301 St Vincent Street

Energy & Sustainability Statement

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Executive Summary

This document outlines the energy and sustainability strategy for the proposed 301 St Vincent Street redevelopment in Glasgow. It has been prepared to support the project's planning application and aims to show how the redevelopment intends to meet the national and local sustainability policies set out in the National Planning Framework and Glasgow City Development Plan (CDP), respectively.

The proposed redevelopment of 301 St Vincent Street stands as a testament to sustainable innovation and responsible development. By integrating energy efficient and low carbon technologies, embracing circular economy principles, and prioritising the wellbeing of occupants and the environment, the project aspires to set new benchmarks in sustainable urban development, contributing positively to Glasgow's urban landscape.

Energy Strategy

The energy efficiency interventions to the 301 St Vincent Street existing building will contribute to meeting the project's targeted sustainability credentials and achieving environmental excellence in terms of design, construction, and building operations.

These are summarised as follows:

- ✓ Replacement or refurbishment of the existing curtain walling (current façade is nearly 40 years old) with an articulated form introducing depth and volume that provide shading to receded glazing and add visual interest.
- ✓ Replacement of existing gas-fired boiler and chiller plant with a high-efficiency electrified system for heating and cooling.
- ✓ Replacement of gas-fired Domestic Hot Water (DHW) system with dedicated high temperature CO_2 heat pumps.
- ✓ Implementation of mechanical ventilation with heat recovery (MVHR) system, with possibility of exploring a mixed-mode ventilation strategy at subsequent stages.
- ✓ Replacement of existing lighting with low energy LED lighting fittings throughout incorporating occupancy and daylighting sensors.
- ✓ Installation of a rooftop solar Photovoltaic (PV) array.
- ✓ Provision of a web-based Building Management System (BMS) with Graphical Unit Interface (GUI).
- ✓ Implementation of rainwater harvesting or greywater recycling systems for non-potable use to be investigated.

To achieve the planning requirements and the scheme's individual energy and sustainability objectives, the design strategy for the proposed redevelopment will follow our "steps to low carbon" methodology, which is in line with the industry recognised Energy Hierarchy and Glasgow's CDP5: Resource Management policy. The three core principles followed to develop the energy strategy for this project are summarised as follows:

- **Be Lean:** energy demand reduction through passive design measures (as far as practical).
- **Be Clean:** use of energy efficient systems for the provision of heating, cooling, and Domestic Hot Water (DHW), low energy lighting, and Building Management System (BMS) to enable energy use to be tracked and allow for efficiency improvements to be identified and implemented.
- **Be Green:** inclusion of Low and Zero Carbon Generating Technologies (LZCGTs) in the scheme such as heat pumps for heating and cooling and solar Photovoltaics (PVs).

The design of the proposed redevelopment will be compliant with Scotland's Section 6 Building Regulations (applicable to works from 5 June 2023) and in line with Glasgow's CDP that currently applies to any planning submission within Glasgow (relevant local policies are detailed within Section 2 of this report).

Please note the following:

Alterations and extensions to buildings are not required to comply with Section 6.1 (Energy Demand and Carbon Dioxide Emissions) of the Scottish Building Regulations, other than:

- **Where the build-up of an element forming part of the insulation envelope is to be altered or dismantled and rebuilt, the opportunity should be taken to improve the levels of thermal insulation and comply with maximum allowable U-value standards applicable to new builds** (please refer to *Clause 6.2.1 (Table 6.3)* of the Non-Domestic Technical Handbook, applicable to works from 5th June 2023 to 31st March 2024)**.**

- **All fixed building services design parameters should be compliant with the minimum standards** listed within the 2022 Non-domestic Building Services Compliance Guide for Scotland (v1.1 – February 2023).

Whole Life Carbon and Circular Economy

For a redevelopment project like 301 St Vincent Street to be aligned with current UK and Scottish standards and targets, upfront and whole life embodied carbon aspiration targets of 400 $kgCO_2e/m^2$ and 650 $kgCO_2e/m^2$ (GIA) have been set respectively. These are aspirational targets that will be reviewed in later stages and will potentially adjust depending on the final scope of the scheme. The embodied carbon targets have been set based on Cundall's experience in whole life carbon and their database of previous projects.

In line with emerging national/local policy best practices, a circular economy statement will also be prepared for the development. These project specific targets will be monitored as the project develops and include a range of aspirational targets. The report will detail the recommended circular economy strategies to follow going forward, which include:

- Maximising responsible and local sourcing of materials.
- 30% of material sources to be from reused and recycled sources.
- 98% of construction waste to be diverted from landfills.
- 0.9 tonnes/100m^2 (GIA) of non-hazardous construction waste generated.
- Ensure 80% of the building NIA is designed for flexibility.
- 60% of materials used to be reused at end of life.

Sustainability Appraisal

In addition to the project's individual energy and whole life carbon objectives, the proposed 301 St Vincent Street redevelopment will deliver sustainable design with respect to the following areas:

Water

The development will aim to reduce water demand and consumption through the use of low flow fittings throughout as well as accurate and detailed metering of water use, as detailed in Section 5. In addition to this, greywater recycling and rainwater harvesting systems will be investigated for development to conserve water resources and reduce consumption.

Transport

The site's location supports active travel modes by being highly accessible by foot and close to traffic free cycling provision. It also benefits from excellent transport links to various locations across the city, limiting the need for building users to rely on private car to travel to and from the site. The decarbonisation of remaining car use is further supported through the provision of electric car re-charging infrastructure within the development's parking facility. Increase in bicycle storage space is also provided within the development. Transport considerations are outlined within Section 6.1.

Building Fabric

The design will adopt a fabric first approach (as far as practical) and attempt to promote the use of sustainable, locally sourced, recycled and healthy materials where possible as detailed within Section 6.2. The option for replacing the existing curtain walling has introduced investigations into new systems such as low carbon glass and recycled aluminium to mitigate embodied carbon impacts. For further details on the impact of materials on WLC and Circular Economy targets, please refer to Section 4.

Waste

Waste will be managed effectively during both the construction and operation phase of the building, following the Waste Hierarchy principles in line with Glasgow's CDP5: Resource Management policy. A waste management plan will be developed to manage construction waste. In addition to that, appropriate provision will be made to manage and store operational waste to facilitate recycling. Waste management considerations are detailed within Section 4.2 and Section 6.3.

Pollution

Local pollution will be minimised through the following actions:

- The products of combustion such as NOx and SOx will be eliminated by featuring no on-site combustion for the provision of heating, cooling, and domestic hot water as detailed within Section 6.4.
- Nuisance from external light and noise pollution will be avoided by following relevant guidance and appropriate standards as detailed within Section 6.4.2 and 6.4.3.

Ecology and Landscape Architecture

Ecological considerations are at the core of the proposed redevelopment, addressing local planning policy requirements, which highlight the need for developments to respect the natural environment, limit their impact on habitats and species, and enhance biodiversity (Policy CPD1: The Placemaking Principle and Policy CPD7: Natural Environment). Ecology surveying has been undertaken (with key findings and recommendations detailed within Section 6.5) and a Biodiversity Enhancement Strategy is being prepared by Wild Survey

Consultants. In addition, a landscape strategy is under development by Murray and Associates Landscape Architects

Health and Wellbeing

The development will be designed to promote health and wellbeing by optimising existing roof terraces and courtyard spaces to provide direct sunlight and fresh air for users. Access to these outdoor spaces will be made feasible through the introduction of level thresholds, strategic access points, and replacement of edge protection across entire perimeter to ensure safe and compliant use.

Other health and wellbeing considerations including acoustic comfort, ventilation strategy, and access to natural light are detailed in Section 6.6. Preliminary noise surveys have been undertaken by Cundall to assess noise levels at representative locations of the building's facade and capture background noise levels at the nearest noise-sensitive properties. It was found that the level of noise could exceed acceptable levels at most locations along the building facade, which influences the feasibility of an openable window (mixed-mode) ventilation strategy. Air quality assessments must also be carried out as this is another critical factor of the preferred ventilation strategy.

Contents

1.0

Introduction

1.0 Introduction

This report has been prepared to support the planning application for the proposed 301 St Vincent Street redevelopment in Glasgow. The report outlines how the development's energy and sustainability strategy sits in the context of the relevant national and local policies. The proposed strategy aims to limit the site's contribution to the causes of climate change by reducing its need for energy and minimising its CO_2 emissions using low carbon and renewable energy sources.

1.1 Existing building

The existing 301 St Vincent Street site is situated in central Glasgow, covering an entire city block between St Vincent Street, Boswell Street, and the M8. Constructed in 1986, the building originally served as the headquarters of Britoil, acting as the hub for its operations in the North Sea.

Figure 1-1: Building location (Google Maps)

301 St Vincent Street is a five-storey building, with an additional roof plant level and two levels below ground (i.e., basement and lower ground-floor). The building features three circulation cores that extend from the North to the South elevation of the building, housing staircases, elevators, and toilet facilities.

The current lower ground levels largely include back-of-house spaces, storage, some offices, and car parking areas. The ground floor features office spaces, reception and waiting areas, and an auditorium. The upper floors, primarily dedicated to office spaces, progressively reduce in floor area. The building also features glazed rooflights over the middle two 'quarters' of the first floor, accompanied by openings directly above on subsequent floors to facilitate the introduction of natural light. Internal courtyard spaces surround the openings on the second and third floors. The roof plant level, positioned above each circulation core, stores MEP equipment for the building which includes air handling equipment and centralised boilers). The total building NIA is approximately 308,000 square feet.

The original building façade was designed to seamlessly integrate with the fabric of surrounding buildings and structures. It boasts a glazed curtain wall system that is generally well-preserved, though specific upgrades are needed to align with future sustainability targets.

Figure 1-2 Existing building at 301 St Vincent Street, Glasgow

1.2 Proposed redevelopment

The proposed redevelopment of 301 St Vincent Street aims to set high standards in terms of both energy efficiency and for the repurposing of major office building refurbishment projects. By retaining its existing building structure and focusing solely on refurbishment, a projected embodied carbon saving of over 40% can be saved compared to a new build equivalent.

The site is to offer a best-in-class grade A office refurbishment, providing up to 308,000 square feet of dynamic space designed to promote collaboration and inclusivity. Redevelopment proposals include the reconfiguration and repurposing of existing spaces to accommodate for building users and for future flexibility. Beyond serving as a workplace, the development is envisioned as a local destination, promoting community engagement and interaction. The provision of bicycle parking, end-of-journey facilities, and communal spaces for co-working, events, and fitness underscores a commitment to creating a vibrant and accessible hub that transcends traditional office boundaries.

The basement continues its use for car parking and storage space, with the addition of secure cycle parking and substantial tenant storage. This level is not solely a functional space, but an integral part of the development's approach to sustainability. By housing its cycling infrastructure and providing ample tenant storage, the development not only encourages sustainable modes of transportation but also addresses the practical needs of its occupants.

The ground and lower ground floors serve as a combination of public and semi-public spaces, featuring office space and dedicated entrances, a food hall, generous reception areas. The upper floors accommodate a range of office spaces that vary in depth and shape to allow easy delineation of tenant areas and for future flexibility. In addition, the upper floors also feature up to 41,000 square feet of courtyards and landscaped terraces, providing not only aesthetic value but also enhancing staff wellbeing by offering external breakout, work, and relaxation spaces. This strategic blend of historic preservation and contemporary design contributes to the site's revitalisation, making it a unique and desirable destination.

The mechanical systems are configured and distributed into three compartment zones allowing for a flexible sub-division and operation of the various spaces. Replacement and improvement of existing mechanical systems are also to take place, such as working towards a fully electric system, to meet energy and sustainability targets.

The building façade is also to be improved, with proposals for an optimal glazing ratio that will improve natural daylight while limiting the risk of overheating. Most recent investigations have explored the use of low embodied carbon curtain wall systems or retaining the existing façade grid to mitigate the impact of embodied carbon.

Overall, the project is dedicated to 'upcycling' the underoccupied existing building into a state-of-the-art establishment, incorporating features not attainable in new constructions. The proposed redevelopment not only addresses sustainability goals but also envisions a dynamic, inclusive, and adaptive space that enhances the overall urban experience.

Figure 1-3: Proposed 301 St Vincent Street Redevelopment.

2.0

Planning Policy

2.0 Planning Policy

2.1 National Policy

Sustainable, inclusive growth is a priority in Scotland. The planning system aims to facilitate it through the creation of high-quality developments, which deliver long-term benefits for the public whilst protecting and enhancing natural resources. This is supported by a number of national and local development policies, as summarised below (please refer to *Figure 2-1* below). Planning in Scotland has undergone major transformation and now contains a number of new policies which favour sustainable development.

