural daylight and lighting strategy Artificial lighting tends to provide a significant contribution to regulated CO₂ emissions. As such, it is anticipated that the proposed development will be supplied with high efficiency lighting installations representing best practise. Natural daylight has also been maximised across the site with reduced external shading unless where appropriate to mitigate against overheating. As well as the reduced energy requirement that will be achieved by implementing these strategies, the contribution to internal heat gains and associated cooling requirements will be reduced. This will further reduce the total energy requirements and CO₂ emissions of the building.

1.3.2 District/ Decentralised Heat Network.

Currently, there are no viable District Heat Networks in close proximity to Site; therefore, the Proposed Development is unable to connect to a decentralised system.

1.4 Grid decarbonisation.

With the on-going decarbonisation of the grid, resultant from the connection of low-carbon and renewable technologies to the national grid (as well as the winddown and decommissioning of coal fired power generation), the carbon factor of electricity generated has significantly decreased since the previous 2013 Part L methodology was released.

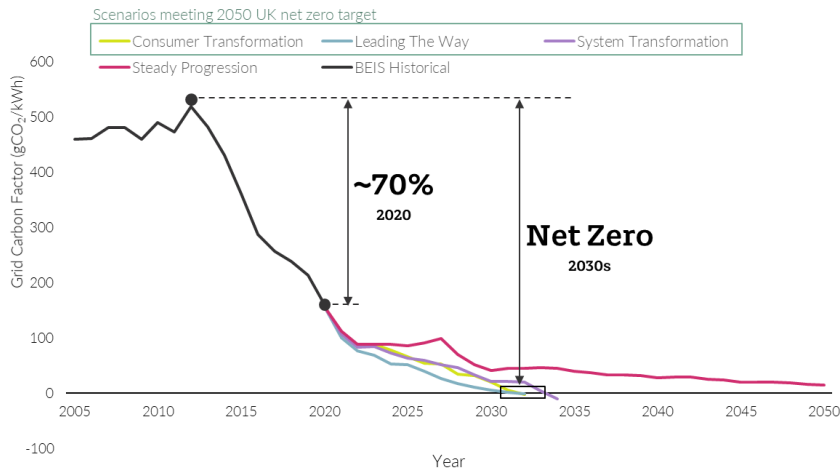


Figure 1.4: Grid decarbonisation graph.

Grid decarbonisation has resulted in the emission rates demonstrated now being far more representative of the UK National Grid carbon factors.

At the end of 2020, the Department for Business, Energy, and Industrial Strategy (BEIS) reported the carbon factor of electricity as having fallen to 0.159 kgCO₂/kWh; a 70% reduction compared to that in Part L, 2021.

1.5 Carbon factors.

The updated Part L 2021 document uses the SAP 10.2 carbon factors. This assesses the emission rate using a different fuel factor for each month of the year depending on the average fuel mix seen to be accessible within that month.

Colder months are seen to have a higher carbon factor due to numerous factors, most notably the reduction in available Photovoltaic power, and the introduction of more fossil fuel sources to help manage the increased energy demand from heating.

Figure 1: Carbon factors comparison.

Month	Carbon Factor kgCO ₂ /kWh	Month	Carbon Factor kgCO ₂ /kWh
January	0.163	July	0.111
February	0.160	August	0.112
March	0.153	September	0.122
April	0.143	October	0.136
May	0.132	November	0.151
June	0.120	December	0.163

1.6 Part L 2021 Regulations.

This report will follow the Part L1 2021 requirements which apply to dwellings and Part L1 2021 requirements which apply to non-dwellings.

Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO₂ emissions from new buildings. The assessment of the proposed development against policy targets has been carried out using Building Regulations Part L 2021 methodology (which supersedes the 2013 methodology).

2. Assessment Drivers.

2.1 Planning and Regulatory.

The following section outlines the national and local policies and drivers.

2.1.1 Building Regulations Part L (2021).

Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO₂ emissions from new buildings relating to the conservation of fuel and power in buildings.

All new buildings must now meet the requirements of Part L 2021 unless captured by the traditional arrangements associated with the ability to use older versions of the regulations. All new buildings must meet the requirements of Part L1 (Domestic – Dwellings) or Part L2 (Non-Domestic).

The residential areas of the Proposed Development will be assessed in accordance with criteria set out in Part L1 2021. The commercial areas will be assessed in accordance with Part L2 2021 requirements.

Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO₂ emissions from new buildings. The assessment of the proposed development against policy targets has been carried out using Building Regulations Part L 2021 methodology (which supersedes the 2013 methodology).

Schedule 1: Conservation of Fuel and Power.

Schedule 1 of the Building Regulations Part L (applicable to be domestic and non-domestic development) states that reasonable provisions shall be made for the conservation of fuel and power in building by:

Limiting heat gains and losses:

- through thermal elements and other parts of the building fabric; and
- from pipes, ducts and vessels used for space heating, space cooling and hot water services.

Providing fixed building services which:

- are energy efficient;
- have effective heat controls; and
- are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power than is reasonable in the circumstances.

Demonstrating compliance – Part L1.

To demonstrate compliance with Part L, Volume 1, there are a number of regulations which must be met. Regulation 25 through to 26C detail the required energy performance of the new building.

Table 2.1.1: Part L1 (2021) Criteria.

Regulation 25	Minimum energy performance requirements for new buildings These requirements are in the form of a target primary energy rate and a target emission rate.
Regulation 25B	Nearly zero-energy requirements for new buildings Where a building is erected, it must be a nearly zero-energy building
Regulation 26	CO₂ Emission rates for new buildings Where a building is erected, it shall not exceed the target CO ₂ emission rate (TER) for the building
Regulation 26A	Fabric Energy Efficiency rates for new buildings Where a dwelling is erected, it shall not exceed the target fabric energy efficiency rate (TFEE) for the dwelling
Regulation 26C	Target Primary Energy rates for new buildings Where a building is erected, it must exceed the target primary energy rate (TPER) for the building

Demonstrating compliance – Part L2.

To demonstrate compliance with Part L, Volume 2, there are a number of regulations which must be met. Regulation 25 through to 26C detail the required energy performance of the new building.

Table 2.1.2: Part L2 (2021) Criteria.

Regulation 25	Minimum energy performance requirements for new buildings These requirements are in the form of a target primary energy rate and a target emission rate.
Regulation 25B	Nearly zero-energy requirements for new buildings Where a building is erected, it must be a nearly zero-energy building
Regulation 26	CO₂ Emission rates for new buildings Where a building is erected, it shall not exceed the target CO ₂ emission rate (TER) for the building
Regulation 26C	Target Primary Energy rates for new buildings Where a building is erected, it must exceed the target primary energy rate (TPER) for the building

2.1.3 National Planning Policy Framework.

The National Planning Policy Framework (NPPF) was first published in on 27 March 2012 and most recently updated in December 2023. The updated NPPF has superseded all Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) documents, with the exception of PPS10 (Waste). The NPPF sets out the Government's strategy on the delivery of sustainable development.

The NPPF states that there is a presumption in favour of sustainable development.

