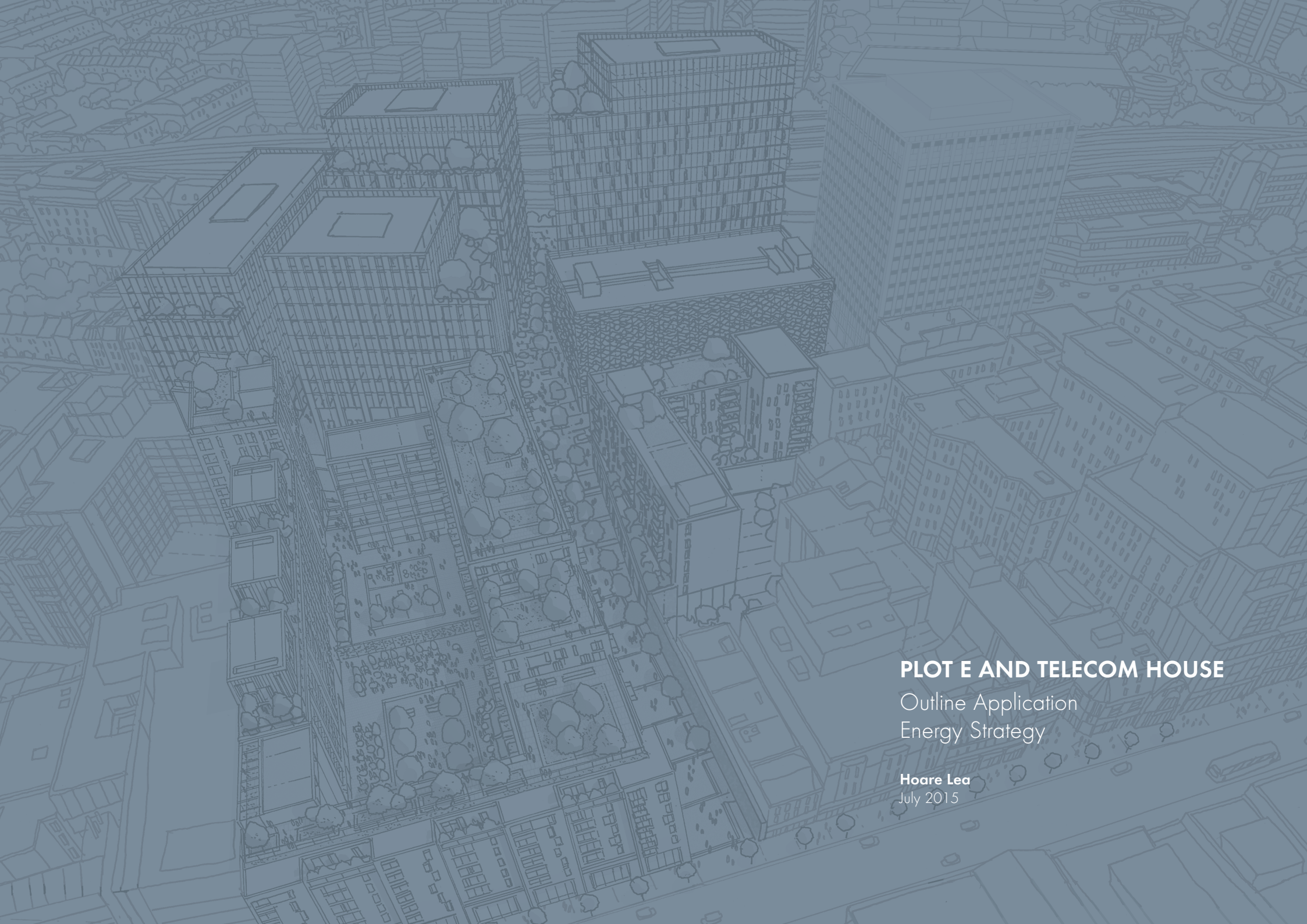




PLOT E AND TELECOM HOUSE

Outline Application
Energy Strategy

Hoare Lea
July 2015



Station Hill
Sackville Developments (Reading) Limited

Updated Energy Strategy
Rev. C
July 2015



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Audit Sheet

Rev.	Description	Prepared and checked by	Reviewed by	Date
A	First draft planning report for comments	L. Wille O. Boswell	J. Godefroy	03.07.2015
B	Planning issue	L. Wille	C. MacPherson	23.07.2015
C	Updated planning issue – change to offices target and inclusion of figure 2.1	L. Wille	-	24.07.2015

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1.0 Executive Summary

This report describes the Energy Strategy supporting the proposed Station Hill development in Reading. The Station Hill proposal is the redevelopment of brownfield land between Reading mainline station and Reading town centre, bound by Station Hill and Reading mainline station to the north, Station Road to the east, Friar Street to the south, and Greyfriars Road to the west. The scheme is a mixed-use, commercial-led development comprising the following minimum and maximum areas:

- Retail and related uses (A1-A5): min 6,000 – max 13,500 m² GEA
- Leisure: min 0 – max 2,200 m² GEA
- Residential: min 26,000 – max 41,500 m² GEA (equivalent to approximately 300 to 475 units)
- Office: min 69,000 – max 122,000 m² GEA
- Back of House facilities: min 1,500 – max 3,200 m² GEA
- Associated car parking (550-1,000 spaces), landscaping, external areas, and new pedestrian routes through the site.

The scheme aims to provide exemplary environmental performance. On January 12th 2015 outline planning permission was granted for the Station Hill Development. It is now proposed to incorporate the neighbouring Telecom House Site (48-51 Friar Street & 4-20 Garrard Street) to enable the development to incorporate an additional 12,000 m² GEA of residential floorspace (and associated back of house areas) in order to deliver up to 175 more homes than the 2015 outline planning permission. This updated energy strategy takes into account the enlarged scheme and builds on the discussions undertaken with the Planning Authorities and their consultants (Thames Valley Energy - TVE) previously. The proposed strategy remains broadly the same, though with updates due to changes in Building Regulations and planning guidance.

Environmental assessments

The following environmental rating targets have been set:

- BREEAM Offices 2011 'Very Good' rating. This could be upgraded to Excellent subject to tenant cooperation (e.g. finishes, handover procedures, long-term commissioning).
- BREEAM Retail 2011 'Very Good' rating, as the spaces will be provided as shell and core

Carbon Strategy

The energy strategy has followed the principles of the energy hierarchy: Be Lean – Be Clean – Be Green.

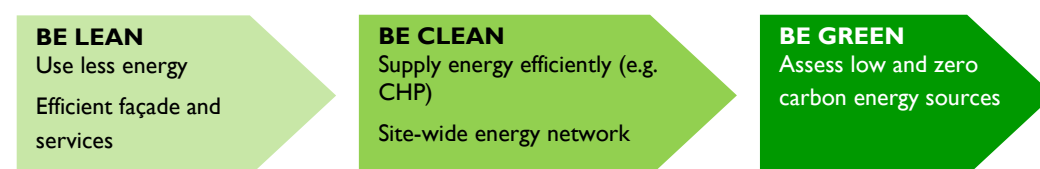


Figure 1.1: The energy hierarchy

The aim is to adopt a 'fabric and energy efficiency first' approach, followed by the implementation of a Low and Zero Carbon technology to achieve **minimum site-wide carbon emission reduction over Part L 2013 of 5-15%**. This target is currently proposed to be achieved entirely through passive design, energy efficiency and potentially with implementation of CHP (subject to technical and financial viability, to be reviewed at the detailed design stage), though opportunities for renewables can be reviewed further at detailed design stage.

This target is estimated to be in line with the previous outline strategy proposal (20-25% reduction in site-wide carbon emissions over Part L 2010), as the regulations have been tightened. See figures 1.2 and 1.3 below.

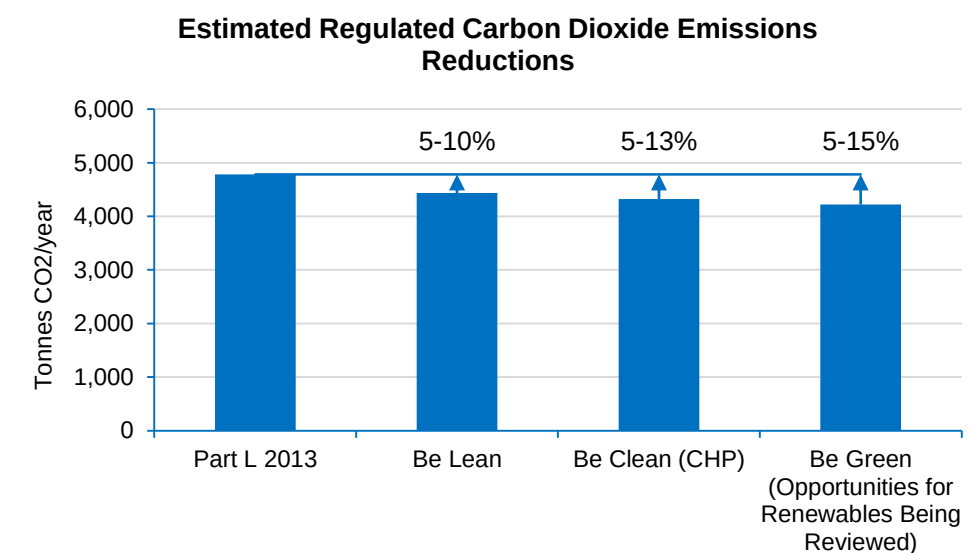


Figure 1.2: Overall carbon reduction strategy

1.1 Minimum carbon performance targets for each element of the scheme

The strategy aims to ensure that each separate building use is energy efficient prior to the contribution of infrastructure and Low or Zero Carbon technologies. The following targets are proposed, with all components of the scheme at least Part L 2013 compliant from passive design and energy efficiency measures only. The previous outline strategy proposal is shown in each graph as well. As shown, each new target against the part L 2013 baseline is assessed to be either equivalent to, or better than the previous target against Part L 2010.

