Government Property Agency

Sustainability and Net Zero Annex

Design Guide

Version 3.0
11 March 2024

Overview

Executive Summary

The property industry has a huge role to play in reducing carbon emissions and maximising energy efficiencies as the world tackles climate change. According to the UK Environmental Audit Committee the built environment accounts for 25%* of the UK's total carbon footprint and our sector will be instrumental in achieving the national emission reduction targets[1].

The Government plans to achieve net zero by 2050 will set the UK on the world's most ambitious climate change target. The target, published in law, will reduce Scope 1 emissions by 50% by 2032 and 75% by 2037 which means that the UK will be more than three quarters of the way to net zero by 2037.

As the delivery body for the government's office and warehouse portfolio strategies, we have committed to reduce Scope 1 emissions by 50%by 2027 and 78% by 2035 for government buildings we manage ahead of the Government's targets.

This Sustainability and Net Zero Annex of the Workplace Design Guide sets out the standards that new build and refurbished buildings must meet to achieve the UK Government's net zero commitment. Using Modern Methods of Construction (MMC) to drive efficiencies and help achieve high quality sustainable designs.

Achieving the required 78% carbon reduction by 2035 will not be easy, and to achieve this we will need both concerted effort and work to deliver our corporate objectives and design outputs at pace.

[1] Building to net zero: costing carbon in construction, House of Commons Environmental Audit Committee, First Report of Session 2022-23.

We currently manage more than 900,000 square metres of the government's office portfolio. This offers us a huge opportunity to maximise the use of sustainable, clean technologies and low and zero carbon energy wherever possible.

Across the industry, we are seeing more businesses shift focus to a wider array of green initiatives. This is allowing a greater understanding of environmental best practice in the built environment, which enables a better understanding of the right measures to decarbonise the GPA estate. We are also exploring the smarter use of design elements on buildings to allow sustainable solutions to blend in better with the facade and fabric of older buildings.

I'm sure we can all agree that the property industry is facing some unique challenges to achieve net zero. But we do have many ways in which we can overcome them. We plan to lead by example and encourage every stakeholder in property to not just reach our redline standards, but to innovate and find ways to push higher and achieve better.

This Sustainability and Net Zero Annex outlines the key actions we will take to maintain compliance and embed recent legislation and policy. We want to adopt best practice and innovative approaches in our aim to become a flagship agency in greening government.

Clive Anderson
Director of Capital Projects, the Government Property Agency.

Introduction: the Government Property Agency

The Government Property Agency (GPA) is at the forefront of the government's transformation agenda. Working with all government departments to help them deliver their business needs and across the nations and regions of the UK. We are rationalising and improving the estate, creating shared, sustainable spaces with transformed digital tools and modern workplace services.

We have a real opportunity to make a huge difference to places, and to change perceptions about the way we work. The GPA is driving sustainability to achieve the Government's carbon net zero ambition, adopting modern technology, and reshaping our services to deliver a revised workplace strategy that is genuinely people-focused.

Our Mission and Vision

The GPA exists to create a transformed, shared, sustainable and value for money government estate that supports civil servants to work productively in every nation and region of the UK. This is achieved by supporting growth across the UK; transforming the Civil Service; contributing to net zero and delivering better taxpayer value across our assets.

Our mission is to provide great places to work for civil servants. We will use our scale and commercial expertise to do this effectively and sustainably, helping to support growth in all parts of the UK.

We recognise and want to embrace the opportunities that arise from our operations whether it be making a real social and economic difference in supporting the government's levelling up agenda or promoting sustainability and improving environmental performance to maximise our contribution to the UK's net zero carbon ambition.

In March 2023, we committed the Government Hubs and Whitehall Campus Programmes to becoming a pathfinder for TIP2023. TIP2030 is the Infrastructure and Projects Authority's (IPA) flagship infrastructure delivery programme considering net zero in all buildings, using modern methods of construction and embracing digital. Feedback on our progress to date suggests a need to go further in seeking opportunities to exploit MMC and to adopt a "platform" approach to our procurement processes.

For more information about the GPA sustainability delivery programme and how we deliver social value please see our Environmental Social Governance (ESG) report on GOV.UK.

Introduction

I. Aims

To identify the key performance criteria for a net zero (NZ) office estate and to set practical NZ-ready performance objectives for the government office portfolio achievable now. This document outlines the GPA sustainability requirements and the process of applying the NZ model and targets to deliver NZ carbon buildings.

II. Approach

The sustainability requirements for government workspaces are based on the following standards and guidelines:

- Low Energy Transformation Initiative (LETI) Climate Emergency Design Guide
- Building Research Establishment Environmental Assessment Method (BREEAM) New Construction Version 6
- BREEAM Refurbishment and fit-out 2014
- Chartered Institution of Building Services Engineers (CIBSE)Guides
- Royal Institution of Chartered Surveyors (RICS) - Whole Life Carbon Assessment for the Built Environment
- Royal Institute of British Architects (RIBA) 2020 Plan of Work
- RIBA 2030 Climate Challenge
- Better Buildings Partnership documents and standards
- Government Soft Landings
- Green Construction Board – Buildings Mission 2030
- The London Plan
- The UK Green Building Council (UKGBC) Net Zero Carbon Buildings – A Framework Definition
- Government Buying Standards
- The Government Buying Standard for Construction Projects
- Implementing Article 6 of the Energy Efficiency Directive
- Energy Technology Product List
- The Greening Government Commitments
- The 25 Year Environment Plan
- The Government Hubs Healthy Building Standards
- Trainsforming Infrastructure Performance [TIP2030]
- Construction Playbook

Objectives have been set where a solid body of evidence exists to support them, backed by published data and case studies.

In addition, analysis of existing buildings has also been undertaken to ensure that the objectives align with best practice industry standards and examples. Exemplar buildings, in terms of building performance and energy consumption, have been highlighted to provide additional guidance to developers and project teams regarding how they adopt these standards to enable a NZ-ready building to be realised.

III. Outline of Annex

The Annex largely aligns with the UK Green Building Council Net Zero Buildings Framework to identify the steps and process that a project team should undertake to enable the delivery of a sustainably operating building. The Annex takes a standardised approach whereby the objectives and guidelines must be adopted by the whole portfolio of buildings within the Government Office Estate and not only a single building. There are 7 defined sections in the Annex as follows:

1 – Net Zero Definition

- This section defines GPAs understanding and application of the term net zero using the UKGBC Net Zero Carbon Buildings definitions for construction, operational energy and whole life emissions.

2 – Net Zero Model – Steps to achieving a NZ Building

- Defining the NZ Model using the UKGBC 5 step framework for construction and operational energy.
- Identifying the key processes and building elements which will support the delivery of a carbon neutral building e.g. using low carbon heat, incorporating renewables, accurate data disclosure and designing for disassembly to reduce embodied carbon in construction and end of life.

3 –-Sustainability Targets

- Identifying the key and supporting targets a GPA Estates building must meet to achieve NZ.
- Identifying the design objectives for a GPA Estates building to achieve a NZ-ready outcome for construction, operational energy, operational utilities and concept design.
- Identifying guidance and recommendations to enable a developer to achieve the NZ-ready objectives and improve the performance of an existing building.

4 – Tools and Assurance

- Identifying industry tools and certification schemes which are of relevance to delivering sustainable outcomes.

5 – Methodology

- The methodology section of the report further clarifies the process each building must go through to achieve the stated standards and targets aligning with the RIBA 2020 Plan of Work for both new build and refurbishment projects.
- The methodology also explains the outcomes expected at each stage which must be met or an evidence-based explanation of why the targets cannot be achieved prior to any derogations or offsetting purchases.

6 – RIBA Stage Deliverables

- The outputs required at each RIBA stage to ensure a sustainable outcome for a new build or refurbishment project and enable a high performing building.

7 – Case Studies

- The case studies identify buildings which have implemented high efficiency systems including plant and lighting to reduce energy consumption to enable a high performing building.

Case studies also include new and refurbished buildings which have achieved a Display Energy Certificate top quartile rating aligning with the GPA Design Guide targets.

1. Net Zero Definition

The UK Green Buildings Council (UKGBC) Net Zero Carbon Buildings: A framework Definition, sets out two approaches for net zero with definitions and principles which are of equal importance:

1.1 Construction

For new buildings and major renovations - *"When the amount of carbon emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy."*

1.2 Operational Energy

For all buildings in operation - *"When the amount of carbon emissions associated with the building's operational energy*[2] *on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset."* The Energy Use Intensity target defined includes all of the energy consumed in the building (regulated and unregulated).

In addition, the **Whole Life Asset Management** (WLAM) emissions of the building should be considered - *"When the amount of carbon emissions associated with a building's embodied and operational impacts over the life of the building, including its disposal, are zero or negative".*

However, whole life carbon is not proposed as an approach at present due to current limitations in the reporting of carbon from the maintenance, repair, refurbishment and end-of-life stages of a building's life cycle. Instead buildings should aim for net zero carbon in construction and operational energy until greater familiarity with whole life carbon impacts has been achieved.

In all instances, the building developer, owner or occupier seeking to achieve net zero should do so over the greatest amount of building area they have control over. The boundary and related floor area should be clearly disclosed to allow the market to appreciate the extent to which the developer, owner or occupier has achieved net zero. The boundary options for construction and operational energy are as follows:

[2] For the purpose of the Sustainability and Net Zero Annex NZ model "energy" refers to both regulated and unregulated.

Boundary Options[3]	
Construction	Tenancy (fitout or major refurbishment)
	Single building (new or major refurbishment)
	Multi-building development (new or/and major refurbishment) (programme)
Operational Energy	Individual dwelling/tenant area in multi-unit building
	Base building
	Whole building
	Multi-building development (programme)
	Portfolio (base or whole building)

[3] Considerations when setting the scope of NZ modelling for compliance with the Sustainability and Net Zero Annex .

2. Net Zero Model

The UKGBC Framework has also been adopted to develop the NZ Model for the Sustainability and Net Zero Annex. The framework lays out a 5-step approach that a building should undertake to achieve NZ.

