



**Former Royal Mail Sorting Office
& Distribution Centre**
80 Cavendish Road, Reading, RG1 8JG
Energy & Sustainability Statement

CHBS-PB-17022-3-A

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Executive Summary

The purpose of this report is to demonstrate in support of the Outline Planning Application that the proposed development has been designed in accordance with low carbon design principles.

The main objective of the study is to present results from a Building Energy Modelling exercise to demonstrate that the Reading Borough Council Code for Sustainable Homes Level 4 equivalent Energy Target shall be satisfied for the proposed energy strategy.

A fabric-first approach to the project, alongside a site layout and building design developed around passive-principles and energy-efficient building services, allows Building Regulations Part L compliance to be achieved through energy-efficiency alone.

A communal heat distribution network is proposed to serve dwellings efficiently with clean energy generated by a gas-fired Combined Heat and Power (CHP) plant within the Phase 1 Energy Centre.

The outline CHP design is to meet the domestic hot water baseload to an estimated proportion of 100%.

As demonstrated in figure 1 the findings of the energy strategy design development and building energy modelling are that a total 36% reduction in predicted domestic carbon emissions may be expected. Showing compliance with the Reading Borough Council Code 4 (19%) target.

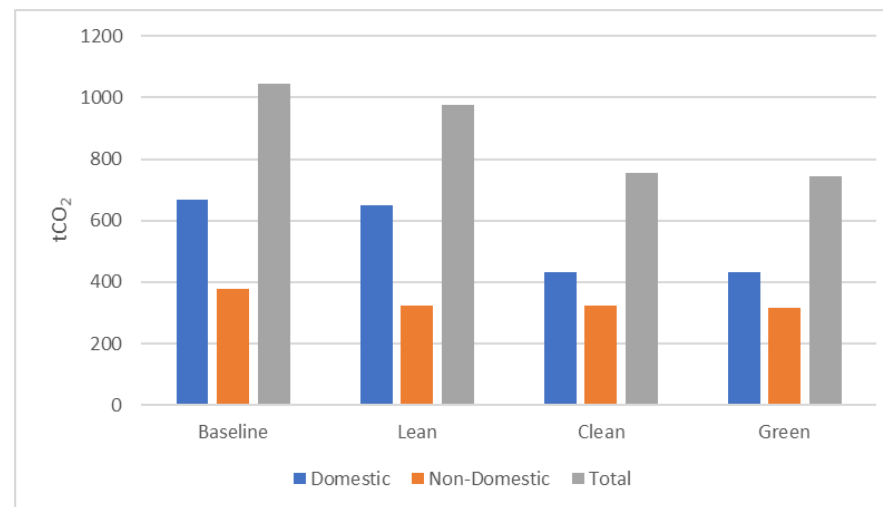


Figure 1: Site-wide results for total regulated carbon dioxide emissions at each stage of Energy Hierarchy.

The non-domestic buildings within the proposed development also benefit from energy efficient design principles. Further reductions are achieved through an energy efficient fit-out utilising low energy lighting, advanced controls and heat recovery technologies.

The Energy Modelling demonstrates that the whole development site is expected to emit 29% less CO₂ emissions than if it were designed to just meet the minimum requirements of Building Regulations Approved Document Part L.

Introduction

Purpose

CHB Sustainability have prepared this Energy & Sustainability Statement in support of the Outline Planning Application for the proposed redevelopment of the Former Royal Mail Sorting Office & Distribution Centre at 80 Cavendish Road, Reading.

The Energy Strategy has been developed in response to the Local Planning Policy and any other relevant drivers for reduction of carbon emissions within the built environment. This report presents the proposed Energy Strategy and details the related specification assumptions to inform future design development.

The objectives of the report are:

- to understand the regulatory and planning policy drivers for sustainable design and construction;
- present the proposed site-wide energy strategy;
- to demonstrate the principles for the site-wide energy strategy design;
- to report results of Energy Modelling to show compliance with the project carbon emissions drivers;
- to record building performance specifications required to achieve energy performance.

Scope

The modelling has been completed in line with CIBSE AM11 utilising the UK National Calculation Method (NCM) for Non-Domestic Buildings Simplified Building Energy Method (SBEM) and the Domestic Standard Assessment Procedure (SAP). The scope of the energy modelling includes regulated energy due to Heating, Cooling, Auxiliary (Pumps & Fans), Lighting and Domestic Hot Water end-uses.

Detailed Energy Models of the Phase 1 Office and Retail areas have been used to gain results representative of the proposed non-domestic building types within the development. SAP calculations have been produced for sample studio, 1 bed, 2 bed, 3 bed and townhouse dwellings. The results of the detailed energy modelling are able to be scaled-up to give an overall estimation of the site-wide energy performance for all phases of the proposed development.