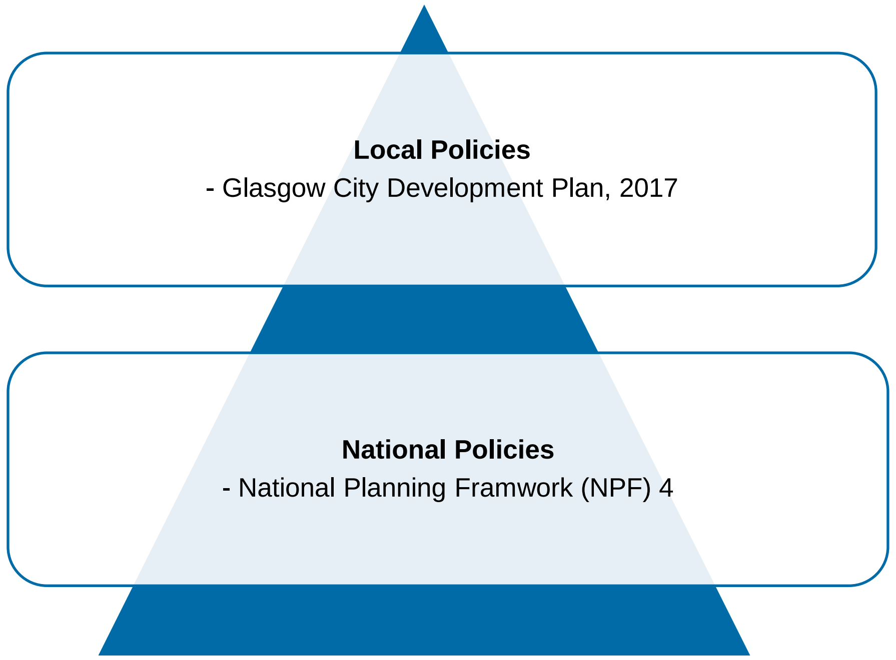


Figure 2-1:Scottish hierarchy of national and local planning policies

This energy and sustainability strategy presents the aspects of the design that are considered important to achieving the goal of a sustainable development. It sets out the relevant policies and outlines how the requirements of each of these policies will be met by the 301 St Vincent Street development.

2.2 National Planning Framework

In February 2023, the Scottish Government adopted the Scotland's Fourth National Planning Framework (NPF4), which replaced the previous NPF3 and the Scottish Planning Policy (SPP) 2014 and removed the need for the development of regional policies (Strategic Development Plans), where such matters are now covered by the NPF4.

NPF4 comprises Scottish Government's long-term spatial strategy to 2045, including national planning policy on a range of topics such as energy, climate change, biodiversity, local living, digital and other infrastructure. It also embeds the UN Sustainable Development Goals and Scotland's National Outcomes.

NPF4 is driven by an overarching goal to address climate change and the nature crisis but has four key outcomes in support of this as illustrated in *Figure 2-2* below.

Figure 2-2: NPF4 Key Outcomes

The first key outcome of the NPF4 focuses on the development of a **national spatial strategy for Scotland 2045** detailing how Scotland will plan its future places in line with six spatial principles as follows:

- **Just transition**: empower people to shape their places and ensure the transition to net zero is fair and inclusive.
- **Conserving and recycling assets**: make productive use of existing buildings, places, infrastructure, and services, locking in carbon, minimising waste, and building a circular economy.
- **Local living:** support local liveability and improve community health and wellbeing by ensuring people can easily access services, greenspace, learning, work, and leisure locally.
- **Compact urban growth**: limit urban expansion, thus optimising the use of land to provide storage, flood risk management, blue and green infrastructure, and biodiversity.
- **Rebalanced development**: target development to create opportunities for communities and investment in areas of past decline and manage development sustainably in areas of high demand.
- **Rural revitalisation**: encourage sustainable development in rural areas, recognising the need to grow and support urban and rural communities together.

By applying the above six spatial principles, Scotland aims to support the planning and delivery of:

- **Sustainable Places**: where we reduce emissions, restore, and better connect biodiversity (NPF4 Key outcome 2)
- **Liveable Places**: where we can all live better, healthier lives (NPF4 Key outcome 3)
- **Productive Places**: where we have a greener, fairer, and more inclusive wellbeing economy (NPF4 Key outcome 4)

Figure 2-3: NPF4 Sustainable Development Goals

Whilst Glasgow City Development Plan was formulated in 2017 and it is therefore in line with NPF3 and SPP 2014, the strategy adopted for the proposed development considers the policy requirements included within the updated NPF4 and how these impact the proposed 301 St Vincent Street development.

The specific policies from the NPF4 that the development aims to address through its design are listed below:

Policy 2 – Climate mitigation and adaptation

The second policy from the 'Sustainable Places' key outcome intends to encourage, promote and facilitate development that minimises emissions and adapts to current and future impacts of climate change. This is achieved by ensuring that:

a) Development proposals will be sited and designed to minimise lifecycle greenhouse gas emissions as far as possible.

b) Development proposals will be sited and designed to adapt to current and future risks from climate change.

c) Development proposals to retrofit measures to existing developments that reduce emissions or support adaptation to climate change will be supported.

Policy 19 – Heat & Cooling

The sixth policy from the 'Liveable Places' key outcome intends to encourage, promote and facilitate development that supports decarbonised solutions to heat and cooling demand and ensure adaptation to more extreme temperatures. This is achieved by ensuring that:

a) Development proposals within or adjacent to a Heat Network Zone identified in a LDP will only be supported where they are designed and constructed to connect to the existing heat network.

b) Proposals for retrofitting a connection to a heat network will be supported.

c) Where a heat network is planned but not yet in place, development proposals will only be supported where they are designed and constructed to allow for cost-effective connection at a later date.

d) National and major developments that will generate waste or surplus heat and which are located in areas of heat demand, will be supported providing wider considerations, including residential amenity, are not adversely impacted. A Heat and Power Plan should demonstrate how energy recovered from the development will be used to produce electricity and heat.

e) Development proposals for energy infrastructure will be supported where they: i. repurpose former fossil fuel infrastructure for the production or handling of low carbon energy; ii. are within or adjacent to a Heat Network Zone; and iii. can be cost-effectively linked to an existing or planned heat network.

f) Development proposals for buildings that will be occupied by people will be supported where they are designed to promote sustainable temperature management, for example by prioritising natural or passive solutions such as siting, orientation, and materials.

2.3 Local Policy – Glasgow City Development Plan

Glasgow City Development Plan (CDP) is the statutory local development plan for Glasgow, adopted in March 2017. The main policies from the Glasgow CDP that the development aims to encompass in its design are listed below:

Policy CDP1: The Placemaking Principle

The aim of this policy is to promote a design-led approach to planning, make the planning process as inclusive as possible, and ensure that new developments attain the highest sustainability levels. The six principles underpinning the CDP1 policy is that new developments should be distinctive; safe and pleasant; easy to move around and beyond; welcoming; adaptable; and resource efficient.

New developments should contribute towards the creation of successful places, which are fit for people and can effectively:

1. provide environments that function well, link well with surrounding settlements, and provide attractive areas to live, work, and visit
2. deliver sustainable buildings, areas, and spaces that improve people's health, happiness, and wellbeing
3. deliver highly creative, innovative, and technical standards in design of buildings, structures, infrastructure, and their setting
4. provide communities with an important cultural context, a sense of pride and belonging, and a sense of local and national identity
5. influence upon the sustainable economic growth of an area
6. respect the historic and natural environment
7. promote connectivity, active travel, and public transport use over private car use
8. ensure new activity does not result in the deterioration of air quality and does not introduce unacceptable additional noise

Policy CDP5: Resource Management

CPD5 Resource Management policy is one of the key policies promoting energy efficient design and utilisation of Low and Zero Carbon Generating Technologies (LZCGTs). It aims to support development proposals that:

a) contribute towards Scottish Government's targets for renewable energy generation.
b) promote energy efficient design and use of LZCGTs to offset a proportion of emissions arising from the use of buildings.
c) avoid a specified and rising proportion of projected greenhouse gas emissions through the installation of LZCGTs.
d) promote building design by accounting for a wide range of factors influencing energy demand and use such as access to sustainable transport and other local facilities.
e) help safeguard communities from the potentially adverse impacts of energy generation or oil/gas extraction.
f) support the use of combined heat and power systems and district heating networks.
g) manage waste to minimise landfill and improve recycling and compositing level in line with Scotland's Zero Waste Plan (2010).
h) benefit from secure supplies of low carbon energy and heat.

SG5: Resource Management Supplementary Guidance supports the above policy by providing further guidance on the use and derivation of energy and the processing of waste in new developments.

- **Renewable energy and heat:** Development proposals should contribute to reducing greenhouse gas emissions and overall energy use as well as facilitating the efficient delivery of renewable energy and heat. However, it is important to ensure that such proposals do not result in unacceptable impacts on landscape character, transport infrastructure, the amenity of surrounding uses or the water, natural, or built environments, local air quality, noise, tourism, and recreation, etc.
- **Low and Zero Carbon Generating Technologies**: To reduce the need for energy from the outset, new developments are encouraged to follow the energy hierarchy (please refer to the figure below) and enable the deployment of a range of onsite LZCGTs. Eligible LZCGTs include the following: biomass; fuel cells; micro-hydro; micro-wind; solar thermal; photovoltaics; ground source heat pumps; water source heat pumps; air source heat pumps; combined heat and power; heat exchange and recovery systems; and geothermal.

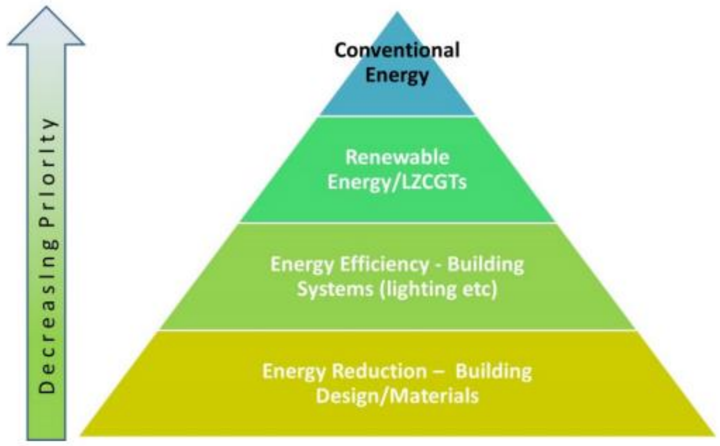


Figure 2-4: The Energy Hierarchy (source: SG5 - Supplementary Guidance)

- **Waste:** To meet waste objectives and contribute to an effective waste management, new developments should:

a) minimise the unnecessary use of primary materials and promote efficient use of secondary materials.
b) promote reuse, refurbishment, remanufacturing, and reprocessing.
c) contribute to Scotland's zero targets (i.e., recycling at least 70% of household waste and sending no more than 5% of Scotland's annual waste to landfill by 2025).
d) follow waste hierarchy (prevention, reuse, recycling, energy recovery, and disposal) as illustrated in the figure below:

Figure 2-5: Waste Hierarchy (source: SG5 - Supplementary Guidance)

Policy CDP7: Natural Environment

CDP7 outlines the importance for new developments to limit their impact on natural environment including sites, habitats, species, or ecosystems protected by law or designated important for their nature conservation value; sites designated important for their geodiversity value; and trees, woodlands or hedgerows that are of importance. The policy outlines the need for new developments to enhance biodiversity through creating, improving, and better linking habitats and ecosystems.

3.0

Energy Strategy

3.0 Energy Strategy

3.1 Overview

The energy efficiency interventions proposed as part of the redevelopment of 301 St Vincent Street will contribute to meeting the project's targeted sustainability credentials and achieving environmental excellence in terms of design, construction, and building operations for an existing building. These are summarised as follows:

- ✓ Replacement or refurbishment of the existing curtain walling (current façade is nearly 40 years old) with an articulated form introducing depth and volume that provide shading to receded glazing and add visual interest.
- ✓ Replacement of existing gas-fired boiler and chiller plant with a high-efficiency electrified system for heating and cooling.
- ✓ Replacement of gas-fired Domestic Hot Water (DHW) system with dedicated high temperature CO_2 heat pumps.
- ✓ Implementation of mechanical ventilation with heat recovery (MVHR) system, with possibility of exploring a mixed-mode ventilation strategy at subsequent stages.
- ✓ Replacement of existing lighting with low energy LED lighting fittings throughout incorporating occupancy and daylighting sensors.
- ✓ Installation of a rooftop solar Photovoltaic (PV) array.
- ✓ Provision of a web-based Building Management System (BMS) with Graphical Unit Interface (GUI).
- ✓ Implementation of rainwater harvesting or greywater recycling systems for non-potable use to be investigated.

3.2 Section 6 of the Scottish Building Regulations

As an alteration of an existing building, 301 St Vincent Street redevelopment is required to comply with Section 6 of the latest Scottish Building Regulations as included within the Non-Domestic Technical Handbook (applicable to works from 5th June 2023 to 31st March 2024)[1]. However, recognising the specific constraints that arise when working with existing buildings, compliance with individual standards (applicable to new builds) is not required for alterations of buildings.

Please note the following:

- **Alterations and extensions to buildings are not required to comply with Section 6.1 (Energy Demand and Carbon Dioxide Emissions) of the Scottish Building Regulations, other than:**
  - Alterations and extensions to stand-alone buildings having an area less than 50 m^2 that would increase the area to 50 m^2.
  - Extensions to non-domestic buildings where the extension will have an area which is both greater than 100 m^2 and greater than 25 % of the area of the existing building, and
  - Alterations to buildings involving the fit-out of the building shell, which is the subject of a continuing requirement.
- **Where the build-up of an element forming part of the insulation envelope is to be altered or dismantled and rebuilt, the opportunity should be taken to improve the levels of thermal insulation and comply with maximum allowable U-value standards applicable to new builds** (please refer to *Clause 6.2.1 (Table 6.3)* of the Non-Domestic Technical Handbook, applicable to works from 5th June 2023 to 31st March 2024)**.**
- **All fixed building services design parameters should be compliant with the minimum standards** listed within the 2022 Non-domestic Building Services Compliance Guide for Scotland (v1.1 – February 2023).

3.3 Design hierarchy

301 St Vincent Street redevelopment scheme has been devised to reduce its annual energy consumption, provide energy in an environmentally friendly way, and minimise its annual CO_2 footprint by setting aspiring sustainability targets and committing to deliver a best-in-class office design. To achieve this, the adopted energy strategy for the project follows our "steps to net zero carbon" methodology (please refer to *Figure 3-1* below), which aligns with the industry recognised Energy Hierarchy and Glasgow's City Development Plan – Policy CDP5: Resource Management (please refer to the Energy Hierarchy graph illustrated in *Figure 2-4* of this report).