The Sustainability and Net Zero Annex identifies the process each building within the GPA Portfolio should follow aligning with the UKGBC Framework as follows:

1. Establish NZC Scope

a) All buildings must disclose the NZ targets the building will achieve as per the targets defined in the Annex for both construction and operational energy.

b) Scope for construction:

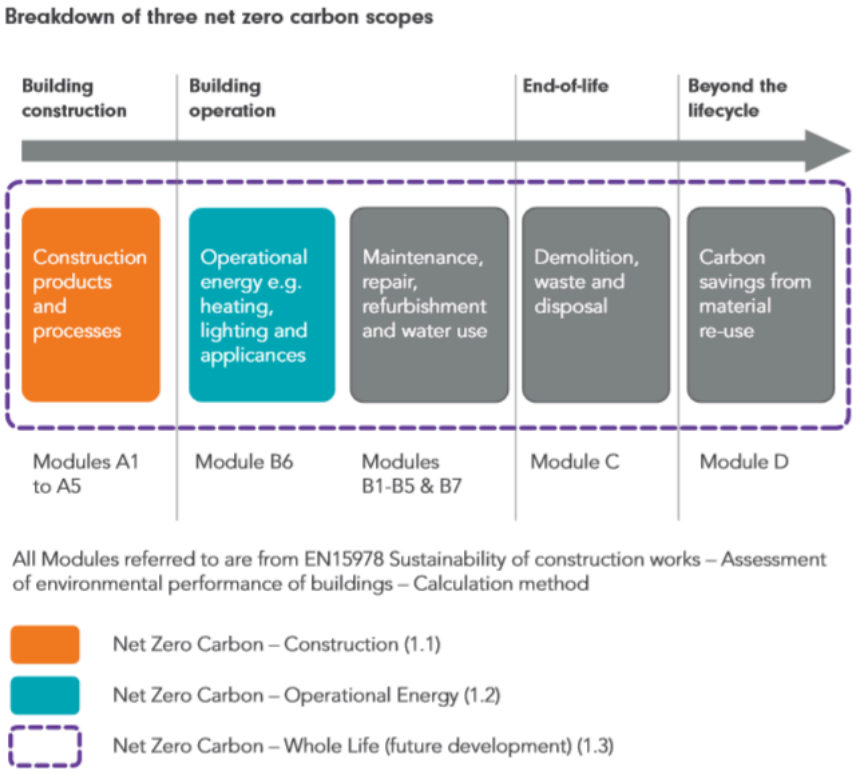
- WLAM carbon assessment must be undertaken to determine the building's carbon impact. The assessment should be audited by a third party and should be in line with RICS Professional Statement.
- Related offsetting of carbon either through the net export of on-site renewable energy or the purchase of offsets should be audited by a third-party.

c) Scope for operational energy:

- Defined as all areas under operational control that have been used to demonstrate a NZ. The energy scope and related gross internal area (GIA) should be disclosed to allow the market to appreciate the extent to which the owner/occupier has demonstrated an annual NZ performance for operational energy.
- The operational energy of a building must be reported annually for carbon impacts as a total emissions (tCO_2e/yr) and intensity ($kgCO_2e/m^2/yr$).
- NZ for operational energy is achieved when the building's total annual net CO_2 emissions equal zero - i.e. all carbon impacts are balanced by all carbon credits as seen in the figure below.
- Where the annual net emissions equal zero, as audited through a third-party, the building is NZ for operational energy

d) Scope for WLAM carbon:

- Will be developed and added to the Sustainability and Net Zero Annex within 5 years to take account of all building lifecycle stages. This will address construction impacts at practical completion and operational energy in-use.



2. Reduce Construction Impacts

a) WLAM carbon assessment should be carried out in three phases. First assessment should take place at RIBA Stage 2 to ensure the assessment is evidence-based and has the greatest potential to drive carbon reductions in all future stages of the project's delivery. A second assessment at RIBA Stage 4 to inform the detailed design by omitting sources of carbon emissions and to identify low carbon material specifications. A third assessment should be undertaken at practical completion which will measure the as-built outcome. This should be used to determine the extent of the embodied carbon to be offset to achieve NZ for construction.

b) A building's product and construction stages are defined as modules A1-A5 of the **RICS Professional Statement.** RICS Guidance must be followed.

c) Best practice design guidance and recommendations should be followed to reduce construction impacts for example reducing the use of carbon intensive materials in the design.

d) The UKGBCs circular economy guidance for construction clients should also be reviewed to ensure that the building is designed to maximise circular outcomes.

3. Reduce Operational Energy Use

a) In-use energy consumption should be calculated and publicly disclosed on an annual basis. In-use energy consumption calculations and modelling must be undertaken. **PHPP** driven compliance-based modelling will be undertaken but supplemented and guaranteed by NABERS UK Design for Performance (**DfP**) & **TM54** modelling.

b) Reductions in energy demand and consumption should be prioritised over all other measures. To reduce energy demand and consumption, the development should:

- Seek to optimise building fabric and passive design.
- Maximise systems efficiency.
- Implement smart energy/building management systems.
- Prioritise physical wellbeing of occupants.

4. Increase Renewable Energy Supply

a) On-site renewable energy should be prioritised. The amount of renewable energy generated on-site (minus any storage losses) should be measured and reported annually.

b) Off-site renewable energy should demonstrate additionality. Any renewable electricity purchased should demonstrate additionality in line with RE100 guidance documents '*Making credible renewable electricity usage claims*' and '*Technical note on renewable electricity options*.'

c) Low and zero carbon technologies(LZC) Carbon modelling to identify on and off-site options to reduce energy consumption

d) Where on-site renewable energy is used as an offset, the achievement of NZ for operational energy should take precedence. When net NZ for operational energy has been achieved, any surplus carbon credits from exporting on-site renewable energy can be used to offset embodied impacts.[4]

5. Offset Any Remaining Carbon

a) Any remaining carbon should be offset using a recognised framework of accredited carbon credits. Offsets should only be considered the action of last resort if the rigorous application of steps 1-4 have not enabled NZ for construction and operational energy to be achieved. Offsets should demonstrate additionality, avoid double-counting and provide a clear process for verification of carbon savings. For construction – offsets should be commensurate with the carbon impacts determined at practical completion. Exported on-site renewable energy can also be used as an offsetting route on an annual basis. For operational energy – offsets should be commensurate with the carbon impacts determined annually.

[4] Care should be taken to avoid double-counting renewable energy used to achieve NZ construction.

b) Government departments are looking into the use of offsetting. The Environment Agency's own net zero target, set for 2030, looks to use best practice carbon offsetting techniques and has highlighted the potential for offsetting to be delivered to high compliance and transparency requirements. Here are its conclusions at the time of authoring this annex.

c) The expectations around the use of carbon credits/ offsetting is evolving and ensuring the quality of a carbon credit is critical to defining a future proof offsetting strategy. Presently the offsetting market is not mature enough to recommend a public sector wide solution to affordable and/or a credible source of certified-authentic auditable carbon credits.

d) Offsetting can be a way to fund nature restoration, as the world realises the risks posed to human welfare from habitat destruction, species loss, and ecosystem damage but until further research is completed by our governmental peers into their use the GPA will not use offsetting to reduce carbon emissions. The GPA will endeavour to make all efforts to minimise the creation of carbon emissions from its buildings and business activities.

e) All offsets must be publicly disclosed. The use of offsets must be accompanied by a plan to eliminate their use by reducing carbon emissions through design improvement and optimisation.

- For construction – offsets should be disclosed at practical completion, in line with the reporting requirements. Where on-site renewable energy is used as an offsetting route, this should be reported annually as a cumulative figure alongside a statement of the outstanding carbon balance.

- For operational energy – offsets should be procured and disclosed annually in line with the reporting for energy consumption.

f) Offsetting of embodied carbon impacts is suggested for up to practical completion rather than the whole life asset management model (WLAM) of the building.

WLAM carbon explained

For all projects (new building, major refurbishments and minor refurbishment), the building construction and performance should be optimised through following the carbon hierarchy, adopting low carbon design solutions, and incorporating low carbon materials, fabric and system efficiency improvements. Consideration should also be given to passive strategies to reduce energy consumption and associated carbon emissions to enable NZ construction and NZ operational energy to be achieved.

To enable NZ to be achieved for both construction and operational energy, the LETI Climate Emergency Design Guide seeks to explain WLAM carbon. The figure below shows the operational carbon reduction stages on the left and the embodied carbon reduction stages on the right.

The methodology section of this Sustainability and Net Zero Annex will identify how all developments can achieve net zero carbon for construction and operational energy aligning with the UKGBC Framework.

3. Sustainability Targets

Through the desktop study of existing standards and guidelines regarding sustainability and the NZ Transition, a number of best practice targets and recommendations have been developed to optimise the sustainability of a building through construction, operational energy, operational utilities and concept design. These targets are identified to provide guidance to all developers regarding the design objectives they should be aiming to achieve.

It is understood that in practice several of these targets impact each other and therefore not all may be achievable when implemented in tandem. However, the developer, owner and occupier should seek to meet as many of the NZ targets during the design process as possible and where the targets cannot be achieved the developer must disclose proof regarding why their objectives cannot meet these targets. The key targets should otherwise be considered the gold standard for all buildings.

The following section identifies the key and supporting targets for a NZ building as well as additional guidance and recommendations that should be followed by all Government Estates buildings for:

1 – Concept Design

2 – Construction,

3 – Operational Energy, and

4 - Operational Utilities

These targets should be achieved in addition to meeting other sustainability requirements, such as minimum BREEAM, NABERS and EPC standards.