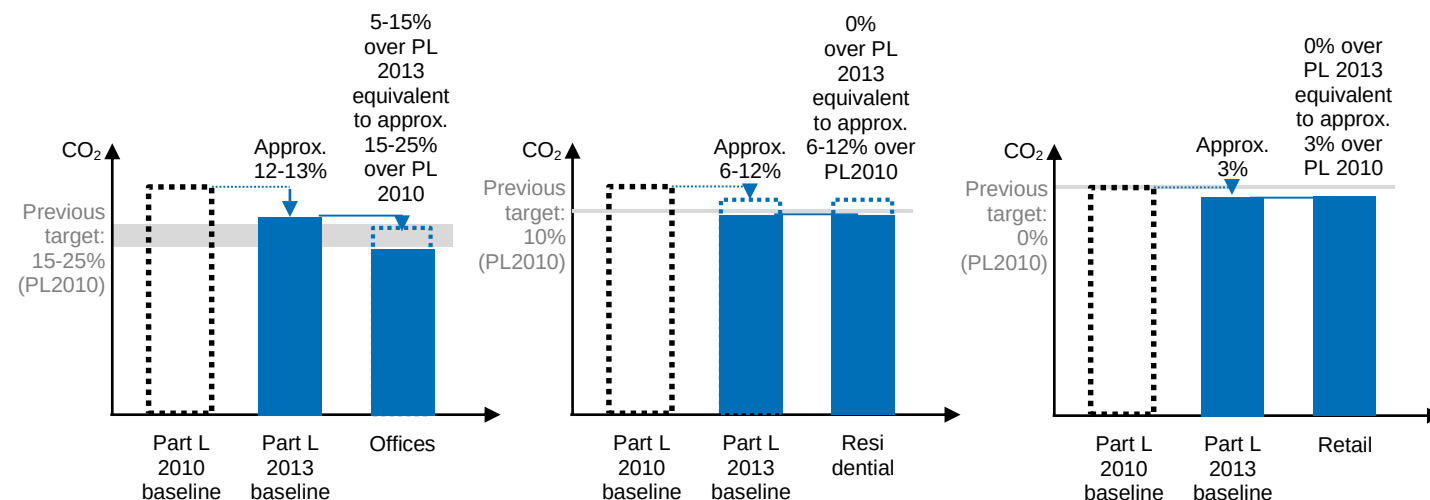


Figure 1.3: Passive design and energy efficiency targets for each space use

On a site-wide basis, these targets are estimated to result in an approximate 5-15% improvement on a Part L 2013 compliant scheme from passive design and energy efficiency alone, which is significant.

1.2 Key infrastructure decisions

The infrastructure proposals are intended to allow efficient operation and a commercially viable, flexible development programme. They have been informed by the following:

- The expected phasing of the scheme, with the commercial elements built in the first phases and the residences in the later phases.
- The site's energy profile, which is commercial-led, dominated by electrical uses and with the domestic hot water load mostly provided by the residential elements in the later phases.

It is therefore proposed that commercial buildings be provided with building-by-building plant rooms hosting heating and cooling plant in order to be able to operate from day one.

For the residential areas two options exist, subject to review at the detailed design stage:

- Option 1: Each residential building to be served by its own plant room. This allows for flexibility for potential design changes within the detailed design stages and phasing. A CHP could potentially serve plot E in this scenario, though the building is estimated to be on the lower limit for size. This option would therefore be subject to commercial viability. Plot F would be estimated to be too small for CHP in this scenario (expected less than 200 residential units).
- Option 2: An energy centre serving both residential plots (plots E&F) could in theory be implemented, and CHP incorporated on completion of the Plot E elements once a sufficient quantum of units and thermal load exists (usually 250-300 residential units are recommended to make CHP viable due to the base thermal load needed to operate the system efficiently).

This energy centre could serve plot F as well. This strategy will be reviewed against the phasing strategy as well as technical and financial viability at the detailed design stage.

The scheme will be future-proofed to allow the expansion of low carbon district energy

As part of the detailed design, locations for plate heat exchangers in the commercial blocks will be identified, as well as possible routes for connection to a central district energy scheme, should this be viable in the future.

As part of the detailed design, location for a plate heat exchanger in the potential residential energy centre would be identified, as well as possible routes for connection to a wider district energy scheme in the vicinity, should this exist in the future.

1.3 Low Carbon Technology

An initial feasibility appraisal has concluded that Gas-fired CHP is considered to be an appropriate Low or Zero Carbon technology currently, to serve Plot E, and potentially Plot F, subject to technical and financial viability at the detailed design stage.

If deemed viable, CHP is proposed to be implemented following either option 1 or 2 as set out above.

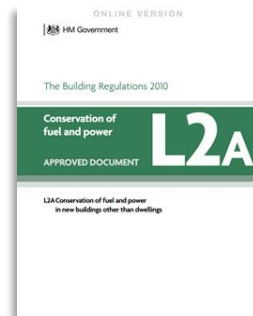
This is expected to reduce regulated carbon emissions for the residences by approximately 10-15% (using Part L 2013 carbon factors), equivalent to approx. 1.3% (option 1) or 2.5% (option 2) site-wide reduction for the whole scheme. The carbon reduction from CHP is estimated to be lower than it was in the previous outline proposal, due to changes to the carbon factors within the Building Regulations, which affect the estimated carbon reductions from CHP.

It should be noted that the calculations at this stage have been based on the maximum areas proposed for each use in the scheme. The viability of CHP plant, and its size and contribution are indicative only at this early stage, and will be reviewed as the accommodation schedule is confirmed and the design develops – for example, a reduction in residential areas would lead to a reduction in the CO₂ savings from CHP in relation to the overall scheme, while a reduction in the commercial elements would lead to higher CO₂ savings from CHP in proportion to the overall scheme.

Opportunities for further carbon reduction have been examined. The roofs in the development will have to accommodate roof top plant, brown roofs, and amenity space. When all these things are considered only small areas are available for PV panels divided between three locations on top of plots F and G (approx. 75 m², 100 m² and 125 m² respectively). This would allow for a maximum of 150 m² of PV panels to be incorporated on site when taking into account the necessary spacing requirements for access, eliminating overshadowing etc. The fact that the PV provision would be split between several areas would mean that an inverter would have to be installed for each separate plot, resulting in a decreased efficiency of the arrays. The PV provision would be expected to contribute only approx. 0.2% carbon emission reductions to the scheme. This very limited carbon saving is not considered a sufficient benefit to the scheme, and PV panels are therefore not recommended for this scheme at this stage.

2.0 Planning Context: Summary of National Regulations and Planning Policies

2.1 National Regulations - Building Regulations Part L



Part L Building Regulations, 2013

On a national level, the leading requirement applicable to the project's energy strategy is Part L of the Building Regulations: L1A for the new build residential buildings and L2A for new-build non-domestic buildings. Under Building Regulations Approved Document Part L: Conservation of Fuel and Power (2013), compliance is achieved for new buildings by demonstrating that the Dwelling Emission Rate (DER) does not exceed the Target Emission Rate (TER).

A further Part L requirement is for limiting the effects of solar gains in summer.

Part L1A 2013 has also introduced Fabric Energy Efficiency Standards (FEES) for residential buildings. This is a measure of the performance of the façade alone, separate to the assessment of the carbon performance of each dwelling.

The Government increased the targets for carbon emission reductions in April 2014. The target for residential units (sector-wide) was increased by 6% compared to Part L 2010 levels. The target for non-domestic areas (sector-wide) was increased by 9% compared to Part L 2010 levels (with separate targets set for various building types – see figure 2.1).

The targets for the development have been updated to show performance against Part L 2013. The new proposed targets are estimated to be approximately equivalent to the previous outline strategy proposal.

Potential scale-back from future zero carbon target

Since 2007 there has been a target set by the UK Government for all new residential development to achieve Zero Carbon status for regulated energy uses from 2016, and all new commercial development to achieve this standard from 2019 onward.

However, in July of 2015 the UK Government issued a statement as part of the HM Treasury's Productivity Report in which it is proposed that, for housebuilders:

The government does not intend to proceed with the zero carbon Allowable Solutions carbon offsetting scheme, or the proposed 2016 increase in on-site energy efficiency standards, but will keep energy efficiency standards under review, recognising that existing measures to increase energy efficiency of new buildings should be allowed time to become established.

The announcement did not specifically mention proposals for zero carbon non-domestic buildings, but it has been widely interpreted by the industry as signalling that these have also been dropped.

This does not change the over-all target for the UK, set within the EU Directive on the Energy performance of buildings, which states that all new buildings must be nearly

zero energy buildings by 31 December 2020 (and public buildings by 31 December 2018). This target is subject to a cost-optimum analysis to be carried out by the UK Government in 2017.