- **Be Lean**: The design will consider the building form and fabric to provide a highly efficient envelope to drive down the energy demand from heating and cooling.
- **Be Clean**: The building services plant and equipment that is specified will be as efficient as possible to drive down energy consumption.
- **Be Green**: The remaining energy demand will be met through **low and zero carbon** energy sources.

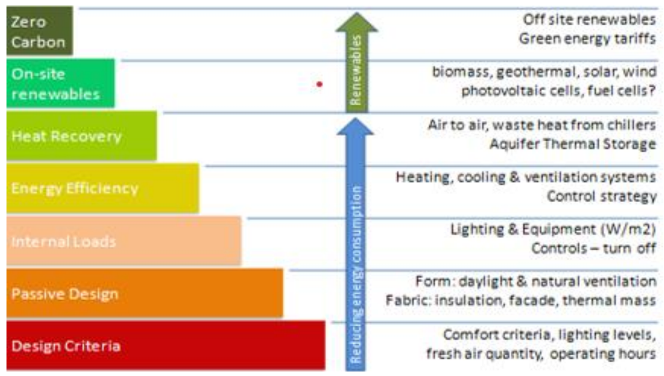


Figure 3-1: Steps to low carbon methodology diagram

3.4 Reducing demand for energy – 'Be Lean'

3.4.1 Building fabric

A fundamental measure for reducing a building's energy consumption and CO_2 emissions as well as limiting heating and cooling costs is improving its thermal efficiency by following a fabric-first approach. Although alterations to buildings are associated with specific challenges and constraints to incorporate passive design measures, the proposed 301 St Vincent Street redevelopment will feature a new or upgraded curtain walling, targeting high thermal performance standards by optimising solar gains while minimising glare and increasing natural light penetration into deep floorplates.

Figure 3-2: Proposed facade design (LOM architecture and design).

Table 3-1 and *Figure 3-3* below presents fabric performance standards and indicative targets considered as part of the 301 St Vincent Street redevelopment works.

- The '*Existing'* column of the table provides the assumed fabric performance values of the existing building (before refurbishment). Please note that values have been assumed based on the building's age of construction (i.e. in accordance with minimum standards of the 1982-1990 Scottish Building Regulations as included within the National Calculation Methodology (NCM) database).
- The '*Section 6 Limiting Standard'* columns provide the maximum U-values for new builds and alterations as included within *Clause 6.2.1 (Table 6.3)* and *Clause 6.2.11* of the Scottish Building Regulations, respectively (please refer to the Non-Domestic Technical Handbook, applicable to works from 5 June 2023).
- The '*Notional Building*' column provides the fabric performance values applied to the notional building calculations as included within *Clause 6.1.4 (Table 6.1)* of the Scottish Building Regulations (please refer to the Non-Domestic Technical Handbook, applicable to works from 5 June 2023).
- The '*NZC aspiration*' column provides aspirational building fabric performance targets in line with operational energy design measures

[1] Please note that an updated version of the Non-Domestic Technical Handbook (April 2024 edition) is available. This is applicable to works subject to a building warrant submitted on or after 1 April 2024 and to works not requiring a building warrant from that date.

applicable to commercial offices as included within the Low Energy Transformation Initiative (LETI) Climate Emergency Design Guide [2].

Element	Existing	Section 6 limiting standards		Notional Building	NZC aspiration
		New builds	Alterations		
Exposed floor U-value, W/m²K	0.58	0.18	0.70	0.13	0.10-0.12
External wall U-value, W/m²K	0.60	0.21	0.70	0.15	0.12-0.15
Roof U-value W/m²K	0.45	0.16	0.35	0.11	0.10-0.12
Pedestrian door U-value, W/m²K	3.00	1.40	1.40	1.20	1.20
Glazing U-value, W/m²K	2.80	1.60	1.60	1.20	1.20
Glazing g-value, %	76	-	-	50	30-40
Glazing Visible Light Transmittance (VLT), %	-	-	-	77	-
Window-to-wall ratio, %	>50	-	-	-	<40
Curtain walling	Scottish NCN modelling guide stipulates curtain walling to be modelled as per 'glazing' and 'opaque' elements – therefore requirements for these elements as outlined above should be met (or overall system performance should meet or improve on corresponding "average" performance requirements).				
Air Permeability (m³/(h.m²)@50Pa)	15 (assumed)	7.00[3]	-	4.00	<1.00

Table 3-1: Building fabric performance values

Please note that regarding alterations, the Scottish Building Regulations mention that where an element of the insulation envelope is to be altered and rebuilt, the opportunity should be taken to improve the level of thermal insulation as per new builds' limiting standards (please refer to the "New builds" column of *Table 3-1*).

Where 301 St Vincent Street redevelopment is aiming to be an exemplar refurbishment project, it will review the feasibility of improving building performance to NZC aspiration levels and improving upon Section 6 backstop requirements.

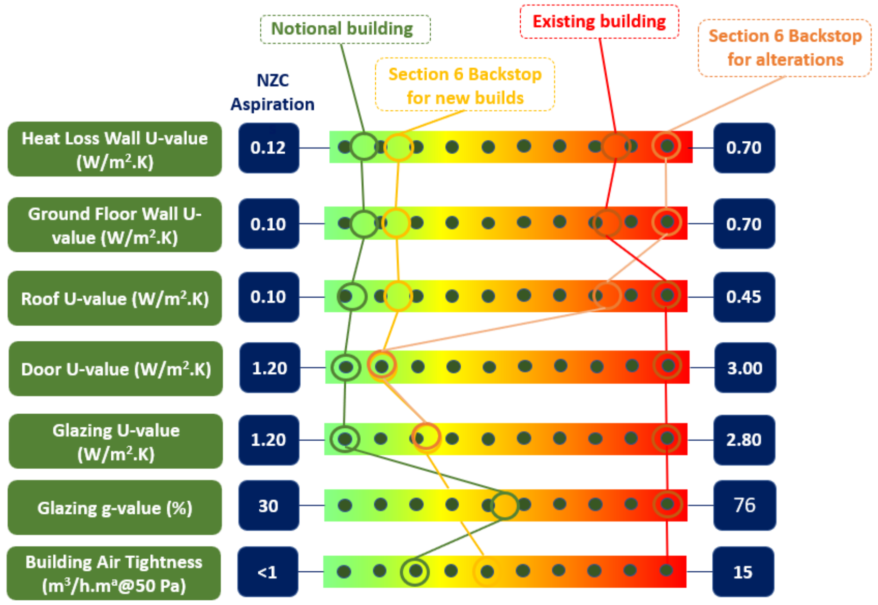


Figure 3-3: Graphical representation of building fabric performance standards

3.5 Energy efficient systems – 'Be Clean'

Once the fabric efficiency has been optimised as far as practical, the project will aim to further reduce the building's operational energy consumption and associated CO_2 emissions by selecting efficient mechanical, electrical, and control systems. The proposed redevelopment will adopt an all-electric strategy, featuring no on-site combustion for heating, cooling, and Domestic Hot Water (DHW) provision, thus negating any negative impact on the local air quality.

3.5.1 Eliminate fossil fuels

Over the last few years, the UK's electrical grid has undergone intense decarbonisation through large scale switch from coal and gas-fired power plants to renewables such as wind turbines. The result of the lower electricity carbon factor, along with the higher efficiencies of electrical technologies, is that electrical systems are no longer at a disadvantage compared to natural gas. Furthermore, combustion-based technologies such as boilers also produce other emissions that are more harmful to humans in the immediate vicinity and short term, such as Nitrogen Oxide (NOx). A fundamental step towards reducing harmful emissions is to eliminate the use of fossil fuels on building projects. Replacing natural gas especially, with cleaner electricity, from both decarbonising the national grid and provision of on-site renewables will be central for this scheme.

3.5.2 Heating and cooling strategy

Three different potential space heating and cooling energy options are currently evaluated by the design team in terms of operational and whole-life carbon, as well as associated capital and running costs. These are summarised as follows:

Option 1 – Air Source Heat Pump (ASHP) 4-pipe fan coil unit

Unlike typical ASHP systems, 4-pipe ASHPs can simultaneously heat and cool spaces, enhancing localised comfort and reducing energy use in mid-season. ASHPs are generally associated with a significantly lower charge of refrigerant compared to Variable Refrigerant Flow (VRF) and Hybrid VRF systems, with low temperature hot water and chilled water distributing heating and cooling, respectively.

Option 2 - Variable Refrigerant Flow (VRF) system

A VRF system can simultaneously heat and cool spaces and operate at high efficiencies. In this system, all pipes are charged with refrigerant. Currently, VRF systems that use R410a as a refrigerant, which has a high Global Warming Potential (GWP), are in the process of being phased out. VRF systems that use R32 refrigerants are preferred as its GWP is approximately 30% lower than R410a, and is more efficient and less costly to operate.

Option 3 - Hybrid VRF

A Hybrid VRF differs from a typical VRF system in the sense that although R32 refrigerant is used between the external condenser units and hybrid branch controller boxes (acting as heat exchangers), hot or cold water runs out of them to feed each the terminal fan coil units (i.e. total volume of refrigerant is lower, thus has reduced GWP implications).

A preliminary high-level comparison of the current three heating and cooling options has been carried out by Cundall at RIBA Stage 2 as follows (please refer to *Table 3-2* below). Please note that all figures in *Table 3-2* represent percentage differences, hence a negative difference indicates potential savings within its specific performance metric, and vice versa. It should also be clarified that all observations are based on industry guidance and past project experience to give an indication of likely impact for comparison purposes only. To verify these findings and evaluate the impact on this specific building, detailed analysis will be undertaken at subsequent stages of the project.

Performance metric	4-pipe ASHP	Typical VRF	Hybrid VRF
Operational carbon (predicted % difference from gas boilers)	- 71 %	- 78 %	- 77 %
Whole-life carbon (predicted % difference from gas boilers)	- 50 %	+ 56 %	-43 %
Whole-life cost (predicted % difference from Hybrid VRF, which is the lowest cost option) *incl. upfront, maintenance, replacement, and operational*	+ 24 %	+ 5 %	Lowest cost option

Table 3-2 :High-level comparison of heating and cooling options for the 301 St Vincent Street redevelopment.

[2] Source: https://www.levittbernstein.co.uk/site/assets/files/3494/leti-climate-emergency-design-guide.pdf

[3] No backstop value is set for air permeability. However, it is recommended that buildings are designed to achieve a value of 7.0 m³/(h.m²)@50Pa or better to allow a balanced approach to managing building heat loss (please refer to Clause 6.2.6 of the Non-Domestic Technical Handbook, applicable to works from 5th June 2023 to 1st April 2024).

The above three potential heating/cooling options present a very similar predicted percentage reduction of operational carbon compared to a gas boiler solution. This is due to the improved system efficiencies combined with the continuous decarbonisation of the electricity grid. However, although the ASHP and hybrid VRF solutions result in a significant whole-life carbon reduction compared to gas-fired boilers (i.e. 50 % and 43 %, respectively), a typical VRF solution can increase whole-life carbon emissions up to 56 % compared to gas boilers due to the significant volume of refrigerant and system leakage associated with its operation.

3.5.3 Domestic Hot Water (DHW)

Dedicated high-temperature CO_2 heat pumps are considered as the most viable option for DHW provision, replacing the existing gas-fired boilers. Embodied carbon is greatly minimised by using CO_2 as a refrigerant as it has a GWP of 1. CO_2 is also classified as a safety group A1 refrigerant which is non-toxic and non-flammable.

3.5.4 Mechanical Ventilation with Heat Recovery

The project is to adopt a fully BMS controlled ventilation strategy involving mechanical supply and extract ventilation with heat recovery and air quality demand control. This system utilises heat recovery in winter and meets peak cooling loads in summer when cooling is required and external temperature exceeds set-point temperatures.

The feasibility of implementing a mixed-mode ventilation strategy will be explored during later stages of the design, with a particular focus on its application to the upper floors. Fire engineering, acoustic, and air quality considerations need to be investigated in detail, particularly where openings are between office and atrium areas, before the feasibility of this strategy is deemed appropriate (see more under secition 6.6.2).

3.5.5 Fixed building services performance targets

Fixed building services will be designed in line with relevant regulation, whereby efficiencies will meet or exceed Section 6 limiting standards as included within the 2022 Non-domestic Building Services Compliance Guide for Scotland (v1.1 – February 2023). *Table 3-3* provides a summary of the Section 6 backstop, notional building, and NZC aspiration values in relation to system characteristics

HVAC Equipment Parameter	Section 6 limiting standards	Notional Building	NZC aspiration
Space heating efficiency, SCOP (applicable to all heat pump types)	2.50	3.00	>2.85
DHW efficiency (applicable to all heat pump types)	2.00	2.70	>2.85
Space cooling efficiency, SEER	5.00	6.40	>5.50
Central ventilation maximum SFP, W/l/s (existing/ new buildings)	2.6/ 2.0	1.80	1.40
Heat recovery, %	50/ 65 / 45	76.0	>75%
plate heat exchanger/ thermal wheel/ run-around coil			
Variable speed with multiple pressure sensors	Recommended	Yes	Yes

Table 3-3:: Fixed building services specifications

301 St Vincent Street redevelopment is aiming to meet the NZC aspirations, thus exceeding Section 6 backstop values, which are shown in the "Section 6 limiting standards" column of the table above,

3.5.6 Low-energy Lighting

Installing efficient low energy light fittings internally and externally can significantly reduce a building's overall lighting load hence lowering its annual CO_2 emissions. The development will reduce the energy consumption by the specification of low energy, high efficacy luminaires in all spaces with daylight and PIR controls throughout.