Sustainable Design & Construction Drivers

Reading Borough Council Core Plan 2008 Policy CS1 set targets for development in terms of reductions in carbon emissions and requirements to meet sustainability assessment criteria (BREEAM/Code for Sustainable Homes).

Policy CS1 requires developments to:

1. Maximise energy efficiency.
2. Include on site generation of renewable energy or Combined Heat and Power where appropriate.
3. Reduce water consumption in line with Code for Sustainable Homes/BREEAM.
4. Incorporate Sustainable Urban Drainage.

As the regulatory landscape has changed since the Core Plan, additional guidance has been published in the form of the Revised Sustainable Design and Construction Supplementary Planning Document (SPD) 2011. The SPD confirms that the CS1 requirements for a 20% reduction in carbon emissions due to application of low and zero carbon technologies is no longer relevant as this performance level has now been superseded by the uplift in Building Regulations Approved Document Part L.

The SPD also confirms that for developments >1,000 m² non-domestic developments should achieve a 50/50 Very Good/Excellent BREEAM rating, and at least 50% of dwellings shall achieve Code Level 4.

The SPD the Government Housing Standards review has resulted in the removal of the Code for Sustainable Homes Assessment criteria, however, guidance provided in the Government Planning Statement March 2015 indicates that Local Authorities may apply the relevant carbon emissions performance standards from the Code for Sustainable Homes up to Code 4.

Therefore, the key carbon reduction drivers for the development are:

- Building Regulations Approved Document Part L1A & L2A: 2013
- A minimum of 50% dwellings to meet Code for Sustainable Homes Level 4 Energy Performance – 19% reduction in Part L1A regulated CO₂ emissions.

Additional sustainability issues are considered within the accompanying BREEAM Pre-Assessments for the non-domestic elements in excess of 1,000 m².

Project Description

The proposed development site is directly to the north of Reading Station and currently contains the former Royal Mail Sorting Office, a workshop, office building and hardstanding. As shown in figure 2.

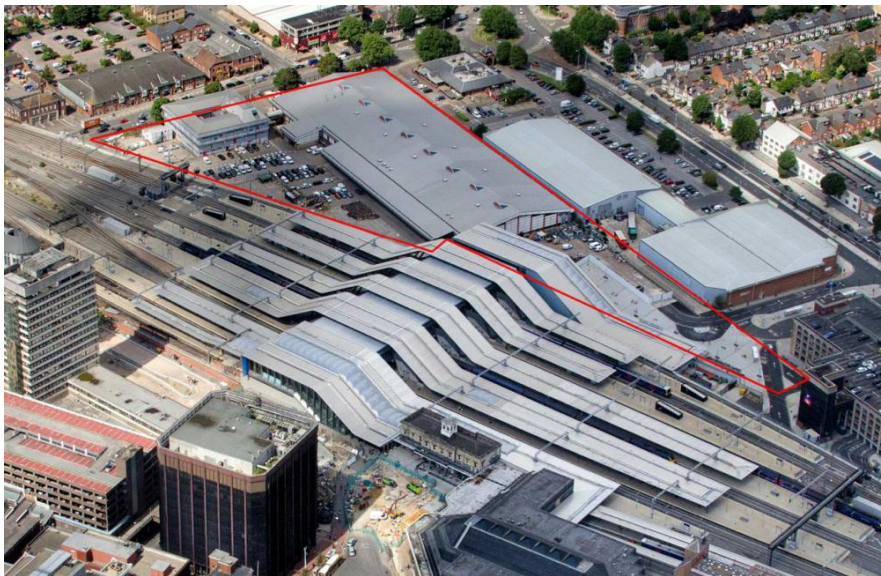


Figure 2: Existing site of proposed development (boundary in red-line)

The proposed redevelopment of the application site is for a mix of uses including employment and business uses (Class B1), residential accommodation (Class C3), retail floorspace (Class A1), food and drink (Classes A3, A4 and A5), leisure uses (Class D2), car parking, public and private open space, landscaping works, highways, access and associated works.

The residential development consists of two high-rise towers to the east of the site above office and retail functions. There are two lower residential towers to the middle of the site and a curved mixed-use block the west of the site, as shown in Figure 3.