Target aggregate reduction	9%
Distribution warehouse	4%
Deep plan office AC	12%
Retail warehouse	8%
Shallow plan office AC	13%
Hotel	12%
School	9%
Small warehouse unit	3%

Figure 2.1: Target reductions for new, non-domestic notional buildings in Part L 2013 compared to Part L 2010.
Source: DCLG Impact Assessment: Changes to Part L of the Building Regulations 2013

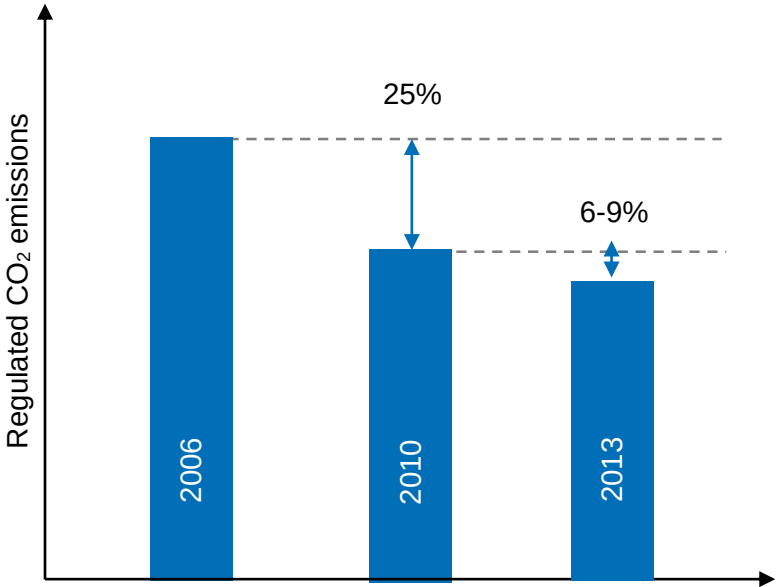
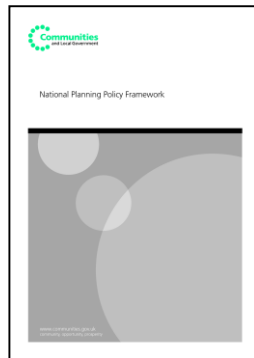


Figure 2.2: Previous changes to Part L of Building Regulations

2.2 National Planning Guidance



National Planning Policy Framework (NPPF), 2012

The National Planning Policy Framework (NPPF) was published in March 2012 and 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 places responsibility for policy making with the Local Planning Authority, who shall communicate their policies through Local Plans and facilitate the creation of Neighbourhood Plans. The NPPF states that there is a presumption in favour of sustainable development. The following is extracted from paragraph 14 of the NPPF:

"For decision-taking this means: approving development proposals that accord with the development plan without delay; and where the development plan is absent, silent or relevant policies are out of date, granting permission unless:

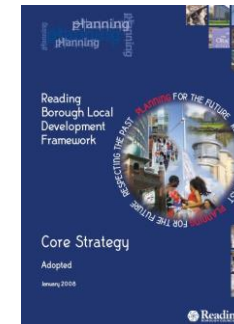
- any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole; or*
- specific policies in this Framework indicate development should be restricted."*

In respect of energy policy contained within the NPPF, paragraph 96 sets out that:

"In determining planning applications, local planning authorities should expect new development to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and*
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption."*

2.3 Planning Framework



Reading Borough Council Core Strategy – Adopted in January 2008 (altered January 2015)

Policy CS1 on Sustainable Construction and Design is the key policy regarding energy. It sets out an overarching strategy in relation to climate change, energy efficiency, energy conservation measures, inclusion of renewable energy sources and reduction in carbon emissions. It requires:

- All new development to maximise the use of energy efficiency and energy conservation measures in their design, layout and orientation to reduce overall energy demand*
- All developments of more than 10 dwellings or 1000m² floorspace incorporate on-site generation of energy from renewable sources and energy efficient design measures (including the use of CHP where appropriate) to off-set at least 20% of predicted carbon dioxide emissions from the estimated energy usage of the completed and occupied development.*

Additionally, sustainability standards (BREEAM and the now-defunct Code for Sustainable Homes) are used for benchmarking. The requirements for BREEAM are:

- In large developments, 50% of new the provision meets the most up-to-date BREEAM Excellent Standards.*

The 20% reduction requirement has now been superseded by the SPG on Sustainable Design and Construction (see below)

Note

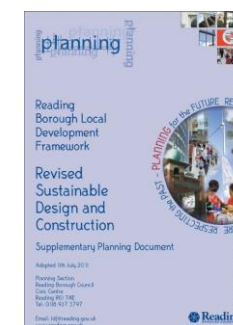
Since the publication of the Core Strategy and the SPG of Sustainable Design and Construction (see below) CfSH has been revoked by the government thus negating the requirements for CfSH set out within Core Strategy Policy CS1.

Reading Borough Council Revised Supplementary Planning Document on Sustainable Design and Construction – July 2011

It is stated within this document that:

- Recent changes to the Building Regulations mean that the requirement in (Core Strategy) Policy CS1 to 'offset at least 20% of predicted carbon dioxide emissions' has now been superseded for both residential and non-residential developments.*

The document contains a Sustainability checklist which has been used to assess the Station Hill Development. Please refer to the Sustainability Statement for details of this.





Reading Station Area framework – Adopted in December 2010. Specifically chapter 10 on Sustainability.

Paragraph 10.5 reinforces Core Strategy Policy CS1 by stating that:

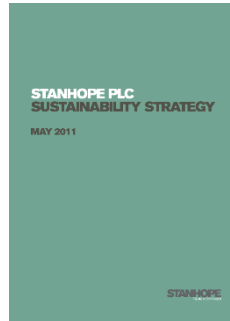
‘Given the mixed nature plus scale and density of the development likely to come forward in the Station Area, decentralised energy should be considered for all developments in this area as part of the requirements of meeting policy CS1.’

2.4 Pre-Application Consultation

The sustainability strategy for this development has been discussed with Thames Valley Energy (TVE), on behalf of Reading Borough Council, at a sustainability and energy strategy meeting. The discussions were based on an initial energy strategy note which was issued prior to the meeting. Following the meeting minutes were issued to all parties. The strategy laid out in the initial note was well received by TVE, with only a few recommendations for further investigation in the energy strategy, which have been addressed.

The scheme aims to provide exemplary environmental performance. On January 12th 2015 outline planning permission was granted for the Station Hill Development. It is now proposed to incorporate the neighbouring Telecom House Site (48-51 Friar Street & 4-20 Garrard Street) to enable the development to incorporate an additional 12,000 m² GEA of residential floor space (and associated back of house areas) in order to deliver up to 175 more homes than the 2015 outline planning permission. This updated energy strategy takes into account the enlarged scheme and builds on the discussions undertaken with the Planning Authorities and their consultants (Thames Valley Energy - TVE) previously. The proposed strategy remains broadly the same, though with updates due to changes in Building Regulations and planning guidance.

2.5 Stanhope's Corporate Sustainability Agenda



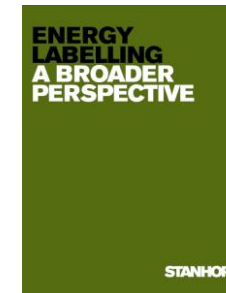
Stanhope Sustainability Policy, May 2011

Stanhope are determined to ensure their projects make sense in a lower carbon and resource constrained world, with the following priorities:

- Environment and natural resources:
 - Prevent pollution and comply with environmental legislation.
 - Use resources efficiently and reduce waste, with targets for energy efficiency, carbon reduction, water reduction, recycling and sustainable materials.
- Regeneration and access:
 - Focus on urban brownfield sites for long-term regeneration.
 - Access to sustainable forms of transport as a key consideration.
 - Community development: Create local opportunities to improve skills and employment, working with existing local initiatives.
- Occupier satisfaction: post-occupancy research to ensure that the intended sustainability benefits are delivered, and learn for future projects.
- Independent assessment: Apply credits from schemes such as BREEAM and the Code for Sustainable Homes where meaningful.

In addition, specific targets apply to operational energy and carbon:

- New office buildings: Energy Performance Certificate of B or better
- 10% on or near site low / zero carbon supply, OR enabling / connecting to local decentralised energy network equivalent to 10% of operational energy
- For major occupiers. provide an energy and occupancy audit of the fit out
- Enable all operators and occupiers to monitor and manage their energy use.



Stanhope Energy Strategy

Stanhope's approach to energy consumption and carbon emissions is to focus on wider issues than the Energy Performance Certificate, in particular:

- Reduce the performance gap between design and operation by enabling the management of the building to monitor and control energy efficiency.
- Take account of carbon associated with transport
- Take account of embodied carbon.

3.0 Approach

This report formally outlines how the Proposed Development will have a reduced impact on climate change by reducing CO₂ emissions.

This Energy Strategy is for the entire development and focuses on targets. For the purposes of providing a benchmark indicative passive design and energy efficiency measures have been included within this assessment. As the detailed design is taken forward the precise measures will be confirmed.

After the inclusion of these passive design and energy efficiency measures, various options have been investigated to reduce CO₂ emissions associated with energy supply. The feasibility of several Low or Zero Carbon Technologies has been investigated.

Therefore the approach to energy efficiency and the integration of renewable energy sources and Combined Heat and Power (CHP) is split up into three sections:

- Section 4.0 is dedicated to the performance targets in terms of energy efficiency and the indicative passive design and energy efficiency measures which will help the development to show a reduction in carbon emissions when compared to Part L 2013 before the implementation of low carbon energy sources
- Section 5.0 summarises the assessment of energy consumption and CO₂ emissions (with passive design and energy efficiency measures but prior to the contribution from Low or Zero Carbon Technologies)
- Section 6.0 is dedicated to infrastructure
- Section 7.0 is dedicated to Low or Zero Carbon technologies (i.e. CHP and renewables)

4.0 Passive Design and Energy Efficiency Measures

An important role of this Energy Strategy is to establish a framework for the energy performance of the individual buildings from passive design and energy efficiency, before the contribution from any Low or Zero Carbon technologies.