3.5.7 Building Management System (BMS)

A web-based BMS incorporating Graphic User Interface (GUI) will be provided with fully addressable set-points and remote alarm monitoring. The BMS will be able to record and monitor all the energy and water consumption throughout the building for primary plant (air handing units, heat pumps, etc.) and on a floor-by-floor and zone-by-zone basis. Out of range values will be identified within the BMS software.

3.6 Local Renewable Energy Technologies – 'Be Green'

The final 'Be Green' stage of the Energy Hierarchy is to provide clean energy onsite with Low and Zero Carbon Generating Technologies (LZCGTs). These can include renewable energy sources such as solar panels and micro-wind as well as heat pumps, combined heat and power, district heating infrastructure, with the latter two technologies using fossil fuels but resulting in significantly lower carbon dioxide emissions compared to conventional heating systems such as gas-fired boilers.

For the proposed 301 St Vincent Street redevelopment, both ASHPs and solar photovoltaics are considered as viable solutions for installation on site to help the project achieve its sustainability targets and comply with the Scottish Building Regulations and Glasgow City Local Development Plan.

The potential for the introduction of a range of LZCGTs targeting heating, cooling, and hot water are summarised in the following sections:

3.6.1 Non-viable LZCGTs

The following technologies have been identified and explored for use within the proposed development but have been ultimately deemed inappropriate. These conclusions are based on both practical and fundamental implications which are discussed further below.

3.6.1.1 Combined Heat and Power (CHP)

Combined Heat and Power (CHP), also known as cogeneration, is an energy system capable of producing both useful heat and electricity simultaneously in a single process. It allows for optimum use of the energy available from the fuel used.

The efficient use of CHP typically depends on finding a use for the heat generated by the process. Issues to consider include:

- If heat is not used, then the system is just an electricity generator and electricity will be greener and cheaper if sourced from the national grid.
- If excess electricity is generated on site, this can be exported (sold) back to the grid whereas excess heat needs to be rejected (wasted). Exported electricity can count towards reducing the site's CO_2 emissions.

Exported electricity will typically not be financially attractive as exports tend to coincide with low demand periods on the national grid so the cost of producing the electricity on site can be more than the prices received for the exported electricity.

The use of CHP is not considered an appropriate technology for the proposed redevelopment as the carbon benefit from electricity generated is negligible due to the rapid decarbonisation of the electricity grid. Furthermore, flue gases from the gas-fired CHP can lead to a reduction in local air quality.

3.6.1.2 District Heating

A district heating or cooling scheme comprises of a network of insulated pipes used to deliver heating or cooling, normally in the form of hot or chilled water from the point of production to an end user.

The feasibility of connecting to an existing district heating network has been investigated. However, the proposed project is located where no district heating schemes are currently operating, therefore the development cannot connect to an existing district heating scheme. No information has been found regarding any future plans for a new district heating network within or nearby the site.

3.6.1.3 Biomass Heating

A base load biomass boiler would have to be integrated into a centralised energy system as a lead boiler in a modular arrangement with a supplementary heat source to address load variations and ensure security of heat supply during times of peak demand. Additionally, biomass boilers require significant space for storage and delivery of fuel. Such a system has higher particulate emissions than gas boilers, which may negatively affect the air quality of the site. There are also significant issues associated with security of fuel supply, storage, and increased annual maintenance requirements. The Glasgow's City Development Plan (CPD5) also mentions that the use of biomass to generate electricity and heat may raise air quality issues in some cases and may not always be an acceptable solution. Consequently, biomass boilers have not been deemed appropriate for the proposed redevelopment.

3.6.1.4 Solar Thermal

Solar collectors are typically designed to meet a development's base heat load, associated with its DHW requirements. However, the available roof space will be covered by solar PVs, which would likely offer a more efficient solution for the development and solar thermal is therefore not considered the best option at this stage. The DHW demand is to be served by an ASHP configuration.

3.6.1.5 Wind Turbines

Wind turbines could be mounted on the roof of the building to access more laminar wind flows that at ground level. It is essential that they are sited away from obstructions, with a clear exposure or fetch for the prevailing wind as their output is highly sensitive to wind speed and typically lower than other renewable energy technologies. As such, the scale of installation that would be required to offer significant benefit is not deemed feasible for this development.

3.6.2 Viable LZCGTs

This initial high-level review of a range of possible Low and Zero Carbon Generating Technologies (LZCGT) for the proposed redevelopment indicates that the ASHP and solar PV panels would likely be the most feasible for installation on site to achieve the required standards.

It should be highlighted that all options listed at this stage are high-level solutions only for the purpose of this initial energy strategy and the final solution for the development will be reviewed in more detail as the design develops.

3.6.2.1 Air Source Heat Pumps

ASHPs are considered a green low carbon technology because they are powered by electricity, but also extract thermal energy from the air at very high efficiencies. They exchange heat between the outside air and a building through refrigerant pipes and terminal units to provide space heating in winter and cooling in summer months.

ASHPs supply more energy than they consume, by extracting heat from their surroundings. Generally, heat pump systems can supply as much as 4kW of heat output for just 1kW of electrical energy input. The efficiency of these systems is inherently linked to the ambient air temperatures, meaning that they have reduced operating efficiency during cold weather. However, the technology is continually improving with relatively high efficiencies still available in extreme winter conditions.

It should be noted at this point that the noise generated by heat pump units must be considered as part of the design, especially when a building is naturally ventilated via openable windows.

The viability of installing ASHP systems to deliver all the heat demand of the proposed redevelopment has been evaluated. This type of system is considered a suitable solution as it provides an element of futureproofing in switching to an electrically powered heating solution, further supported by the largely decarbonised UK electricity grid.

Based on our initial high-level review of ASHPs, VRFs, and hybrid VRFs as heating and cooling solutions for the building, operational energy and carbon savings are similar between a 4-pipe ASHP and a VRF/hybrid VRF system. However, the whole-life cost associated with the ASHP system is estimated to be approx. 25 % higher than a hybrid VRF system (please refer to Section 3.5.2). ASHPs' viability and scope will be further reviewed at subsequent stages of the project.

3.6.2.2 Photovoltaics (PV) panels

Photovoltaic solar cells convert solar energy directly into electricity. The cells consist of two layers of silicon with a chemical layer between. The incoming solar energy charges the electrons held within the chemical. The energised electrons move through the cell into a wire creating an electrical current. Once the photovoltaics cells are installed, they require minimal maintenance over their operational life and have no primary fuel requirements.

A high-level review of the feasibility of onsite electricity generation has been undertaken. The site offers the potential for the installation of PV panels due to the roof space available. A solar PV system could be installed, potentially in conjunction with some form of storage as a means of utilising renewable electricity on site and offsetting some of the development's electrical demand.

The installation of a photovoltaic array to meet part of the electricity demand of the building is therefore considered as a viable low carbon solution for the 301 St Vincent Street redevelopment.

The following assumptions have been made in relation to solar PV provision for the proposed redevelopment:

- PV orientation: South-West
- Array inclination (º from horizontal): 40 º
- (Individual) PV panel area: 1.7 m^2
- (Individual) PV panel efficiency: 22 %
- Total PV area: 1,450 m^2, covering 35% of the available roof area at Level 4 and 5 to allow for maintenance between panel arrays (please refer to *Figure 3-4* below).

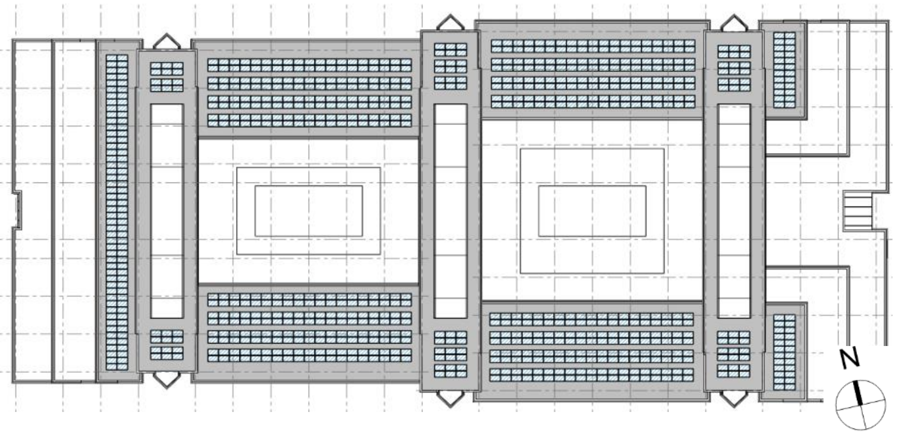


Figure 3-4: Initial PV array configuration, produced by LOM architects.

A high-level assessment of the above rooftop PV array has been carried out using the approved IES Virtual Environment (IES-VE) 2023 dynamic simulation software (version 3.1) to estimate its predicted annual output. Assuming moderate shading from neighbouring buildings (shading factor = 0.70) and using Glasgow's weather file (GlasgowTRY05.fwt), the above PV is estimated to be able to generate approx. 190 MWh/annum. Depending on the Energy Use Intensity (EUI) achieved for the development, this has the potential to deliver upwards of 5% of anticipated annual energy consumption (based on an EUI of ~120kWh/m2(NIA), broadly corresponding with a 3.5 NABERS star rating), or an even greater proportion (e.g. 7.4% if an EUI of ~90 kWh/m2(NIA) can be achieved, broadly equivalent to a 4.5 NABERS star rating). These figures are indicative, based on conservative assumptions at this stage (regarding EUI and corresponding NABERS rating). These are to be reviewed and optimised, subject to detailed NABERS energy modelling to be undertaken from the next RIBA stage onwards.

Detailed operational energy modelling will help understand the number of PV panels required in order for the project to achieve its specific sustainability targets (i.e. EPC rating, BREEAM rating, targeted Energy Use Intensity, etc.). Although maximising renewable energy generation from PVs is highly recommended, this should be assessed alongside the available roof area to allow for sufficient space between panel arrays for any maintenance works required.

3.7 Energy modelling

A dynamic thermal model of the 301 St Vincent Street building is currently under development by Cundall using the approved IES Virtual Environment (IES-VE) 2023 dynamic simulation software (version 3.1).

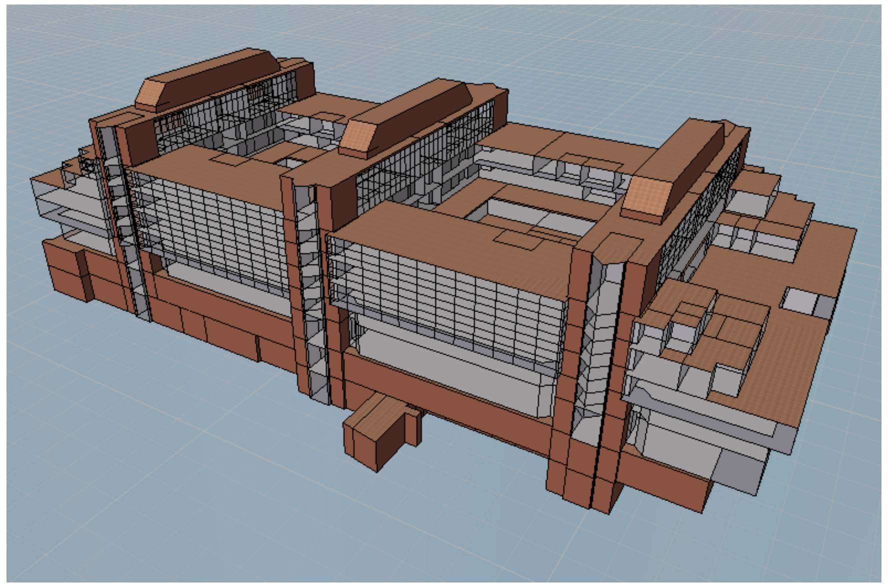


Figure 3-5: 301 St Vincent Street IES model (IES VE 2023)

The model will be further developed at subsequent stages of the project to better understand the building's energy requirements and further review the various design options for heating/cooling/ventilation provision as well as the amount of PV required for the project to achieve its sustainability targets. Our recommendation for the project going forward is to undertake a detailed operational energy assessment following the NABERS DfP methodology (or equivalent). This will allow the design team to make informed decisions for the design and make sure the project is on track to achieving its specific sustainability targets.

3.8 Conclusions

Eliminating fossil fuel dependence, increasing energy efficiency, and using LZCGTs are at the heart of the proposed energy strategy for the 301 St Vincent Street redevelopment scheme. The design options outlined in the previous sections demonstrate that the proposed development embraces national targets for renewable energy generation and addresses local planning policy requirements for the utilisation of LZCTs on-site as outlined within Policy CDP5: Resource Management (for further details, please refer to Section 2.3 of this report).

4.0

Whole Life Embodied Carbon and Circular Economy Strategy

4.0 Whole Life Embodied Carbon and Circular Economy

4.1 Whole Life Embodied Carbon

The built environment contributes to nearly 40% of the global emissions. 11% of this arises from the upfront and construction activities that are associated with the building materials and construction activities. These emissions are termed as *"embodied carbon"* and they are becoming a greater percentage of a buildings emissions over its lifetime as they become more energy efficient and the energy network decarbonises.

Whole life-cycle embodied carbon is the total greenhouse gas emission arising from a development over its lifetime. The embodied carbon element includes the emissions associated with raw materials extraction, the manufacture and transport of materials, to installation/ construction, maintenance, minor and major refurbishments, deconstruction, and the reuse of building materials, as shown by the life cycle modules in *Figure 4-1* below.