The following is extracted from paragraph 8 of the NPPF:

“Plans and decisions should apply a presumption in favour of sustainable development.

an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering well-designed beautiful and safe places, with accessible services and open spaces that reflect current and future needs and support communities’ health, social and cultural well-being; and

an environmental objective – to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

Furthermore, in relation to energy policy paragraph, 157 sets out that:

“The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to:

shape places in ways that contribute to radical reductions in greenhouse gas emissions,

minimise vulnerability and improve resilience;

encourage the reuse of existing resources, including the conversion of existing buildings;

and support renewable and low carbon energy and associated infrastructure.

In respect of energy policy contained within the NPPF, paragraph 160 sets out that:

“To help increase the use and supply of renewable and low carbon energy and heat, plans should:

(a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts);

(b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

(c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

2.1.4 Reading Borough Local Plan 2019.

The Reading Borough Local Plan 2019¹ sets out the planning policies for developments in Reading up to 2036. Reading Council declared a Climate Emergency in 2019. The Local Plan sets out how the Borough intends to address this issue, its overall sustainability approach, and the commitment to work towards achieving a carbon neutral Reading by 2030.

The key policies in relation to energy performance are summarised in the table below.

Table 12.1.4: Reading Borough Local Plan 2019 Energy Policies.

Policy	Policy description
CC2	Sustainable Design and construction – All major non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Excellent' standards, where possible; – All minor non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Very Good' standard as a minimum;
CC3	Adaptation to Climate Change All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development: – Wherever possible, new buildings shall be orientated to maximise the opportunities for both natural heating and ventilation and reducing exposure to wind and other elements; – Proposals involving both new and existing buildings shall demonstrate how they have been designed to maximise resistance and resilience to climate change for example by including measures such as solar shading, thermal mass, heating and ventilation of the building.
CC4	Decentralised Energy – Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sqm shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision. – Where there is existing decentralised energy provision present within the vicinity of an application site, further developments of 10 dwellings or more or non-residential development of 1,000 sqm or more will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.
H5	Standards for New Housing New build housing should be built to the following standards, unless it can be clearly demonstrated that this would render a development unviable: – All major new-build residential development should be designed to achieve zero carbon homes. – All other new build housing will achieve at a minimum a 19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations.

Policy CC2 is not applicable to the Proposed Development as it is a new build residential scheme.

Policy CC3 is addressed throughout the report. Connection to a District Heat Network (policy CC4) is considered in section 4.6 below and the development's route to 'zero carbon homes' (policy H5) is discussed in section 4.5.

¹ https://images.reading.gov.uk/2019/12/Local_Plan_Adopted_November_2019.pdf

3. Assessment Methodology.

The apartments at Waterfront Square have been assessed against Approved Document Part L1 2021 using Design SAP. The following is a summary of the data used and inputs / assumption made.

3.1 Architectural Drawings.

The geometry used to assess the building was determined from the following drawings provided by Assael Architects.

Table 2.1: Architectural drawing information.

Source	Drawing Type	Description	Data Type	Date Received
Assael Architects	Revit Model	A4012-ASA-ZZ-ZZ-M3-A-0001_P04	rvt.	27/06/2024
Assael Architects	GA Plans	A4012-ASA-XX-GF-DR-A-0200-P014-00 Ground Floor Plan A4012-ASA-XX-01-DR-A-0201-P011-01 First Floor Plan A4012-ASA-XX-02-DR-A-0202-P010-02 Second to Fourth Floor Plan A4012-ASA-XX-05-DR-A-0205-P011-05 Fifth to Sixth Floor Plan A4012-ASA-XX-07-DR-A-0207-P08-07 Seventh Floor Plan A4012-ASA-XX-08-DR-A-0208-P011-08 Eighth Floor Plan A4012-ASA-XX-09-DR-A-0209-P011-09 Ninth to Tenth Floor Plan	dwg.	27/06/2024
Assael Architects	Elevations	A4012-ASA-ZZ-ZZ-DR-A-0400-P03-North Elevation & West Elevation A4012-ASA-ZZ-ZZ-DR-A-0401-P03-South Elevation & East Elevation A4012-ASA-ZZ-ZZ-DR-A-0402-P03-Courtyard West Elevation A4012-ASA-ZZ-ZZ-DR-A-0403-P03-Courtyard East Elevation	dwg.	27/06/2024

As part of this assessment, 10 sample apartments have been assessed which represent 254 apartments across the development. A model was also built to represent the non-domestic elements of the scheme.

3.2 Weather Data.

A building's thermal performance is its response to external environmental conditions. The more dependant a building is on passive features to achieve acceptable internal comfort, the more important the use of external weather information becomes.

The UK Meteorological Office (MO) collects weather data at stations across the UK. Climate variables measured at hourly intervals include air temperatures, wind speed and direction and air pressure amongst various other characteristics.

CIBSE licenses the historic weather data from the MO for 14 locations in the United Kingdom: Belfast, Birmingham, Cardiff, Edinburgh, Glasgow, Leeds, London (3 sites), Manchester, Newcastle, Norwich, Nottingham, Plymouth, Southampton and Swindon.

The weather variables are synthesised into 2 types of CIBSE weather file:

- **Test Reference Year (TRY)**
The TRY is composed of 12 separate months of data each chosen to be the most average month from the collected data.
The TRY is used for operational energy analysis and for compliance with the UK Building Regulations (Part L).

Both TRY and DSY files were developed for future climate and emissions scenarios. based on the UKCIP09 projections:

- 2020s (2010 – 2039): High emissions scenario
- 2050s (2040 – 2069): High and medium emissions scenarios
- 2080s (2070 – 2099): High, medium and low emissions scenarios

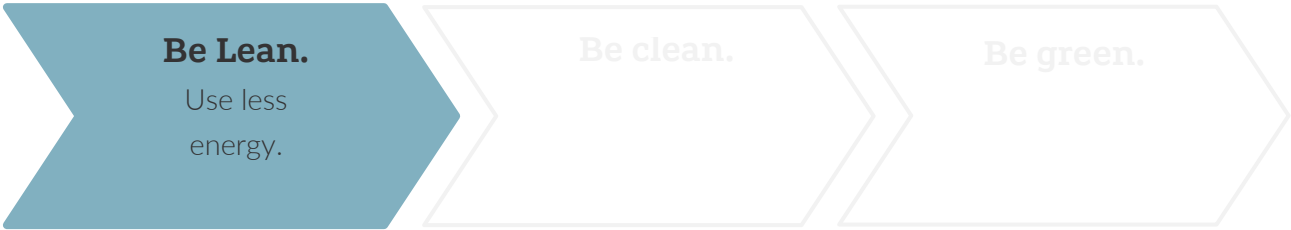
Following the standardised methodology behind the Part L requirements, the closest CIBSE weather file location for the proposed development is **Swindon**.

Therefore:

- The **Swindon TRY** weather file has been utilised for the purposes of the Part L2 calculations for the non-residential part of the development.
- **Residential Areas** - Calculations for fabric energy efficiency (FEE), regulation compliance (TER and DER, TPER and DPER) and for ratings (SAP rating and environmental impact rating) are done with UK average weather.

4. Be Lean.

Passive design and energy efficiency measures form the basis for the reduction in overall energy demand and carbon emissions for the proposed development. This energy strategy aims to reduce the energy demand initially by optimising the envelope and building services within the development.