4.1 Target Improvements over Part L 2013

The Proposed Development is a composite of different uses. The diverse nature of the spaces (e.g. retail, residences, offices or leisure) and their BREEAM aspirations have led to the adoption of specific targets compared to Building Regulations 2013. It should also be noted that carbon improvements are more difficult to achieve on some building types than on others. The following targets were therefore set:

Residential

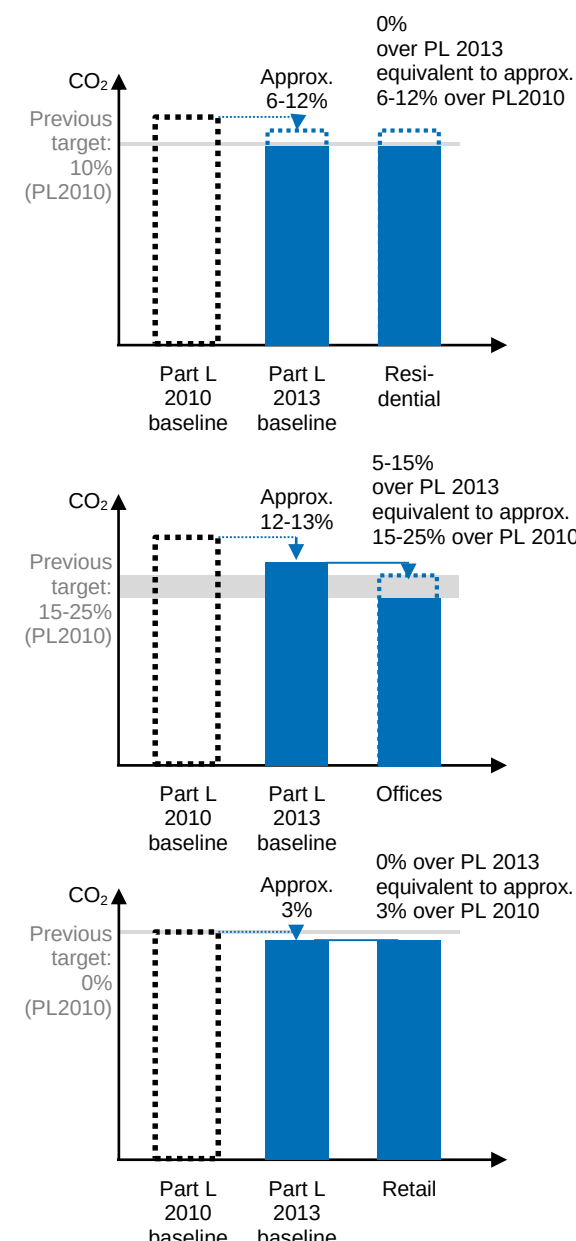
It is proposed that on an area-weighted average basis the apartments would achieve compliance with Part L 2013 from passive design and energy efficiency only. This is estimated to be approximately equivalent to the previous outline strategy proposal (10% improvement on Part L 2010).

Offices

It is proposed that each of the office buildings as a whole achieve an ambitious 5-15% improvement over Part L 2013 from passive design and energy efficiency. This is estimated to be approximately equivalent to the previous outline strategy proposal (15-25% improvement on Part L 2010). While significant benefits will be achieved through the provision of central (building-by-building) heating and cooling, guidance will also be provided to individual office tenants on low-carbon fit out design solutions.

Retail

The operation of these spaces and their development (e.g. most of the retail units will be designed as shell and core units only) have led to the conclusion that the target performance should only be to comply with Part L 2013. This is estimated to be approximately a 3% improvement on the previous outline strategy proposal (meeting Part L 2010). Demonstration of this level of compliance will be the responsibility of each tenant unless an overarching compliance strategy is agreed with Building Control (e.g. tenant fit-out guide).



4.2 Indicative Passive Design and Energy Efficiency Measures

The Energy Strategy offers flexibility for each building to achieve the target level of improvement over Part L 2013 from passive design and energy efficiency with the appropriate combination of building specific measures. Therefore, this document does not detail the strategy which will be adopted for each building, but a number of key overarching principles that will be followed are set out below.

Principle 1 – A façade design which limits solar gains

Commercial buildings

Part L2A of the 2010 Building Regulations, which covers the conservation of fuel and power in new buildings other than dwellings includes Criterion 3 which focuses on limiting the effects of solar gains in the summer.

All spaces in each office building and retail spaces will have to demonstrate that the solar gains through the facade, aggregated over the period from April to September inclusive are no greater than would occur through the reference facade systems.

The relevant reference glazing system is described as follows: *'for every space that is defined in the NCM database as being side lit, the reference case is an east facing façade with full width glazing to a height of 1.0m, having a framing factor of 10% and a g-value of 0.68'.*

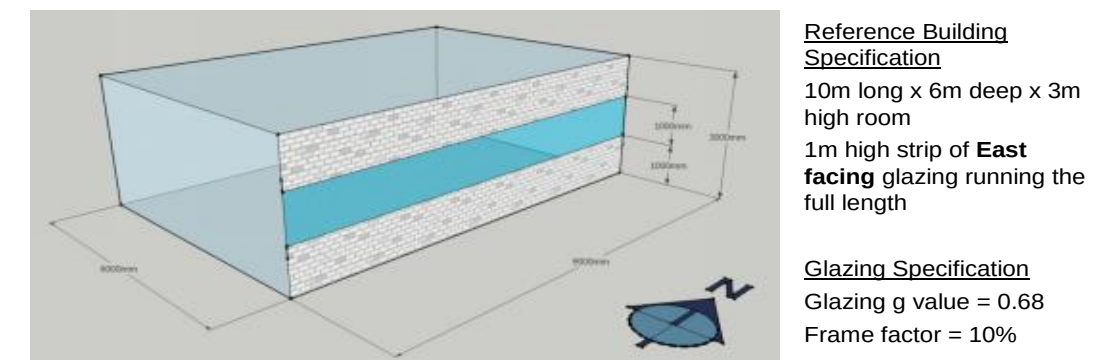


Figure 4.1: Reference façade for Part L Criterion 3

Various strategies will be investigated for each of the façades to ensure that they meet Criterion 3, including the proportions of glazing, the density of vertical elements and their width, the recess depths of the glazing, etc. measures being considered in particular include:

- As an indicative starting point, a good solar control glazing with a g-value of 0.4-0.45 is being targeted for all façades.
- It is recommended for all of the buildings to have an insulated panel in front of the bulkhead in order to reduce solar gains.

- Another key parameter is to vary the recess (i.e. the distance between the edge of the glass and any external horizontal and vertical solid elements shading the façade) depending on the orientation.

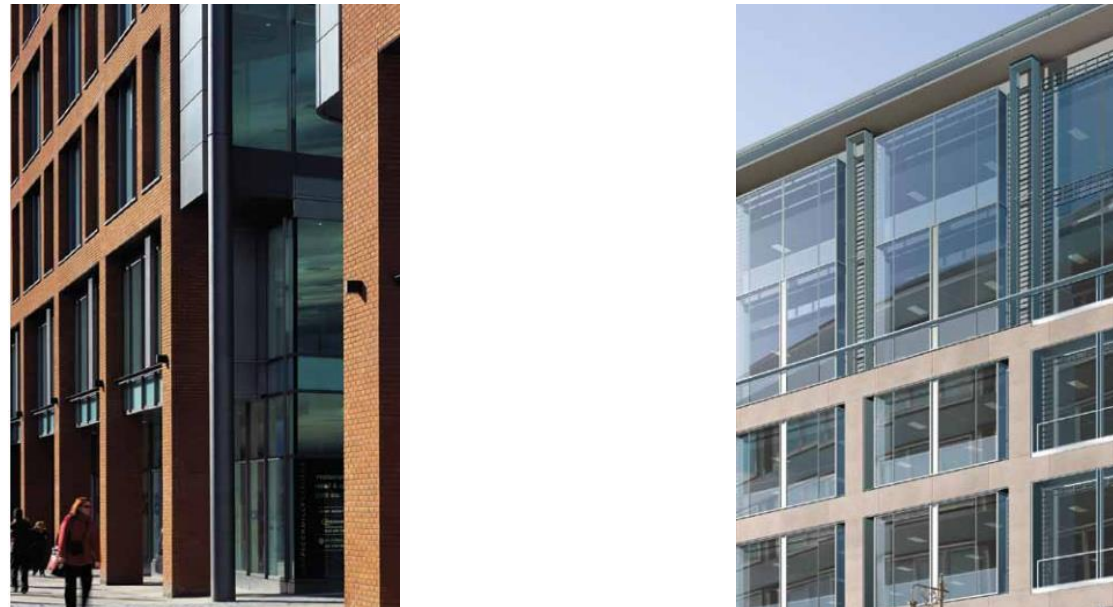


Figure 4.2: Illustrative design responses for various elevations: Recesses, opaque areas, tinted glass with high solar protection

The texture and reveals introduced in order to create an external shading effect, associated with the reduced proportions of glazing and the performance of the glass, can be combined to create office buildings which significantly exceed the energy performance of fully glazed design scenarios.

Residential Buildings

For the residential buildings, Criterion 3 of the Building Regulations Part L1A, which covers the conservation of fuel and power in new dwellings, differs as it considers the overall risk of overheating rather than solar gains only. Similar principles will however be adhered to in order to meet the criterion, with appropriate percentage of transparent glazing and/or external shading (including balconies) reducing solar gains in the summer and therefore minimising overheating risk. As a result, summer solar gains in the residential buildings will be controlled through careful proportions of glazing, glazing selection (e.g. glazing solar protection factor below 0.55) and shading devices. This should help to achieve comfortable conditions for residents without the need for mechanical cooling.

Principle 2 – An energy efficient envelope which minimises heat losses

Heat losses through the fabric will be further limited by the optimisation of insulation. U-values will be reviewed as part of the design development, but are typically likely to be at least as low as the following:

- External wall U-value: 0.25 W/m².K (compared to 0.35 W/m².K as limiting Part L 2013 value)

- Window U-value: 1.40 W/m².K (compared to 2.2 W/m².K as limiting Part L 2013 value).