1 – Concept Design

To achieve the Sustainable Outcomes for Office building projects, the following guidance and recommendations should be followed:

	Guidance and Recommendations
Government Hubs	• Central to the design and fit-out of our buildings is the creation of workspaces that promote and enhance occupant health and wellbeing. • The **Government Hubs Healthy Building Standards** seeks to provide an overarching standard. The criteria and features listed within this specification are based upon the WELL Building Standard. Whilst buildings will not necessarily be WELL Certified, this standard will allow for the delivery of features that are proven to have physical and mental health benefits. This guide is a working document, requirements should be delivered in line with the published addenda, equivalences and alternative paths of adherence.
Environmental Plan	• The setting of environmental performance benchmarks will follow the guidance set out in Government Soft Landings (GSL). Performance outcomes will be set for operational energy consumption of all energy sources and resulting CO_2 emissions, operational water consumption, and operational waste disposal. To comply with GSL, a project Environmental Plan should be produced. • The development of a robust energy consumption target is complex as it is dependent on the building design, the method and quality of its construction, how it is operated, and how it is maintained – each of which are likely to be under the control of different parties. Establishing this performance outcome should therefore follow a defined process such as that set out in CIBSE guidance TM54: Evaluating Operational Energy Performance of Buildings at the Design Stage. The modelling of operational energy consumption must take account of both regulated energy consumption (i.e. that assessed under Part L of the Building Regulations in England and corresponding approved documents in devolved administrations) and unregulated energy consumption (i.e. everything else; including specialist equipment such as catering, IT servers, etc), the approach to building services controls, the anticipated occupancy patterns of the building, management factors, and any other aspects likely to impact actual energy consumption. The model should also equate energy consumption to CO_2 emissions. • The Plan will need to be monitored and updated as the design progresses and should be used to support decision making where changes would have an impact on environmental outcomes. The final iteration of the energy model should reflect the ‘as built’ building and should be used as a guide to the process of optimisation by matching actual performance to the performance outcomes as closely and quickly as possible. This should be achieved through a collaborative process involving designers, constructors, facilities management providers, and occupiers. In order to ensure the support of all parties, activities during this fine-tuning period should be explicitly defined in appointment contracts. • Note: At the time GSL was published, CIBSE had not finalised the reference number or title of the guidance, therefore GSL uses its working reference of TM99. • For further guidance, refer to Low Carbon Strategy.

Re-use of Existing built assets	• Re-use all or part of existing structural frames, substructure, foundations or façade to minimise the demolition and impact of new development. This may require record searches to be undertaken for archive drawings and/or specifications of the existing building together with fabric surveys to establish the basis of the original design and identify the opportunities for reuse.
Re-use of furniture	• Guidance set out in Government Buying Standards requires departments to consider their existing furniture stock (to use as is or with adaptations), if this does not provide a solution the Furniture Clearing House facility should be used. Where such furniture is available but no longer fits the footprint or supports the appropriate working style of the workspace, opportunities to remodel existing furniture should be explored. • Individual projects will decide whether use of new or refurbished furniture is appropriate on the basis of the ability of suppliers to respond in a timely and cost-effective manner to the quality and scale of the requirement.
Design for Flexibility	• Ensure that the development is able to respond to users' current and future needs to maximise the life of the building. If future changes to the building are envisaged then early consideration of these in the design process will influence the preferred form, layout and choice of structure. Developers need to ensure that loading plans are included within operations and maintenance to aid future adaptations.
Assessment and Certification Process	• Since large parts of the WELL Building Standard are based on building conditions, IWBI uses Performance Verification as a process for on-site assessments. These inspections and measurements include tests related to air and water quality and sound and light levels. It is a process distinct from traditional building commissioning and assures that the building is performing as intended in accordance to the WELL Building Standard. Performance Verification is completed by an authorised third party WELL Assessor who will usually spend one to three days in the building to validate the project's design documentation and to complete a series of performance tests, spot-checks and measurements spanning all WELL Concepts. • Testing is completed according to IWBI's sampling protocols based on the size and type of the project, and samples are sent to third-party labs for analysis. Any WELL feature is subject to verification on-site by a WELL Assessor during Performance Verification, even those accounted for by documentation. The assessor may therefore provide additional documentation generated during spot-checks or spot-measurements for final consideration, in the form of an inspection document.
Scoring	• In evaluating adherence to the WELL Building Standard, a project's assessor will grade each Concept independently on a numerical scale. While this Concept-by-Concept analysis is used initially to ensure that all Preconditions per Concept are met, the final WELL Score is calculated based on the total Preconditions and Optimisations achieved across the board and certification is awarded at the Silver, Gold or Platinum Levels. • For the base build, core and shell certification can be achieved and can set a good baseline for future certification of Fit-outs under the Interiors Certification.
Smart Buildings	• A smart building is the linking of systems in a building which enables the building to be managed more effectively. Individual systems can be termed as smart if they allow additional control and an enhanced user interface, however installing these alone does not create a smart building.

	• To create the smart environment, the GPA will connect live data from installed systems to enhance the operation of the building. Outputs from this will reduce cost of operation and enhance the user experience.
	• Systems must be connectable by one of the listed protocols:
	  • Application Programming Interface (API) » Open Platform Communications Unified Architecture (OPC UATM)
	  • Open Platform Communications Tunnelling (OPC Tunnelling)
	  • Building Automation and Control Networks (BACnet)
	  • Simple Network Management Protocol (SNMP)
	  • Modbus Systems may include but not be limited to: BMS, Heating, Cooling, Lighting, Security Barriers, Internal Door Control, Meeting room booking, Occupancy sensors, Desk sensors, WiFi infrastructure, Reception systems, Plant room, Computer-aided Facility Management (CAFM), BIM, Smart metering BEMS, and Lifts

Design	• Design for a form factor of 1-2 to reduce fabric exposure to outdoor conditions • Reduce glazing area and improve U-Values of the building fabric • Include openable windows and cross ventilation where possible • Balance daylight and overheating and include external shading • All rooms but be designed in-line with SLL lighting guidance • Reduce internal gains and relax setpoints • Install heating and cooling set point controls • Local heaters at point-of-use to meet DHW demands • Demand controlled and use of CO_2 sensors and linked to occupation • Use variable speed drives for pumping and fans with demand and load controlled speed operation
Renewables	• Maximise use of renewables to generate the annual energy requirement for at least two floors of development including the use of heat pumps • Consider battery storage • Ensure heating and hot water generation is fossil fuel free • Implement high efficiency services systems and onsite renewables where possible
Energy consumption	• Reduce regulated energy consumption from controlled, fixed building services • Reduce unregulated energy consumption through occupant's incentive schemes • Reduce lighting, ventilation and small power energy consumption • Lighting design should be implemented to effectively light the spaces • Use LENI calculation method to understand true lighting system consumption ($W/m^2/100lux$)

In addition to the operational energy targets, the following monitoring and metering recommendations should be adopted through the design process:

Guidance and Recommendations – Monitoring and Metering
• Energy sub-metering should provide a breakdown of major energy end uses (lighting, small power, cooling, heating, ventilation) in line with Soft Landings requirements should provide accurate, useful information for building operators. The metering strategy should be designed in collaboration with the building operators, where possible, and include proving that the meters are providing accurate readings that are useful for energy management purposes. • Implement a sustainability and efficiency energy management plan in line with ISO 50001 that includes provisions for carrying out a Display Energy Certificate (DEC) assessment,

reporting on the DEC assessment outcome on an annual basis and incentivise incremental performance improvement
- Implement a metering management scheme to ensure that meters are and remain calibrated throughout the operational life of the building
- Metering should also provide a breakdown of major energy uses in line with Soft Landings and TM39 requirements to provide accurate, useful information and should be designed in collaboration with building operators
- Install an automated metering system (AMR) with half hourly data logging separate from the BMS with data storage and interoperability to access CSV data and interface with energy management systems
- The Building Management System (BMS) should be integrated between Cat A and Cat B and will enable 100% point commissioning

2 – Construction

Embodied carbon impacts from the product and construction stages should be minimised, measured and offset at practical completion.

Key targets to achieve sustainable construction for all office buildings within the GPA Portfolio:

	Key Target
BREEAM – New Build[5]	• BREEAM New Construction Version 6 >Excellent[6] (for Parts 1, 2, 3 & 4), with a NABERS UK rating of >5* and DEC top quartile[7] to achieve 78% reduction • BREEAM New Construction Version 6 >Excellent (for Part 1 or Parts 1 & 2), then BREEAM 2014 RFO >Excellent (for Part 2 and or Parts 3 & 4) with a NABERS UK rating of >5* to achieve 78% reduction
BREEAM - Refurbishment	• BREEAM 2014 RFO >Very Good with a NABERS UK rating of >4* to achieve 78% reduction
Embodied Carbon[8]	• By 2030 the total embodied carbon from the product and construction stages [A1-A3, A4 & A5][9] should be less than or equal to 350 $kgCO_2e/m^2$ through efficient design and criteria to minimise the use of new material and wastage. • Currently the total embodied carbon from the product and construction stages should be less than or equal to the RIBA Stage 4 forecast from a linear sliding scale from 600 $kgCO_2e/m^2$ in 2020 to 350 $kgCO_2e/m^2$ in 2030 in order to generate targets.

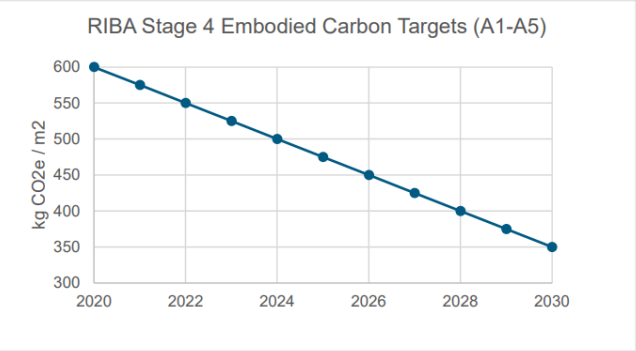
[5] BREEAM Version 6 New Construction

[6] Government Buying Standard requirement

[7] Top quartile of the UK buildings performance

[8] BREEAM Non-Domestic Refurbishment and Fit-Out 2014

[9] EN 15978 Life Cycle Stages



- Maximise off-site prefabrication to minimise on-site construction activity, reduce wastage and optimise safety.
- Materials that are reused should be more than or equal to 50% inc. use of recycled aggregates for non-structural concrete frame elements, sub-bases for temporary hard standing, piling mats or general fill to reduce the impact on new resources.
- 80% or more of the embodied carbon in products and materials [A1 - A3] should be in items that are designed for reuse.
- or PFA to reduce the carbon impact of concrete production.