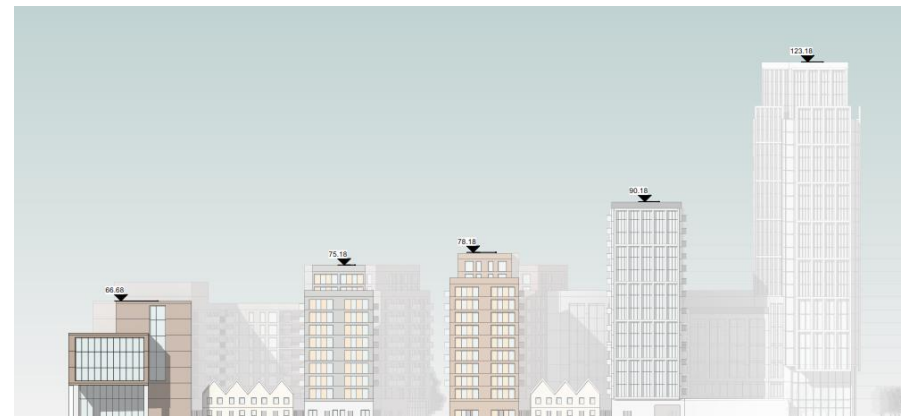


Figure 3: Proposed south elevations

The development is expected to be constructed in 3 phases as shown in figure 4, which also illustrates the 3D massing of the proposals.

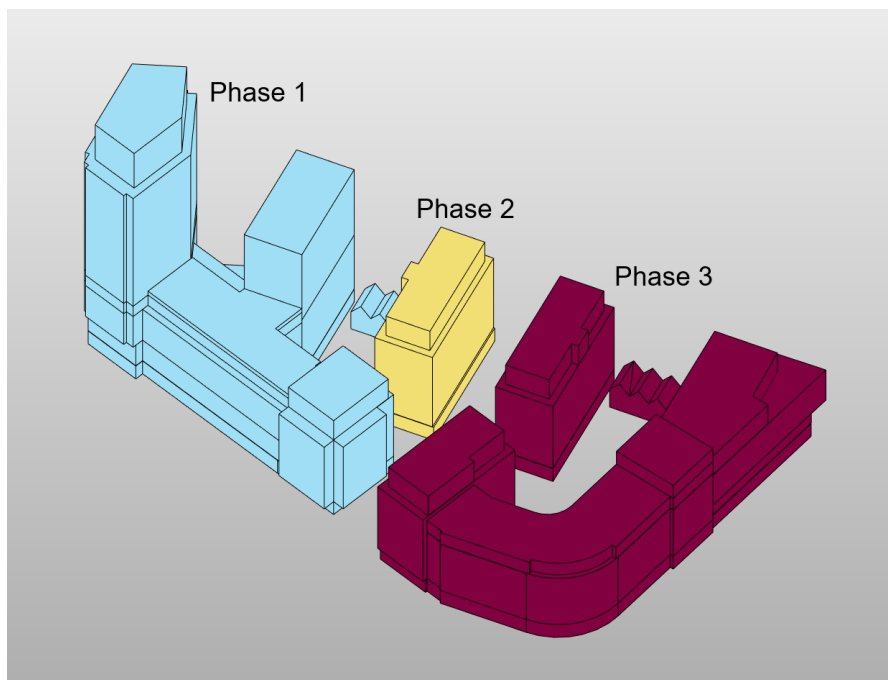


Figure 4: Massing and phasing diagram (view from north west)

Resources

This assessment has been based on information provided in the following documents:

A11113C2099 P1
A11113C2100 P1
A11113C2101 P1
A11113C2102 P1
A11113C2103 P1
A11113C2104 P1
A11113C2105 P1
A11113C2106 P1
A11113C2107 P1
A11113C2108 P1
A11113C2109 P1
A11113C2110 P1
A11113C2111 P1
A11113C2112 P1
A11113C2113 P1
A11113C2116 P1
A11113C2123 P1
A11113C2127 P1
A11113C2200 P1
A11113C2201 P1
A11113C2202 P1
A11113C2203 P1
A11113C2204 P1

Sustainability

It is proposed that all non-domestic units in excess of 1,000 m² shall achieve an enhanced BREEAM Very Good rating (score >62.5%).

Two BREEAM Pre-Assessment reports are submitted in further support of the Outline Planning Application. These set out the proposed strategy for achieving the target BREEAM rating for each of the assessment types required: a shell only retail assessment for the large Phase 1 retail unit; and a fully-fitted office assessment for the office elements in Phases 1 and 2.

For full details please refer to documents:

CHBS-PB-17022-1-A_Reading Metropolitan Retail_BREEAM2018_PRE

CHBS-PB-17022-2_Reading Metropolitan Office_BREEAM2018_PRE

The BREEAM categories which are expected to be the biggest contributors to the score are: Materials; Land Use & Ecology; and Management.