All buildings will be designed and built to high standards to reduce air infiltration rates. A maximum air permeability rate of 5m³/h/m² at 50 Pa is likely to be achieved across all buildings (compared to 10m³/h/m² at 50 Pa allowed as maximum by Part L).

Part L1A 2013 has introduced Fabric Energy Efficiency Standards (FEES) for residential buildings. This is a measure of the performance of the façade alone, separate to the assessment of the carbon performance of each dwelling. The residential buildings facades will aim to comply with the level of FEES required in Part L 2013.

Principle 3 – Energy efficient building services

The central gas boilers will be very efficient. The gas boilers in the plant rooms (and potentially in the residential energy centre if implemented) will be selected with a targeted seasonal efficiency of 92%, which will reduce gas requirements. Each commercial building will be equipped with its own cooling plant, which will be highly efficient. Seasonal efficiencies (SEER) are currently expected between 4.05 and 5.5.

The thermal distribution network will be insulated beyond the requirements of the relevant standards to reduce distribution losses. The distribution will also be properly metered to make sure that its efficiency can be monitored and improved upon.

Dwellings will be equipped with separate, very energy efficient Mechanical Ventilation with Heat Recovery (typically, Specific Fan Power between 0.6 and 0.8 W//s and Heat Recovery Efficiency between 85 and 92%).

Commercial spaces will be served with very efficient ventilation and cooling systems, typically:

- As preferred option, fan coil units, with EC/DC fan coil units selected for their high efficiency and high level of control
- Alternatively, displacement ventilation with low Specific Fan Power and chilled beams

Heat recovery will also be implemented (e.g. thermal wheel systems, which are highly efficient). A Heat Recovery efficiency of 70% is targeted.

Heat recovery on the ventilation systems will be equipped with a summer bypass to assist with maintaining comfortable internal conditions and reducing cooling requirements.

Other features likely to be considered at the next design stage include:

- High Efficiency Variable Speed Drives: By varying the fan and pump speeds for the chilled water, low temperature hot water and ventilation systems in order to match the building heating and cooling load profiles, fan and pump energy consumption is considerably reduced. This will be maintained and controlled through constant monitoring via the BEMS (Building Energy Management System).
- Power Factor Correction of 0.95 or greater, thus improving the efficiency of the electrical supply

Principle 4 – Energy efficient lighting

All fixed lighting fittings in the dwellings will be energy efficient.

In offices, the specification of the lighting types and spacing of the fittings should generally be limited to provide an intensity of 400 lux on the working plane using high efficiency lamps, thereby limiting power requirements as well as cooling requirements necessary to offset the lighting heat gain. A target efficiency has been proposed of approximately 10 W/m², with the investigation of further improvements to 8 W/m². High frequency ballasts will be used to improve occupant well-being and energy efficiency. The lettable office lighting installation will generally comply with CIBSE SLL Lighting Guide 7: Office Lighting and SLL Code for Lighting (2012).

Lighting controls will be implemented in communal and office areas, and encouraged in retail areas:

- Time controls
- PIR movement detectors to monitor occupancy and switch off the lights when the area is vacant for a sustained length of time (where appropriate)
- Intelligent dimming in perimeter office areas to monitor daylight and adjust the lighting intensity accordingly. 'Back space' sensor will also be encouraged to ensure that lighting in this perimeter area is accurately controlled in order to maximise energy savings.

Principle 5 - Building Energy Management System and Metering

A comprehensive Building Energy Management System ('BEMS') will be installed in the commercial buildings to monitor and report energy consumption. The system will highlight any out-of-range consumption figures and readings, allowing a preventive approach through interrogation and resolution of potential problems.

In the commercial areas, metering of energy usage (i.e. heating, cooling, and electricity) on all floors and for each tenancy will allow building owners / occupiers to view and interrogate where potential energy savings can be made.

5.0 Energy Demand Assessment

5.1 Energy Consumption Benchmarks

As the scheme is only at outline stage of design, typical Part L modelling results from similar schemes have been used to develop the energy strategy, along with energy benchmarks for energy uses not covered by Part L:

- Offices: typical air-conditioned office, 10% lower than Part L 2013 compliance
- Residences: typical residences with mechanical ventilation and heat recovery, without cooling.
- Retail: previous modelling results 'notional buildings' used as benchmark, weighted average of 75% 'clothes shop' and 25% 'restaurant with bar'
- Leisure: previous modelling results 'notional buildings' used as benchmark

The resulting energy consumption benchmarks are as follows:

Table 5.1: Energy Consumption Benchmarks for the Proposed Development
(Energy Efficient Scheme, before the inclusion of Low/Zero Carbon Energy Sources)

Space	Heating (gas)	Cooling (electricity)	Auxiliary (electricity)	Lighting (electricity)	Hot Water (gas)	Unregulated (electricity)
	(kWh/m ² /yr)	(kWh/m ² /yr)	(kWh/m ² /yr)	(kWh/m ² /yr)	(kWh/m ² /yr)	(kWh/m ² /yr)
Offices	4	6	21	17	5	44
Retail A1	4	7	16	56	2	18
Retail A3	6	9	44	55	44	115
Residential	27	0	1	4	32	32
Leisure	41	0.3	9	13	227	64
Back of House	5	0	0	15	0	0
Car Parking	0	0	0	1	0	0

The energy consumption benchmarks have been applied to the *maximum* areas of the Proposed Development:

- Office: max 122,000 m² GEA
- Retail and related uses (A1-A5): max 13,500 m² GEA
- Leisure: max 2,200 m² GEA
- Residential: max 41,500 m² GEA
- Back of House facilities: max 3,200 m² GEA
- Associated car parking and external areas: approximately 25,000 m².

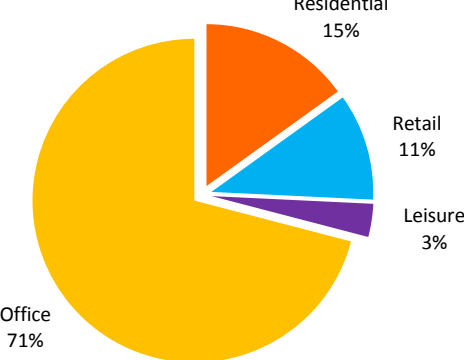
5.2 Assessment of Energy Consumption and CO₂ Emissions

Energy consumption

Table 5.2: Energy Consumption Breakdown at the Proposed Development
(Energy Efficient Scheme, before the inclusion of Low/Zero Carbon Energy Sources)

Space	Heating (gas)	Cooling (electricity)	Auxiliary (electricity)	Lighting (electricity)	Hot Water (gas)	Total (regulated)
	(kWh/yr)	(kWh/yr)	(kWh/yr)	(kWh/yr)	(kWh/yr)	(kWh/yr)
Offices	513,000	732,000	2,467,000	1,992,000	564,000	6,269,000
Retail A1	41,000	67,000	160,000	547,000	17,000	832,000
Retail A3	20,000	30,000	145,000	180,000	143,000	517,000
Residential	868,000	0	36,000	134,000	1,043,000	2,081,000
Leisure	87,000	1,000	20,000	28,000	485,000	619,000
Back of House	15,000	0	0	48,000	0	63,000
Car Parking	0	0	0	25,000	0	25,000
Total	1,544,000	830,000	2,828,000	2,954,000	2,252,000	10,406,000

Energy Consumption at Station Hill
Breakdown by Space Type (kWh/year)



Energy Consumption at Station Hill
Breakdown by End Use (kWh/year)

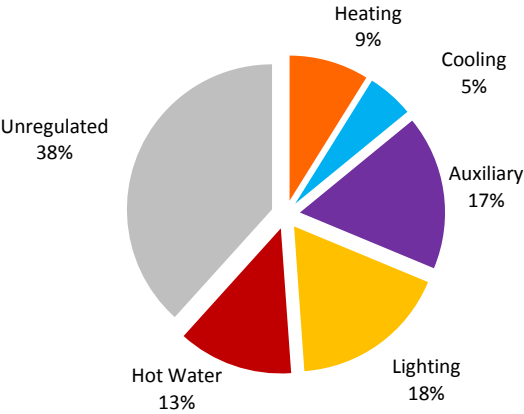


Figure 5.1: Estimated energy consumption breakdown by areas and end-uses (before LZC sources)

CO₂ emissions

The predicted carbon dioxide emissions for the development have been calculated using the following carbon dioxide emission factors (source: Part L 2013):

- Natural gas: 0.216 kgCO₂/kWh
- Grid supplied electricity: 0.519 kgCO₂/kWh

Table 5.3: CO₂ Emissions Breakdown for the Proposed Development
(Energy Efficient Scheme – no contribution from low carbon energy sources)

Space	Heating (gas) (kgCO ₂ /yr)	Cooling (electricity) (kgCO ₂ /yr)	Auxiliary (electricity) (kgCO ₂ /yr)	Lighting (electricity) (kgCO ₂ /yr)	Hot Water (gas) (kgCO ₂ /yr)	Total (regulated) (kgCO ₂ /yr)
Offices	111,000	380,000	1,280,000	1,034,000	293,000	3,098,000
Retail A1	9,000	35,000	83,000	284,000	4,000	414,000
Retail A3	4,000	15,000	75,000	93,000	31,000	219,000
Residential	188,000	0	19,000	70,000	225,000	501,000
Leisure	19,000	0	10,000	14,000	105,000	148,000
Back of House	3,000	0	0	25,000	0	28,000
Car Parking	0	0	0	13,000	0	13,000
Total	334,000	430,000	1,467,000	1,533,000	658,000	4,421,000