For the Key Targets to be achieved, specific building elements should be optimised as follows:

	Supporting Targets
% of materials that are reused	50%
% of materials designed for reuse	80%
Embodied CO_2 in products and materials [A1 - A3] inc. recycled steel in reinforcement and GGBS as cement replacement	<250 $kgCO_2/m^2$

To achieve the key and supporting targets within construction, the following guidance and recommendations should be followed:

	Guidance and Recommendations
Timber	• Timber will be purchased in accordance with Government Buying Standards • Timber must be purchased in accordance with UK Timber Procurement Policy. Only timber and timber products originating either from independently verified legal and sustainable sources or from a licensed Forest Law Enforcement Governance and Trade (FLEGT) partner can be purchased. Recycled timber is also accepted (TPAN April 2010 for further detail).
Responsible sourcing of materials	• Obtain concrete, steel, cladding metals, bricks, gypsum, glass from manufacturers with BS EN ISO 14001: 2015 or BES6001 (Minimum 'Very Good' rating).

Environmental Product Declaration (EPD) EN15804	• Products should have an EPD[10] that quantifiably demonstrates their environmental impact in line with ISO 14025.
Flood risk assessment	• Where the development is located in NPPF Flood Zone 2 or 3, use appropriate flood resistant and resilient construction techniques in accordance with BREEAM Pol03 requirements.

Biodiversity	• The new Nature Recovery and Biodiversity Annex of the Design Guide introduces four new targets:
	  • Biodiversity and Nature Recovery net gain of 10%
	  • Urban Greening Factor score of >0.3
	  • 90% Native species in landscaping
	  • 10% Non-native for extending pollination season
	  • 100% BREEAM ecology credits in development

Functional adaptability	• Undertake a functional adaptability study of the building as set out in BREEAM Wst06.
Health & Wellbeing	• Assess the project using the Well Building Standard and achieve 'Core and Shell Compliance'
Access View Out	• Achieve view out criteria, as set out in BREEAM, Hea01.
Internal air quality	• All internal finishes including paints, coatings, adhesives, sealants, flooring, insulation, furniture and furnishings should achieve the WELL Building Standard for volatile substances in accordance with Air Feature 04.
Green lease	• Provision of a 'green clause' in the lease that states that the Landlord and Tenant will cooperate on sustainability issues, particularly relating to energy use, water use and waste generation in accordance with the BBP Green Lease Guide.
Soft Landings	• Apply Government Soft Landings Framework, including design workshops, commissioning management, fine tuning & post occupancy evaluation. Targets should be set and communicated at the end of RIBA Stage 1.
Base build and fit-out criteria	• Developers agree finishes and ceiling types to common areas with the fitout team prior to specification and installation.
Sustainability, Wellbeing and Soft Landings champion	• Contractor teams should include a member with specific responsibility for championing sustainability, wellbeing and Soft Landings.
Design	• Simplify the design to use less materials (Tonnes of material per m^2) • Reduce the weight of dead loads where possible • Restrict long structural frame spans • Consider regular structural grid and future-proofed risers and central plant space • Avoid over-provision of MEP plant and reduce duct runs where possible • Structural members should be designed for 100% utilisation rate • Minimise structural weight, using lightweight materials to reduce foundation load and size
Transportation	• Reduce transportation to site and onsite construction through off-site modular construction, manufacture, consolidation centres and distribution hubs

[10] An EPD is a type III environmental declaration that is compliant with the ISO 14025 standard.

	• Use existing materials on or near the site where possible
Manufacture & Assembly	• Explore design for manufacture and assembly (DfMA) solutions to reduce waste and site works • Mechanically fix systems so that they can be demounted and reused/replaced in the future to support a circular economy • Consider durability, maintenance and design life during product selection • Consider access and replacement strategy for building layers with shorter design life • Consider end-of-life use of structure, including ease of demolition and reuse of structural elements and materials

3 – Operational Energy

Consideration shall be given to integrated structural and services systems to improve performance of the building, such as the use of thermal mass from concrete structures to reduce operational energy.

Key targets to achieve net zero carbon for operational energy all office buildings within the GPA Portfolio:

	Target
Energy Use Intensity (EUI)	70 kWh/m²/yr (NIA), 55 kWh/m²/yr (GIA)
Space Heating Demand	15 kWh/m²/yr
DEC Rating	In the top quartile of performance
EPC Rating	Energy Performance Certificate (EPC) Rating should be A (New Builds) or B (Refurbishments)
Renewable Energy (RE) Supply	Local Plan requirement for minimum % on-site RE achieved
Energy Performance of Equipment	Energy consuming equipment including building services equipment, ICT and white goods should meet the relevant Government Buying Standards and Article 6 of the Energy Efficiency Directive. Items with an A rating should be used where possible.

For the Key Targets to be achieved, specific building elements must be optimised as follows:

	Supporting Targets
Form Factor	1-2
Window areas guide (% of wall area)	25-40% per wall
Fabric U-Values W/m^2.K	Achieve minimum U-Values (W/m^2.K) for wall (≤0.15), floor (≤0.12), roof (≤0.12)
U-Value: Windows	1 (triple glazing)
U-Value: Doors	1.2
Air Tightness	<1 (m^3/h. m^2@50Pa)[11]
Thermal Bridging	0.04 W/m.K (y-value)
G-Value of glass	0.3-0.4
Low carbon concrete	min % GGBS or another substitute

[11] Where impractical this value may be increased up to the MEP threshold of <2.5 (m^3/h. m^2@50Pa).

CO_2 Levels	<900 ppm with sensors for ventilation
Total VOCs	<0.3 mg/m^3
Daylighting	>2% av. Daylight factor, 0.4 uniformity
Daylight	Use of Climate Based Daylight Modelling (CBDM) as part of design process, both for CAT A and fit out
Lighting Power Density	4.5 (W/m^2 peak NIA)
Lighting out of hours	0.5 (W/m^2 peak NIA) Install lighting sensors/controls with daylight dimming
Tenant power density	8 (W/m^2 peak NIA)
ICT Loads	0.5 (W/m^2 peak NIA)
Small power out of hours	2 (W/m^2 peak NIA)
Automation	Common sensors for lighting and HVAC to reduce components and enable capital and maintenance cost savings
Refrigerants	DELC CO_2e of ≤1000kgCO_2/kW cooling/heating capacity[12]
Free-cooling/Night cooling	Reduce LTHW to 55-60 °C. Increase CHW temperature to 8 °C flow
Comfort set points	22±-2°C[13]
Overheating	24±2°C[12]
Heat Recovery	90% (efficiency)
Heat pump SCoP	≥ 2.8
Chiller SEER	≥ 5.5
Low SFP	FCU 0.35 W/l/s, Central AHU 1.2 – 1.5 W/l/s

4 – Operational Utilities

Key targets to achieve net zero carbon for operational use of utilities in all office buildings within the GPA Portfolio:

	Target
Transport	Prepare a travel plan that includes a survey of prospective occupants to provide views on the potential to use more sustainable transport modes in accordance with BREEAM requirements.
Water	Water fittings will comply with the flow rates set in the Best Practice Government Buying Standards including showers, taps, WCs and urinals. Fittings should also meet AECB standards and DEFRA best practice guidelines. CIRIA W11 4m^3/fte/yr, 16 l/fte/day or 0.55 m^3/m^2 NIA
Waste	Develop an operational waste strategy and ensure that building design incorporates facilities to accommodate recycling including allowance for space within the tenant's demise for intermediate storage. Waste (tonnes), <5% to Landfill, >70% recycled, nil single use plastics, >15% reduction from 2017/18 baseline.

[12] The refrigerants used in the cooling system in the building will have Direct Effect Life Cycle CO_2 equivalent emissions (DELC CO_2e) of ≤1000kgCO_2/kW cooling/heating capacity as calculated using the BREEAM Pol01 tools.

[13] Temperature for work areas see MEP Annex for other area temperatures.

4. Tools and Assurance

The tools and schemes identified in this section aim at providing guidance and assurance. However, it needs to be noted that while their implementation promotes sustainable outcomes (i.e. NZ-ready), they are not sufficient to achieve the NZ ambition as defined in Section 1 of this document.

4.1 GPA project types

The GPA's building projects encompass a wide range of works from new construction, refurbishment, fit-out through to practical completion and maintenance. The three definitions most applicable to GPA projects are as follows:

Name:	Definition:
New Build	A development that results in a new standalone structure, or new extension to an existing structure, which will come into operation or use for the first time upon completion of the works.
Major Refurbishment	Development of an existing shell or shell and core that results in a building that will return to operation or use upon completion of the works.
Minor Refurbishment	Maintenance of an existing building, by repairing or replacing the interior finishes, furniture, fittings and equipment to permit continued operation or use upon completion of the works.

4.2 Red Lines

The red lines for GPA projects are as follows:

Project Type:	**BREEAM**	**NABERS UK**	**EPC**	**Dec**
New Build	> Excellent[14]	5* >	A	Top quartile[15]
Major Refurbishment	> Very Good[12]	4* >	B	Top quartile
Minor Refurbishment	Out of Scope	Out of Scope[16]	Out of Scope	Out of Scope

4.3 BREEAM Assessment Scope

The scope of the BREEAM schemes are described using recognised industry definitions, such as the British Council for Offices definition of Category A and B fit-out as far as possible. However, in practice, there is no fixed industry standard definition of refurbishment and fit-out works, with a large degree of variability from project to project.

The BREEAM UK New Construction Version 6 (BREEAM NC) scheme is used to assess the environmental life cycle impacts of a new build project at the design and construction stages. A number of assessment options are defined and can be applied to assess and rate the performance of a new build project. These are:

Name:	**Includes:**
Fully Fitted	Applies to New Build projects on practical completion

[14] Government Buying Standard requirement
[15] Top quartile of the UK buildings performance
[16] Work should not degrade the existing performance of a building

Fully Fitted simple	Applies to a "simple" New Build project[17]
Shell & Core	Applies to New Build projects where the scope of works is restricted to shell & core
Shell	Allies to New Builds projects where the scope of works is limited to shell

The BREEAM (2014) Refurbishment and Fit-out (BREEAM RFO) scheme is used to assess the environmental life cycle impacts of a major refurbishment project at the refurbishment and fit-out stages. The definition of 'refurbishment' encompasses a wide range of works to improve the performance, function and overall condition of an existing building. 'Fit-out' also encompasses a wide range of works, however it is more associated with internal works to the building including the first fit-out of a newly constructed building or re-fitting of an existing building.