4.1 Passive design and energy efficiency features.

Passive design measures are those which reduce the demand for energy within buildings, without consuming energy in the process.

These are the most robust and effective measures for reducing CO₂ emissions as the performance of the solutions, such as wall insulation, is unlikely to deteriorate significantly with time, or be subject to change by future property owners. In this sense, it is possible to have confidence that the benefits these measures will continue at a similar level for the duration of their installation.

4.1.1 Fabric Parameters.

Table 4.1.1 below details the U-values/construction types used within the Stage 2 models for the Proposed Development. Please note that the corridors are heated while the stairwells, lifts and risers are unheated spaces. Walls to these unheated spaces have been treated as a sheltered external wall and will require additional insulation to minimise heat loss and enable compliance with the Fabric Efficiency measure.

Table 4.1.1 Fabric constructions.

Parameter	Value
Residential	
External Wall	0.15 W/m ² K
Sheltered Wall	0.22 W/m ² K
Party Wall	Filled Cavity with Edge Sealing: 0
Ground/ Exposed floor to unheated space	0.10 W/m ² K
Roof	0.10 W/m ² K
Windows (g-value)	1.2 W/m ² K (0.4)
Door	1.0 W/m ² K
Air permeability (m ³ /m ² /h@50Pa)	3.00
Non-Residential	
External Wall	0.15 W/m ² K
Internal Partition	0.22 W/m ² K
Ground Floor	0.10 W/m ² K
Roof	0.10 W/m ² K

Parameter	Value
Windows (g-value)	1.2 W/m ² K (0.4)
Spandrel Panel/ Louvre	1.2 W/m ² K

4.1.2 Thermal Bridging.

Thermal Bridges are required by Part L1 2021 to be independently assessed. However, these calculations have not been completed at this stage. In the meantime, the Part L1 2021 reference psi values have been used. In order to maintain the results presented within this analysis, designed thermal bridges should achieve or exceed the value presented below. These values have been reviewed by the architectural team.

Table 4.1.2 – Thermal Bridge psi-values

Junction	Source Type	Psi (W/mK)
E2 Other lintels	PL 2021 Notional	0.05
E3 Sill	PL 2021 Notional	0.05
E4 Jamb	PL 2021 Notional	0.05
E5 Ground floor (External)	PL 2021 Notional	0.16
E5 Ground floor (Shelter)	PL 2021 Notional	0.16
E7 Party floor between dwellings (External)	PL 2021 Notional	0.07
E7 Party floor between dwelling (Sheltered)	PL 2021 Notional	0.07
E14 Flat roof	PL 2021 Notional	0.08
E15 Flat room with parapet	PL 2021 Notional	0.56
E20 Exposed floor (normal)	PL 2021 Notional	0.32
E21 Exposed floor (inverted)	PL 2021 Notional	0.32
E24 Eaves (insulation at ceiling level - inverted)	PL 2021 Notional	0.24
E16 Corner (normal)	PL 2021 Notional	0.09
E17 Corner (inverted)	PL 2021 Notional	-0.09
E18 Party wall between dwellings	PL 2021 Notional	0.06
E25 Staggered party wall between dwellings	PL 2021 Notional	0.06
E20 Exposed floor (normal)	PL 2021 Notional	0.22
P1 Party wall – Ground floor	PL 2021 Notional	0.08
P3 Party wall – Intermediate floor between dwellings	PL 2021 Notional	0.00
P7 Party wall – Exposed floor (normal)	PL 2021 Notional	0.16
P8 Party wall – Exposed floor (inverted)	PL 2021 Notional	0.24

4.1.3 Be Lean – System Specification.

Table 4.1.3: Proposed system parameters

System parameters	Residential	Non-Residential – New Build
Heating and Cooling	Heat Source: Electric Heater Efficiency: 100	Heat Source: Heat Pump Overall Efficiency: 264% Cooling Source: Heat Pump Overall Efficiency SEER: 5.00
Ventilation	MEV System: Nuaire MRXBOXAB-ECO5 SFP: 0.61 – 0.63 MVHR Efficiency: 89 90%	Mechanical ventilation with heat recovery Heat recovery efficiency: 75%. Specific Fan Power: 1.80 W/l/s
Domestic Hot Water	Heat Source: Gas boiler Summer Efficiency: 88.9 Winter Efficiency: 80.3	Heat Source: Direct electric Overall Efficiency: 100%
Lighting	Power: 7W Efficacy: 90 No. Fittings: 10	As per NCM lux

4.2 Be Lean results.

The following is an appraisal of the anticipated CO₂ emissions of the Proposed Development, after the inclusion of the passive design and energy efficiency measures described above, across the building typologies.

The Be Lean results of the residential elements, non-residential elements, and whole site are presented below based on indicative Building Regulations Part L1 and L2 2021 assessments, utilising SAP10.2 carbon factors.

4.2.1 Be Lean Residential.

The results detailed below for the ‘Be Lean’ assessment demonstrate the percentage variance against Approved Document Part L1 and be lean baseline for the residential of the proposed development.

Table 4.2.1: Be Lean Results for Residential Aspects of the Proposed Development.

	Target Emissions (tonnesCO ₂ /year)	Building Emissions (tonnesCO ₂ /year)	Percentage variance
Block compliance	186.4	166	10.9%

Be Lean Non-Residential.

The results detailed below for the ‘Be Lean’ assessment demonstrate the percentage variance against Approved Document Part L2 for the non-domestic plots of the proposed development.

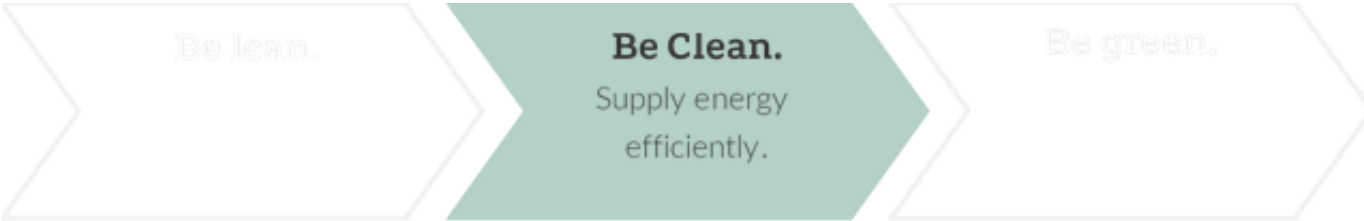
Table 3: Be Lean Results for Non-Residential Aspects of the Proposed Development

	Target Emissions (kgCO ₂ /m ² /year)	Building Emissions (kgCO ₂ /m ² /year)	Percentage variance
Non-residential	3.99	3.93	1.5%

Both the residential and non-residential achieve an emission saving over the Part L notional.

6. Be Clean.

This stage of the energy hierarchy refers to the use of heat networks or on-site Combined Heat and Power (CHP) in order to provide energy and reducing consumption from the national grid and gas networks, through the generation of electricity, heating and cooling on-site.



6.1 Be clean: network and technologies.

The following sections detail considerations of the infrastructure and low-carbon energy supply measures that have been considered.