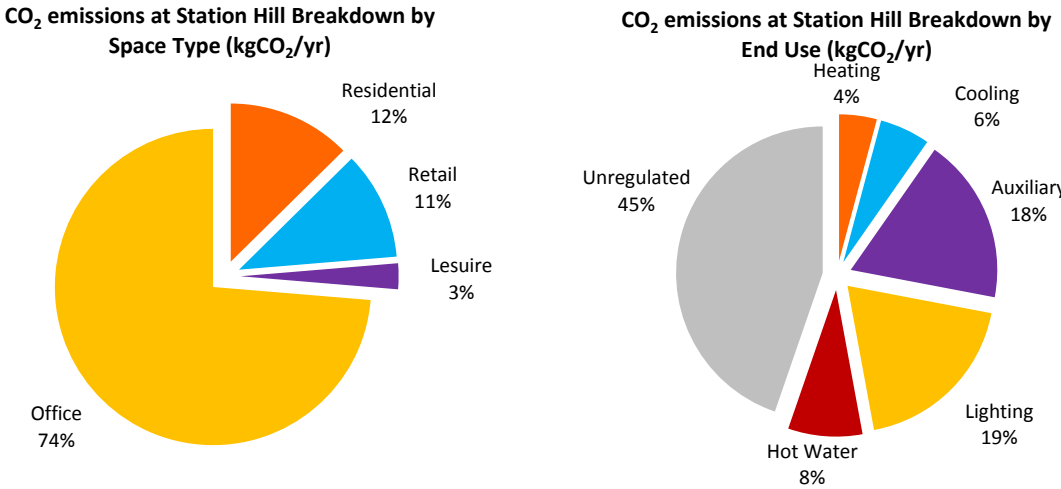


Figure 5.2: Estimated CO₂ emission breakdown by areas and by end uses
Energy Efficient Scheme – no contribution from low or zero carbon energy sources

It can be seen from the above pie chart that unregulated electricity and offices represent the dominant sources of energy consumption and CO₂ emissions at the Proposed Development.

A key aspect of the development's energy profile is the breakdown of thermal load (space heating and domestic hot water) between the different uses. As represented in the figure below, the residential elements are the main source of thermal load, responsible for approximately 65% of the total thermal load.

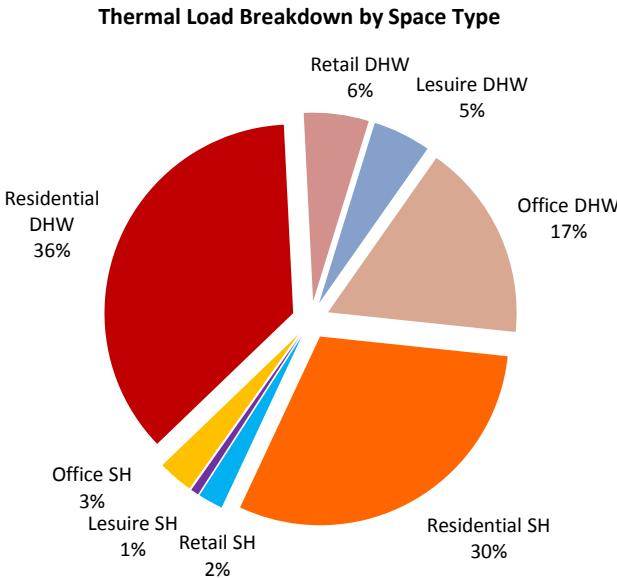


Figure 5.3: Estimated breakdown of annual thermal load by space type

6.0 Infrastructure

6.1 Current Proposals

The infrastructure proposals intend to allow efficient operation and a commercially viable, flexible development programme. They have been informed by the following:

- The expected phasing of the scheme, with the commercial elements built in the first phases and the residences in the later phases.
- The site's energy profile, which is commercial-led, dominated by electrical uses and with the domestic hot water load mostly provided by the residential elements in the later phases.

It is therefore proposed that commercial buildings be provided with building-by-building plant rooms hosting heating and cooling plant in order to be able to operate from day one.

For the residential areas two options exist, subject to review at the detailed design stage:

- Option 1: Each residential building to be served by its own plant room. This allows for flexibility for potential design changes within the detailed design stages and phasing. A CHP could potentially serve plot E in this scenario, though the building is estimated to be on the lower limit for size. This option would therefore be subject to commercial viability. Plot F would be estimated to be too small for CHP in this scenario (expected less than 200 residential units).
- Option 2: An energy centre serving both residential plots (plots E&F) could in theory be implemented, and CHP incorporated on completion of the Plot E elements once a sufficient quantum of units and thermal load exists (usually 250-300 residential units are recommended to make CHP viable due to the base thermal load needed to operate the system efficiently). This energy centre could serve plot F as well. This strategy will be reviewed against the phasing strategy as well as technical and financial viability at the detailed design stage.

Table 6.1: Recommended design temperatures

Design Temperatures, °C	Primary side		Secondary side	
	Flow	Return	Flow	Return
Space heating new existing	115-110	55	70-80 80	40-50 60
DHW	70	max. 25	55	10

It should be noted that the space heating secondary side temperatures depend on the internal heat distribution system being used.

An area of approx. 84m² has currently been allocated for the residential energy centre in Plot F, to be reviewed as design progresses.

6.2 Future Proofing and Possible Extension of Community Energy

There is no known existing district energy scheme in the direct vicinity of the site.

There is a planned development proposed directly adjacent to the Station Hill development ('Thames Tower'). No connection to it is currently proposed, for the following reasons:

- The Thames Tower scheme is understood to also be commercial-led and it is therefore not expected that a connection would offer significant carbon benefits (i.e. it would not substantially increase the thermal load and not allow significantly increased CHP capacity)
- The viability of district energy would rely on suitable construction programmes and certainty on delivery to allow saving in capital equipment. This is considered too uncertain at this stage.

The Station Hill scheme will be future-proofed to allow the expansion of low carbon district energy:

- The proposal for a potential energy centre with CHP and thermal stores could provide a certain level of future proofing in itself, with potential space and infrastructure to facilitate the implementation of other large scale low carbon technologies in the future, as they become available. Biomass heating (for boilers or CHP) has been given initial consideration but would be subject to a detailed review of air quality, storage space, and fuel delivery implications at the detailed design stage.
- As part of the detailed design, locations for plate heat exchangers in the commercial blocks will be identified, as well as possible routes for connection to a central district energy scheme, should this be viable in the future.
- As part of the detailed design, location for a plate heat exchanger in the potential residential energy centre would be identified (e.g. in place of a boiler), as well as possible routes for connection to a wider district energy scheme in the vicinity, should this exist in the future.

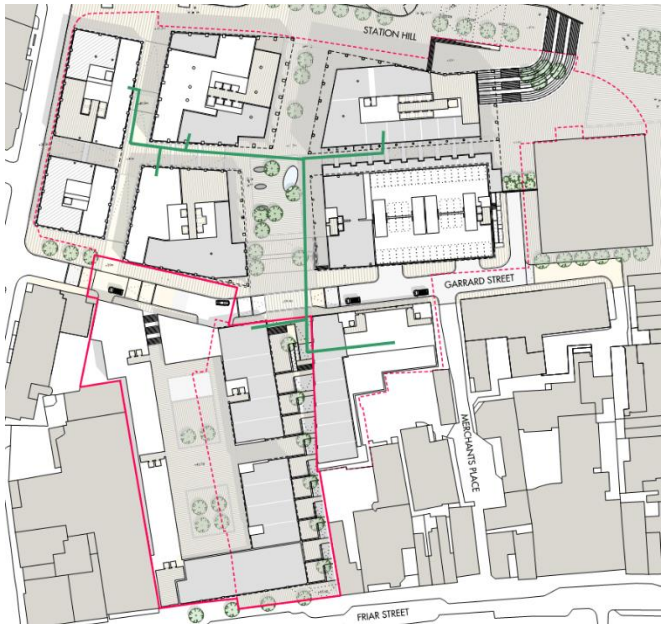


Figure 6.1: Potential future district energy routes to commercial buildings shown in green (indicative only at this stage).

7.0 Appraisal of CHP and Renewable Energy Sources

7.1 Appraisal of a Low Carbon Energy Source: CHP and CCHP

This section covers a low carbon, or ‘clean’ energy source: Combined Heat and Power (CHP). CHP or ‘Co-generation’ is the on-site generation of electricity and the heat. If distribution losses are minimised through appropriate insulation, metering and monitoring, this can lead to substantial CO₂ savings.

The Station Hill residential element lends itself to the implementation of CHP because of its size and year-round demand for domestic hot water, in addition to space heating. As described in section 6.1, two options exist for implementation of CHP on the Station Hill site subject to review at the detailed design stage:

- Option 1: An energy centre serving the residential areas (plots E / Telecom House & Plot F)
- Option 2: CHP Serving plot E / Telecom House alone

CHP has been considered within the following parameters:

- Assumed phasing and resulting thermal load build-up.
- Electrical demand – annual demand (kWh) and electrical load (kW) of each building. For commercial viability reasons, producing electricity at times of low demand should be avoided as this could lead to exporting electricity to the grid under potentially disadvantageous financial conditions.
- Thermal demand – if implemented, the CHP would be proposed to operate with large thermal stores in order to help reduce starts/stops and ensure it can operate at times of low thermal demand to produce electricity, with heat stored and then used when thermal demand increases.

