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Harton Quay

Sustainability and Energy Statement

04/12/2020

REVISIONS

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1.0 Executive Summary

Sustainability shall be achieved at Harton Quay via the following measures:

- The development is targeting net zero carbon using the UK Green Building Council's (UKGBC) framework
- The building shall incorporate U-values that are similar to those used in Passive House Buildings to minimise the heating and cooling demand.
- Heat recovery shall be incorporated into the ventilation systems to minimise heat loss due to fresh air requirements.
- All lighting shall be extremely efficient LED type luminaires.
- Lighting shall be linked to occupant and daylight sensors to only provide artificial lighting when required.
- Ventilation shall be linked to CO_2 sensors so that the fans only run when required.
- A detailed life cycle assessment (LCA) shall be undertaken to minimise embodied carbon involved in the construction and building services.
- Net zero carbon for the construction shall also be targeted via the UKGBC's framework.
- The development is targeting BREEAM "outstanding" which represents the highest rating achievable.
- A site waste management plan shall be produced to minimise waste during construction.
- Water shall be reduced through low flow sanitaryware and automatic shut off valves in WC areas to avoid leaks.
- As the site shall be served by electricity there shall be no impact on local air quality due to combustion.
- A PV array shall be installed on the roof to generate a proportion of the building's energy demand.

The breakdown of the energy analysis are shown below:

Energy Demand

	Energy (KWh/m^2)	CO_2 saving (%)
Baseline Emissions	30.6	
Savings From Energy Efficiency	8.8	28.9%
Savings from Renewable Energy	12.61	42.1%

[1] Regulated energy only

[2] Based on Part L2A electrical CO_2 conversion factor of 0.519 kg CO_2/kWh and gas CO_2 conversion factor of 0.216

[3] Renewable energy incudes ASHP for heating

Additionally, the detailed operational energy modelling demonstrates that the proposed design shall far exceed a typical baseline building and is inline with UKGBC's stretch scenario which represents predicted good practice in 2030.

2.0 Introduction

This document has been produced to provide details on sustainability at the Glassworks development at Harton Quay, South Shields.

2.1 Site Context

Glassworks is located in Harton Quay in South Shields. The development is a 5 story CAT A office building incorporating landscaping around the building.

2.2 BREEAM

Glassworks at Harton Quay aims to achieve sustainability far in excess of minimum standards. To facilitate this and provide a metric against other buildings, certification with BREEAM shall be targeted.

2.2.1 BREEAM

BREEAM assesses a building against a range of sustainability categories:

- Management
- Health & Wellbeing
- Energy
- Transport
- Water
- Materials
- Waste
- Land Use and Ecology
- Pollution
- Innovation

The building shall be assessed against BREEAM New Construction 2018 and shall target an 'Outstanding' rating. To a achieve BREEAM Outstanding, 85% of available credits must be achieved. The building shall target at least 90% of credits to ensure that the excellent rating can still be achieved in the event that credits become unachievable as the design progresses. Further details of the targeted credits can be found in Harton Quay BREEAM Tracker – 2.

3.0 Relevant Planning Policy

Extracts of the relevant policies or relevant parts of policies are shown below:

3.1 South Tyneside Core Strategy 2007

3.1.1 Policy ST1 - Spatial Strategy for South Tyneside

The Spatial Strategy for South Tyneside is to:

D – Ensure the sustainability of our settlements by reducing the emissions which cause climate change and adapting to its effects

E – Maximising the re-use of previously developed land in the built up areas

3.1.2 Policy ST2 – Sustainable Urban Living

High quality in sustainable urban living shall be promoted by ensuring that:

A - Highest standards of urban design are promoted so that buildings and their settings make a positive contribution to the local area.

B - The use of environmentally sound and energy efficient construction materials and operational techniques are achieved and that developers work towards low carbon and zero carbon standards.

C – On-site generation of renewable energy is maximised, with a target of 10% of each schemes energy requirements.

D – Use is made of 'sustainable urban drainage systems' and water conservation features including 'grey water recycling' and other technologies wherever possible.

E - Priority is given to alternative modes of transport to the private car, and access by:

i) requiring travel plans for developments which would have significant transport implications.

ii) enhancing electronic communication infrastructure.

F - The need to design out crime and eliminate the fear of crime has been addressed.

G - Buildings and their settings are designed to be flexible, enabling them to adapt to future needs and to take into account the needs of all users.

H - All new development is encouraged to incorporate biodiversity and geological features at the design stage.

3.1.3 Policy A1 - Improving Accessibility

The Council shall support public transport, walking and cycling initiatives that maximise the accessibility of new development being focused at:

A - regeneration areas along the riverside corridor, including South Shields, Jarrow and Hebburn town centres.

Priority shall also be given to improving accessibility, particularly by encouraging and promoting public transport improvements, both within the Borough and between the Borough and:

B - The A19 Economic Growth Corridor (including employment areas at Boldon Colliery, Doxford Park, North Tyneside and South East Northumberland)

C - Other destinations in the Tyne and Wear City Region, such as Newcastle and Sunderland city centres, Newcastle Central Station and Newcastle International Airport.

Transport Assessments shall be required for any major development proposal.

Parking standards shall apply to new development, and shall be set out in a Supplementary Planning Document.

3.1.4 Policy SC1 – Creating Sustainable Urban Areas

To deliver sustainable communities, development proposals shall be focused and promoted within the built-up areas, in accordance with the spatial strategy for South Tyneside and Regional Spatial Strategy's sequential approach to development (RSS Policy 3), where they:

A - Create a strong sense of place by strengthening the distinctive historic and cultural qualities and townscape of our towns and villages, and promote high quality design.

B - Revitalise our town centres and other main shopping centres

C - Maintain and improve the provision of accessible basic local services and community facilities, whilst focusing high trip-generating uses within our town centres

D - Restore links between the River Tyne and the town centres and residential areas within the Tyne riverside regeneration corridor.