The key areas of interest from the BREEAM Pre-Assessments that respond directly to the Reading Borough Council Sustainable Design & Construction SPD are summarised under the following headings:

Climate Change & Adaptation

- Thermal modelling exercise to be carried out on offices utilising future weather scenarios to ensure thermal comfort may be maintained in a changing climate.
- Any negative impacts on ecology & trees shall be managed to ensure no net loss.
- Landscape Management Plan to ensure long-term care & protection of ecological resources.
- All surface water calculations to include an allowance for future increased rainfall in a changing climate.

Water Management

- Drainage design to use SUDs principles to achieve a reduction in peak rate of water run-off by 30%.
- No significant change in impermeable area expected due to proposed development.

Waste Minimisation

- Opportunities for designing out construction waste to be considered at all RIBA Stages.
- Pre-Demolition Waste Audit.
- Site Waste Management Plan.
- Dedicated operational waste areas for segregating recycling waste.

Proposed Energy Strategy

The proposed energy strategy follows the Energy Hierarchy (Figure 5).

The key elements of the strategy are a 'fabric-first' energy efficient design and Combined Heat and Power clean energy provision.

The proposals utilise a high thermal performance building fabric to reduce heat loss and solar gains alongside a building layout to control solar gains and optimise daylight provision.

The benefits of Combined Heat and Power (CHP) generation are that both the generated electricity and 'waste' heat from power generation may be used on site. This may be compared to centralised electricity generation from power stations where the heat by-product is lost to atmosphere, and transmission losses in electricity supply further reduce the overall system energy efficiency. This gives an overall carbon and primary energy improvement, and as such the technology is recognised by Reading Borough Council as a Low Carbon Technology.

It is proposed that a community heat distribution network shall serve the residential units. The proposed Energy Centre location within the Phase 1 basement is shown in Figure 6.

Where non-domestic elements of the development are to be fitted-out within the base-build (Offices), they shall utilise heat recovery and heat pump technologies.

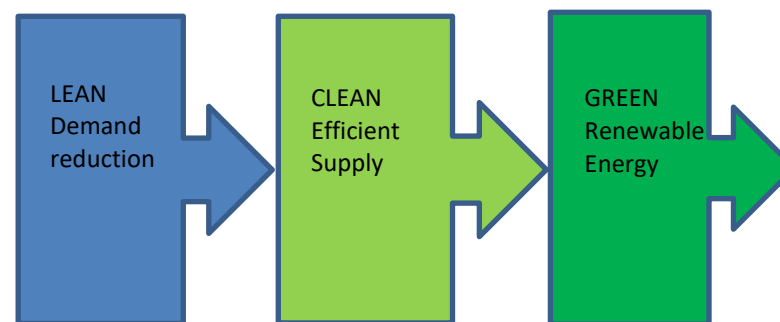


Figure 5: The Energy Hierarchy



Figure 6: Phase 1 Basement level drawing showing Energy Centre location

Energy Efficient Design

The form and layout of the development has been designed with consideration for energy efficiency. The individual blocks are located around four south facing courtyards as shown in figure 7, this maximises the area of building facades facing east, south and west and minimises north facing facades. This site layout maximises opportunities for beneficial solar and daylight gains.

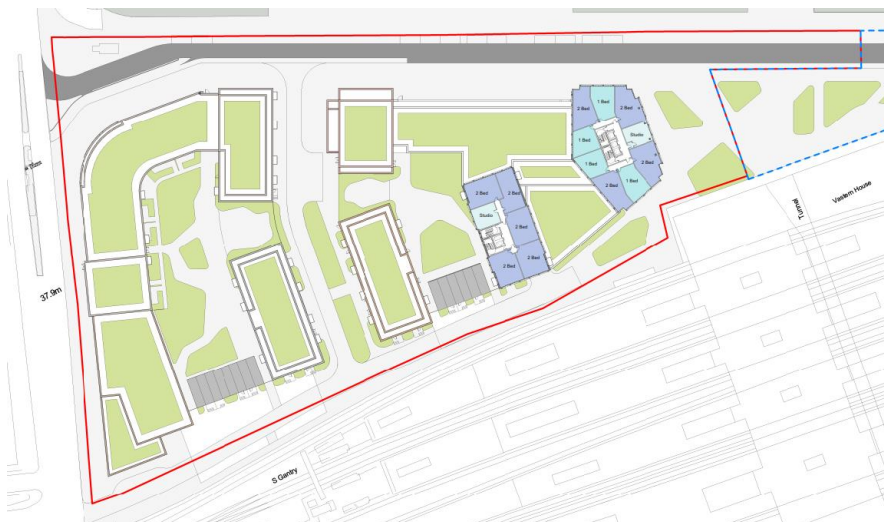


Figure 7: Site layout/upper floor plan.