4.1.1 Assessment Methodology

The use category and lifecycle modules follow BS EN 15978: 2011: (Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method). This standard aligns with the RICS Professional Statement: Whole Life Carbon assessment for the built environment (referred to as the 'RICS PS' for the remainder of this document)[5]. The RICS PS serves as a guide to the practical implementation of the BS EN 15978 principles. It sets out technical principles and calculation details and will be used as the methodology for assessing this development. This ensures that embodied carbon assessments have consistency in their assessment and reporting across the built environment industry.

The whole life carbon assessment accounts for all components relating to the project during all life stages. Embodied Carbon emissions are attributed to four main categories taken from BS EN 15978. The categories are:

- **Product Stages** (module A1 to A3): The carbon emissions generated at this stage arise from extracting the raw materials from the ground, their transport to a point of manufacture and then the primary energy used (and the associated carbon impacts that arise) from transforming the raw materials into construction products.
- **Construction (module A4 to A5):** These carbon impacts arise from transporting the construction products to site, and their subsequent processing and assembly into the building.
- **In-Use Stages (module B1 to B5):** This covers a wide range of sources from the embodied carbon emissions associated with the operation of the building, including the materials used during maintenance, replacement, and refurbishment. Operational estimations of energy use are excluded from embodied carbon assessments. Key stages are the replacement stage, B5.
- **End of Life Stages (module C1 to C4):** The eventual deconstruction and disposal of the existing building at the end of its life takes account of the on-site activities of the demolition contractors. No 'credit' is taken for any future carbon benefit associated with the reuse or recycling of a material into new products.
- **Benefits and loads beyond the system boundary (module D):** Any potential benefit from the reuse, recovery and recycling potential of a building or a building product. This module has been included within the assessment scope of this study but excluded in the final results.

4.1.2 Embodied Carbon Indicators

There are a range of industry accepted targets for new build schemes (i.e LETI or RIBA). As the building is being refurbished and the primary structure retained then these aren't applicable to the scheme. Embodied carbon targets have been set based on Cundall's experience in Whole life carbon and their database of previous projects.

Having the overall target will help inform design decisions on the refurbishment to ensure the target will be met. Embodied carbon is a key metric that is being considered when design options are being reviewed at the concept stage.

Upfront targets relate to the initial construction stage (Stage A1-A5). Whole life carbon relates to the full building lifecycle including replacement events and end of life scenarios for the various building materials.

Indicator	Requirement	Aspiration	Unit
Upfront embodied carbon (A1-A5)	<400	<350	$kgCO_2e/m^2$ (GIA)
Whole Life Embodied Carbon (A1-5, B1-5, C1-4)	<650	<550	$kgCO_2e/m^2$ (GIA)

Table 4-1: Upfront and WLC Embodied Carbon Targets

The following building elements have been considered as part of the assessment as they are to be part of the building refurbishment:

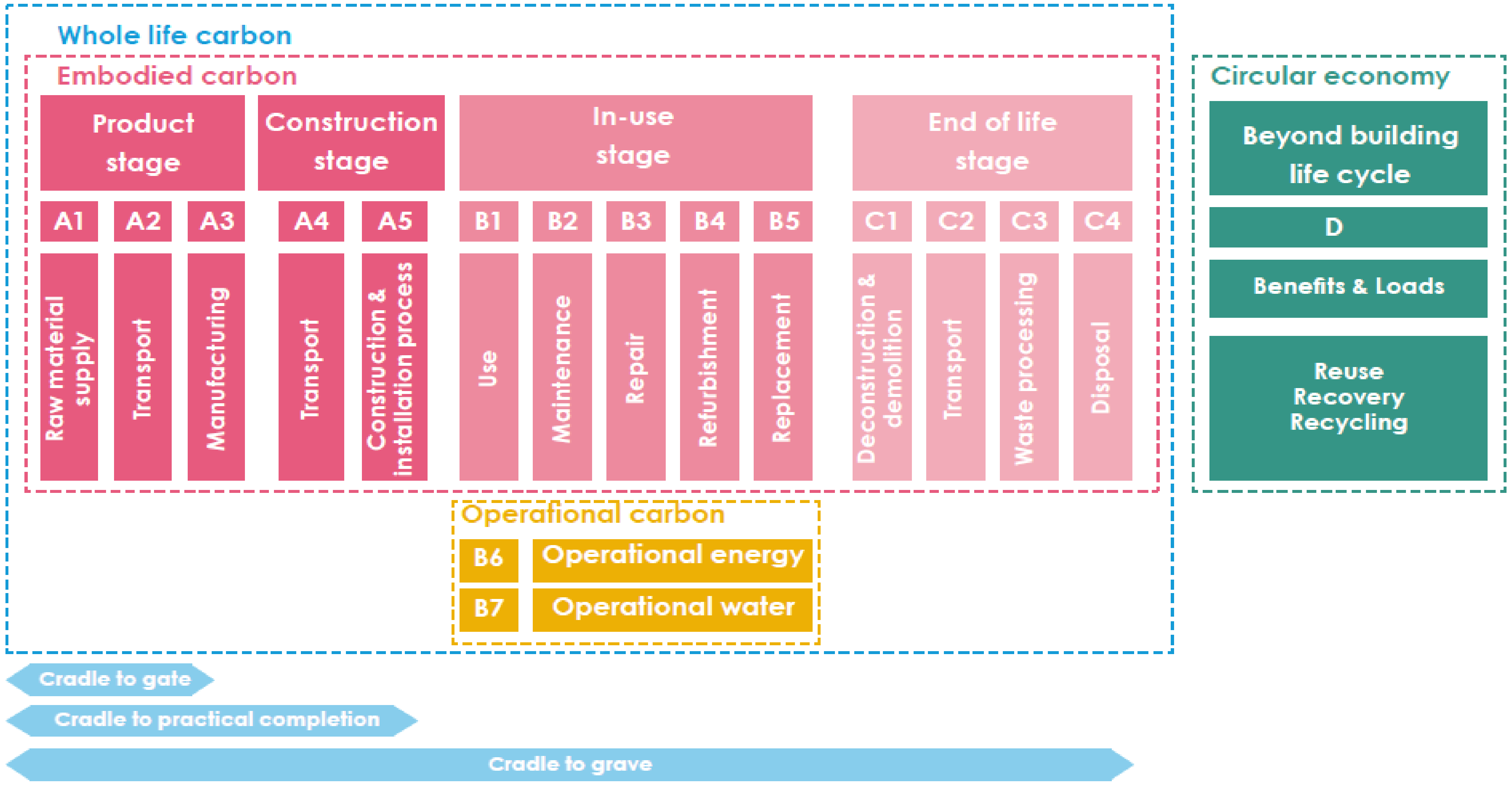


Figure 4-1: Life Cycle Modules as per BS EN 15978 and RICS methodology

[5] *Royal Institution of Chartered Surveyors (2017), RICS Professional Statement: Whole Life Carbon assessment for the built environment. 1st Edition. Available at: https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf*

- Envelope (Curtain walling, glazing, insulation)
- Building Services (Heating, lighting etc)
- Internal Finishes (Partitions, carpets, ceilings etc)
- Furniture, Fixings and equipment (white goods, office furniture, etc)

4.1.3 NPF4 Alignment

The whole life carbon assessment aligns with the principles of NPF4. Measuring and reducing Whole life embodied carbon helps reduce carbon emissions as being part of the aim for Scotland to be Net Zero by 2045.

Policy 1: Tackle Climate and Nature Crisis

Policy Intent: To encourage, promote and facilitate development that minimises emissions and adapts to the current and future impacts of climate change.

The WLECA will help the project minimise its embodied carbon emissions over the full design life of the building. The report will also promote low carbon materials with a focus on biogenic materials. These reports and recommendations will help promote a low carbon design and satisfy the principles of a Just Transition.

Policy 2: Climate Mitigation and Adaption

Policy Intent: a) Development proposals will be sited and designed to minimise lifecycle greenhouse gas emissions as far as possible.

b) Development proposals will be sited and designed to adapt to current and future risks from climate change.

c) Development proposals to retrofit measures to existing developments that reduce emissions or support adaptation to climate change will be supported.

This project aligns with this policy as we are reusing the existing building structure. The building is being future proofed by having a new envelope and building services installed. Both will be designed to accommodate the current and future climate.

4.1.4 Next steps

The targets set above will be monitored during subsequent design stages of the project. The assessment will be updated as more designs are finalised and specific materials and specifications are confirmed. Cundall will work with the design team to identify the carbon "hot spots" and provide reduction options to minimise the embodied carbon for the scheme.

The following hierarchy for design decisions will be promoted when Cundall work with the design team. Early engagement with the design will help ensure that the embodied carbon is minimised when key design decisions are made.

4.1.4.1 Low Embodied Carbon Design Hierarchy

It is useful to consider and follow the low embodied carbon design hierarchy to facilitate reducing carbon density throughout the design process. The six steps of the hierarchy are:

- **Build Less** – Can existing elements be reused or challenge if new elements required
- **Build Light** – Minimise new material use and promote high design utilisation that is to be balanced with rationalisation for buildability.
- **Build Wise** – Repurpose and recycle materials using circular economy and whole life carbon principles.
- **Build Lower Carbon** – Prioritise natural, low carbon materials, while considering material efficiency.
- **Build for the Future** – Design for flexibility and durability to ensure carbon sinks are long-life.
- **Build Collaboratively** – Consider end-of-life and prioritise circular economy principles.

We are already meeting the first level of **Build Less** by retaining the structural frame and foundations**.** The circular economy report will also highlight other elements that could be retained and reused.

4.2 Circular Economy

In line with emerging national/local policy best practices, a circular economy statement will be prepared for the development. This will detail the circular economy strategies followed including:

- Retention and reuse of the existing building where possible
- Promote the inclusion of reused materials
- Following the waste hierarchy in dealing with strip-out and construction waste
- Adopting design for disassembly principles where feasible
- Selecting materials with a high level of recycled content
- Provision of suitable waste recycling facilities, including the monitoring, and reporting of waste generation

4.2.1 Circular Economy Targets

Table 4-1 compiles circular economy commitments suggested by Cundall for the development covering waste management, recycled content, and design for disassembly. These are initial targets that will be reviewed in subsequent stages and will be adjusted as the building scope of works is finalised.

Indicator	Requirement	Aspiration	Unit
Responsible and local sourcing of materials	Maximise	Maximise	N/A
Material from reused sources	20	30	% (by cost/tonnage)
Material from recycled sources	20	30	% (by cost/tonnage)
Construction waste diverted from landfill	>95	>98	% (by tonnage)
Non-hazardous construction waste generated	1.9	0.9	Tonnes/100m² (GIA)
Design for Flexibility and Adaptability	Ensure a 50% of the NIA of the building is designed for flexibility	Ensure a 80% of the NIA of the building is designed for flexibility	%
Material which can be reused at end of life	50	60	% (by cost/tonnage)
Materials included in a digital passport	Minimum 30% of new materials can be included in material passport or a similar database.	Minimum 50% of new materials can be included in material passport or a similar database.	%

Table 4-2: Circular economy KPI Targets.

4.2.2 Circular Economy Methodology

According to the Ellen MacArthur Foundation, a leading authority on the circular economy, a circular economy is based on the principles of designing out waste and pollution, keeping products in use, and regenerating natural systems.

The circular economy is a move away from the linear economy, where materials are mined, manufactured, used, and thrown away, to a more circular approach, where resources are kept in use and their value is retained. The linear economy has facilitated rapid growth in manufacturing and responding to resource demands, however, it is inherently unsustainable in the long term. Recycling is an integral aspect of reducing waste, however, a circular economy seeks to prevent the waste from being created in the first place, limiting the need for new resources.

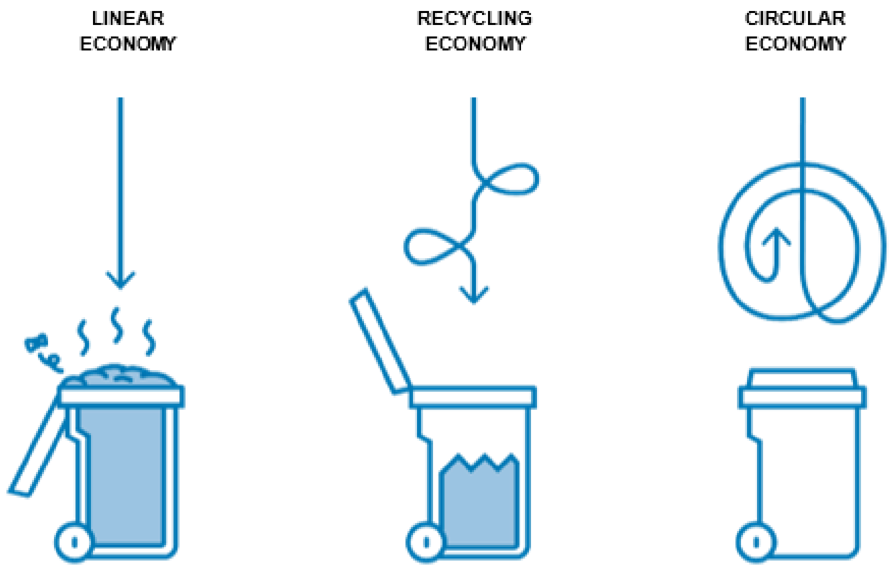


Figure 4-2: Linear, recycling, and circular economy models.

Circular economy embraces a shift away from the consumption of finite resources and a move towards the adoption of renewable energy sources, this is based upon three principles, as set out by the UKGBC:

- Design out waste and pollution.
- Keep products and materials in use.
- Regenerate natural systems.

For the built environment, this translates into creating a regenerative built environment which prioritises retention and refurbishment over demolition and rebuilding.