3.1.5 Policy EA3 – Biodiversity and Geodiversity

To optimise conditions for wildlife, implement the Durham Biodiversity Action Plan and tackle habitat fragmentation the Council shall:

A - Secure and enhance the integrity of designated sites

B - Maintain, enhance, restore and add to biodiversity and geological conservation interests

C - Ensure that new development would result in no net loss of biodiversity value of any of the following Priority Habitats:

i) magnesian limestone grassland;

ii) coastal sand dunes;

iii) maritime cliffs and slopes;

iv) mudflats;

v) rivers and wetlands;

vi) species rich neutral grasslands;

vii) rocky shores;

D - Reduce the fragmentation of, improve or extend existing Priority Habitats

E - Create new Priority Habitats, especially in the Habitat Creation Zones of:

i) Cleadon Hills;

ii) Downhill;

iii) River Don Valley;

iv) Wardley Colliery;

F - Protect and strengthen populations of Priority or other protected species

G - Enhance the biodiversity value of wildlife corridors

H - Where appropriate, restrict access and usage in order to conserve an area's biodiversity value.

3.1.6 Policy EA5 – Environmental protection

To complement the regeneration of the Borough, the Council shall control new development so that it:

A - Acts to reduce levels of pollution, environmental risk and nuisance throughout the Borough

B - Minimises adverse impacts on the Magnesian Limestone Aquifer and its associated groundwater protection zones

C - Focuses the treatment of contaminated and derelict land so as to achieve a balance

between:

i) the management of risk approach in its Contaminated Land Strategy; and

ii) the regeneration of the riverside corridor;

D - Ensures that the individual and cumulative effects of development do not breach noise, hazardous substances or pollution limits

E- Does not permit unsustainable schemes to be located in those areas of the coast, Tyne corridor and Don Valley where flood risk is unacceptably high.

3.1.7 Policy EA6 – Planning For Waste

To integrate waste management into the creation of more sustainable communities throughout the Borough the Council shall:

A - Build on the success of its reduction and recycling initiatives.

B - Allocate land for waste management facilities in sustainable locations to make an appropriate contribution towards dealing with the estimates of waste requiring management in Tyne and Wear identified in the Regional Spatial Strategy.

C - Allocate land for any additional sewage management facilities required by the Water Framework Directive, especially those associated with the Jarrow Pre-Treatment works and its network of pumping stations.

D - Require major proposals and those generating significant volumes of waste to incorporate an appropriate level of waste sorting, recovery and recycling facilities.

E - Refuse permission for landfill, unless it meets a need which cannot be met by treatment higher in the waste hierarchy.

3.2 SPD 1 – Sustainable Construction and Development 2007

The following types of larger scale or significant development (outline or full application) shall be required to demonstrate their sustainability principles by means of completing a Sustainability Statement:

a) Residential development comprising more than 10 dwellings or on a site of more than 0.5 hectares.

b) Non-residential development comprising more than 1,000 square metres of gross floor space or on a site of more than 1 hectare.

c) All applications for minerals, waste or energy development.

d) All applications where the submission of an Environmental Statement, Retail Impact Assessment or a Transport Assessment is required.

e) Any combination of applications that shall (over phases) meet any of the above limits.

3.2.1 Energy Efficient Design and Layout

Maximising the use of natural systems

Developers shall be expected to pay special attention to the orientation of the development to ensure maximum passive solar gain through the use of natural ventilation, airflow through the building, and minimising the overshadowing of adjoining buildings. Where possible, buildings should be orientated so that the main living spaces face towards the south/southwest, in order to gain maximum solar gain.

Maximising The Use of Natural Ventilation And Shading

Reducing the reliance of mechanical ventilation and cooling systems complements the principles of Passive Solar Design and reduces energy consumption. Natural ventilation and shading involves:

- Allowing cool air at night to be drawn into the building at a low level, and for normal convection currents to encourage the air upwards through the building and ejected at a high level.
- Shading to allow for shade in summer but allowing weaker winter and evening sun to penetrate the building, thereby increasing heat and light input into the building.
- Minimising the need for artificial cooling.

3.2.2 Energy Efficiency and Conservation

Using less energy

Carbon dioxide emissions can be reduced through the minimisation of energy use by way of energy efficient design and technology. The majority of energy consumption occurs during the life of a building and buildings actually account for nearly half of total energy consumption in the UK. The energy efficiency of a building is determined largely by its design, the choice of materials (including their thermal mass) and the choice of plant equipment. The use of timed fans, pumps and controls that respond to the occupancy of the building, along with the education of users, all contribute to using less energy. Designs should allow for the maximum use of low carbon techniques, such as optimising U-values (see left-hand margin for definition) and natural ventilation. Increasing the energy efficiency of a building reduces its overall energy requirements and thus its carbon footprint. This reduction makes it easier for developers to provide a greater proportion of the development's energy demands through on-site renewable energy production.

Supplying Energy Efficiently

In energy efficiency terms, buildings can benefit from a centralised heating system with individual time and temperature controls for each area. These systems need to be well designed and fit-for-purpose. In terms of reducing carbon emissions, the use of electric heating should be avoided. New developments should incorporate tri-generation of Cooling Heat and Power (CCHP) or Combined Heat and Power (CHP) wherever feasible. If CCHP or CHP is not feasible, the developer shall be expected to provide clear and sound evidence why neither can be incorporated.

For new dwellings developers should consider gas-heating systems. The use of electrical heaters contributes to higher carbon dioxide (CO_2) emissions per unit of energy delivered to a building than for gas, hence electric heating systems should be avoided unless served by heat pumps or renewable energy. Where electric heat pumps are used, the efficiency of the heat pump can balance out additional CO_2 emissions.

3.2.3 Renewable Energy

Developers shall be required to show how they shall generate at least 10% of a scheme's total energy demands (calculated as carbon units) from on-site renewable energy sources. Renewable energy can be obtained from a variety of sources, and the choice of which technologies to use should be based upon a mix of the feasible technologies that can achieve the greatest reduction in carbon dioxide emissions.

3.2.4 Energy Statements

For those developments outlined in paragraphs 6.3 and 7.3, all developers shall be required to submit an Energy Statement, which should provide a full and detailed account of the development's energy demands.