Due to this variety and also the need to ensure a consistent definition is used for assessment comparability purposes, BREEAM has defined a number of optional assessment 'parts'. The four parts of construction projects are categorised as follows:

Parts:	Name:	Includes:
1:	Shell	External walls, windows, doors, roof, core internal walls, structural floors and landscaping
2:	Core Service	Transportation, water, common area fit-out, central mechanical and electrical inc. HVAC
3:	Local Service	Lighting, local heating, cooling and ventilation
4:	Interior Design	Interior finishes, furniture, fittings and equipment

The scope of Part 1 of the BREEAM RFO scheme aligns with the shell only option of BREEAM NC. Parts 1 and 2 combined align with the shell and core option of the BREEAM NC. Parts 3 and 4 cover the scope of work that is covered under the tenant's fit-out works which can be used to 'top up' a shell and core assessment.

4.4 BREEAM Credits

Where minimum Credit scores are mandatory to achieve the desired BREEAM rating these are indicated below.

BREEAM Criteria		Minimum for Very Good	Minimum for Excellent
Man 03	Responsible construction practices	None	1 Credit: Responsible construction management
Man 04	Commissioning and handover	None	1 Credit: Commissioning - test schedule and responsibilities and Criterion 11 (Building User Guide)
Man 05	Aftercare	None	1 Credit: Commissioning - implementation
Ene 01	Reduction of energy use and carbon emissions	None	4 Credits: Energy performance or Prediction of operational energy consumption[18]

[17] A Simple building is defined as having building services that are predominantly of limited capacity and local in their delivery, largely independent of other systems in the building fabric and without complex control systems

[18] It must be demonstrated that the operational energy performance has been significantly improved

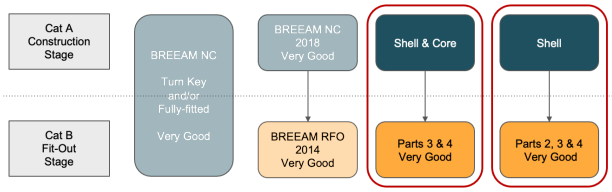
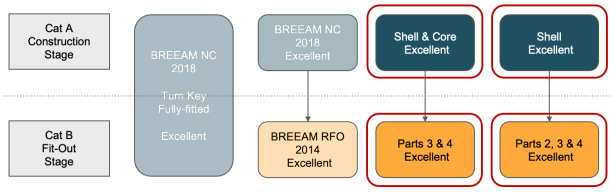
Ene 02	Energy monitoring	Parts 2, 3 and 4: One credit (First sub-metering credit)	1 Credit: First sub-metering credit
Ene 03	External lighting	None	None
Ene 04	Low carbon design	None	None
Ene 05	Energy efficient cold storage	None	None
Ene 06	Energy efficient transportation systems	None	None
Ene 08	Energy efficient equipment	None	None
Wat 01	Water consumption	1 Credit	1 Credit
Wat 02	Water monitoring	Part 2: Criterion 1 only	Criterion 1 only
Mat 01	Environmental impact from products - Building life cycle assessment (LCA)	None	None
Mat 02	Environmental impact from products - Environmental product declarations	None	None
Mat 03	Responsible sourcing of materials	Criterion 1 only	Criterion 1 only
Mat 04	Insulation	None	None
Mat 05	Designing for durability and resilience	None	None
Mat 06	Material efficiency	None	None
Wst 01	Construction waste management	None	None
Wst 02	Recycled aggregates	None	None
Wst 03	Operational waste	None	1 Credit
Wst 04	Speculative floor and ceiling finishes	None	None
Wst 05	Adaptation to climate change	None	None
Wst 06	Design for disassembly and adaptability	None	None
LE 01[19]	Site selection	2 Credit	2 Credit
LE 02	Ecological value and protection	> 2 Credit	> 2 Credit
LE 03	Mitigating negative impact	> 3 Credit	> 3 Credit
LE 04	Nature recovery	> 4 Credit	> 4 Credit
LE 05	Biodiversity	2 Credit	2 Credit

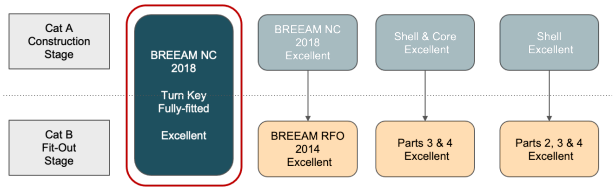
[19] The LE Credits are GPA requirements from the Biodiversity and Nature Recovery Annex of the Design Guide.

4.5 BREEAM Assessment Options

The BREEAM NC scheme can be used alone or in conjunction with the BREEAM RFO scheme to assess a fully fitted building where the construction works and finishing stages have been carried out separately. A fully fitted GPA project can be reassessed under BREEAM NC, to the Excellent standard, following a shell and core assessment [Option 3]. A GPA Shell only or Shell and Core project assessed to meet Excellent under the BREEAM NC can undergo a first fit-out (and subsequent fit-outs) to meet Excellent against the BREEAM RFO scheme. GPA New Build projects that have separate Cat A contractors (fabric and structure) and Cat B fit out contractors should follow this framework [Option 2]. A refurbishment project consisting of a combination of Parts 1, 2, 3, and 4 should be assessed to meet Very Good against BREEAM RFO [Option 1].

For projects where there is a separate shell and core or shell contractor from the fit-out contractor then there are several options to consider. The GPA methodology is:

No of Assessments	Assessment Split	Commentary
OPTION 1: Major Refurbishment - BREEAM RFO assessment to Very Good standard		BREEAM RFO certification. One assessment is completed for the building (Parts 1, 2, 3 and 4 combined). - One BREEAM assessor and AP are appointed - BRE fees are paid once - Collaboration and transfer of compliant evidence is required - Contractual requirements for completion and transfer of information (*additional risk for contractor who holds final BREEAM responsibility*) - Risk that programmes do not align and late BRE certification **- Most commonly used on a refurbishment project where one BREEAM certificate is required.**
OPTION 2: New Build - BREEAM NC and BREEAM RFO assessments. End-to-End meets Excellent standard		Two BREEAM assessments are completed for the building. BREEAM NC for shell (Part 1) or shell and core (Parts 1 & 2) and BREEAM RFO Fit Out (Parts 2 and/or 3 and 4) - Two BREEAM assessors and APs are appointed (one to each team). - BRE fees are paid twice. - Each design team and contractor is responsible for their own BREEAM compliance - Two certifications are awarded for the building which could be different ratings but no less than Excellent.

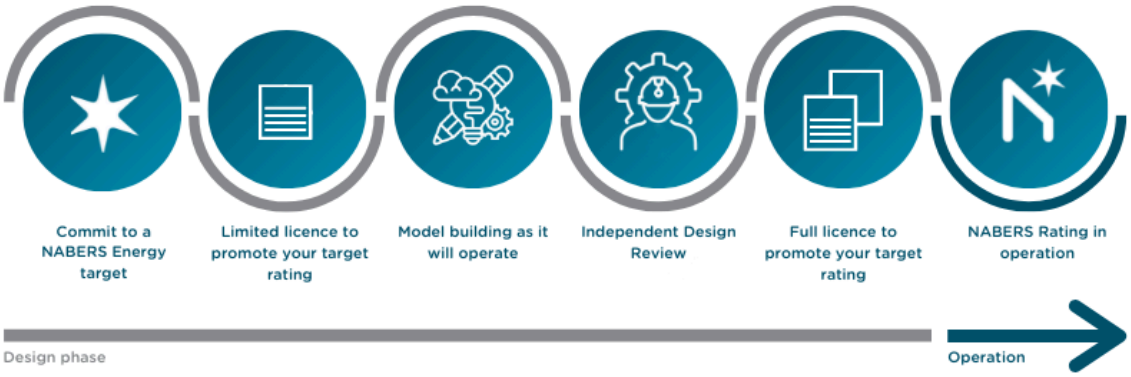
OPTION 3: New Build - BREEAM NC One Shell & core completing as fully fitted assessment to Excellent standard	 It is possible to complete an assessment as fully fitted following a design stage certification as a shell & core project. Whilst the assessment will reference much of the same evidence gathered for design stage, it must be re-registered and submitted as a post construction assessment (cost approx £300-400 + £3,000) and may be submitted as a fully-fitted post-construction assessment (rather than review).	One BREEAM NC assessment completed for the building. Consolidated requirements under KBCN0394: Shell & Core completing as fully fitted. - Each contractor holds responsibility at the relevant stage. This project (and potentially the BREEAM Assessor) is then novated over to the fit-out contractor. - One certificate for the building - **Most commonly used on a new build shell / shell & core with a secondary fit out.**

4.6 NABERS UK

The Government Buying Standard (GBS) requirements do not meet the GPA's net zero ready ambition to cut Scope 1 (direct) emissions from offices by 78% by 2035. The latest versions or the ERs and RfPs require projects to explore the time, cost and delivery implications for opportunities to improve on the GBS. To meet the GPA targets for energy performance projects need to explore meeting BREEAM Ene01 or NABERS UK minima.

A recent British Council for Offices Guide to Specification proposes NABERS UK 5* as the minimum standard. In Australia government offices are required to be 4.5* (New Builds) or 4* (Refurbishments). Also buildings with >5.5* ratings are deemed compliant with Australia's National Construction Codes (equivalent to our Building Regulations).

The NABERS UK Design for Performance (DfP) process:



The DfP process is applicable to GPA's new build projects[20]. DfP uses designs informed by forecast outcomes (predicted and measured EUI[21]) which are similar to the BREEAM NC Ene01 Credits. The BRE has aligned the requirements of BREEAM NC with DfP so the information required can now evidence both.