4.2.3 Strategic Approaches

The project maintains the existing the structure and refurbishes the building to provide a modern office space.. The following 4 approaches can be followed as the key core circular economy principles for refurbished development. This has been aligned with Zero Waste Scotland (ZWS) 'Construction Resources in a Circular Economy[6]', which shows the path that has been followed to inform the design process for the development from the outset to ensure it can be adapted to extend its life.

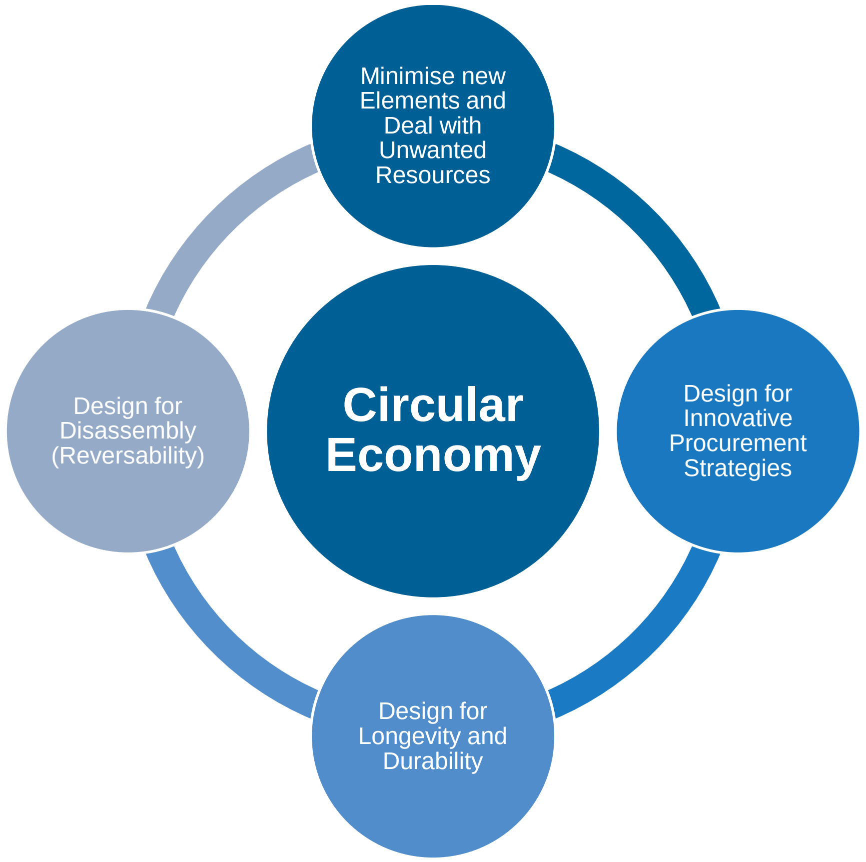


Figure 4-3: Circularity design principles.

- **Minimise new elements and deal with unwanted resources**: The first focus to reuse existing elements where possible. Items such Raised access floor are an example of potential reuse. Existing materials not suitable for retention will looked to be dealt with appropriately to avoid unnecessary landfill and maintain the value of materials.
- **Design for innovative procurement strategies**: The development will evaluate whole life impacts of new materials and maximise the use of recycled content. Priorities will also be given to sourcing the materials and other resources responsibly and sustainably during design and construction with a focus on local suppliers and using products as services.
- **Design for longevity and durability**: The development will ensure that components and materials are built with an optimal lifetime, taking resource efficiency perspectives into account. Obsolescence will be avoided by utilising building components that can be easily repurposed or refurbished with minimal environmental impact.
- **Design for disassembly (Reversibility):** The development will ensure building structures & elements can be taken apart or dismantled easily, with the original materials and components being reused to maximize their lifespan.

Buildings need to be more adaptive to future changes, facilitating deconstruction and reconstruction easily to extend beyond an expected 60-year lifespan. Materials must maintain a high quality and be fully salvageable when dismantled, to ensure suitability for repurposing and reuse.

4.2.4 Work at Stage 2

Cundall is commissioned to support circular economy principles in the refurbishment works to optimise embedded material reuse and whole-life waste reduction strategies. During Stage 2, workshops were held with the design team to investigate the material options for the project, look at opportunities for a circular design and provide reporting and guidance to embed through the project.

4.2.5 NPF4 Alignment

There are a number of policies within the NPF4 that are met with incorporating circular economy principles into the building design.

Policy 12 Zero Waste: To encourage, promote and facilitate development that is consistent with the waste hierarchy.

The promotion of the circular economy design principles for the design will naturally help minimise waste in the projects construction stage. The various KPI's noted will help minimise the materials that would typically be sent to landfill during the refurbishment. The project will look to retain the value of any existing materials not required in the new design, The principles also highlight design decisions that can help minimise design waste for new elements of the design.

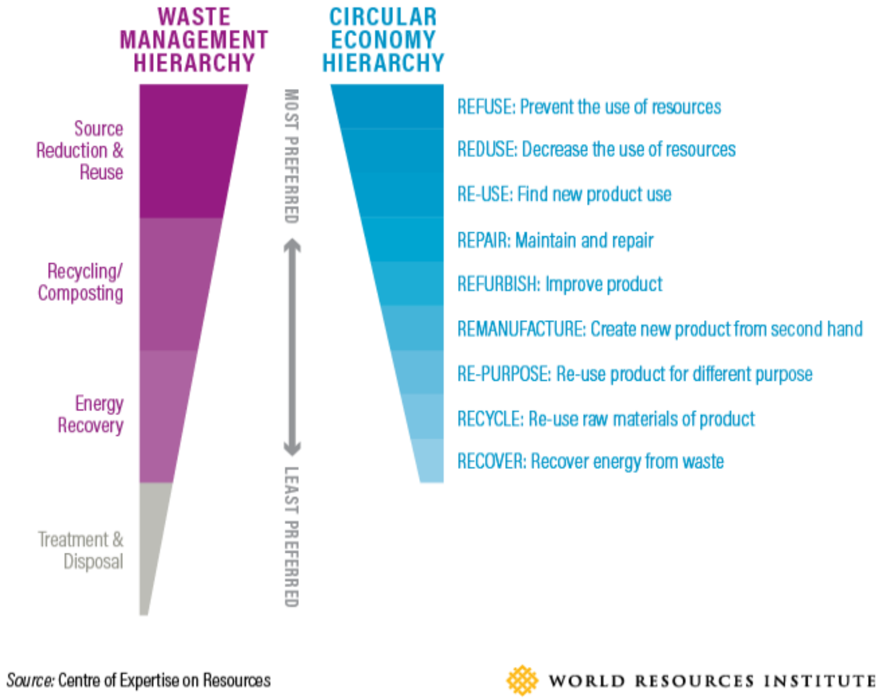


Figure 4-4: Waste Management Hierarchy vs. Circular Economy Hierarchy.

Policy 14 Liveable Places: To encourage, promote and facilitate well designed development that makes successful places by taking a design-led approach and applying the Place Principle .

This policy highlights as part of their principles supporting the efficient use of resources that will allow people to work and stay in their area, ensuring climate resilience, and integrating nature positive, biodiversity solutions. Furthermore, the development Supporting commitment to investing in the long-term value of buildings, streets, and spaces by allowing for flexibility so that they can be changed quickly to accommodate different uses as well as maintained over time.

The whole life carbon and circular economy assessments will ensure an alignment to the policy and planning statement based on the folowing:

- The design will accommodate change, allowing for realistic reconfiguration and remodelling suitable for the predominant office typology and other mixed-use areas. This includes materials, considering their replacement frequency and strategies to prevent premature end-of-life for all components, given the high expected traffic.
- Durable and resilient materials will be considered during the subsequent design stage to ensure they are protected against damage and material degradation. These measures will extend the lifespan of materials, reducing the frequency of replacement and maintenance procedures.
- Furthermore, strategies will be in place at the end of life, products, components, and materials should be recovered at the highest possible

[6] https://www.zerowastescotland.org.uk/resources/construction-resource-library

value. This means the project should avoid specifying materials and products that have no known recovery route, incentivising the servitisation and leasing of building materials and products.

4.2.6 Circular Economy Next Steps

To ensure that the principles outlined in the current Circular Economy Statement and targets set for the development are incorporated in the later design stages, during construction and at handover it is advised:

- The commitments taken forward are developed further, addressing how the circular economy principles and initial strategies will be implemented using the guidance provided in this report.
- Investigate further into designing for disassembly and recoverability when looking at the lifetime of the project – consider long-term cost optimisation and financial risk.
- Develop a detailed responsible procurement strategy at later stages from the outcome of what is agreed within the circular economy strategy for the contractor to follow and provide to suppliers as needed.
- Hold a circularity workshop with the principal contractor (when appointed), and key sub-contractors, to advise on the circularity targets and discuss how these would be best incorporated and monitored during construction.
- Hold regular circularity workshops including the project design and construction teams to check progress against the circularity targets, collating evidence of implementation and also noting deviations.
- Initial outcomes and objectives are to be reviewed periodically through focused workshops at key stages.
- Collate as-built information, above and beyond the standard O&M and other handover documentation, to ensure that the circularity principles incorporated are known during operation and end-of-life.
- To further develop the current site waste management plan and commit to work towards achieving zero waste targets.

It is also advised that upon completion the client, design team and principal contractor reflect on the initial strategy and progress against the set targets noting lessons learnt through both achievements and deviations to pass on to the next project.

5.0

Water

5.0 Water

5.1 Water efficiency

Water consumption in the UK has risen by 70% over the last 30 years. Trying to meet the increasing demand by locating new sources of water supply is both expensive and damaging to the environment. Therefore, the following proposals focus on reducing the demand for water and managing the existing resources.

Scottish Water estimates that the average water consumption is 165 litres per person per day in Scotland, with this being the highest figure across the UK. Water consumption has generally increased over the last few decades and is expected to continue to rise based on water consumption for sanitary facilities, laundry, drinking, washing, and external use. Reducing water consumption can help save energy and reduce CO2 emissions in relation to the following areas:

- Treating water so it is suitable for drinking.
- Distribution and delivery of water.
- Collection and pumping of wastewater.
- Treatment of wastewater.
- Heating of water for health and hygiene.

The aim is to minimise internal and external potable water use within the development. Good water management can contribute to reducing the overall level of water consumption, maintaining a vital resource and, having environmental as well as cost benefits in the life-cycle of the building.

The following water saving measures are being considered throughout the 301 St Vincent Street redevelopment.

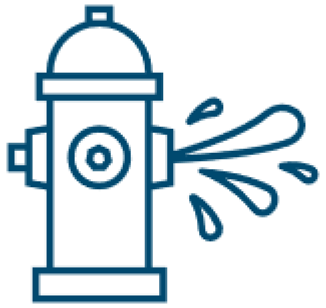
- ***Dual Flush Cisterns on WC's*** - These units have the ability to provide a single flush of 4L and/or a full flush of 6L. It is proposed that these are used throughout the development in order to minimise water consumption.
- ***Flow Restrictors to Taps*** - Flow restrictors reduce the volume of water discharging from the tap. Spray taps have a similar effect and are recommended to reduce both hot and cold-water consumption. Low flow taps in one of the above forms should be considered for all areas.
- ***Low Flow Showers*** - The average shower uses 15 litres of water a minute. By restricting the output of the showers in the development to a maximum of 9 litres/ minute, a 40% water saving can be achieved. Flow rate can be reduced down to 6 litres/minute without compromising on water pressure and hence will be considered as the design develops.

5.2 Water monitoring

In 2017, approximately 5.3 billion cubic meters of water were abstracted for water supply, making up over half of all water abstracted in the UK. To reduce this figure, accurate information on usage is required for management of a building's water consumption. Water meters will be specified on the main supply and include sub-metering where appropriate.

The Building Management System (BMS) currently considered for the project will be able to record and monitor water consumption throughout the building and on a floor-by-floor and zone-by-zone basis (please refer to Section 3.5.6 of this report).

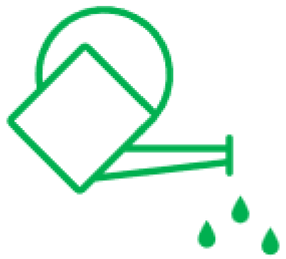
5.3 Leak prevention and detection



To minimise the risk of major water leaks occurring, a water leak detection can be installed. The flow rate of the incoming water meter will be monitored by a leak detection system, which will highlight when there is a significant rise in water consumption, indicating a major leak within the development.

The leak detection system can be standalone or integrated within the BMS. It will feature programmable thresholds to suit the specific consumption of the development and an audible alarm if those thresholds are exceeded.

5.4 Irrigation



External irrigation can also contribute towards significant water consumption if not appropriately managed. External planting will primarily utilise plants which are adapted to the local climate and can rely on precipitation alone for most of the year. Where irrigation is required, this will be water efficient.

In addition, landscape enhancements and external watering point will be considered and agreed with architects and landscape consultants.

5.5 Greywater recycling and rainwater harvesting

Greywater recycling and rainwater harvesting systems will be investigated for development to conserve water resources and reduce consumption. The suitability of site, water quality, integration with building systems, and maintenance requirements are all potential factors that will influence the feasibility of implementing these systems.

6.0

Wider Sustainability Considerations

6.0 Wider Sustainability Considerations

6.1 Transport

The transport of people between buildings is the second largest source of CO_2 emissions in the UK after energy use in buildings and remains the main source of many local pollutants. Energy use and emissions from transport are growing at 4% per year, and at the same time the effects of climate change are becoming more severe.