Combined heat and power (CHP)

Changes to the carbon factor of grid electricity have meant that previously favoured systems such as Combined Heat and Power (CHP) are becoming much less carbon efficient. In fact, CHP systems are now expected to lead to greater carbon emissions than conventional gas-fired boilers due to their lower efficiency.

Due to the decarbonisation of the electricity grid, alongside air quality concerns, CHP is not proposed.



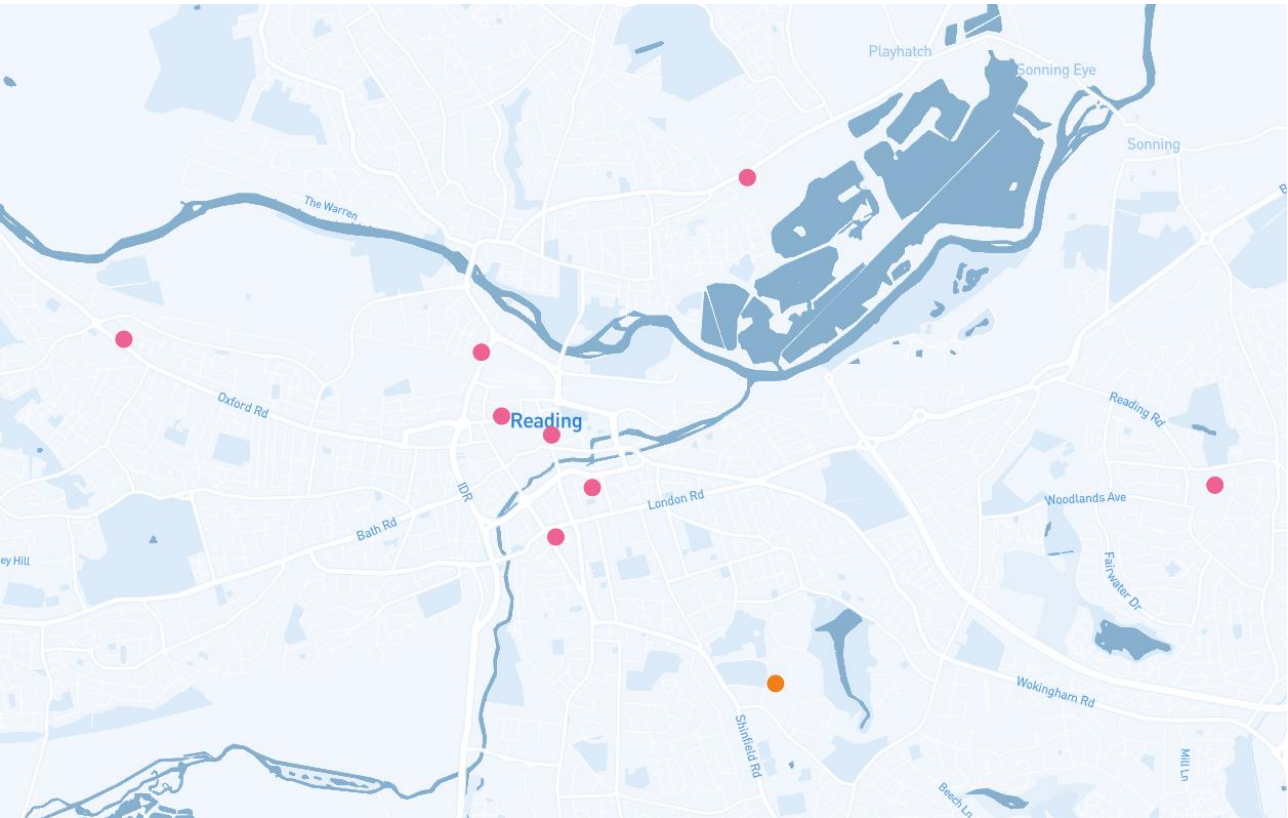
District/ Decentralised heat networks

The site is located within the north of the station district heating cluster as per figure shown in the Supplementary Planning Documentation. Currently, however, there are no viable District Heat Networks in close proximity to Site; therefore, the Proposed Development is unable to connect to a decentralised system.

Further details are shown in Figure 6.1 below. This section address policy CC4 of the Reading Borough Local Plan 2019.

Figure 6.1 below highlights Heat Networks within the Borough however, these are all still in planning or are awaiting construction. Further, the below heat networks are localised heat networks designed to supply energy to individual large-scale developments as opposed to District Heat Networks. Therefore, once constructed these Heat Networks may not have the capacity to serve the Waterfront Square site so it is also not appropriate to plan for a future connection to these systems.

Figure 6.1: A map showing Heat Networks in Reading. Pink dots represent Heat Networks that are in planning; orange dots represent Heat Networks awaiting construction.



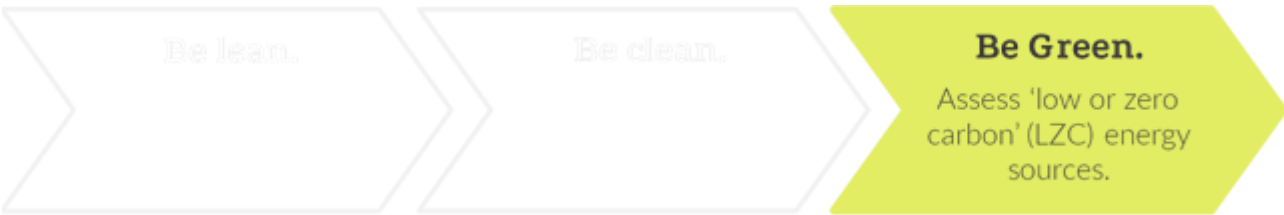
6.2 Be Clean Results

There are no existing district energy networks within feasible vicinity of the site that would enable a connection to the Proposed Development.

Therefore, no further carbon reductions are envisaged for the Be Clean stage of the energy hierarchy.

7. Be Green.

The Be Green stage of the energy hierarchy explores the feasibility of Low and Zero Carbon (LZC) technologies to allow for the production of renewable energy onsite in order to offer a further reduction in carbon emissions.



7.1 Low and zero carbon (LZC) technology assessment.

Renewable or zero carbon technologies harness energy from the environment and convert this to a useful form. Many renewable technologies are available, however, not all of these are commercially viable or suitable for urban locations.

As identified in section 6 above, there are currently no feasible existing or proposed district heat networks in close proximity to the site. Therefore, the Proposed Development is unable to connect to a decentralised system.

Table 7.1 below summaries different low and zero carbon technologies and assesses the suitability for the Proposed Development.

Figure 7.1: Summary of low and zero carbon technologies.

	Ground source heat pumps Ground Source systems work to extract heat or cooling energy from the ground. They are generally slightly more efficient than air source systems, as the ground temperature is more stable over the course of the year relative to air temperature. There are four common varieties: – Vertical, open loop, direct cooling (i.e. without heat pump) – Vertical, open loop, with heat pump – Horizontal, closed loop, with heat pump – Vertical, closed loop, with heat pump Suitability to Proposed development: Regardless of the type of ground source heat loop used, all would require extensive below ground works to bury and install the system on site. A ground test would need to be undertaken to determine whether the site’s ground conditions would be able to support a sufficient number of piles to provide for the heating demand of the project. Therefore, this technology has been considered not appropriate for the Proposed Development due to the additional costs and implications associated with ground works. Despite efficiencies of Ground Source Heat Pumps being slighter better than Air Source Heat Pumps, the associated upfront carbon of the system and emissions due ground works are much higher.
	Water source heat pumps Water source heat pumps use bodies of water, such as rivers, lakes or oceans to provide heating or cooling energy to a building. Suitability to Proposed development: The Proposed Development is located beside the River Thames.