The retail and office areas are located around the site boundaries to the north, east and west (figure 8). These orientations offer the optimal potential for daylight benefits whilst reducing the risk of excessive solar gains and minimizing cooling demands.

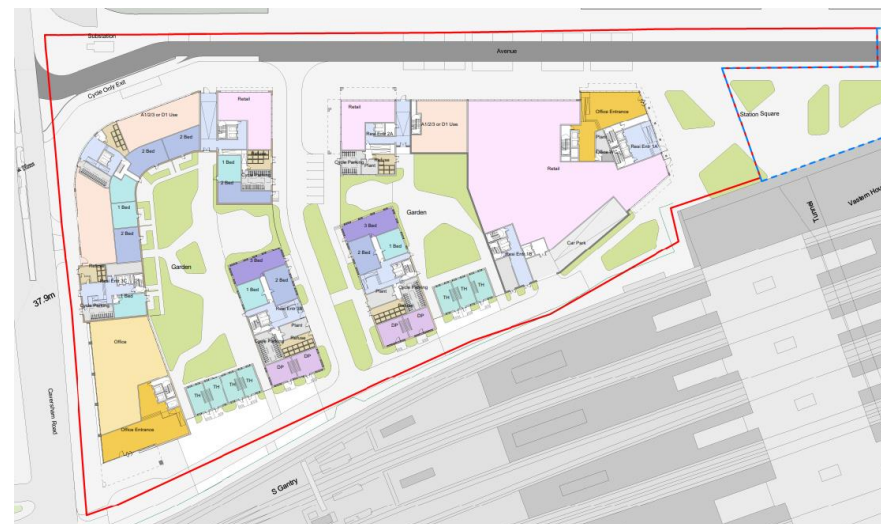


Figure 8: Ground floor plan. Retail pink & office orange.

The proposed building fabric specification exceeds the minimum performance standards required by Building Regulations Part L in order to reduce heat demands.

Building services specification shall further reduce heat demands by utilising heat recovery ventilation. Summertime over heating risks shall be minimised through solar control glazing and low energy lighting.

The assumed building performance specification is detailed fully in Appendix A.

Principles of Energy Strategy Design: CHP

The gas-fired CHP shall be designed to supply the heat energy baseload. For the proposed development the consistent year-round heat demand that makes up the baseload is due to the domestic hot water demands associated with the residential development.

Sample SAP calculations were used to calculate the annual domestic hot water demands of the development.

Daily demand profiles have been used to perform an initial CHP sizing exercise, the results of which are presented in Figure 9.

The initial Energy Centre sizing assumes 2 number Shenton T120 CHP engines (or similar) and a 12,000-litre thermal buffer. This scenario is estimated to meet 100% of domestic hot water loads when operating at 12 hours per day.

It is assumed that the communal heat distribution network shall supply all dwellings with their domestic hot water and space heating requirements.

The Energy Centre shall contain gas-fired boilers to top-up the heat generated by the CHP. An initial boiler sizing assumes 3 number Hamworthy MC 1650 boilers (or similar).

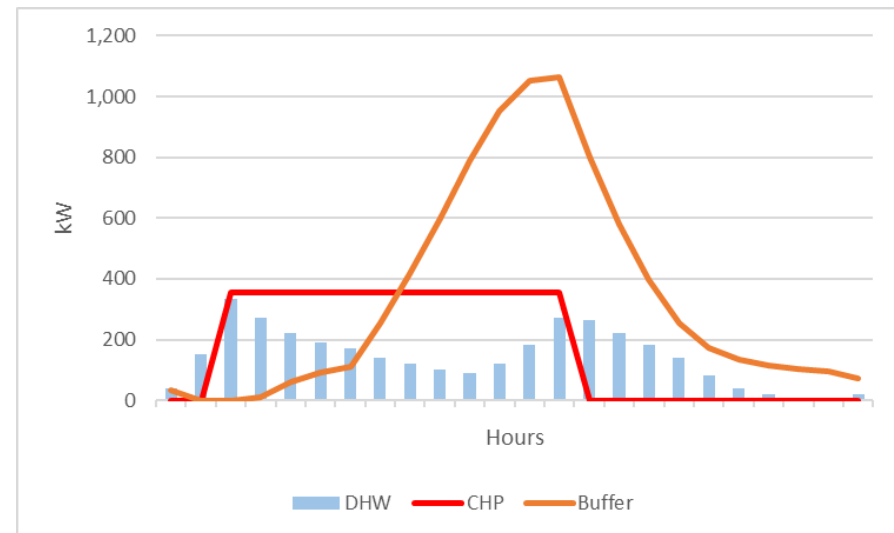


Figure 9: Daily CHP sizing profile based on SAP DHW demands & assuming 20% distribution losses (in-line with SAP2016 consultation document).