3.2.5 Sustainable Construction

Waste

As part of the construction phase the use of prefabricated materials and consolidation centres can contribute to waste reduction. The preparation of a Site Waste Management Plan (SWMP) shall be required for all new major development applications and should identify quantities and types of construction and demolition waste, and demonstrate how off-site disposal of waste shall be minimised and managed. As part of the SWMP, developers shall be expected to demonstrate that they have considered the use of pre-fabricated elements and modern methods of construction where appropriate to reduce total energy used, and where these are sourced.

Materials and Resources

Developers should consider the use of materials that not only meet the material specifications for the proposed development, but at the same time give consideration to the use of materials that have a low embodied impact, such as the use of recyclable materials, sustainable timber, and insulating materials which do not contribute to stratospheric ozone depletion. Embodied energy is a measure of the energy required to manufacture a product. A product that requires large amounts of energy to obtain and process the necessary raw materials, or a product that is transported long distances during processing or to market, shall have a high-embodied energy level. Buildings could be constructed from thermally massive materials that store heat during warm conditions and release heat at cooler times. In addition, all buildings enclosed in a 300-millimetre insulation jacket shall be more energy efficient.

Procurement of Materials

The repair, adaptation and re-use of existing buildings should always be considered first, on the basis that the existing fabric embodies environmental capital that requires energy and materials to replace. If redevelopment is considered feasible, however, the simple procurement and selection of materials can help to minimise energy demand from the outset, which takes into account whole life energy principles. For major developments, developers shall be expected to submit a Materials Procurement Strategy and should include the following principles:

- Where demolition or conversion of existing buildings is involved the developer shall be expected to recover and re-use materials from the site as part of the re-development proposals, wherever possible. A pre-demolition audit should be undertaken to identify value and recovery options for existing materials.
- Optimise the use of re-cycled materials and select materials that are appropriate to the building's use, thereby minimizing new aggregate use. South Tyneside Local Development Framework (Adopted) SPD 1: Sustainable Construction and Development .36.
- Maximise the proportion of materials and components that can be re-used at the end of the building's life – by designing for deconstruction and disassembly, and avoid using materials that are difficult to recycle.
- Materials that have low-life cycle environmental and toxicity impacts – extraction, processing, manufacture, transportation and disposal (low carbon input).
- Maximise the use of timber from the Forest Stewardship Council or from another source that has a sustainable purchasing policy. The Department for the Environment, Food and Rural Affairs (DEFRA) has created a Central Point of Expertise on Timber Procurement, which offers on-line advice on procurement.
- Minimise using materials such as aluminium and concrete with high-embodied energy, unless a whole life energy or technical case exists.
- Optimise the use of local materials to reduce transportation impacts.
- Where the procurement of materials that minimise energy demand conflicts with other planning priorities and objectives, the developer shall be expected to demonstrate why such materials cannot feasibly be incorporated into the development. An example may be where a development that involves changes to a listed building, or a building within conservation area, would be adversely affected if materials of low energy embodiment were used. In such instances the Local Authority shall take into consideration matters of historic conservation and heritage importance, which may take precedence over other sustainable development objectives.

3.2.6 Water Efficiency and Energy Conservation

The simple use of water saving devices within major developments can avoid water wastage and developers shall be expected to:

- Incorporate low flush toilets, such as dual flush toilets with flush volumes as low as 4 to 2 litres, and waterless urinals for buildings with high occupancy rates.
- Use taps that are spray or low flow taps, self-closing or infrared controlled with flow restrictors, set to ensure minimal consumption of water per use.
- Install low water use white goods, such as washing machines and dishwashers.
- Install low-flow showerheads and low volume baths.
- Recycle water used in swimming pools with treatment systems.

Sustainable Urban Drainage Systems (SUDS)

The Council shall expect major and significant planning applications, as defined in paragraphs 6.3 and 7.3, whether outline or detail, to demonstrate how a more sustainable approach to drainage has been incorporated into their development proposals, through the submission of a Sustainable Urban Drainage Programme. This should include sufficient detail to demonstrate how to control the quality or run-off from a development, improve the quality of run-off, and enhance the nature conservation, landscape and amenity value of the site and its surroundings. Where it is not possible or feasible to submit detailed drainage designs for the development, the Council shall impose planning conditions requiring such details to be provided prior to the commencement of development on site. Such conditions shall only be appropriate where sufficient evidence has been submitted with the application to indicate that sustainable urban drainage techniques have been included from the out-set in the design process, and can be accommodated into the design and layout of the proposed development without significant modification.

3.2.7 Sustainable Waste Management

The design of individual or shared waste sorting and recycling facilities, such as storage bins in kitchens and integrating recycling bins or composting areas into the building or site fabric. Provision of local shared recycling centres for mixed use developments to provide for the recycling of glass, paper, plastics, cans and clothing. Provision should be made for a local shared recycling facility at a rate of one site per 500 persons, or per 1,000 habitable rooms. Suitable recycling storage facilities should also be incorporated into non-domestic developments.

4.0 Material Selection

Significant amounts of energy and natural resources are consumed in the production, transportation and disposal of building materials. Two issues are of significant importance in the procurement of materials: the environmental impact of materials and the sourcing of materials. The main contractor is required to take pro-active measures to addressing these issues.

The building shall be targeting net zero target construction under the UKGBC's framework.

Timber products are only to be sourced from suppliers who can adequately demonstrate and provide appropriate evidence that the supplied material is responsibly and legally procured from a sustainable source. In all instances, suppliers must present Chain of Custody or FSC certificates demonstrating compliance prior to the purchase of materials.

The main contractor should afford advantage to those materials which have a lesser environmental impact than rival products and to review alternative materials that have a lower environmental impact when developing material specifications. As part of the procurement the main contractor should review the Environmental Management Systems of all suppliers and where possible sources materials from suppliers who have Environmental Management Systems in place which conform to the BES or ISO standard.

As part of the review of the proposed Sustainability Strategy the environmental impact of the proposed build specification shall be assessed against the BRE Green Guide. The Guide assesses the relative environmental impact of construction materials commonly used in buildings. Materials are given an overall rating of A+ to E, based on Life Cycle Assessments using the BRE's Environmental Profiles Methodology.

4.1 Re-Use and Recycling of Materials

The development shall be constructed based on the principles of re-using and recycling materials as far as possible. This shall increase the extent to which natural resources are preserved and sustained as far as possible, at all stages of the development. This includes demolition, ground remediation/preparation, construction, operation, and even – looking further ahead - potential future re-use and demolition.