	It is anticipated that this body of water could provide sufficient capacity to support the demands of the development however, similar to Ground Source Heat Pumps the associated costs and upfront carbon would out-weigh the benefits. Therefore, this technology has not been included within the site proposal.
	Air source heat pumps Air source heat pumps (ASHP) use thermodynamic principles to convert heat from the air into useable heat within the building. Unlike some other sources of renewable energy, heat pumps do require energy (typically electricity or gas) to pump and compress refrigerant through the system. However, under the Renewable Energy Directive 2009/28/EC they are classified as renewable technologies provided that the final energy output significantly exceeds the primary energy input required to drive the heat pump. ASHP need to be located externally with access to the ambient air, typically at roof level. Suitability to Proposed development: Due to grid decarbonisation and the proposed SAP10 carbon factors, it is expected that ASHP technology will offer significant carbon emission reductions over the gas boiler baseline scenario. Implementing heat-pump technology brings the additional benefit of a shift towards combustion-free development, with the associated benefit to local air quality. This approach is expected to result in significant regulated CO₂ emission reductions beyond the Building Regulations Part L (2021) ‘baseline’ on a site-wide basis. Individual Exhaust Air Source Heat Pumps are therefore proposed for the development as the heat generating technology for domestic hot water. This provides a low carbon low energy solution for occupant water heating demands.
	Photovoltaics Photovoltaic panels harness energy from sunlight and convert this into useful energy in the form of electricity. A PV system requires viable roof space in order for the system array to be installed and function effectively. Suitability to proposed development: Solar irradiance analysis on the site has shown a good opportunity for the implementation of Photovoltaic technologies for on-site electricity generation. The provision and location of PV panels has been reviewed in detail, with consideration of overshadowing and orientation, A circa 100m² array of PV has been proposed to generate renewable energy for the residential aspects. Further details in section 5.4 A circa 41m² array of PV has been proposed for the non-residential aspects.

7.1.1 Be Green – System Specification.

Table 7.1.1: Proposed system parameters

System parameters	Residential	Non-Residential – New Build
Heating and Cooling	Heat Source: Electric Heater Efficiency: 100	Heat Source: Heat Pump Overall Efficiency: 300% Cooling Source: Heat Pump Overall Efficiency SEER: 5.00
Ventilation	MEV System: Nuaire MRXBOXAB-ECO5 SFP: 0.61 – 0.63 MVHR Efficiency: 89 90%	Mechanical ventilation with heat recovery Heat recovery efficiency: 75%. Specific Fan Power: 1.80 W/l/s
Domestic Hot Water	Heat Source: Exhaust ASHP Fuel type: Electric Efficiency: 337.73 - 338.53%	Heat Source: Direct electric Overall Efficiency: 100%
Lighting	Power: 7W Efficacy: 90 No. Fittings: 10	As per NCM lux

7.2 Be Green Results.

The Be Green results of the residential elements, non-residential elements, and whole site are presented below based on indicative Building Regulations Part L1 and L2 2021 assessments, using the SAP10.2 current carbon factors.

7.2.1 Be Green - Residential.

The Proposed Development is an all-electric scheme with the residential aspects of the scheme to be served by an ASHP as well as a roof-mounted PV array of around 100m². This will contribute to a significant reduction in carbon emissions at the Be Green stage, as outlined below.

Table 4: Be Green results for the residential aspects of the Proposed Development.

	Target Emission Rate (tonnes CO ₂ /year)	Building Emission Rate (tonnes CO ₂ /year)	Percentage variance
Block compliance	186.4	53.2	71.5%

The residential aspects achieve compliance with Building regulations, with an overall percentage reduction in carbon emissions of 71.5% over the Part L target emissions.

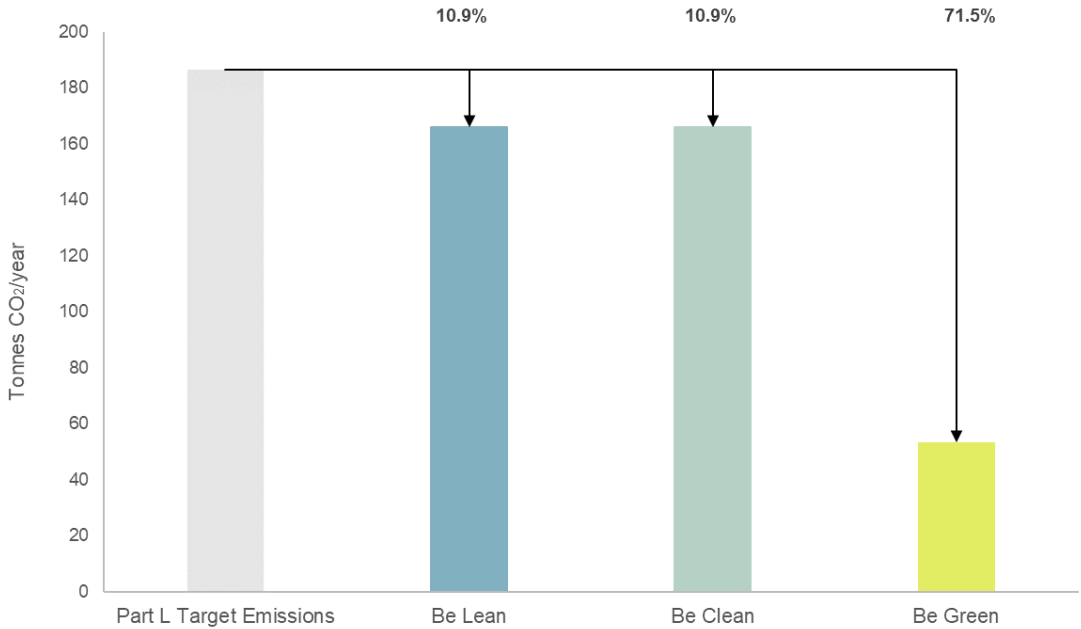


Figure 7.2.1: Reduction over Part L1 Target Emission for residential aspects of the Proposed Development

7.2.2 Green – Non-Residential.

The non-residential portion of the site, an ASHP led heat network will also power the scheme as well as an array of PV estimated to generate a total annual yield of 7,420 kWh (which is equivalent to an active panel area of ~41m² dependant on panel type and configuration specified).

	Target Emission Rate (tonnes CO ₂ /year)	Building Emission Rate (tonnes CO ₂ /year)	Percentage variance
Non-residential	3.99	2.57	35.6%

The residential aspects achieve compliance with Building regulations, with an overall percentage reduction in carbon emissions of 35.6% over the Part L target emissions.