For a heat-led CHP it should also be confirmed that there is sufficient electrical demand for the power generated by the CHP to be used on-site in order to maximise the benefit of this technology. The logistics of a private wire agreement to all residential units would be problematic, therefore it is beneficial to utilise the low-carbon electricity generated on site for the non-domestic uses. Figure 10 shows the CHP electricity generated against the typical electricity demands of the office and larger retail unit within the Phase 1 development. It can be seen that there is a close match between the non-domestic power demands and the CHP supply such that the majority of the CHP power generated may be utilised on-site.

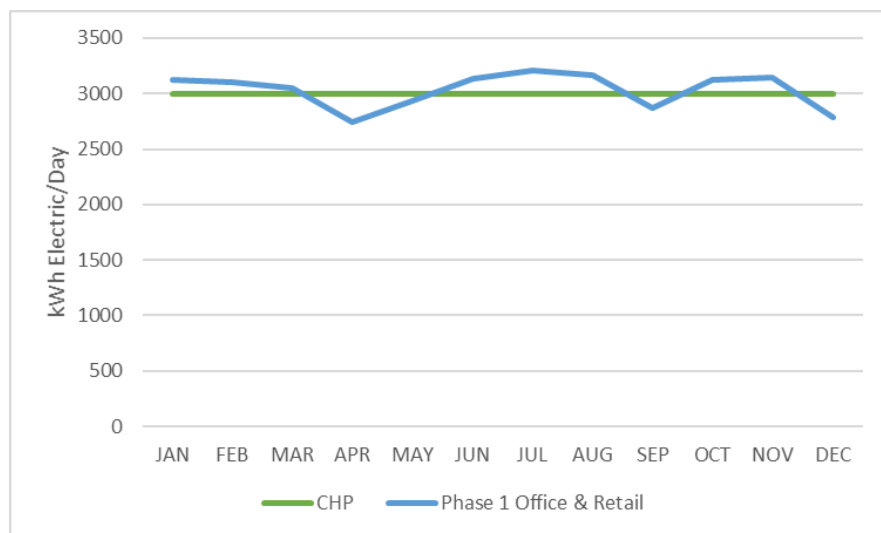


Figure 10: Typical daily electrical power generated by CHP & consumed by Phase 1 office & retail

Energy Modelling

Standard Assessment Procedure (SAP) and Simplified Building Energy Model (SBEM) calculations have been performed to inform this Energy Statement.

This involves creating a geometric model of the proposed building (Figure 10) and then populating the model with the building fabric and building services specification. The energy simulation model is then run to calculate the building energy consumption and resultant carbon dioxide emissions due to the predicted operation of the building over a typical year. The

Energy Performance Specification used as the inputs for the energy model is detailed within Appendix A.

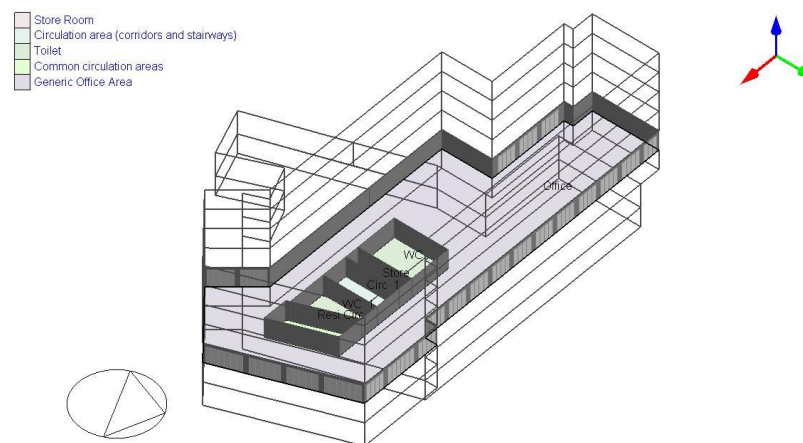


Figure 10: Internal wireframe view showing typical mid-floor phase 1 office Designbuilder 3D Model

Energy Modelling Results

The modelling demonstrated that the proposed Energy Performance Specification (see Appendix A) is sufficient to exceed the minimum requirements of Building Regulations Approved Documents Part L1A and L2A (2013) for the Lean Energy Efficient stage of the Energy Hierarchy.

The breakdown of results for end-use energy within the proposed Energy Efficient design is shown in figures 11 and 12 split to domestic and non-domestic buildings.