4.2 Ground Remediation/Earthworks

As mentioned above, following the cut and fill exercise, as part of the proposed development, it is intended to re-use the majority of excavated material on the site, and to avoid any materials being taken to landfill.

Where there is soft landscaping and SUDS features, the ground shall be capped by clean subsoil, supplemented by topsoil material. Any contamination discovered during the works shall be recorded and dealt with in an appropriate manner.

The profile of the site and finished levels have been calculated using ground modelling software, in order to ensure that a balanced cut and fill is achieved. This would ensure that the majority of earth material available on site is re-used and that the only material to be removed from site would be the initial topsoil scrape.

4.3 Construction Phase

The site is of a size that allows an effective materials management strategy to be implemented, allowing effective segregation of materials and reducing the risk of cross contamination on site. Contractors shall also be encouraged to select materials that comply with BES6001 – Responsible Sourcing of Construction Products.

The selected main contractor shall take the lead on procuring materials during the construction phase of the development. However, in selecting this contractor, a number of key principles shall be taken into account, based on the objective of using fewer resources and less energy. These principles include the need to:

- procure timber products from sustainable sources;
- procure other construction materials giving priority to recognised responsible sourcing schemes;
- use resource-efficient products;
- use local procurement if feasible;
- source materials which can be reused; and
- consider future deconstruction and recovery of resources.

In addition, preference shall be given to contractors that provide opportunities for small and medium sized enterprises (SME's), and other which support local employment, diversity and training.

4.3.1 Materials

Building and construction activities worldwide consume 3 billion tonnes of raw material each year, which account for approximately 50% of total global consumption. Using 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.

4.3.2 Environmental Impact of Materials –Life Cycle Assessment(LCA)

The use of construction materials leads to a wide range of environmental and social impacts across the life cycle through procurement, wastage, maintenance and replacement. In order to reduce the environmental impacts of materials, a building Life Cycle Assessment (LCA) appraisal shall be carried out with 2 to 4 significantly different superstructure design options. The LCA options appraisal shall be integrated within the wider design decision-making process. The design option selected by the client to be progressed beyond Concept Design with the reasons for and reasons for not selecting the other design options.

4.3.3 Sustainable Timer

All the timber and timber-based products used on the project shall be 'Legal' and 'Sustainable' as per the UK Government's Timber Procurement Policy (TPP). All timber used for basic or finishing building elements in the scheme shall 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 bodied carbon impact of the development can be reduced.

4.3.4 Locally Sourced Materials

A building that is truly sustainable must be constructed 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 environment impacts and CO_2 emissions associated with transportation to the site.

4.3.5 Recycled Materials

Scope for increased recycling shall be incorporated by specifying recycled materials where possible and ensuring that even where new materials are used, as much as possible 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.

5.0 Pollution During Construction

The National Planning Policy Framework (NPPF) requires sustainable development proposals to take measures to protect the natural environment on site and adjacent to it. Measures concerning waste are detailed in other sections of this report and biodiversity in an accompanying report, instead this section concentrates on those measures to be included in the construction phase to mitigate the negative impacts of construction on the natural environment and public health.

The semi-urban location of the site means there shall be no significant air or water quality risks arising from the scheme post construction. Therefore, measures shall be targeted to reduce water and air pollution during the demolition and construction phases. Below are a sample of the measures to be undertaken by site operatives;

- Fuel and chemical stores shall be located on impervious bases with a bund and secured. The base and walls of the container shall be impermeable to the material stored;
- Where dust is generated in small quantities through the normal construction process, such as the cutting of bricks and, where significant volumes are required, specialist cutting equipment shall be used i.e. brick saws which have dust suppression built in through the use of water jetting onto the cutting surface;
- If cutting is required on a lesser scale i.e. the cutting of pipes, bricks, blocks, paving slabs, chases etc. during installation or laying of these materials. This shall be carried out in a part of the site which is considered the most appropriate at that time and, away from any sensitive receptors;
- Waste containers and skips shall be covered;
- Just in time deliveries shall prevent the stockpiling of unnecessary materials on site, but where unavoidable materials shall be secured and covered where necessary to prevent pollution; and
- Hard surfaced roads shall be constructed as soon as possible or at the earliest time that the build programme allows.

The measures above shall be implemented through induction and toolkit talks with all site operatives and the posting of literature and signs in the site compound.

6.0 Waste Management

In 2012 the Government repealed the Site Waste Management Plan Regulations, therefore there exists no legal obligation to operate such a plan at the application site. However, as an environmentally responsible developer the proposed contractor should intend to operate such a plan.

The proposed contractor should be engaged in a drive to reduce the volumes of waste generated on site and increase the percentage of waste diverted from landfill through reuse and recycling.

This should be enforced through the adoption of a robust Site Waste Management Plan but also through effective and coordinated design and procurement. The following briefly summarises waste management policies the proposed contractor could adopt.

- Design to minimise wastage during the construction phase;
- Landform design and mass balance exercises are undertaken to retain as much material on site and reduce disposable volumes. There should be careful sub and topsoil storage and accommodation within the predetermined landform;
- Maximise the value of recycled aggregates through the separation of physical and chemical contaminates and through the careful matching of the materials generated with appropriate site use;
- Regular inductions and toolkit talks to all contractors and sub-contractors are standard. Careful site management of stockpiling and storage, segregation of waste groups and the prevention of cross contamination are implemented as standard;
- Agreements are in place with suppliers to reduce the amount of packaging on goods delivered to site. Take back agreements and "just in time delivery" are in place with key suppliers;
- All waste contractors are required to segregate demolition waste off site and provide records of such; and landfill shall be the last option when no economic solution can be found.

Buildings and building sites produce a significant amount of waste per year. Most of the waste produced in the UK is disposed of in landfill sites and only a small percentage of it is recycled or reused.