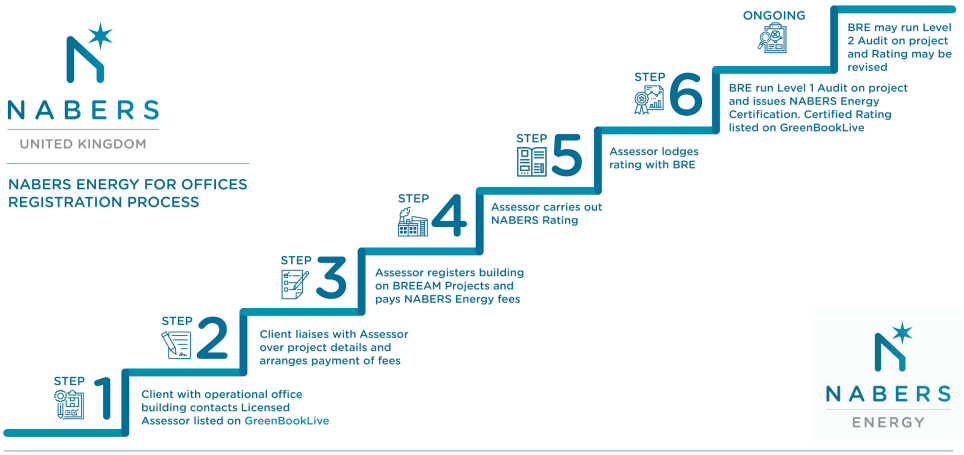
The impact of DfP tails off quickly when applied at later RIBA stages (0 to 2 recommended). When DfP is applied at RIBA 4 the outcomes are lower because the majority of the design parameters have already been decided. The costs to a GPA project to achieve a minimum 4*

[20] EN15978 Stages A1 to A5
[21] Energy Usage Intensity (kWh/m2)

rating will depend on the RIBA stage where the standard is applied. Aecom says the cost of DfP is negligible if applied from RIBA 0.

All GPA projects below RIBA Stage 2 should carry out a gap analysis against their potential to achieve a NABERS UK 5* whole building energy outcome and agree to any changes at CAB. Alternatively, a GPA project could apply for a derogation from meeting the 5* standard at CAB for them to decide whether the project needs to go to WDA for a technical review.

The NABERS UK Energy for Offices (EfO) process:

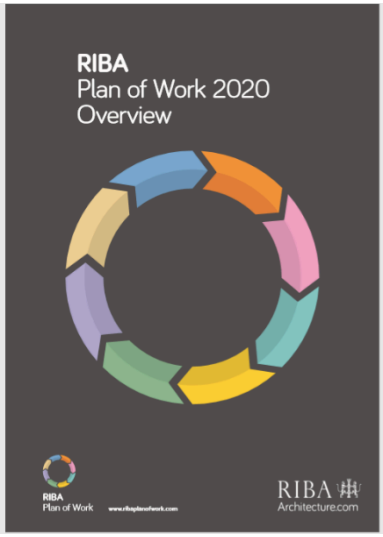


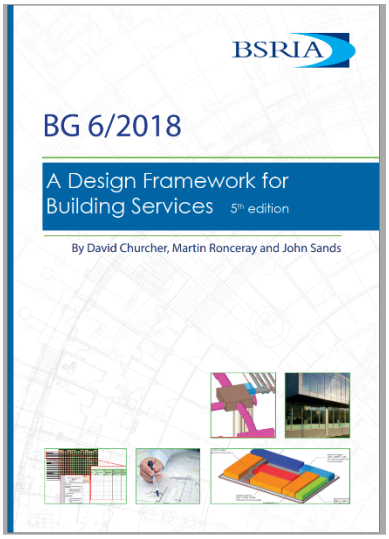
The EfO process is an optional POE applicable to all GPA projects at practical completion. EfO uses building plant and service measurements to forecast optimal energy performance and EUI. The EfO is an annual post occupancy evaluation process applicable to GPA's major refurbishment projects.

5. Methodology

To design a NZ Building, sustainability principles should be applied at each stage of the project lifecycle. The methodology identifies a high-level process that should be adopted across all GPA portfolio buildings to ensure that the net zero targets outlined in this annex are achieved. The guidance has been developed in collaboration with and upon review of:

- UK Government Net Zero Playbook
- Better Buildings Partnership
- UKGBC Net Zero Carbon Buildings Framework
- CIBSE Guides
- London Energy Transformation Initiative – Climate Emergency Design Guide
- RIBA Plan of Work 2020 - including the Sustainability Strategy Chapter
- BSRIA BG6 2018
- NABERS Design for Performance





UK GBC
Together for a better built environment

UKGBC Framework	RIBA 2020 Stages	0 – Strategic Definition	1 – Preparation & Brief	2 – Concept Design	3 – Spatial Coordination
1 – Establish NZC Scope 		• Identify net zero (NZ) Champion for the project • Identify NZ targets that the development wi as per Section 4 of this Sustainability and Net Zero Annex document • Consider contractual incentives for achievement of performance targets	• Set clear intent for NZ targets and define what this includes, document boundaries and targets i.e. base building or whole building, single development or portfolio	• Establish clear energy use and embodied carbon targets, document the targets and strategies to achieve them and share with all project stakeholders • Highlight the roles and opportunities for overcoming the performance gap for example through the adoption of the BSRIA soft landings framework • Identify soft landings champion to overcome performance gap	• Submit building regulations applications and interim certification applications e.g. BREEAM
2 – Reduce construction Impacts 		**For new build**: • Undertake site appraisal to assess opportunities and constraints • Identify and review the options for formal assessment/modelling which will be undertaken to achieve embodied carbon targets **For refurbishment** • Review opportunity for retention of existing structure and building fabric and how the quantum of materials of the refurb/new build can be reduced • Undertake study of existing structure to identify current	• Set an embodied carbon target for the development (2030 target for embodied carbon previously defined within this report) and embed within the brief. • Appoint an LCA specialist to be responsible for the whole life carbon assessment • Review circular economy statements to ensure that the whole life impact is considered at this design stage. • Specify in the brief that the development will	• Develop the concept design in accordance with the critical design parameter recommendations and targets as defined in this annex including % reused materials, opportunities for offsite manufacture • Analyse carbon reduction options for building elements following the guidance and recommendations presented in this annex and use numerical analysis and initial modelling to quantify results • Specify low carbon material and product specification as per the targets and recommendations to reduce	• Discuss whole life carbon targets and A1-A5 embodied carbon targets with potential contractor • Advance modelling and numerical analysis to optimise material specification and design • Undertake in depth analysis of the elemental and component parts of the building including identifying specific materials, products and lifespans to generate a baseline model. Optimise the baseline model using low carbon alternatives and establish the carbon reduction target. • Develop a whole life carbon budget representing the total carbon emitted over the lifetime of the building

	embodied carbon and disclose performance	have low embodied carbon, adopting the principle of reuse and refurbishment	construction impacts and minimise waste • Identify recommendations for a carbon reduction strategy over the in-use stage	• Ensure proposed construction details are robust to support low energy and airtightness performance characteristics • Disclose where NZ targets for construction cannot be practically achieved and state reasons why. Challenge these statements during the technical design phase
3 – Reduce Operational Energy Use 	• Identify project team responsibilities to achieve operational energy use targets including calculations, documenting assumptions, risk management and validating in-use performance • Identify and review the options for formal assessment/modelling which will be undertaken to achieve operational targets • Identify a project team member who can advise on demand response **For refurbishment:** • Identify current energy performance of building for metering systems, DEC/EPC ratings and previous years data disclosure	• Set an energy use intensity target for the development (2030 target for operational energy previously defined in this report) and embed within the brief • Identify demand response programmes that are suitable and eligible for project implementation • Incorporation of data disclosure into BIM requirements. • Discuss localised energy constraints issues with the DNO	• Develop the concept design in accordance with the critical design parameter recommendations and targets as defined in this annex including: form factor, glazing ratio, operating scenarios, technical systems integration and efficiency • Develop preliminary operational energy model aligned to the predefined energy use intensity targets and incorporating the building element targets defined in this annex • Reduce the reliance on fossil fuels by following the LETI Heat Decision tree when making decisions on heating and hot water systems • Implement the most significant carbon/energy reduction measures in design including demand response and energy storage opportunities.	• Refine a full operational energy model for evaluation of produced energy demand and EUI against the NZ targets. Ensure this simulation goes beyond regulated energy and considers unregulated energy as well • Test proposed design improvements as per the NZ targets using the energy model • Update and document strategies to achieve the target. Include design measures and assumptions of likely occupancy patterns as well as strategies for long term adaptability • Undertake overheating assessment to ensure the risk can be mitigated through design changes • Develop demand response strategy and simulate impact • Develop a sub-metering strategy. Heating and cooling energy consumption should be metered separately to enable fabric performance to be assessed. • Establish a secure remote source for metered data to be transmitted over a communications network • Disclose where NZ targets for operational energy cannot be practically achieved and state reasons why. Challenge these statements during the technical design phase

4 – Increase Renewable Energy Supply 	**For new build:** ● Undertake desktop study of surrounding context to identify potential renewable energy sources including rooftop PV and district heat network connections ● Identify the local plan requirement for onsite renewable energy generation % **For refurbishment:** ● Review performance of current on and off-site generation		● Highlight the on-site energy storage opportunities and design in on-site renewable energy generation and supply in accordance with the local plan minimum requirements ● Maximise the on-site renewable energy generation through baseline modelling	● Develop on and off-site renewable design strategies to minimise carbon offsetting requirement ● Develop a more accurate renewable energy generation model to quantify the offset available from low carbon sources
5 – Offset Remaining Carbon 	**For refurbishment:** ● Identify current offsetting schemes and carbon price for offsets annually			