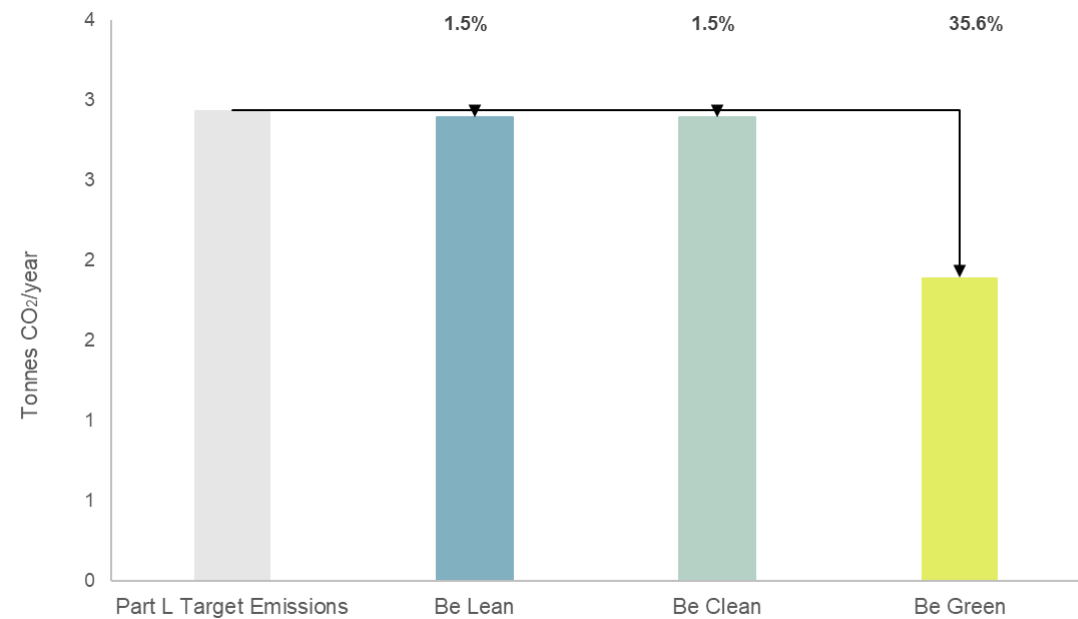


Figure 7.2.2: Reduction over Part L2 Target Emission for residential aspects of the Proposed Development

7.2.3 Be Green – Site wide.

For the whole site, the adoption of an ASHP heat network and PV contribution contributes to an overall reduction in carbon emissions of 70.9% at the Be Green stage using the SAP10 carbon factors.

Results for the whole site are based on results for detailed residential and non-residential sections of the site which were applied on a GIA (m²) basis for the proposed building use type.

Table 5: Sitewide Be Green Results for the Proposed Development.

	Target Emission Rate (tonnes CO ₂ /year)	Building Emission Rate (tonnes CO ₂ /year)	Percentage variance
Sitewide	189.3	55.1	70.9%

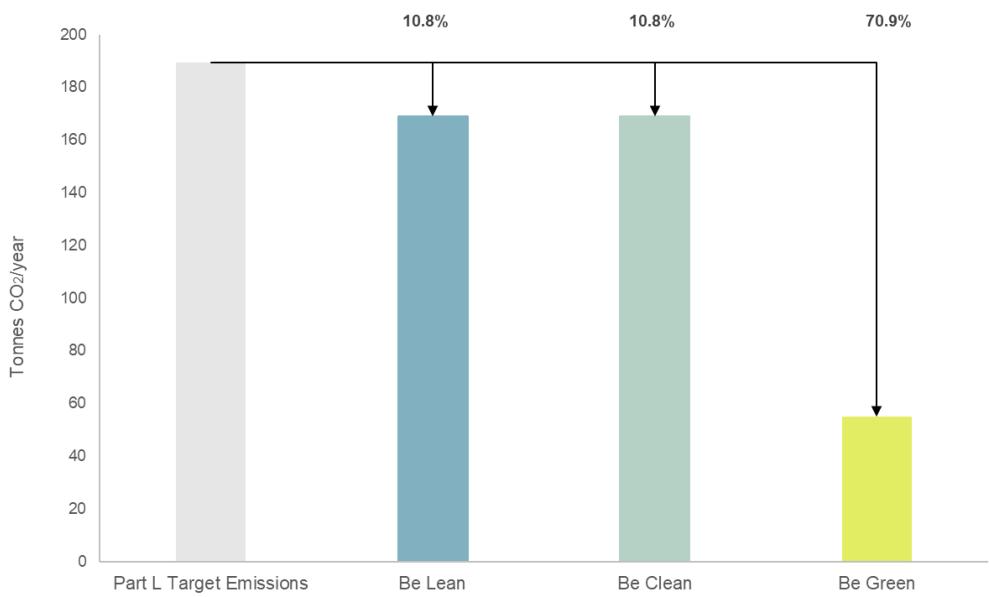


Figure 7.2.3: Sitewide reduction over Part L1&2 Target Emissions.

7.3 Route to Zero Carbon Homes.

Policy H5 of the Reading Borough Local Plan requires all major new-build residential development to be designed to achieve zero carbon homes. The Proposed Development is an electrically led project therefore, as the national grid continues to decarbonise the scheme will move towards zero carbon.

7.4 Energy Performance Certificates (EPCs).

Our analysis of the proposals has shown that dwellings can achieve predicted EPC B&C ratings. A review of the non-domestic EPCs have not been undertaken due to shell and core nature of these spaces at this stage.

8. Conclusion.

This Building Regulations Part L1 2021 analysis has been undertaken for the proposed Waterfront Square residential development in Reading and confirms that the proposed strategy will results in a highly efficient, low carbon scheme.

New, high efficiency servicing equipment and efficient fabric will minimise the energy usage of the proposed dwelling. Using the energy hierarchy, the strategy has been developed to ensure that the proposed development is efficient and low carbon.

This strategy has been prepared to demonstrate that the client and design team have given due consideration to the principles of energy and sustainability, and how these can be implemented for the proposed development.

The carbon emissions associated with regulated energy use at the proposed development have been compared against targets set by the Building Regulation Approved Document Part L 2021 and have been shown to comply. In addition, the primary energy associated with regulated energy use and the fabric energy efficiency have also been compared against targets set by Part L1 2021 and have also been shown to comply.

	Waterfront Square
Be Lean	A fabric first approach and energy efficient building services will be utilised to reduce carbon emissions and energy demand through best practice passive design measures. Residential: Overall reduction in Building Emission Rates of 10.9% over Part L 2021. Non-Residential: Overall reduction in Building Emission Rates of 1.5% over Part L 2021.
Be Clean	There are no existing district energy networks within feasible vicinity of the site that would enable a connection the Proposed Development.
Be Green	The Proposed Development is an all-electric scheme, powered by EAHP alongside roof-mounted PV panels for renewable energy generation. Residential: Overall reduction in Building Emission Rates of 71.5% over Part L 2021. Non-Residential: Overall reduction in Building Emission Rates of 35.6% over Part L 2021

8.1 Compliance with Part L1&2.

It is anticipated that the proposed development, with the inclusion of passive and active low carbon measures, will achieve a reduction in CO₂ emissions beyond the notional building baseline, meaning building regulation compliance is achieved by the scheme.