6.1 Waste Targets

Under EU legislation the UK shall have to ensure that less than a third of its waste is sent for burial in landfill sites by 2020 and the figure at present is about 80%. To achieve this target several measures are implemented, including landfill tax, aiming to discourage disposal of waste to landfill. Good waste management is a key component of sustainable development and is an important means of:

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

6.2 Construction Waste

During the construction phase a large amount of waste material shall be generated through construction and land clearing procedures. In 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) that complies with the requirements of current legislation and BREEAM shall be prepared. This plan shall identify the local waste haulers and recyclers, determine the local salvage material market, identify and clearly label site spaces for various waste material storage and require a reporting system that shall quantify the results and set targets. As a minimum, the RMP shall contain:

1. A target benchmark for resource efficiency, i.e. m^3 of waste per $100m^2$ or tonnes of waste per $100m^2$.
2. Procedures and commitments to minimise non-hazardous waste in line with the target benchmark.
3. Procedures to minimise hazardous waste.
4. A waste-minimisation target and details of waste minimisation actions to be undertaken.
5. Procedures to estimate, monitor, measures and report on hazardous and non-hazardous site waste and demolition waste, where relevant, arising from work carried out by the principal contractor and all subcontractors. Waste data obtained from licensed external waste contractors needs to be reliable and verifiable, e.g. using data from EA/SEPA/EA waste return forms or a PAS402 compliant company.
6. Monthly reporting of all construction waste data throughout the project checked against expectations based on the stage of the project, invoices, etc., to validate completeness of waste reporting data.
7. Procedures to sort, reuse and recycle construction waste into defined waste groups, either on site or through a licensed external contractor.
8. Procedures to review and update the plan.
9. The individual responsible for implementing the above.

6.3 Waste Management and Reporting in Operation

The detailed design phases shall identify the potential waste streams that the development shall produce. As a minimum, plans shall be formulated to handle the separation, collection, and storage of common recyclable materials such as paper, glass, plastics, and metals. The collection points shall be easily accessible to all of the users.

The main aim shall be to recycle as much waste as possible, this shall 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 occupation, shall include the following:

- Be clearly labelled to assist with segregation, storage and collection of the recyclable waste streams
- Be placed within accessible reach to building occupants or facilities operators for the deposit of materials and collections by waste management contractors
- Of a capacity appropriate to the building type, size, number of units (if relevant) and predicted volumes of waste that shall arise from daily or weekly operational activities and occupancy rates.

Waste collection points – at key ground floor location there shall be waste recycling collection points, which shall be emptied on a regular basis. The split recycling streams shall then be directed to an accessible refuse area, where the separate streams can be stored until collected by the local council.

A waste management strategy for the development shall be developed based on local Council guidance, with the aim of supporting recycling of as much waste as possible. These facilities shall be easily accessible to all users and sized according with BREEAM guidance.

7.0 Water Use

7.1 Water Conservation

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 design team shall focus on reducing the demand for water and managing the existing resources.

7.2 Water Demand Reduction and Water Efficiency

To meet water efficiency targets the following water saving measures are being considered for a range of areas in line with the BREEAM requirements:

Dual Flush Cisterns on WC's - These units have the ability to provide a single flush of 4L and/or a dual flush of 6/3 L with an effective flush volume of 3.75 litres. It is proposed that these or better 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. Maximum 5 Litres/min is recommended on the taps. 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 shall be installed in all of areas so as to comply with the BREEAM mandatory requirements.

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/ min a 40% water saving can be achieved. Flow rate can be reduced down to below 8 litres/ minute without compromising on water pressure and hence shall be considered as the design develops.

Water Meters - In 1995 approximately 33,200 million litres of water a day were extracted in England and Wales, this increased to 44,130 million litres/day in 2001, and much of this was for domestic water supply. To reduce this figure, accurate information on usage is required for management of a building's consumption. Water meters shall be specified on the main supply and sub- metering in line with the BREEAM requirements. Metering shall look to include features such as smart metering that can improve user ability to manage consumption.

8.0 CO_2 Emissions

8.1 Sustainable Design

The proposals seek to embed principles of sustainable design in all aspects of the development, including the target for net zero carbon. The approach for the proposed development, in terms of minimising its environmental impact, shall therefore be as follows:

- to reduce demand for energy;
- to meet demand for energy efficiently; and
- considering supply from renewable energy sources.

A 'fabric first' approach has been adopted to the development of. This means that the design of the proposed buildings aims to create a building envelope which is robust, air tight and thermally efficient. Along with efficient heating, lighting, ventilation and other service functions, this approach shall help to minimise heat energy demand.

8.2 Meeting Carbon Reduction and Energy Efficiency Targets

Government guidance for carbon reduction and energy efficient levels for development is set out in 'Approved Document L2A – Conservation of Fuel and Power in new buildings other than dwellings, 2013 edition with 2016 amendments'.

Compliance with Approved Document L2A shall be demonstrated through SBEM (Simplified Building Energy Model) calculations. In particular, it is proposed to improve upon minimum fabric standards and system efficiencies, limiting the effects of solar gain in summer, and heat loss and gains from circulation pipes, party wall and thermal bypasses, and air permeability.

Specific details shall be dependent on end operators, however, compliance with Approved Document L2A is summarised below.

8.3 Fabric Standards

Part L2A sets out the minimum (limiting) values for building fabric components. These are set out in the table below, against the values used in the SBEM notional building and the proposed 'enhanced' specification. The target air leakage rate for the purposes of the Part L2A calculation shall be 3, as this is subject to an air pressure test at practical completion. Robust construction details shall be used to minimise air leakage and thermal bridging.

Element	Part L2A Minimum U-Values	Proposed U-Values	Improvement
Walls W/m^2K	0.35	0.10	71%
Floor W/m^2K	0.25	0.15	40%
Roof W/m^2K	0.25	0.10	60%
Glazing W/m^2K	2.2	1.00	55%
Air Permeability (m3/hr/m2)	10	3	70%

8.4 System Efficiencies

All fixed building services efficiencies shall exceed the minimum requirements of the Non-Domestic Building Services Compliance Guide

8.5 Low Energy Lighting

The fit out of the proposed units shall comprise of highly efficient low energy LED luminaires, complete with high quality control gear, and subsequent long-life expectancy. The lighting shall have an average minimum efficacy of 130 lumens/circuit watt in the office areas which represents extremely efficient luminaires.