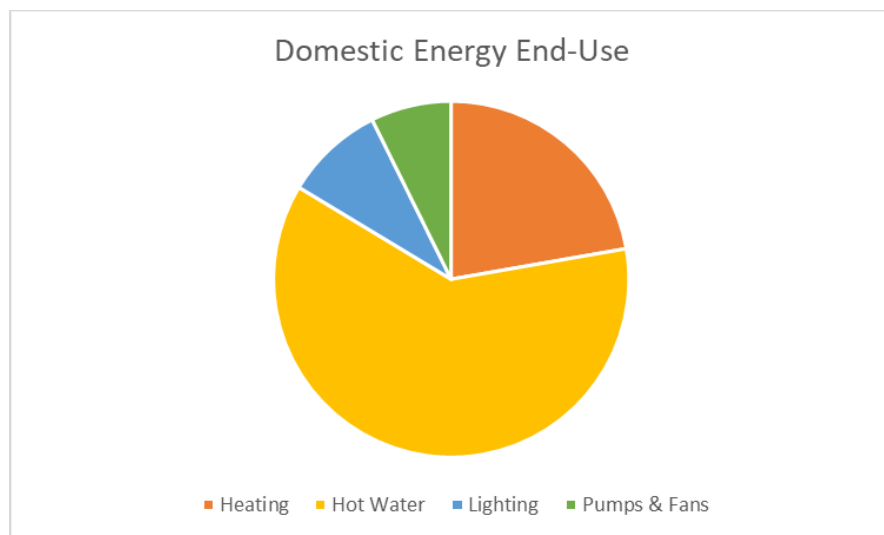


Figure 11: Development domestic energy use profile to regulated end-uses.

Figure 11 shows that the domestic energy profile is dominated by domestic hot water, this is a consistent year-round demand and highlights that a CHP system is well suited to supplying heat to the dwellings.

The non-domestic energy uses are dominated by cooling and lighting (Figure 12). Any benefits of connecting the non-domestic buildings to the proposed communal energy network would be limited as this would reduce the heat demand density for the development.

A Variable Heat Volume/Flow (VRV/F) heat pump system would be well suited to the office energy profile. VRV/F systems allow heat to be transferred throughout the building between different rooms and orientations where there may be simultaneous heating and cooling demands. A hot water module may also be used which uses waste heat extracted from the cooling demands in order to heat domestic hot water.

The site-wide results in terms of regulated carbon emissions are presented in table 1 and figure 13 for each stage of the energy hierarchy.

The site-wide results demonstrate that the proposed gas-fired CHP serving the domestic energy demands results in the most significant carbon dioxide reductions. In terms of the non-domestic energy demands the largest reductions in emissions are due to energy efficient design, with the proposed VRV/F heat pump to the office only making a marginal reduction in emissions.

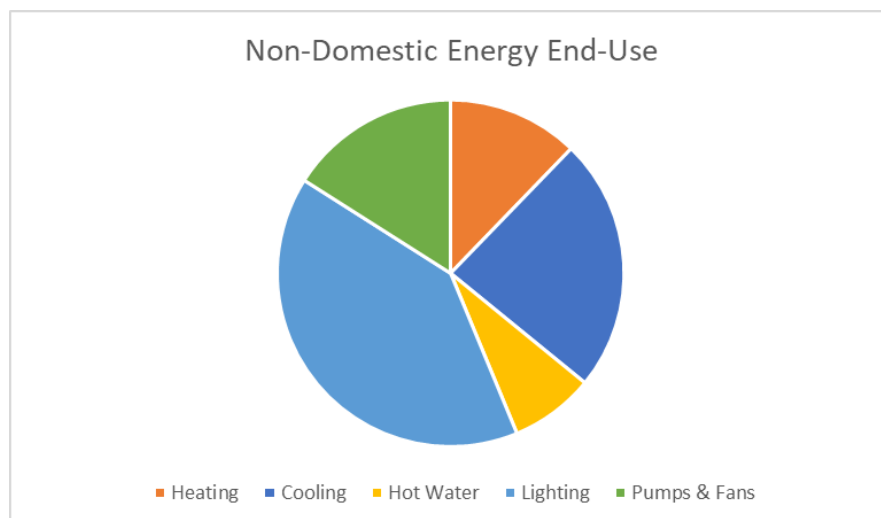


Figure 12: Development non-domestic energy use profile to regulated end-uses.

tCO2	Domestic	Non-Domestic	Total
Baseline	668	377	1045
Lean	651	325	976
Clean	431	325	756
Green	431	315	745
LZC (Clean/Green) vs Lean	34%	3%	24%
Total Reduction vs Part L Baseline	36%	16%	29%

Table 1: Results of total estimated regulated carbon dioxide emissions & reductions.