The following assumptions have therefore been used:

- Potential CHP implementation to suit the development phasing, once a sufficient quantum of residential units has been built
- CHP to meet a maximum of 100% of the annual residential domestic hot water load and max 40% of the annual residential space heating load
- For commercial viability reasons, CHP should run for at least 5,000 full load equivalent hours per year.
- CHP to run a maximum of 6,000 full load equivalent hours a year to allow for maintenance times and to reduce operation at times of low electrical demand, when export to the grid may otherwise be required under financially disadvantageous conditions
- Commercially available CHP units have been used for the calculations. The actual specifications of the CHP plant will be determined as design develops, but using commercially available engines helps ensure that the predicted performance is achievable.

It should be noted that the calculations at this stage have been based on the maximum areas proposed for each use in the scheme. The size of CHP plant and its contribution is indicative only at this early stage, and will be reviewed as the accommodation schedule is confirmed and the design develops – for example, a reduction in residential areas in percentage terms would lead to a reduction in the CO₂ savings from CHP in relation to the overall scheme, while a reduction in the commercial elements would lead to higher CO₂ savings from CHP in proportion to the overall scheme.

Table 8.1: Estimated potential energy contribution from CHP at the Proposed Development

Energy source	Running hours per year (full load equivalent)	Annual thermal output (kWh/yr)	Annual electrical output (kWh/yr)	Net annual CO ₂ savings (kgCO ₂ /yr)	Net annual regulated CO ₂ reductions, for Plot E (option 1), or Plots E&F (Option 2)	Net annual regulated CO ₂ reduction site-wide	CHP unit assumed
Option 1: 110 kWe CHP (And associated thermal stores)	5,500	1,007,000	602,000	59,000	10-15%	1.3%	1 No 110kWe (184kWth / 364 kW gross fuel input)
Option 2: 173 kWe CHP (And associated thermal stores)	6,000	1,579,600	1,035,000	114,000	10-15%	2.5 %	1 No 173kWe (264kWth / 536 kW gross fuel input)

The incorporation of gas-fired CHP unit is estimated to lead to a 10-15% carbon reduction in the residential areas, equivalent to an approximate 1.3-2.5% reduction on regulated CO₂ emissions for the whole site, after passive design and energy efficiency measures.

The carbon reduction from CHP is estimated to be lower than it was in the previous outline proposal. This is due to changes to the carbon factors within the Building Regulations, which affect the estimated proportional carbon reductions from CHP.

As the carbon emissions from implementation of CHP are small on a site-wide basis, and in order to allow flexibility within the phasing plan of the development, it is recommended that this strategy is reviewed against technical and financial viability at the detailed design stage.

Please note that the size of CHP plant and its contribution is indicative only at this early stage, and will be reviewed as the accommodation schedule is confirmed and the design develops – for example, a reduction in residential areas would lead to a reduction in the CO₂ savings from CHP in relation to the overall scheme, while a reduction in the commercial elements would lead to higher CO₂ savings from CHP in proportion to the overall scheme. The sizes estimated here however (110kWe or 173kWe) are based on the current area schedule and estimated energy uses (as described in section 5.0), and are expected to be a good approximation of the size needed based on these inputs.

Combined Cooling, Heating and Power (CCHP) has been investigated. However, there are a number of constraints which have led to the conclusion that a centralised provision of cooling and CCHP would not be appropriate, including:

CCHP would have significant maintenance implications

- CCHP and district cooling would have significant capital cost implications
- Absorption chillers have significant heat rejection requirements and would operate with cooling towers, which are not considered acceptable on a sensitive site
- Cooling is expected to represent a small proportion of CO₂ emissions at Station Hill and CCHP could therefore deliver only limited CO₂ savings compared to high-efficiency mechanical chillers.

7.2 Appraisal of Large Scale Low Carbon Sources

A number of LZC technologies could in theory be implemented in the potential Energy Centre, alongside of or in place of gas CHP. An initial appraisal has been carried out as follows:



Biomass CHP

Biomass CHP combusts biomass material in a CHP plant. The process usually involves either burning the fuel in a boiler and driving a turbine from steam or the boiler fuel gases, or converting the solid biomass fuel into gas which then drives a CHP engine. Similar to biomass boilers, biomass CHP requires regular fuel deliveries and should be subject to an air quality assessment. It is a relatively new technology in the UK, particularly at the size that would be suitable for Station Hill (existing installations are typically of larger size, min 1-2MWe, than would be suitable at Station Hill) and have significant maintenance, space and logistics implications.

Biomass CHP is therefore **not considered suitable for Station Hill** due to current commercial availability at this scale. It is in theory possible that it could be implemented in the future as technologies develop but this would need to be subject to an assessment of thermal load, air quality, and logistics (deliveries, transport, fuel storage), as well as commercial viability.



Energy from waste, e.g. Anaerobic Digestion

Energy from waste technologies such as Anaerobic Digestion (AD) can turn organic waste into fuels such as biogas to be then burnt in a CHP engine in order to generate heat and electricity. These technologies are suitable for much larger scales than at Station Hill, and are therefore **not proposed**. They are however identified as potential technologies for the future network, and may therefore benefit the Station Hill site in the future.



Fuel cells

Fuel cells are electro-chemical devices which generate electricity by combining oxygen and hydrogen, without combustion or moving parts. They are still a relatively new technology with short lifetimes and high capital costs. An important other issue is the lack of readily available hydrogen: there is currently no established supply chain for hydrogen in the UK, and currently most available fuel cell products are fed from gas, which is used directly or converted internally into hydrogen for use in the cell. These gas-fed products are then essentially CHP products (fuel cell based rather than engine/turbine based) and do not typically offer CO₂ savings compared to engine or turbine based CHP.

Fuel cells are not currently considered viable, but they are one of the potential technologies that may be implemented at Station Hill in the future as hydrogen supply and commercial products develop.

No large scale LZC technology is currently proposed to operate in lieu of or alongside the CHP plant in the Energy Centre.

7.3 Appraisal of Other Low Carbon Sources

A number of renewable energy sources have been considered for the Proposed Development.

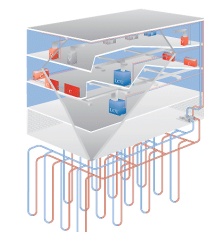
- The first table provides a general introduction to the renewable energy systems considered;
- benefits and is followed by an analysis explaining why certain renewable energy technologies have not been considered appropriate for the Proposed Development.

Potential small- and medium-scale LZC sources at Station Hill



Solar Water Heating

Solar water heating systems use energy from the sun to pre-heat domestic hot water. Solar water heating systems are generally composed of solar thermal collectors and a fluid system to move the heat from the collector to a storage tank to store the heat for subsequent use. The system requires solar panels on the roof, ideally south facing, linked to hot water storage cylinders.



Ground Source Heat Pump

Ground source heat pumps can be used to extract heat from the ground by circulating a fluid through a system of pipes to a heat exchanger which transfers the energy to the distribution network. This can provide space heating and/or pre-heat domestic hot water. Ground source heat pumps have the advantage that they can act as a source of both heating and cooling for the buildings. Ground source heat pumps are either open-loop (extracting and rejecting water to the aquifer below the site) or closed-loop.



Biomass

Biomass heating systems combust biomass material in a biomass boiler in order to heat water in the same way that gas boilers combust gas. Biomass materials include all land and water based vegetation, e.g. wood chips, wood pellets. The carbon dioxide emitted from burning biomass is balanced by that absorbed during the fuel's production. Biomass heating therefore approaches a carbon neutral process. Biomass boilers require storage adjacent to the boiler to be provided. The fuel is then delivered on a regular basis.



Wind Power

Wind turbines use the wind's forces to turn a rotor which in turn generates electricity. Wind power is used in large scale wind farms for national electrical grids as well as in small individual turbines or building integrated turbine.



Photovoltaic Electricity Generation

Photovoltaic modules are devices or banks of devices that use the photovoltaic effect to generate electricity directly from sunlight. Current applications to buildings include roof-mounted PVs, PV curtain walling systems and PV louvred external shading devices.

The table below summarises the maximum theoretical contribution from renewable energy sources.

Table 8.2: Potential contribution from renewable energy sources at the Proposed Development

Energy source	Annual thermal output (kWh/yr)	Annual elec. output (kWh/yr)	Net annual CO ₂ savings (tCO ₂ /year)	Net annual CO ₂ reduction after potential implementation of CHP (regulated) (%)	Sizing and performance notes
Solar water heating panels (150 m ²)	68,500	-	23	0.5 %	Area of panels sized to 150 sqm of roof as estimated available – see figure 8.1 Thermal output assumed to be 500kWh/m ² .
Open Loop Ground Source Heating and Cooling (10kW)	32,500 (Heating) 29,900 (Cooling)	-	7	0.2 %	Plot A is the only plot estimated to have distances great enough to accommodate the required separation between aquifer intake and output boreholes (see figure 8.2). Sizing therefore based on one pair of open-loop boreholes with heat pump serving Plot A, used to meet up to 30% of annual space heating and up to 30% of annual cooling, with balanced amounts of heat rejected to and taken from the ground. The limiting factor is therefore the heating demand. Assumed to operate with COP = 4 in heating mode and COP = 8 in cooling mode (i.e. best operating with high-temperature cooling systems).
Closed Loop Ground Source Heating and Cooling (65kW)	162,400 (Heating) 179,100 (Cooling)	-	24	0.6 %	Based on closed-loop heat pump systems serving all commercial areas and meeting up to 30% of annual space heating and up to 30% of annual cooling, with balanced amounts of heat rejected to and taken from the ground. The limiting factor is therefore the heating demand. Assumed to operate with COP = 4 in heating mode and COP = 4 in cooling mode
Biomass boiler (120 kW)	243,400	-	42	1.0 %	Biomass boiler sized to cover up to 30% of the annual residential space heating load. Assumed 2,000 operating hours at varying load.
Small vertical axis wind turbines (7 No 6kW)	-	35,700	18	0.4 %	Based on 1 No 6kW wind turbine on the roof of each of the 7 buildings on site
Solar PV modules (150 m ²)	-	15,000	8	0.2 %	Area of panels sized to 150 sqm of roof as estimated available – see figure 8.1 Annual power output 850kWh per kW peak output on average, and 8sqm per kW peak.