UKGBC Framework	RIBA 2020 Stages	4 – Technical Design	5 – Manufacturing & Construction	6 - Handover	7 - Use
1 – Establish NZC Scope 		• Finalise requirements and targets for whole life carbon for construction and operational energy in specifications and tender documentation at the start of procurement	• Ensure appointment of a clerk of works is responsible for quality checks throughout the construction process • Engage with supply chain regarding the design targets and provide toolbox talks to help upskill contractors and to communicate the importance of quality construction to achieve the targets for both construction and operational energy	• Undertake light touch post occupancy evaluation • Provide induction and training of building users and facilities managers • Review seasonal performance and update the building manual to reflect changes. Issue the building manual to managers and building users	• Comply with in use planning conditions • Undertake more detailed post occupancy evaluation and use the data to evaluate the building elements and performance against original NZ carbon scope
2 – Reduce construction Impacts 		• Finalise requirements with potential contractors and subcontractors around whole life carbon targets. Identify options for improvements and include carbon questions on tender return forms. • Undertake further modelling and analysis to optimise the material specification. • Update carbon budget to include design development and finalise the carbon reduction options list to define the final specifications in line with the embodied carbon targets	• Engage with contractors to reduce waste • Review alternative products and materials proposed by contract against NZ targets, technical and performance standards and whole life carbon requirements. • Prepare for post-completion analysis by collecting data through the construction phase • Send RFIs to suppliers to receive carbon data	• Undertake post completion analysis using as-built information to assess upfront the embodied carbon • At the end of site works the contractor should confirm the final carbon data to the LCA specialist who will develop the practical completion carbon report. • Align the design stage NZ for construction targets with what was achieved at the end of construction • Carbon report to be issued to the client	• The carbon reduction strategy for the in-use stage should be followed through the building lifecycle including at the end of life stage • In-use report disclosed to the client

	• Send pre-procurement RFI forms to suppliers to collect carbon data to provide information for supplier selection. • Assess the design against the previously defined NZ targets. Ensure specifications include embodied carbon of the materials	and validate the environmental credentials • Undertake building site monitoring through monthly site logs and construction progress reporting. Undertake gap analysis frequently to identify gap between targets and actual construction data		
3 – Reduce Operational Energy Use 	• Update building energy model with design amendments and ensure NZ operational energy targets are still being achieved. Document strategies to achieve the targets by creating a Building Performance Register • Confirm envelope specification and complete detailed design ensuring targets are achieved e.g. thermal bridging and air tightness • Check suitability of heating and hot water system and confirm HVAC system type and performance specification aligning with NZ targets and Design Guide MEP criteria. • Iterate design response model with exact data to gain accurate prediction of	• Update energy model to account for design changes and reject substitutions or omissions if they compromise the NZ targets being achieved • Ensure contractors understand the commissioning requirements including metering and validation of manual vs half hourly readings • Ensure the contractors has quality monitoring processes in place to ensure proper installation of insulation, air tightness and mechanical equipment for whole construction period • Carry out benchmark inspections to clarify quality expectations as	• Review final construction including rectification work for quality including in-situ thermal performance tests, thermographic and air tightness testing • Finalise the as-built energy model to account for changes in the design or assumptions behind it • Ensure commissioning and testing is fully completed and witnessed and that the 'as installed' controls strategies, setpoints, commissioned flow rates, metering etc. are in line with the energy model. • Ensure the building user is trained and understands use of the building systems • Ensure that planned demand response activities occur correctly as part of the commissioning process and that the initial setup parameters are recorded	• For the first year of occupation both the building and the targets should be tuned to actual building usage patterns. Ensure a dual focus of improving accuracy of targets as well as improving building operation • Ensure hourly energy consumption trends match the operating hours • Ensure the metering system is operating correctly and is regularly validated against utility meters • Identify and track key efficiency metrics. Aim to track the fewest but most useful metrics • Assign an annual budget for monitoring energy use and tuning controls in response. Aim for monthly review and quarterly 'deep dive' analysis • Line up energy efficiency assessments with post occupancy evaluation assessment to ensure occupant satisfaction with conditions in the building • Upload total energy and heating energy consumption data to a public data

	carbon savings and monetary gains ● Ensure specified metering and submetering is incorporated ● Include operational energy in construction tender package e.g. using DfP type of target and feedback loop ● Incorporate in contractors' prelims with guarantees to recalculate energy models if items are value engineered. Confirm that the as built project still metes the net zero targets for operational energy ● Create risk register and confirm responsibility for management during construction and commissioning	per the targets and continue to monitor construction quality including thermal performance tests, thermographic and air tightness testing	● Ensure a suitably qualified individual understands the energy management and measurement systems. For further information refer to the BBP better metering toolkit ● Ensure that performance data from sensors and meters are reconciled with main meter, spot meter and BMS readings and that logs are set up in BMS to facilitate long term monitoring of building performance.	platform for the first 5 years post-completion. ● Carry out annual DEC report to maintain top quartile rating
4 – Increase Renewable Energy Supply 	● Maximise on-site and offsite renewable energy generation to offset carbon emissions of the development ● Identify the opportunities to export renewable energy to offset emissions ● Prioritise offsetting the operational energy prior to embodied carbon	● Update renewable energy generation model to account for design changes and ensure correct capacity and number of modules are installed ● Ensure contractors understand monitoring and metering requirements	● Measure actual output of on-site and offsite renewable energy generation and benchmark against initial targets and modelling ● Ensure regular testing and commissioning of all installations to ensure efficiency is maintained throughout the lifecycle ● Training FM team and building management on proper maintenance of low carbon installations	● Regular maintenance and testing of renewable energy capacity and output ● Regular cleaning of installations for example solar PV to ensure efficiency is maintained ● Annual reporting of renewable energy generation to offset carbon emissions from the development

5 – Offset Remaining Carbon 				• Where net zero carbon targets have not been achieved through fabric and system optimisation for both net zero construction and operational energy, carbon offsets should be purchased through certified schemes • Annual disclosure of offsets purchased must be reports publicly

6. RIBA Stage Deliverables

To achieve a sustainable building, outcomes focused principles should be applied at each stage of the project lifecycle. The methodology identifies a high-level process that should be adopted across all GPA portfolio buildings to ensure that projects get as close to the net zero targets outlined in this annex as possible. The activities and processes listed below are a guide to what needs to happen at each RIBA stage to assure the outcome of a project is a sustainable building:

RIBA Stage	Action	Scope of Services	Deliverable	Benefits
0 – Strategic Definition	Environmental lead assigned, Outcomes, Client Requirements & Targets. BREEAM or equivalent Targets agreed.	0.1 Sustainable outcomes defined to meet the Client Requirements (occupying department)	List of Client Sustainability requirements beyond the Sustainability and Net Zero Annex	Design for Soft Landing and meeting Customer expectations first time
		0.2 Site Appraisal of sustainability opportunities and constraints of potential sites and building assets.	Site specific register of sustainability opportunities and constraints, to include "exceeding" and "derogations" from the Sustainability and Net Zero Annex	A shared understanding of the Project Scope
		0.3 Identify relevant current and emerging global, European, national and local sustainability-related policy and legislation.	Policy review and updates to project brief	A shared understanding of the Project "red lines"
		0.4 Review relevant Post Occupancy Evaluation Feedback from previous projects (e.g. energy use).	Sustainability Design workshops for new Project Teams to introduce sustainability elements and relevant staff	Time and money saved through not repeating earlier mistakes and adopting best practice
		0.5 Review whether development is an option in the Business Case to deliver the Client Requirements (occupying department).	Proposed high level plan of Client Requirement delivery through the Project and/or WLAM stages	Early Client buy-in to when to expect the Asset to fully meet their requirements
1 – Preparation and briefing	Environmental targets in Project Brief, Post Occupancy Evaluation, aftercare defined. BREEAM 'Engaged' or equivalent.	1.1 Use Feedback from Post Occupancy Evaluation, precedent review data, Site Surveys, and past experience of the client's Facilities Management team (if applicable) to state clear, deliverable and ambitious Sustainability Outcomes in the Project Brief.	Clear, deliverable and ambitious Sustainability Outcomes in the Project Brief.	Defining the project brief from the outset ensures non-sustainability staff are clear on core elements.

RIBA Stage	Action	Scope of Services	Deliverable	Benefits
		1.2 Use Feasibility Studies to verify that the Sustainability Outcomes can be achieved on the site within the project budget.	Pre-BREEAM assessment of project plans to forecast expected embodied carbon, EUI, BREEAM outcome and EPC rating. Certification requirements scope (based on Net Zero Annex) and BREEAM pre assessment detailing timetable	Aligns with targets set out in the Sustainability and Net Zero Annex and offers the best opportunity to achieve a higher BREEAM score if this is implemented at earliest possible opportunity.
		1.3 Verify local authority sustainability requirements (e.g. enhanced regulatory requirements or assessment methods to be used).	List of local project "red line" requirements and compliance assessment methods beyond the Sustainability and Net Zero Annex	Project design for compliance saving money by getting right first time
		1.4 Define certification requirements, including timetable for assessor appointments and early stage client actions.	Protocol for accreditation and assessors appointment	Ensures work is in line with current guidelines
		1.5 Identify sustainability expertise required, include it within the Responsibility Matrix and appoint "Out of Scope" consultants.	Sustainability responsibility matrix (inc RIBA stages) for F&D+G, D&E, and "Out of Scope" consultants across all sustainability disciplines including Soft Landings, LCA etc.	Avoids duplication of work and provides clarity for teams
		1.6 Work with the design team to develop sustainability brief, identify and set net zero and sustainability targets in accordance with the GPA Design Guide and Sustainability and Net Zero Annex	Sustainability Design Brief	Baseline for remainder of project.
		1.7 Energy audit of existing building (might include HVAC inspection, air tightness testing, thermographic inspection, insulation inspection) (refurbishment only)	Baseline EUI, fabric improvement plans and forecast EUI and EPC post works	
		1.8 Model operational energy use of current building (refurbishment only)	Baseline EPC, EUI and sources of demand, LCR recommendations and EPC forecast post works	

RIBA Stage	Action	Scope of Services	Deliverable	Benefits
		1.9 Gap analysis of current building against net zero targets (refurbishment only)	Performance baseline, target and NZP interventions identified and reviewed on case by case basis for project	Allows baseline data for the project and offers room for improvement where required.
		1.10 Site visit to understand local environment, constraints and opportunities	Site report, detailing opportunities and constraints, to include "exceeding" and "derogations" from the Sustainability and Net Zero Annex	
		1.11 Produce NZ and sustainability feasibility	NZ and sustainability feasibility report	Offers clear plans at an early stage to ensure realistic targets set and teams aware of the current status of the project.
		1.12 BREEAM assessor appointment	BREEAM assessor appointment and introduction to team	Designated day to day contact useful for project teams and offers consistency
2 – Concept design	Sustainability / BREEAM - concept strategy & risks. Targets in Design Brief, Spec & Costings. BREEAM or equivalent feedback sought.	2.1 Benchmarking and quality assurance requirements in initial design work.	Benchmarking and qauality assurance requirements via review of major documents released	Ensures sustainability considered throughout major documents released.
		2.2 Incorporate lessons learned from post occupancy evaluation feedback and the review of precedents in developing the architectural concept.	Lessons learned workshop and write up suitable for use in developing architectural concept	Offers collaboration with team
		2.3 Carry out sufficient energy and other modelling to test and refine the architectural concept, sustainability strategy and delivery of sustainability outcomes.	Design Meeting updates as and when required	
		2.4 Review the architectural concept against the intended sustainability outcomes and report and mitigate any deviations.	Design Meeting updates as and when required	Ensures regular communication with team