Conclusions

The Energy Statement has considered the regulatory framework for energy efficient design and application of low and zero carbon technologies. An Energy Strategy has been derived following the principles laid out within the relevant Local Planning Policy.

On the basis of the representative building energy modelling performed it can be concluded that the proposed Energy Performance Specification is sufficient to achieve Building Regulations Approved Document Part L compliance.

A communal district heat network is proposed to serve the dwellings from a gas-fired CHP. The CHP is sized to meet the domestic hot water baseload. The initial energy modelling results have shown that the proposed CHP system is expected to contribute to reducing domestic CO₂ emissions by 34%. The total reduction in domestic carbon emissions due to the proposed strategy is 36%, in excess of the 19% Code 4 equivalent target performance level for all dwellings.

The non-domestic buildings within the proposed development also benefit from energy efficient design measures in terms of layout, form and fabric specification. Further reductions are achieved through an energy efficient fit-out utilising low energy lighting, advanced controls and heat recovery technologies.

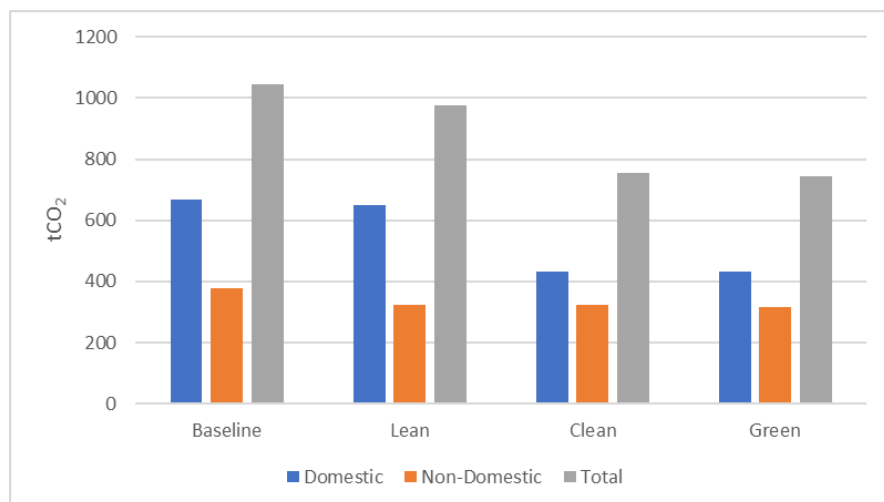


Figure 13: Site-wide results for total regulated carbon dioxide emissions at each stage of Energy Hierarchy.

As such the Energy Modelling demonstrates that the whole development site is expected to emit 29% less CO₂ emissions than if it were designed to just meet the minimum requirements of Building Regulations Approved Document Part L.

Appendix A: Energy Performance Specification

Building Fabric Element	Energy Performance Specification	Units
Ground & Exposed Floors	0.15	W/m ² .K
External Walls	0.20	W/m ² .K
Semi-Conditioned Walls (To unheated areas)	0.20	W/m ² .K
Roof	0.15	W/m ² .K
Domestic Window	1.4	W/m ² .K
	0.63	G-value solar transmittance ratio
Commercial Window	1.4	W/m ² .K
	0.3	G-value solar transmittance ratio
	0.5	Light transmittance ratio
Air Tightness	4	m ³ /m ² .hr @ 50 Pa
Thermal Bridging Details	<i>To accredited details (where available)</i>	

Building Services Element	Energy Performance Specification		
	Domestic	Non-Domestic Office (Fully-Fitted)	Non-Domestic Retail (Shell Only)
Ventilation	Mechanical Ventilation Heat Recovery (MVHR) 0.9 W/l/s 90% HR	Mechanical Ventilation Heat Recovery (MVHR) max 1.6 W/l/s 90% HR + WC extract	Natural
Space Heating	Energy Centre & Heat Distribution Network: Communal Boilers & Gas-fired CHP	A-Rated VRF/V Electric Heat Pump Electric Heating to cores	D-Rated Split-Multi-Split
Domestic Hot Water	From Communal Heat Distribution Network	A-Rated VRF/V Electric Heat Pump	Direct Electric
Lighting	Low Energy	100 Lumens/Watt Daylight sensing & occupancy control	60 Lumens/Watt Daylight sensing & occupancy control
Cooling	N/A	A-Rated VRF/V Electric Heat Pump	D-Rated Split-Multi-Split
Additional Features	N/A	Power Factor Correction Automatic Metering with Alarms for Out of Range	N/A