The following conclusions were drawn from this preliminary analysis:

- ✗ **PVs on the roofs** are the most appropriate option due to the load profile of the site and their limited maintenance requirements, suited to speculative commercial development. The roofs in the development will have to accommodate roof top plant, brown roofs, and amenity space. When all these things are considered only small areas are available for PV panels divided between three locations on top of plots F and G (approx. 75 m², 100 m² and 125 m² respectively). This would allow for a maximum of 150 m² of PV panels to be incorporated on site when taking into account the necessary spacing requirements for access, eliminating overshadowing etc. The fact that the PV provision would be split between several areas would mean that an inverter would have to be installed for each separate plot, resulting in a decreased efficiency of the arrays. The PV provision would contribute only 0.2% carbon savings to the scheme. This very limited carbon saving is not thought to be a sufficient benefit to the scheme, and PV panels are therefore not recommended for this scheme at this stage. Tenants could in theory implement PV panels in the future on the roofs of their buildings, should they consider this viable at the time.



Figure 8.1: Rooftop areas theoretically suitable for Photovoltaic panels (shown in blue)

- ✗ **Vertical PVs on the façade** were also considered but based on their reduced efficiency (-25% compared to the roof mounted PVs) and the difficulty of integrating them in the current façade design (which consists of vertical elements with stone cladding), they were not considered appropriate.
- ✗ **Open-loop and closed-loop ground source systems** are not considered appropriate for the Proposed Development. The main reasons are the following:
 - Ground source systems have only been considered for the commercial areas, since the residential areas are not proposed to have cooling and most of their thermal load will be

served by the CHP. The commercial cooling and heating demands are significantly imbalanced and therefore, for the ground source system itself to be balanced (i.e. to reject and abstract as much heat in/from the ground on an annual basis), its size and operating hours would be limited by the heating contribution, much reducing the potential contribution in cooling mode.

- **Closed-loop:** As the system would be compared against an efficient 'baseline system' (particularly the chillers which will have a high seasonal efficiency of at least 4.5, the potential CO₂ savings of closed-loop systems would be very limited (approx. 0.6% for a system that would serve 30% of the space heating loads of all commercial areas, and approx. 6% of the cooling load to ensure balanced amounts of heat rejected to and taken from the ground), and are not considered to justify the cost and technical implications of such a system.
- **Open-loop** systems, subject to a suitable aquifer, could in theory offer carbon savings compared to efficient boilers and chillers, particularly if they operate alongside high-temperature cooling systems (e.g. chilled beams). This is however highly dependent on a suitable aquifer and would need to be determined via a desktop study, followed by detailed aquifer and building load modelling, and finally by a test borehole and licence application with the Environment Agency. The boreholes would need to be suitably spaced to avoid thermal interference: a minimum distance of 80-100m is typically recommended by borehole specialists. As the commercial plots will be served by individual plants, an open-loop system could then only be in theory installed on Plot A, with a maximum borehole separation of 85m. The separation distance possible on the other plots is not considered sufficient – see figure below. An open-loop system on Plot A could then in theory provide approximately 10kW of thermal capacity and meet up to 30% of the space heating demand of that plot, and approximately 5% of its cooling load to ensure balanced amounts of heat rejected to and taken from the ground. The equivalent CO₂ saving across the site would then be estimated at just 0.2%, and is therefore not considered at this stage to justify the installation of the system.

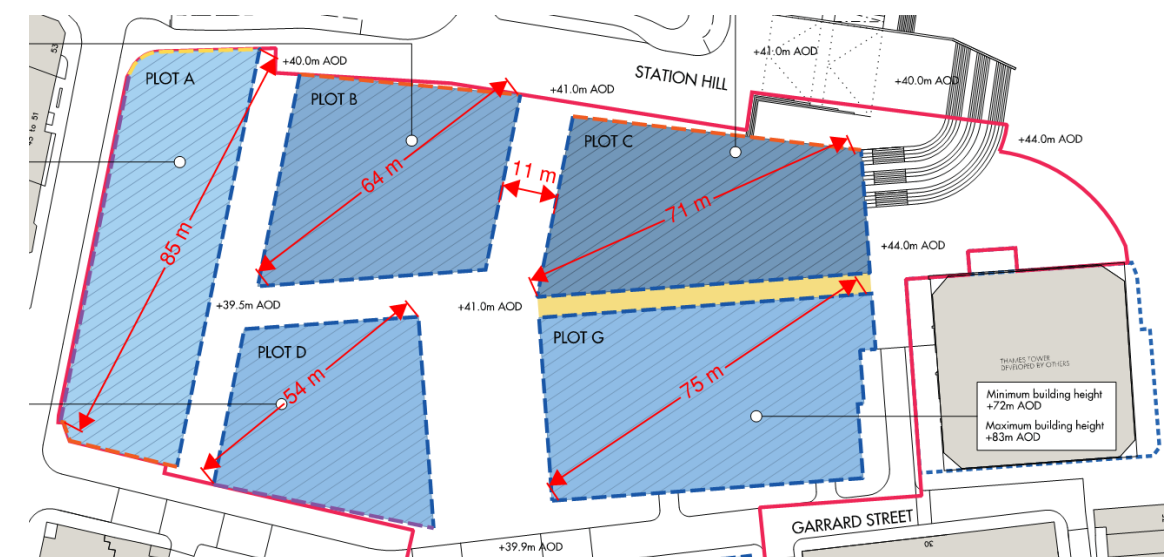


Figure 8.2: Illustrative maximum borehole separation on the commercial plots

- ✖ **Biomass boiler:** Its implementation is not considered viable in the individual commercial plant rooms due to limited space heating requirements and high maintenance implications. It could in theory be installed in the potential residential energy centre to meet up to 30% of the space heating load as a maximum (as it would otherwise displace load available for the CHP) but would lead to limited savings in CO₂ emissions (approx. 1%) while having significant implications in terms of integration alongside the CHP, logistics of fuel delivery, air quality, and maintenance. As a consequence, a biomass boiler is not considered appropriate for the site.
- ✖ **7 no 'small' wind turbines** (with a 3.5m mast) could potentially be implemented on the buildings roofs. They would only lead to very limited CO₂ emissions, with uncertainty on their output due to wind turbulence in urban areas. Furthermore, their impact on architecture and townscape generally would be significant and they are therefore not proposed. The maximum potential Carbon emission savings for wind turbines is estimated as 0.4% site-wide, and they are therefore not proposed.
- ✖ **Solar water heating panels** would not be appropriate in the residential areas as they would compete with the CHP system for the base thermal load. If they were installed to serve the commercial areas, their contribution would be relatively small to carbon savings, i.e. only approximately 0.5% for an array covering the available roof space (150 m²). They are therefore not proposed.

8.0 Conclusion

The aim of the energy strategy is to follow the energy hierarchy and adopt a 'fabric and energy efficiency first' approach, followed by the implementation of Low and Zero Carbon technology (including Combined Heat and Power, or CHP) to achieve an **overall CO₂ improvement over Part L 2013 of 5-15%**.

This target is estimated to be in line with the previous outline strategy proposal (20-25% reduction in site-wide carbon emissions over Part L 2010), as the regulations have been tightened.

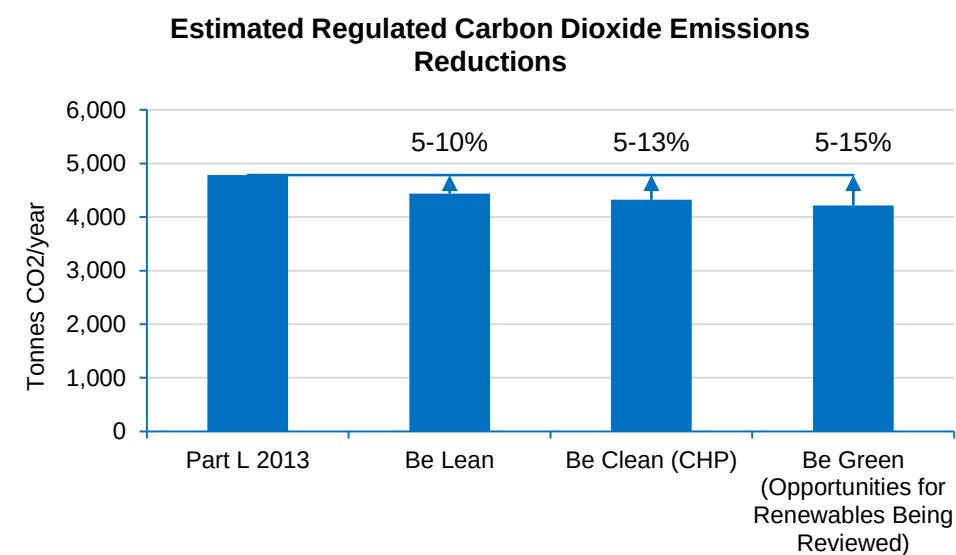


Figure 9.1: Overall carbon reduction strategy

The report sets out the following strategic considerations for the development:

1 – A set of minimum carbon performance targets for each element of the scheme

2 – Key infrastructure decisions

- Potential energy centre serving the residential areas
- The scheme will be future-proofed to allow the expansion of low carbon district energy

3 –Low Carbon technology

- Potential for CHP incorporated in Plot E or in the potential energy centre serving the residential areas
- Due to site constraints and limited roof area availability no renewable energy technologies are currently proposed for the development.