Additionally lighting shall be linked to occupancy controls and daylight dimming to ensure that artificial lighting is only used when required.

8.6 Limiting the Effect of Solar Gains

The solar gain shall be minimised while balancing the need to maximising daylighting and beneficial solar gains in winter. A detailed energy model has been completed to determine the "sweet spot" for the G-values in terms of minimum energy use.

8.7 Ventilation

Ventilation shall be provided via highly efficient, localised supply and extract fans incorporating heat recovery. The fans shall be linked to CO_2 sensors so that they only run when the CO_2 levels rise above the desired air quality levels. This shall reduce the amount of the energy the fans consume, in particular during times of low/partial occupancy.

8.8 Heating and Cooling

Heating and cooling shall be provided via a multi stage system. In cooling mode, a chilled water "ambient" loop shall be precooled via a high efficiency air source heat pump. This shall then distribute chilled water around the building where localised Hybrid VRF air source heat pumps shall then cool further to provide the desired room temperatures. The ambient loop circulates low grade heat or coolth around the building. This has the benefit of increasing the heat pumps efficiency due to the smaller temperature difference. Furthermore, as the water temperature in the ambient loop is much closer to the room temperature when compared to a traditional system, the distribution losses are significantly reduced.

The zonal heat pumps shall then extract heat/coolth from the ambient loop to condition the internal spaces to the required temperatures. Again, as the temperature difference at this stage, is smaller than in a traditional system the efficiency is improved.

Furthermore, this allows plant to be more accurately sized for each zone and operate within its optimum efficiency range.

8.9 Hot Water

The hot water shall be provided by dedicated heat pumps, by using heat pumps to provided hot water, they can reduce the associated carbon emissions by over 50%.

9.0 Energy Statement

Detailed operational energy modelling has been undertaken to predict the likely operational energy of the building, including a breakdown of its end uses.

9.1 Modelling

To compare energy savings and make informed decisions on the passive design options, modelling was undertaken on a representative sample floor using Part L2A methodology. The baseline is a building that would just meet the Part L2A emissions requirements. This represents the maximum allowable CO_2 emissions under Part L2A and a business as usual case.

The results of the baseline analysis are shown below:

	Energy Consumption (kWh/m^2)
Heating	17.85
Cooling	2.07
Auxiliary	9.41
Lighting	9.78
Hot Water	4.87
Total	43.99

As can be seen the main end uses are heating, auxiliary (fans and pumps) and lighting. Office equipment and other small power has not been included as this is not considered "regulated energy". This shall largely depend on the tenant and is outside of the designer's control.

Based on the above, a focus was made on reducing the heating demand through the following measures:

- Improved building fabric U-values
- Improved air tightness
- Reduced glazing heights.
- Reduced G-value.

9.2 Results

The results of this analysis are shown below:

	Test	Total Emissions (kg/m²)	Percentage Reduction to Notional	Notes
Passive Measures	Notional	16		
	Baseline	15.9	-0.6%	
	Reduced G-Value 0.18	15.7	-1.9%	All Glazing set to 0.18 G-Value
	Reduced Glazing Height 0.5m	15.4	-3.9%	Glazing height reduced by 0.5m with 0.5m high sill running round the whole building on all floors
	Reduced Glazing Height 1.0m	15	-6.7%	Glazing height reduced by 1.0m with 1.0m high sill running round the whole building on all floors
	Improved U-Values	14.3	-11.9%	U-Values improved to Passive Haus standards
	Passive U-Values and Air Tightness	14.2	-12.7%	Passive Haus U-Values with air tightness of $3m^3/h.m^2$@50Pa
	All measures Building	13.4	-19.4%	0.18 G-Value applied on all glazing, Glazing height reduced by 1.0m with 1.0m sill applied whole façade, Passive U-Values and Air Tightness applied.

This was then used to determine the impacts of improved building service design. This incorporated improved lighting efficacies, automatic lighting control, demand controlled ventilation and improved fan efficiencies.

In addition to the above measures a PV array of $334m^2$ is proposed to be located on the roof and the heating and hot water are to be provided via air source heat pumps. The results of including this are shown below:

Energy Demand

	Energy (KWh/m^2)	CO_2 saving (%)
Baseline Emissions	30.6	
Savings from Energy Efficiency	8.8	28.9
Savings from Renewable Energy	12.61	42.1

Energy Demand Assessment

	Baseline Scheme		Proposed Scheme		Change	
	kWh/m^2	Kg CO_2/m^2	kWh	Kg CO_2/m^2	kWh	Kg CO_2/m^2
Aux and lighting	19.2	10.0	13.9	7.2	-5.3	-2.8
Heating	22.7	4.9	9.8	2.1	-12.9	-2.8
Cooling	2.07	1.1	3.9	2.0	+1.8	+0.9
Total	44.0	16.0	27.6	11.3	-16.4	-4.7

Energy Efficiency Savings Summary

	KWh/m^2	Percentage
Reduction in Energy Demand	8.8	28.8%
Reduction in CO_2 emissions	4.7	29.4%

Renewable Energy Savings

		Amount	Percentage
Carbon	Required reductions from renewables	1.6 kg/m^2	10%
	Proposed CO_2 reduction from renewables	6.7 kg/m^2	42.1%
Energy	Required energy generation from renewables	2.8 kWh/m^2	10%
	Proposed generation from renewables	12.6 kWh/m^2	42.1%