The following sections outline the transport options that are available to the proposed 301 St Vincent Street development. Overall, its location is extremely suitable for personnel to travel to and from the site without the reliance on a personal car. The site is in central Glasgow and benefits from its proximity to National Cycle Network routes and numerous public transport links. It is also located 800 m and 1 km away from Glasgow Central and Queen Street stations, respectively.

Non-reliance on private car to travel to and from the site is in line with local planning requirements as outlined within Policy CDP1: The Placemaking Principle, which, amongst others, is in place to promote developments that provide connectivity and support active travel and public transport use over private car use.

6.1.1 Walking

Walk Scores measure the walkability of a location based on its distance to nearby places (e.g., shopping, schools, parks, entertainment, etc.) and pedestrian friendliness.

301 St. Vincent Street is located in central Glasgow and has a “Walker’s Paradise” Walk Score of 98 (please refer to *Figure 6-1* below), revealing excellent links to amenities and accessibility by foot.

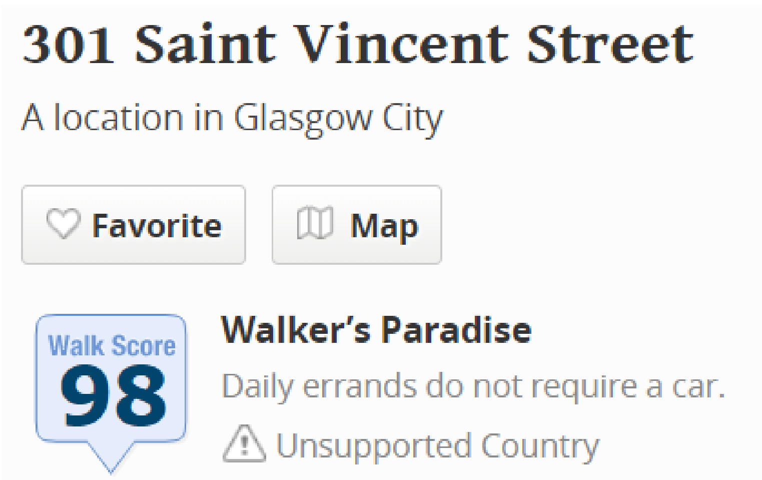


Figure 6-1: Walk Score of 301 St. Vincent Street, Glasgow (301 Saint Vincent Street, Glasgow City Scotland - Walk Score)

6.1.2 Cycling

The site is close to Routes 756 and 75 of the National Cycle Network (NCN), offering the opportunity to easily move from the site to several areas across the river Clyde (please see *Figure 6-2* below). Routes 756 and 75 are also connected to Route 7 of the NCN, which runs between Sunderland and Inverness and spans over 540 miles. Secure cycle parking will be provided within the development.

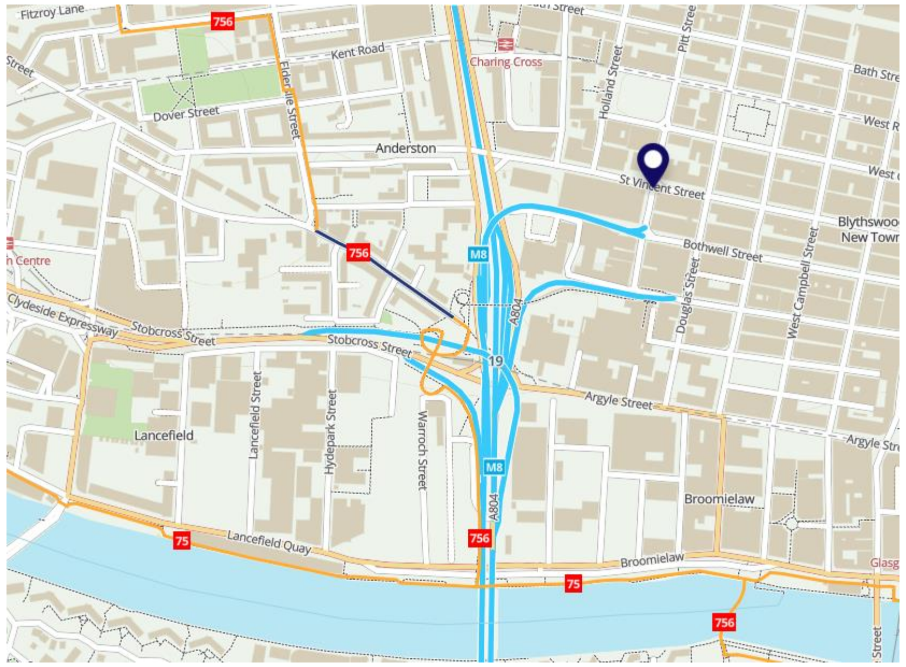
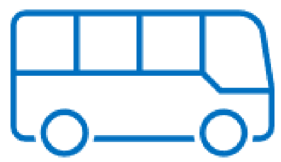


Figure 6-2: National Cycle Network near 301 St Vincent Street (St Vincent Street | OS Maps)

6.1.3 Public Transport



The site is highly accessible and benefits from excellent transport links to various locations across the city.

Glasgow Central and Queen Street train stations are conveniently accessible on foot, with both being situated at an approximate distance of 800m and 1km from the site, respectively. The closest bus stops are less than a minute’s walk away and is located directly outside the site, along St Vincent Street. These factors offer the opportunity for great access to a variety of locations within and outside Glasgow City.

Figure 6-3: Site’s nearest bus stop, Holland Street (Google maps photo).

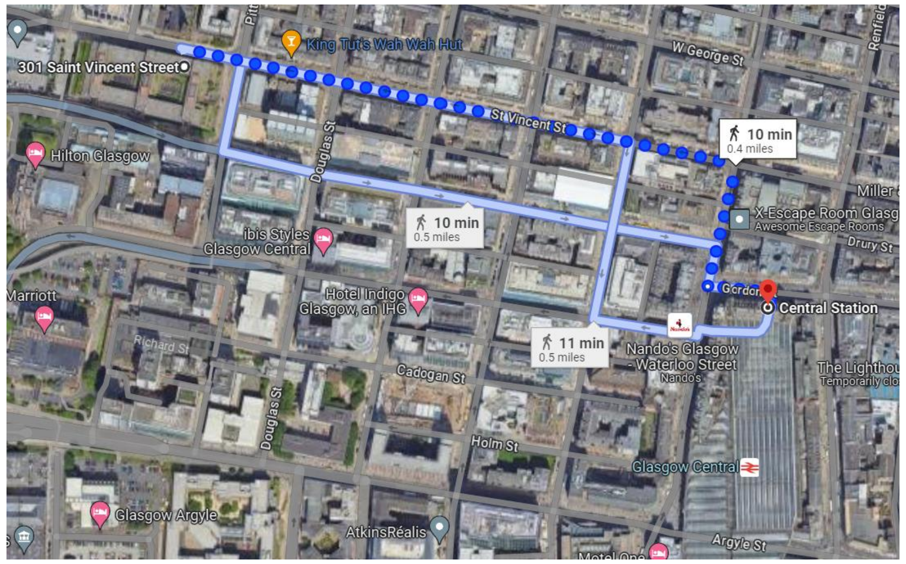
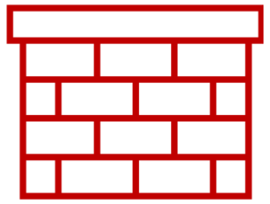


Figure 6-4: Access to Glasgow Central Station (Google maps photo).

6.1.4 Electric vehicles

While public transport access to the site is ample, it is envisaged that there may still be a reliance on private car usage. To promote the shift from traditional petrol and diesel vehicles to Ultra Low Emission Vehicles (ULEVs), the existing basement parking facility will be equipped with electric vehicle charging points, with an additional ten charging points made outside of the basement.

6.2 Building Fabric



Building and construction activities worldwide consume 3 billion tonnes of raw material each year, which account for approximately 50% of total global consumption. Using green/sustainable building materials and products promotes conservation of dwindling non-renewable resources. In addition, integrating sustainable building materials into building projects can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of these source materials.

301 St Vincent Street redevelopment can reduce site-wide embodied carbon emissions through reuse of the existing site materials and structure and careful selection of new building materials. The opportunity to reuse certain elements means that CO_2 emissions associated with the procurement, manufacture, and transportation of new materials can be reduced. Currently, replacement of the existing curtain walling of the development with new systems such as low carbon glass and recycled aluminium are being investigated to mitigate embodied carbon impacts.

In summary, the choice of building materials can have a significant impact on WLC and for further details, please refer to Section 4 of this report.

6.2.1 Responsible Sourcing and Procurement

All timber used for basic or finishing building elements in the scheme should be sourced from responsibly managed and sustainable forests or plantations. Such timber products are the only truly renewable construction material in common use and the responsible management of forests for timber helps to lock in CO_2. By maximising the use of timber for structural or finishing purposes, the embodied carbon impact of the development can be reduced.

The proposed redevelopment recognises the importance of using locally sourced, sustainable materials, i.e. materials that can be supplied without any adverse effect on the environment. Therefore, where practical, materials should be sourced from local suppliers, reducing the environmental impacts and CO_2 emissions associated with transportation to the site.

6.2.2 Recycled Materials

Scope for increased recycling will be incorporated by specifying recycled materials where possible and ensuring that even where new materials are used, these can be recycled at the end of the building's life. Specifying materials with a high-recycled content is also another method of saving processing or manufacturing energy. The recycled content of a material can be described as either post-consumer or post-industrial to indicate at what point in the life cycle a material is reclaimed (please refer to Section 4 of this report).

6.2.3 Durability and Resilience

To ensure the longevity of the materials used in the building construction and avoid the need for replacement, durability and protection measures should be specified, where appropriate. This will prevent damage to vulnerable parts of the building.

The building elements will also be designed to incorporate appropriate measures to limit material degradation due to environmental factors. This includes degradation due to factors such as temperature variation, water/moisture damage, pollutants etc.

6.2.4 Healthy Materials

Volatile Organic Compounds (VOCs) are emitted as gases (commonly referred to as off-gassing) from certain solids or liquids. VOCs include a variety of chemicals, some of which are known to have short-term and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products numbering in the thousands. Examples include paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials, furnishings, adhesives, Urea-Formaldehyde Foam Insulation (UFFI), pressed wood products (hardwood plywood wall panelling, particleboard, fibreboard), and furniture made with these pressed wood products.

'No' or 'low' VOC paints are available from most standard mainstream paint manufacturers. The 'eco-friendly' paints are made from organic plant sources and powdered milk-based products. The design team should select internal finishes and fittings with low or no emissions of VOCs and comply with European best practice levels as a minimum.

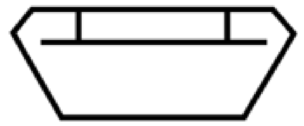
6.3 Waste

Under EU legislation, the UK will have to ensure that less than a third of its waste is sent to landfill sites by 2020; the figure at present is about 80%. To achieve this target, the UK Government has implemented several measures, including landfill tax aiming to discourage disposal of waste to landfill. Reducing waste is an important means of:

- reducing unnecessary expenditure.
- reducing the amount of natural resources used for production of new materials.
- reducing energy for waste disposal.
- reducing levels of contamination and pollution arising from waste disposal.

Waste management strategy for the 301 St Vincent Street project will be in line with Glasgow's CDP5: Resource Management policy requirements and specifically, will follow the Waste Hierarchy principles as outlined within SG5 Supplementary Guidance (please refer to *Figure 2-5* of this report). Waste management is covered in detail within the circular economy statement, which will be prepared by Cundall (for details, please refer to Section 4.2 of this report).

6.3.1 Construction Waste Management



During the construction phase, a large amount of waste material will be generated through construction and refurbishment works. In typical building construction, the primary waste products in descending percentages are wood, asphalt/concrete/masonry, drywall, roofing, metals, and paper products.

Prior to commencement on site, a Resource Management Plan (RMP) covering the waste arising from refurbishment works should be developed and implemented. This should comply with the requirements of current legislation and industry best practice (e.g. BREEAM). As a minimum this is advised to include:

- A target benchmark for resource efficiency.
- Procedures and commitments for minimising non-hazardous waste.
- Procedures for minimising hazardous waste.
- A waste minimisation target and details of waste minimisation actions to be undertaken.
- Procedures for estimating, monitoring, measuring, and reporting on hazardous and non-hazardous site waste and demolition waste, where relevant (waste data obtained from licensed external waste contractors needs to be reliable and verifiable).
- Monthly reporting of all construction waste data throughout the project must be checked against what would be expected based on the stage of the project, invoices, etc. to validate completeness of waste reporting data.
- Procedures for sorting, reusing, and recycling construction waste into defined waste groups, either on site or through a licensed external contractor.
- Procedures for reviewing and updating the RMS.
- The name of the job title of the individual responsible for implementing the above.

Construction waste will have significant impact on whole life carbon. Please refer to Section 4 of this report.

6.3.2 Operational Waste

As a minimum, storage facilities should be provided for the separation, collection, and storage of common recyclable materials such as paper, glass, plastics, and metals. The collection points will be easily accessible to all the building users.

The main aim will be to recycle as much as possible. This will be achieved by making sure that waste recycling facilities are strategically placed in convenient locations.

Dedicated storage space for recyclable materials generated by the site during operation will be:

- Clearly labelled for recycling.
- Placed within accessible reach of the buildings.
- Placed in a location with food vehicular access to facilitate collections.
- Of a capacity appropriate to the building type, size, and predicted volumes of waste that will arise from daily or weekly operational activities and occupancy rates.

6.4 Pollution

6.4.1 Air Quality

Global concern for environmental pollution has risen in recent years as concentrations of harmful pollutants in the atmosphere are increasing. Buildings have the potential to create major pollution arising from their construction and operation, largely through pollution to the air (dust emissions, NOx emissions, ozone depletion and global warming), but also through pollution to watercourses and ground water.