Whilst this does not achieve net zero regulated operational carbon, results show a significant 71.5% reduction against Part L1 2021 of the building regulations for residential aspects and a 35.6% reduction against Part L1 2021 of the building regulations for non-residential aspects. The overall reduction for the whole site is **70.9%**. This is an electrically led scheme meaning that, as the grid continue to decarbonise, the proposal represents a route to net zero operational carbon.

It should be noted that, in order to ensure compliance with Part L, thermal bridges should be designed to achieve the proposed psi-values, and the parameters listed within this report should be used within the design.

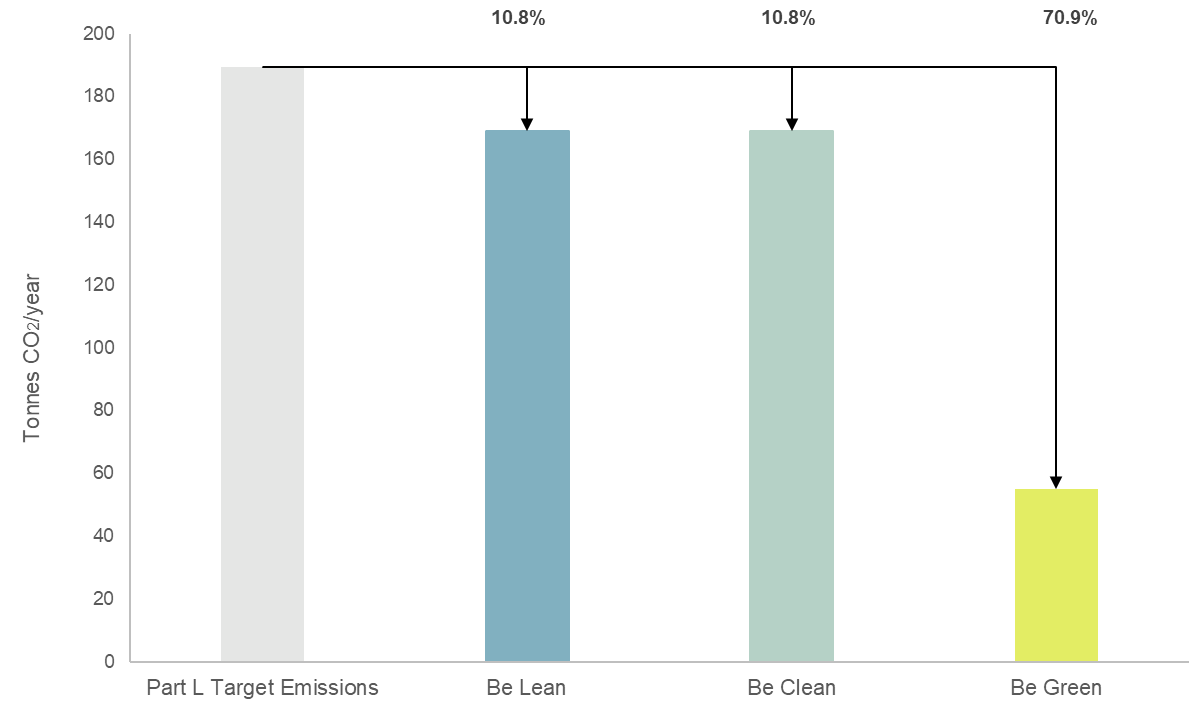


Figure 8.1: Sitewide reduction over Part L Target Emissions.

To achieve net zero regulated emissions in operation, an offset fund cost of **£99,161.96** has been calculated for the residual emissions aligning with Reading's Local Plan paragraph 4.4.46. Full details are shown in Appendix A.

Appendix A – Offset Fund Cost.

	Site-Wide Regulated Carbon Dioxide Emission Savings (tonnes CO ₂ /yr.)	
	Regulated	
Baseline: Part L 2021 Building Regulations	189.334	
After energy demand reduction (Be Lean), (Be Clean) and renewable energy contribution (Be Green)	55.090	
Total target savings	189.334	100%
Shortfall (tonnes CO ₂ /yr)	55.090	29.1%
Local carbon offset price (£/tCO ₂)	£60	
Offset period (years)	30	
Total Offset Payment	£99,161.96	

Values are in line with Paragraph 4.4.46 of the Reading Local Plan.

Appendix B - Apartment Outputs.

Table A-1: Detailed Outputs of Sample SAP Assessment for Be Lean.

Dwelling reference	GIA	Multiplier	Total area	CO2 emissions			Primary Energy			Fabric energy efficiency		
				Target Emissions Rate (TER)	Dwelling Emission Rate (DER)	Variance	Target Primary Energy Rate (TPER)	Dwelling Primary Energy Rate (DPER)	Variance	Target Fabric Energy Efficiency (TFEE)	Dwelling Fabric Energy Efficiency (DFEE)	Variance
	m²	-	m²	kgCO ₂ /m²/yr.	kgCO ₂ /m²/yr.	%	kWh/m²/yr	kWh/m²/yr	%	kWh/m²/yr	kWh/m2/yr	%
B2-0-1-1B2P	52.7	18	948.6	21.01	16.97	19.23	114.05	120	-5.22	59.66	57.85	3.03
A1-0-4-2B3P	68.33	13	888.29	13.39	12.22	8.74	72.75	80.12	-10.14	31.22	31.2	0.06
B2-2-1-2B3P	62.78	9	565.02	15.99	13.09	18.14	86.77	88.44	-1.92	42.54	41.31	2.9
B1-2-1-2B3P	62.29	67	4173.43	12.33	11.46	7.06	67.13	69.58	-3.65	24.16	22.9	5.25
A2-2-4-1B1P	43.92	27	1185.84	11.01	10.8	1.91	60.11	62.74	-4.37	16.91	16.01	5.32
A1-2-9-1B1P	44	59	2596	12.6	13.16	-4.44	69.11	74.87	-8.33	13.84	13.47	2.68
A1-2-11-2B3P	61.61	6	369.66	13.2	13.19	0.08	72.33	75.26	-4.05	17.68	16.51	6.61
A2-8-1-3B5P	87.03	14	1218.42	12.49	11.61	7.05	68.02	70.59	-3.78	24.67	23.35	5.37
B1-9-9-1B1P	47.77	6	286.62	14.15	12.37	12.58	76.57	87.85	-14.73	39.7	39.85	-0.37
B1-9-2-2B4P	69.63	25	1740.75	17.28	15.42	10.76	94.12	100.74	-7.03	40.03	39.31	1.78

Table A-2: Detailed Outputs of Sample SAP Assessment for Be Lean.