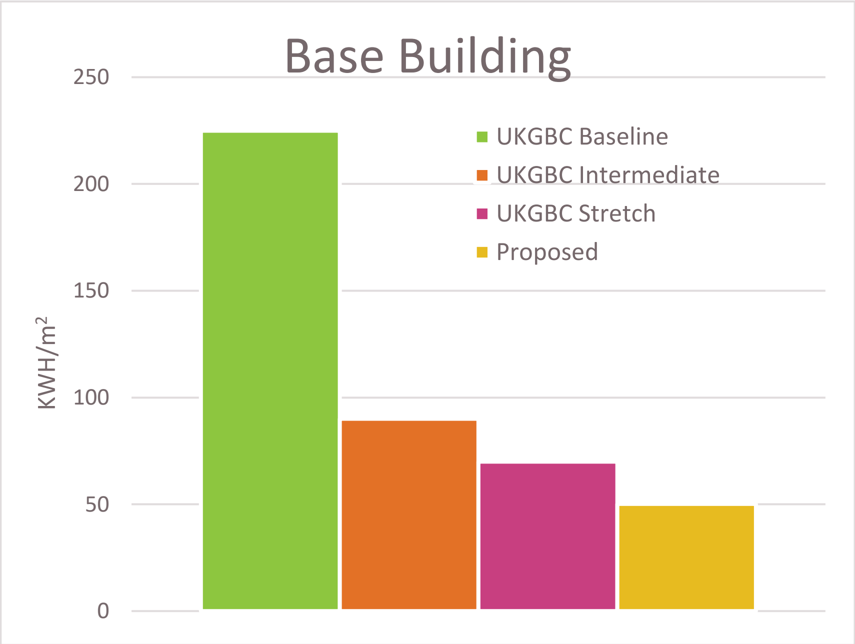
Following this, a more detailed model was created based on BREEAM ENE 01 methodology and CIBSE TM54.

This is used to more accurately predict the building's energy consumption and to include unregulated energy uses such as small power, external lighting and lifts.

This was used to compare the proposed design to the UKGBC's framework documentation. The results are shown below:

Operational Energy Usage (kWh/m²/year)	Proposed
Cooling	6.46
Heating	3.67
Auxiliary	5.54
Lighting	16.38
Small Power	14.81
Server	5.71
DHW	2.50
DCW	1.83
Lifts	0.14
External Lighting	0.54
Other Power (i.e. security systems)	0.10
Car Charging	0.37
Photovoltaic	-7.90
Total	50.15

Comparing this to the UKGBCs scenario, it can be seen this is a significant improvement over an expected baseline:



The baseline represents a typical building built in 2020. Whereas The UKGBC's intermediate scenario represents a good practice building in 2025 and the stretch scenario represents good practice in 2030.

The proposed building is an improvement over the baseline by 78% and improvement over the 2030 stretch scenario by 28%. This demonstrates that the proposed design at Glassworks represents the very best practice in current building design and shall be an extremely low energy building.

9.3 Renewable energy

A detailed assessment has been undertaken to determine the feasibility of incorporating a range of LZC technologies. The assessment is detailed below.

9.3.1 Photovoltaics

Photovoltaic (PV) systems convert the energy from solar irradiation into electrical energy which can then be fed into the building or exported to the national grid.

The technology is low impact as it produces no noise and can be installed on the rooftop to mitigate its visual impact. PV systems offer the greatest economic advantage when the generated energy can be used on site rather than exported as the cost per unit of electricity is higher to purchase than the price paid for exported electricity.

9.3.1.1 Feasibility

The building is likely to have a large electric demand as office buildings have a high density of IT equipment, in addition to the ventilation and air conditioning requirements. As a result, it is likely that the majority of the generated energy can be utilised on site, maximising the benefit of a PV system.

9.3.1.2 Proposal

The roof space offers a suitable area to locate PV panels. Spatial efficiency varies depending on the size and inclination of the panels but a spatial efficiency of 60% is achievable. This would allow for sufficient panel spacing to allow access and prevent shading of adjacent panels.

A PV array with an efficiency of at least 20% is recommended. The exact area and location of the PV array shall be determined as the design progresses.

As the design progresses, the area available to a PV array may change and thus the total PV area may differ from the current recommendation but based on current roof layouts a PV array of approximately 334m^2 can be installed. This array shall consist of circa 209 panels with a peak capacity of circa 70 kWp.

9.3.2 Solar Thermal Systems

Solar thermal systems, or solar hot water systems, convert the energy from solar irradiation into hot water. to provide domestic hot water.

To ensure the maximum utilisation of solar thermal systems a sufficient hot water demand during the summer when the output is high is required and as such these technologies are typically associated with residential buildings.

As the output from the system shall typically not occur at the same time as the peak demand storage vessels are required to store the energy generated during peak times (typically midday) to be used later when demand is higher.

9.3.2.1 Feasibility

Due to the nature of the site, there shall be a very low hot water demand relative, to the other building demands. In this instance only a very small solar array would be feasible. Furthermore, the requirement for a storage vessel would require additional plant space which would reduce the available office space.

9.3.2.2 Proposal

Due to the limited hot water demand and additional plant space required for minimal benefit, any available roof space would be better allocated to PV panels. A solar thermal system is not recommended for this building.

9.3.3 Combined Heat and Power

Combined heat and power (CHP) units generate electricity on site and capture the waste heat to deliver it to the building and provide heating and hot water. When compared to traditional energy generation this offers significant efficiency gains.

Accounting for transmission loss and thermal efficiency in gas turbines, grid electricity generated from natural gas would typically have an overall efficiency of 30%. While on site CHP units have similar electrical efficiency, they can capture around another 50% of the energy in the form of heat. This results in an overall energy efficiency if around 80%.

CHP units work best with a consistent year-round base heat demand. If there is no heat demand when electricity demand a CHP unit shall offer no benefit over grid supplied electricity.

Historically, CHP units offered large reductions in CO_2 emissions due to the high carbon emissions factors of gird supply electricity. However, as the grid has become decarbonised and CHP still relies on burning fossil fuels to generate electricity the savings are greatly reduced. This is demonstrated in the tables below using the government's SAP10 carbon factors:

Carbon emissions factors

Fuel	Part L2A Emissions factors (historical)	SAP10 emissions factors (Current)
Electricity	0.519 $kgCO_2/kWh$	0.233 $kgCO_2/kWh$
Natural Gas	0.216 $kgCO_2/kWh$	0.210 $kgCO_2/kWh$

Typical system seasonal efficiencies

Plant Item	Efficiency
Natural Gas Boiler	90%
CHP Electrical Efficiency	30%
CHP thermal efficiency	60%
ASHP COP	350%

Carbon Calculations

	Historical Emissions Factors			Current Emissions Factors		
	Gas Boiler	CHP Unit	Heat Pump	Gas Boiler	CHP Unit	Heat Pump
Heat Demand	100KWh					
Electrical Input	0kWh	0kWh	28.6kWh	0kWh	0kWh	28.6kWh
Gas Input	110kWh	167kWh	0kWh	110kWh	167kWh	0kWh
Electrical Output	0kWh	50kWh	0kWh	0kWh	50kWh	0kWh
Carbon Emissions from Gas	24kg	36kg	0kg	23kg	35kg	0kg
Carbon emissions from grid Electricity	0kg	0kg	15kg	0kg	0kg	7kg
Carbon Savings from generated electricity	0kg	26kg	0kg	0kg	12kg	0kg
Net Carbon Emissions	24kg	10kg	15kg	23kg	23kg	7kg

9.3.3.1 Feasibility

The building shall have a low hot water demand and as such is not well suited to a CHP unit. Furthermore, a CHP would have a negative impact on local air quality and would require management of the noise a CHP unit would create.