Nitrous oxides (NOx) are emitted from the burning of fossil fuels and contribute to both acid rain and to global warming in the upper atmosphere. At ground level, they react to form ozone, a serious pollutant and irritant at low level. Burners in heating systems are a significant source of low-level NOx, while power stations (and therefore electric heating) are a significant source of NOx in the upper atmosphere.

The proposed 301 St Vincent Street redevelopment is taking action to minimise the above impacts by featuring no on-site combustion for the provision of heating, cooling, and hot water. All services will be electrically driven, which significantly helps to negate any negative impact of the development on the local air quality.

6.4.2 Night Sky Pollution

External lighting encompasses vehicle and pedestrian access lighting, security lighting, facility illumination, and general feature lighting. Lighting will be designed to meet relevant mandatory requirements and aesthetic considerations. The strategy is to provide a balance between adequate external lighting for safe and secure operation of the site without unnecessary illumination or power consumption.

The intention is to be a good neighbour and not to introduce nuisance glare or light pollution of the night sky from misdirected or unnecessary lighting. Feature lighting, where required, will be focussed on the task/subject. The external lighting design will take into consideration the relevant guidance from the British Standards and other recommended documents.

6.4.3 Noise Pollution

Developments can have an adverse impact on their local surroundings by creating nuisance noise that did not exist before. It is therefore important to understand and limit these noises to avoid disturbances and ensure wellbeing for building users and neighbours.

Additionally, any new items of building services plant will need to be selected, mounted, and attenuated such that the local authority noise criteria are achieved. It is proposed that noise from any new items of building services plant associated with the development be designed to meet the BS4142:2014 requirements.

Acoustics considerations for the proposed redevelopment are detailed within Section 6.6.1 of this report.

6.5 Ecology and Landscape architecture

As well as a climate crisis, the UK faces a biodiversity crisis with a rapid decline in biodiversity in recent years. The built environment can respond to this through sustainable land use, habitat protection and creation as well as improvement of long-term biodiversity for the site and surrounding land.

A site survey was carried out at 301 St Vincent Steet by Wild Survey Consultants on Tuesday 16th January 2024. Key findings are outlined as follows:

- No suitability on site for any protected species (other than common nesting birds).
- No evidence for sensitive habitats to be protected or retained.
- Evidence for some non-native plant species on site, which are recommended to be removed.

A Biodiversity Enhancement Strategy is currently in progress by Wild Survey Consultants (as part of the preliminary Ecological Assessment report), which aims to outline the measures the development is taking to both protect and enhance biodiversity on site.

In addition, Murray and Associates are engaging in site surveys to support the planning application for the proposed 301 St Vincent Street redevelopment and develop an appropriate landscape and planting strategy informed by the Biodiversity Enhancement strategy.

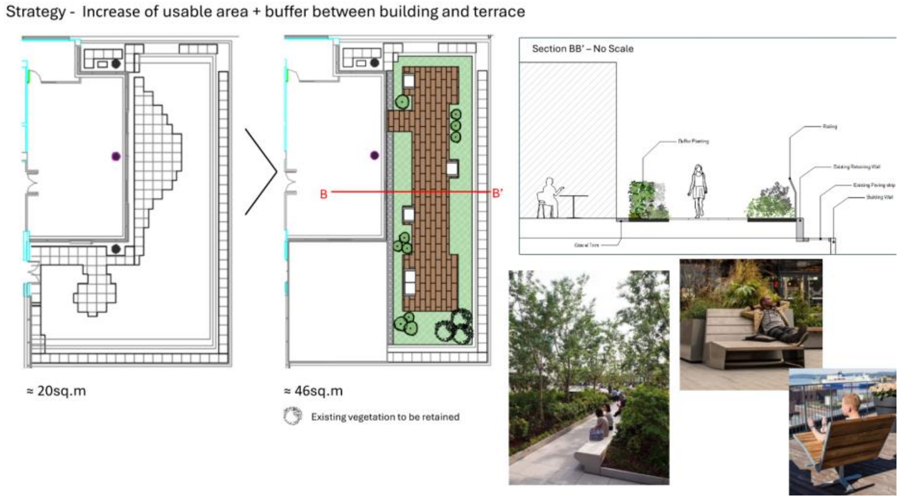


Figure 6-5:Landscape strategy for Level 4 east area (produced by Murray and Associates)

Ecological considerations are at the core of the 301 St Vincent Street redevelopment, addressing local planning policy requirements, which highlight the need for developments to respect the natural environment, limit their impact on habitats and species, and enhance biodiversity (Policy CPD1: The Placemaking Principle and Policy CPD7: Natural Environment).

6.6 Health and Wellbeing

There has been a growing awareness and interest in the importance of providing healthy and productive environments for building occupants. As design for health and wellbeing becomes increasingly prevalent and public focus on the topic grows, many business owners and developers are increasing their focus on incorporating health and wellbeing in built environment design across all building types.

301 St Vincent Street aims to provide a healthy environment for its users through optimising existing roof terraces and courtyard spaces to allow access to direct sunlight and fresh air. Additionally, other outdoor spaces in the form of usable hard landscaped areas will be provided. Access to these outdoor spaces will be made feasible through the introduction of level thresholds, strategic access points, and replacement of edge protection across entire perimeter to ensure safe and compliant use.

6.6.1 Acoustics

Acoustics conditions can have a significant impact on health and wellbeing. Commonly, sites located near major roads, train lines, airports, etc. can suffer from noise nuisance. Excessive noise can result in building users having to choose between discomfort due to noise or discomfort due to overheating. In order to develop an effective solution that does not require building users to make compromises in comfort, the outdoor noise conditions need to be determined and evaluated.

Cundall has assessed the proposed redevelopment with regards to the relevant BREEAM credits under Hea 05 and Pol 05, including internal sound insulation, indoor ambient noise levels, and noise pollution resulting from the development on the nearby noise-sensitive properties.

To accommodate the ongoing design's spatial flexibility, the assessment for the indoor ambient noise was conducted against the Hea 05 criteria for staff / meeting rooms, training rooms, and general cellular offices. These criteria are more stringent than the ones for open-plan offices.

Extensive noise surveys were carried out to quantify noise levels at representative locations on the development's façades for indoor ambient noise assessment. Additionally, surveys were conducted to capture representative background noise levels at the nearest noise-sensitive properties.

The following findings have been reached:

- To meet the criteria for internal ambient noise levels, open window ventilation is only viable for façades facing internal terraces on the third floor. If passive ventilation is preferred, the consideration of natural ventilation through acoustic ventilators is recommended. Façades facing the surrounding streets should achieve a minimum sound insulation rating of 31 - 33 dB $R_w + C_{tr}$ depending on the specific circumstances. This is subject to further review based on studies using a 3D acoustic model that is currently under development. It is advised to position rooms with a high sensitivity to noise, such as meeting rooms, away from the facades overlooking the streets, particularly the locations near the slip road to the south of the development.
- Based on the available information and site inspection, the existing floors of offices are believed to be constructed using 225 mm concrete, 30 mm wooden flooring supported by rigid pedestals, and carpet. The predicted sound insulation performance of these floors is expected to meet the requirements for obtaining the credit for internal sound insulation. However, for the floor constructions separating plantrooms from noise-sensitive areas, a more detailed assessment will be conducted following the acquisition of plant noise data.
- To qualify the BREEAM Pol 05 credit, the rating levels generated by the plant items associated with the proposed development, as perceived at nearest noise-sensitive properties, should not exceed 54 dBA during daytime and 47 dBA during night-time.

These should be reviewed and taken into consideration to inform the preferred ventilation strategy for the proposed redevelopment.

6.6.2 Ventilation

Ventilation requirements and proposed strategies for the development can be broken down into the following components:

- **Background fresh air** – To enable everyday activities to be undertaken, it is anticipated that the background fresh air requirements will be served by a mechanical ventilation system (specifications to be in line with Scottish Building Regulations and industry best practice).
- **Limit summertime overheating risk**– To manage internal high temperatures, mechanical cooling is to be employed and will prioritise enhanced mechanical ventilation rates over comfort cooling.

The potential for utilising openable windows to introduce fresh air to spaces and address summertime overheating will be explored at later stages of the design.

If deemed viable, this would offer a mixed-mode ventilation strategy for the development. However, it is important to note that several factors including exposure to noise and air quality must be investigated first, before any conclusions are made.

In relation to noise, the findings of the noise survey (as per section 6.6.1) already suggest that intrusive noise from nearby road traffic could exceed acceptable levels at most locations along the building facades and these will have direct implications should the openable window strategy for ventilation be adopted.

Air quality is another critical factor of the preferred natural ventilation strategy. Sites in areas with substantial levels of airborne contaminants and toxins put building users at risk of respiratory ailments if they are exposed over longer periods of time. In such situations, mechanical ventilation with filtration is recommended to mitigate the harmful effects of the ambient air quality. To develop an effective solution that does not require occupants to make compromises in comfort, the ambient air quality needs to be determined through air quality assessments.

6.6.3 Daylight and sunlight

Access to daylight and sunlight is important for human health as they provide benefits such as circadian rhythm and vitamin D. Preliminary daylight and sunlight assessment should be carried out for the proposed development. Conducting this exercise early in the design process can help inform whether the massing of the scheme needs to be revised before any commitments to design decisions have been made that may be costly to modify for better results. Daylight and sunlight availability within the internal elements of the proposed development should be conducted at a later stage once the design is sufficiently developed and more information is available.

7.0

Conclusions

7.0 Conclusions

7.1 Energy Strategy and Hierarchy

301 St Vincent Street redevelopment's energy and sustainability approach are aligned with Scotland's Fourth National Planning Framework and the Glasgow City Development Plan. The strategy revolves around the embodiment of the Energy Hierarchy: Be Lean, Be Clean and Be Green.

- **Be Lean:** energy demand reduction through passive design measures (as far as practical).
- **Be Clean:** use of energy efficient systems for the provision of heating/ cooling/ Domestic Hot Water (DHW), low energy lighting, and Building Management System (BMS) to enable energy use to be tracked and allow for efficiency improvements to be identified and implemented.
- **Be Green:** inclusion of Low and Zero Carbon Generating Technologies (LZCGTs) in the scheme such as heat pumps for heating and cooling and solar Photovoltaics (PVs).

The 301 St Vincent Street energy strategy is highlighted below:

- ✓ Replacement or refurbishment of existing curtain walling (current façade is nearly 40 years old) with an articulated form introducing depth and volume that will provide shading to receded glazing and add visual interest.
- ✓ Replacement of existing gas-fired boiler and chiller plant with a high-efficiency electrified system for heating and cooling.
- ✓ Replacement of gas-fired Domestic Hot Water (DHW) system with dedicated high temperature CO_2 heat pumps.
- ✓ Implementation of mechanical ventilation with heat recovery (MVHR) system, with possibility of exploring a mixed-mode ventilation strategy at subsequent stages.
- ✓ Replacement of existing lighting with low energy LED lighting fittings throughout incorporating occupancy and daylighting sensors.
- ✓ Installation of a rooftop solar Photovoltaic (PV) array.
- ✓ Provision of a web-based Building Management System (BMS) with Graphical Unit Interface (GUI).
- ✓ Implementation of rainwater harvesting or greywater recycling systems for non-potable use to be investigated.

7.2 Whole Life Carbon and Circular Economy

The upfront and whole life embodied carbon aspiration targets for 301 St Vincent Street, Glasgow are 350 $kgCO_2e/m^2$ and 650 $kgCO_2e/m^2$ (GIA) respectively. The embodied carbon targets have been set based on Cundall's experience in whole life carbon and their database of previous projects. The whole life embodied carbon assessment considers emissions across the project's life stages, including raw material extraction, construction, in-use, and end-of-life. Targets set for upfront and whole-life embodied carbon are to reflect aspects of the design such as the building envelope, building services, internal finishes, and furniture and fixings.

In line with emerging national/local policy best practices, a circular economy statement will also be prepared for the development. The circular economy statement emphasises reuse, recycled content, and design for disassembly, aligning with zero waste principles. The targets specify responsible and local material sourcing, sourcing materials that are reused and recycled. waste diversion, and flexibility in design.

7.3 Wider Sustainability Considerations

The proposed 301 St Vincent Street redevelopment prioritises sustainable design across key areas. These sustainability measures include:

- Water conservation incorporating low-flow fittings and accurate metering. Greywater recycling and rainwater harvesting systems will also be investigated to conserve water resources and reduce consumption.
- Promotion of active travel, minimising car reliance through provision of secure bicycle parking and electric car charging.
- Building fabric that prioritises sustainable, locally sourced, and recycled materials. Currently, replacement of the existing curtain walling of the development with new systems such as low carbon glass and recycled aluminium are being investigated to mitigate embodied carbon impacts.
- Waste management following Glasgow's CDP5 principles, with accommodation for construction and operational waste.
- Pollution control that includes eliminating on-site combustion and adhering to light and noise guidelines.
- Ecological considerations aligning with local policies, including biodiversity enhancement strategies.
- Health and wellbeing considerations that feature optimisation of existing roof terraces and courtyard spaces to allow access to direct sunlight and fresh air, providing a healthy environment for its users. Acoustics, ventilation, and natural light considerations along with subsequent steps are also detailed.

In summary, the proposed redevelopment of 301 St Vincent Street stands as a testament to sustainable innovation and responsible development. By integrating energy efficient and low carbon technologies, embracing circular economy principles, and prioritising the wellbeing of occupants and the environment, the project aspires to set new benchmarks in sustainable urban development, contributing positively to Glasgow's urban landscape.

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