Dwelling reference	GIA	Multiplier	Total area	CO2 emissions			Primary Energy			Fabric energy efficiency		
				Target Emissions Rate (TER)	Dwelling Emission Rate (DER)	Variance	Target Primary Energy Rate (TPER)	Dwelling Primary Energy Rate (DPER)	Variance	Target Fabric Energy Efficiency (TFEE)	Dwelling Fabric Energy Efficiency (DFEE)	Variance
	m²	-	m²	kgCO ₂ /m²/yr.	kgCO ₂ /m²/yr.	%	kWh/m²/yr	kWh/m²/yr	%	kWh/m²/yr	kWh/m2/yr	%
B2-0-1-1B2P	52.7	18	948.6	20.91	6.4	69.39	113.53	64.34	43.33	59.66	57.85	3.03
A1-0-4-2B3P	68.33	13	888.29	13.31	4.78	64.09	72.28	49.5	31.51	31.22	31.2	0.06
B2-2-1-2B3P	62.78	9	565.02	15.92	5.67	64.38	86.35	58.62	32.11	42.54	41.31	2.9
B1-2-1-2B3P	62.29	67	4173.43	12.23	3.48	71.55	66.61	36.44	45.29	24.16	22.9	5.25
A2-2-4-1B1P	43.92	27	1185.84	10.91	2.58	76.35	59.57	27.48	53.86	16.91	16.01	5.32
A1-2-9-1B1P	44	59	2596	12.44	2.7	78.3	68.24	28.89	57.67	13.84	13.47	2.68
A1-2-11-2B3P	61.61	6	369.66	13.05	2.85	78.16	71.53	30.41	57.48	17.68	16.51	6.61
A2-8-1-3B5P	87.03	14	1218.42	12.39	3.54	71.43	67.49	37.03	45.13	24.67	23.35	5.37
B1-9-9-1B1P	47.77	6	286.62	14.08	6.02	57.24	76.21	61.96	18.7	39.7	39.85	-0.37
B1-9-2-2B4P	69.63	25	1740.75	17.15	6.1	64.43	93.45	63.15	32.42	40.03	39.31	1.78

Appendix C – Be Green BRUKL Extracts.

BRUKL Output Document

Compliance with England Building Regulations Part L 2021

HM Government

Project name

IES-5325365-20241202-Norman Place-Part L2-SH-Rev00

Date: Thu Dec 05 13:36:59 2024

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.20

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.20

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 735.45

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m²:annum	3.99
Building CO ₂ emission rate (BER), kgCO ₂ /m²:annum	2.57
Target primary energy rate (TPER), kWh _{EP} /m²:annum	43.38
Building primary energy rate (BPER), kWh _{EP} /m²:annum	27.57
Do the building's emission and primary energy rates exceed the targets?	BER <= TER BPER <= TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{g-Limit}	U _{g-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	SP000000:Surf[2]
Floors	0.18	0.1	0.1	SP000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	SP000000:Surf[1]
Windows** and roof windows	1.6	1.2	1.2	SP000000:Surf[4]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _{g-Limit} = Limiting area-weighted average U-values [W/(m²K)] U _{g-Calc} = Calculated area-weighted average U-values [W/(m²K)] U _{i-Calc} = Calculated maximum individual element U-values [W/(m²K)] * 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. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m²K NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	735.4	735.4
External area [m²]	1342	1342
Weather	SWI	SWI
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	422.18	397.08
Average U-value [W/m²K]	0.31	0.3
Alpha value* [%]	25	10

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

Building Use

% Area	Building Type
37	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
63	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	3.64	2.46
Cooling	5.05	1.83
Auxiliary	10.14	11.12
Lighting	5.04	9.56
Hot water	4.97	4.4
Equipment*	11.56	11.56
TOTAL**	28.84	29.37

* 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	10.09	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	10.09	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	99.31	55.14
Primary energy [kWh _{EP} /m²]	27.57	43.38
Total emissions [kg/m²]	2.57	3.99

Appendix D - Proposed PV Roof Plan.

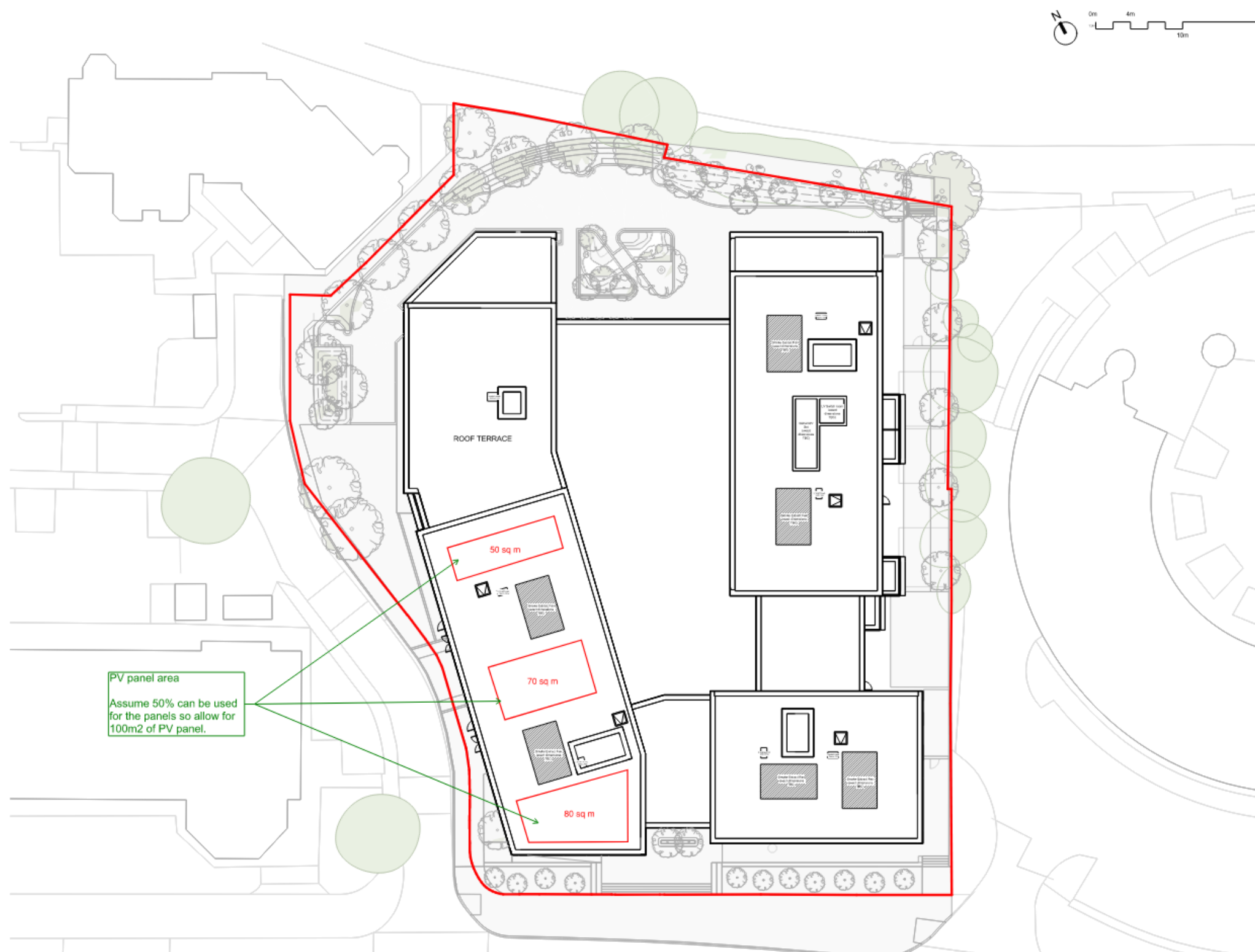


Figure C: Proposed PV layout for Waterfront Square.



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