9.3.3.2 Proposal

Due to the low heat demand and the decarbonisation of the grid, CHP units would be unlikely to provide carbon savings and may even increase the CO_2 emissions when compared to other heat generating technologies.

9.3.4 Wind Turbines

Wind turbines work by converting the kinetic energy in the wind into electrical energy. To maximise their output, they require consistent wind speeds within their operating range, typically between 3m/s and 25m/s. They work best where there is little turbulence created by nearby obstructions and as such, are best suited to rural and coastal locations.

Wind turbines can create noise and a visual strobing affect, both of which can have a negative impact on the wellbeing of nearby building occupants and must be considered when determining the suitability of wind turbines to a site.

9.3.4.1 Feasibility

As the site is located within a built up area only a very small wind turbine could be installed without creating a negative impact on neighbouring buildings, such as from noise or visual impact. Furthermore the wind speeds at the site are likely to be low due to turbulence created by neighbouring buildings.

9.3.4.2 Proposal

As the site has no suitable location to site a wind turbine and the local wind conditions would not be suitable, a wind turbine is not recommended for this building.

9.3.5 Air Source Heat Pumps

Air source heat pumps (ASHP) extract heat from the air and, through a cycle of expansion and compression, can extract heat from low external temperatures while still providing sufficient heat requirements. As the energy to heat the space is being extracted from the air, the amount of energy generated is greater than the electrical input. ASHPs can achieve a coefficient of performance (COP) in excess of 3, meaning that the heat output is three times the input.

9.3.5.1 Feasibility

As the site shall require cooling, the same systems that provides cooling can also provide heating, reducing capital costs associated with plant and heating infrastructure.

9.3.5.2 Proposal

ASHPs are recommended to provide all space heating and hot water at Harton Quay, with the exception of small, isolated rooms where heating is required but cooling is not.

9.3.6 Ground Source Heat Pumps

Ground source heat pumps (GSHPs) work in the same way as ASHPs except they extract heat from the ground via buried loops or bores rather than from the air. As the ground maintains a more consistent temperature than the air, which is warmer in winter and cooler in summer, COPs in excess of 4.5 are typical.

As the GSHPs are extracting heat from the ground the cooling and heating load must be balanced to allow the annual temperatures to recharge. If the heating demand is too large the ground temperature shall slowly reduce, and the COP shall be reduced.

9.3.6.1 Feasibility

While the site has a balanced heating and cooling demand, a GSHP would offer similar savings to an ASHP but at a significant uplift in cost. As the heating and cooling demand has already been significantly reduced via passive measures

9.3.6.2 Proposal

A GSHP would only offer a modest saving in comparison to an ASHP and as a result, would not be economically feasible.

9.3.7 Biomass

Biomass boilers provide hot water by burning plant or animal material. Typically, this involves the burning of wood pellets or chips. Biomass is considered low carbon as the CO_2 emitted during the burning process is absorbed as the tree grows and shall be absorbed again if the trees is replaced.

Biomass boilers are not zero carbon however, as the fuel requires delivery and emissions associated with the transportation.

To ensure security of heating supply, large storage silos are required to ensure that heating can be supplied between deliveries. Additionally, back up gas boilers are installed to further guarantee security of supply.

Biomass boilers work best when the deliver a consistent output and they do not have low turndown ratios. As a result, they should be sized to meet the base heating demand with peaks provided via either a thermal store, backup gas boilers or a combination of both.

Burning of biomass can have a negative impact on local air quality.

9.3.7.1 Feasibility

The building shall have a low hot water demand and as such is not well suited to a biomass boiler. Furthermore, a biomass boiler would have a negative impact on local air quality and the plant area required for the floor area would reduce the lettable area of the building.

9.3.7.2 Proposal

Biomass is not recommended for this building.

10.0 Summary

Sustainability shall be achieved at Harton Quay via the following measures:

- The development is targeting net zero carbon using the UK Green Building Council's (UKGBC) framework
- The building shall incorporate U-values that are similar to those used in Passive House Buildings to minimise the heating and cooling demand.
- Heat recovery shall be incorporated into the ventilation systems to minimise heat loss due to fresh air requirements.
- All lighting shall be extremely efficient LED type luminaires.
- Lighting shall be linked to occupant and daylight sensors to only provide artificial lighting when required.
- Ventilation shall be linked to CO_2 sensors so that the fans only run when required.
- A detailed life cycle assessment (LCA) shall be undertaken to minimise embodied carbon involved in the construction and building services.
- Net zero carbon for the construction shall also be targeted via the UKGBC's framework.
- The development is targeting BREEAM "outstanding" which represents the highest rating achievable.
- A site waste management plan shall be produced to minimise waste during construction.
- Water shall be reduced through low flow sanitaryware and automatic shut off valves in WC areas to avoid leaks.
- As the site shall be served by electricity there shall be no impact on local air quality due to combustion.
- A PV array shall be installed on the roof to generate a proportion of the building's energy demand.

The breakdown of the energy analysis are shown below:

Energy Demand

	Energy (KWh/m^2)	CO_2 saving (%)
Baseline Emissions	30.6	
Savings from Energy Efficiency	8.8	28.9%
Savings from Renewable Energy	12.61	42.1%

Additionally, the detailed operational energy modelling demonstrates that the proposed design shall far exceed a typical baseline building and is inline with UKGBC's stretch scenario which represents predicted good practice in 2030.

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