RIBA Stage	Action	Scope of Services	Deliverable	Benefits
		2.5 Include a record of key design decisions to deliver the sustainable outcomes in the Stage Report.	RIBA2 Report inc. key decisions and their impacts	Works as a checkpoint to ensure all targets are being considered
		2.6 Work with design team and client to analyse NZ and sustainability options		
		2.7 Identify methodology to apply the Net Zero Model in the Sustainability and Net Zero Annex to inform BREEAM & GSL (include RE:FIT & Passivhaus)		
3 - Spatial coordination	Sustainability / BREEAM or equivalent - Finalise strategy & risks. Design & Outcomes alignment inc. seasonal and CCA.	3.1 Undertake Design Studies and Engineering Analysis to test the Sustainability Outcomes, including carrying out a building performance assessment following Plan for Use protocol, and develop the design in more detail.	Technical note detailing the alignment between MEP and sustainability if required	Ensuring sustainability in design
		3.2 Submit a Building Regulations Application and any interim certification applications (e.g. BREEAM).	Confirmation of applications received	Organisation per each project and provides clear tracking
		3.3 Integrate sustainability outcomes into a spatially coordinated design aligned to project stakeholder consultation feedback. incorporating lessons learned from post occupancy evaluation feedback and the review of precedents, and record new lessons learned.	Technical note detailing changes to spatial design	
		3.4 Identify and update record of performance risks to inform Stage 4 tasks and deliverables, and mitigate any deviation from the sustainability outcomes.	Risk register produced/reviewed to mitigate any potential issues in project	Can be updated from across disciplines to ensure all areas considered.
		3.5 Embed the requirements for post occupancy evaluation in the procurement strategy.	Confirmation of post occupancy assessment being embedded in the procurement strategy.	

RIBA Stage	Action	Scope of Services	Deliverable	Benefits
		3.6 Include a record of key design decisions to deliver the sustainable outcomes in the Stage Report.	Register of key decisions impacting on sustainability are captured in the Stage 3 Report	
		3.7 Review options for onsite renewable energy generation and identify on-site energy storage opportunities	Renewable strategy per site created to consider alternatives	Ensures all avenues of sustainability considered
		3.8 Support the development of design in accordance with the critical design parameter recommendations and targets defined in the NZ annex	DTM input as required	
		3.9 Advance modelling of operational energy following CIBSE TM54 and/or DfP recommendations and numerical analysis to optimise material specification and design	Embed the findings of CIBSE TM54 and/or DfP energy analysis report on material specification and design in the Stage 4 Design	
		3.10 Consider options for offsetting and identify relevant offsetting schemes	Forecast of the gap between predicted project outcome and net zero	
4 – Technical design	Sustainability / BREEAM or equivalent - Detailed design & finalise spatial coordination. Manufacture & Construction targets in information, Spec & drawings	4.1 Undertake technical design, including Final Specifications and material sourcing, to manufacture and construct the building to achieve the target Sustainability Outcomes.		
		4.2 Coordinate design team and specialist subcontractors' Manufacturing Information, Construction Information and Final Specifications, embedding the target Sustainability Outcomes and the Plan for Use Strategy.	Revise analysis of the Forecast Sustainability Outcomes as informed by the Stage 4 Design and Plan for Use Strategy	Regular review ensures targets are being met accordingly
		4.3 Whole life carbon and life cycle costing analysis	EN 15978 WLAM Carbon and Life Cycle cost analysis	
		4.4 Update any target commitments (e.g. to reduce carbon, energy or water use, and improve health and wellbeing).	Embed any amendments to the Sustainability target commitments into the Project success criteria.	

RIBA Stage	Action	Scope of Services	Deliverable	Benefits
		4.5 Include the Sustainability Strategy in tender information or Employer's Requirements and review tender returns or Contractors Proposals – including any alternatives – against sustainability outcomes.	Confirm tender return and/or Contractor Proposal alignment with the desired Sustainability Outcomes	
		4.6 Mitigate or control as many building performance and climate change impact project risks as possible and identify strategies for managing those that remain.	Confirm sustainability risks and progress are monitored and managed at project level with programme oversight using risk register	Allows for any risks to mitigated at earliest possible venture
		4.7 Address the sustainable outcomes targets – and Part F, G and L Building Regulations requirements – and submit a Building Regulations Application/discharge of planning conditions	confirmation of F, G and L Building Regulations compliance – and Building Regulations application/discharge of planning conditions submitted	
		4.8 Additional modelling to optimise material and system specification (see row 44)	Revise sustainability outcomes forecast for the Stage 4 Design and Plan for Use Strategy	Allows teams to touch base and review current status
		4.9 Further development of metering and in-use strategy	Confirm Sustainability and Net Zero Annex alignment	
		4.10 Risk management model for management during construction and commission	Confirm relevant sustainability construction risks are monitored and managed	
		4.11 Develop and optimise design briefs and tender packs	Confirm sustainability criteria embedded in design briefs and tender packs	
5 – Manufacturing and construction	Environmental / BREEAM or equivalent. Interim testing Maintenance and ftercare commissioned. Certification stage.	5.1 Manufacture, construct and commission the building to meet the target sustainability outcomes (e.g. to reduce carbon, energy or water use, and improve health and wellbeing).	Confirm building manufacture and construction specification align with current sustainability outcomes specifications	To ensure current specifications being met

RIBA Stage	Action	Scope of Services	Deliverable	Benefits
		5.2 Commission all the equipment required for monitoring the sustainable outcomes.	Confirm sustainability outcomes assessment protocol and monitoring process in place	
		5.3 Review any construction stage changes, and report and mitigate any deviation from the sustainability outcomes.	Review any construction stage changes, and report and mitigate any deviation from the sustainability outcomes via risk register	
		5.4 Compile construction stage information required for certification and demonstrate compliance with the sustainability outcomes.	Complete due diligence evidence collection of evidence for BREEAM Certification and sustainability outcomes compliance	Clear tracking of work making it easier to audit if required,
		5.5 Submit final information for statutory approval and certification, and performance in use verification.	Submit evidence for BREEAM Certification, EPC & Sustainability Outcomes	
		5.6 Review and update the record of performance risks on site, and use it to identify and avoid any defects.	Sustainability performance risks used to identify and avoid any defects.	
		5.7 Implement handover and aftercare procedures, as outlined in the Plan for Use Strategy.	Implement GSL handover and aftercare as outlined in the Plan for Use Strategy.	Discussions with project teams
		5.8 Compile the asset information required for the effective performance and management of the building for the building manual.	Complete due diligence evidence collection for sustainable operation for the building manual	
		5.9 Review alternative products and materials proposed by contractors	Sign-off of changes to products and materials for performance compliance	
		5.10 On site guidance for sustainability including commissioning plan reviews	Sign-off sustainable operation for the building manual	Determines whether building in line with targets and allows for another review
6 - Handover	Environmental / BREEAM or equivalent. Manual, GSL,	6.1 Support on completion and handover for sustainability performance	Confirm sustainability performance through technical note	

RIBA Stage	Action	Scope of Services	Deliverable	Benefits
	Post Occ Eval., Lessons learnt	6.2 Hold a projectpPerformance session with the project team to gather their views on the process of embedding the sustainability Outcomes in briefing, design and construction and handover for the benefit of future projects.	CompilesSustainability lessons learnt for all product stages and embed them into the programme lessons	Allows for changes to made in future if issues arise
		6.3 Provide induction and training of building users and facilities managers, with reference to the sustainability strategy.	Sign Off WS Building Manual and Induction	
		6.4 Begin gathering Feedback through light touch post occupancy evaluation of the Sustainable Outcomes in use.	Compile post occupancy sustainability performance (inc. DEC) and monitor ongoing performance	
7 - Use	Environmental / BREEAM or equivalent. Performance Outcomes inc. DEC, DG NZ Annex deviations and mitigation	7.1 Comply with in use Planning Conditions in relation to sustainability (e.g. meeting ongoing renewable energy use requirements).	Confirm compliance with the sustainability pPlan,client and local sustainability requirements	Final sign off against requirements
		7.2 Use observations from the light touch post occupancy evaluation to fine tune and improve and sustainable outcomes performance against the sustainability outcomes targets, and keep the Building Manual up to date.	Agree post occupancy performance parameters and trigger points for intervention	
		7.3 Undertake more detailed post occupancy evaluation as required, after putting in place separate professional services contracts, to test delivery of the in use sustainability outcomes.	Agree and monitor service delivery KPIs and trigger points for intervention	
		7.4 Report and mitigate any deviation from the sustainability outcomes.	Report deviations from target sustainable outcomes to SusCo for guidance and advice	Useful when looking at GPA projects as a whole to review individual schemes.
		7.5 Share Feedback from lessons learned with the client, users, design and construction team members and with project stakeholders.	Compile post occupancy lessons learnt for all product stages and embed them into the programme lessons	Provides insight into how teams can improve/what can be done next time.

RIBA Stage	Action	Scope of Services	Deliverable	Benefits
		7.6 Support with PoE and energy monitoring	Compile PoE and metering data for performance monitoring and condition-based energy efficient servicing and/or replacement	

7. Case Studies

The GPA Design Guide states that all Government buildings will have a DEC rating in the top quartile and will achieve the net zero targets defined in the Sustainability and Net Zero Annex. To provide insights into best practice design a number of case studies will be provided as extra guidance for developers to follow to achieve the required DEC rating and to achieve the defined targets. Some of the case studies will provide overall exemplar buildings while others will be for specific building elements e.g. lighting.

- Government Property Agency ESG Report
- The Enterprise Centre, University of East Anglia, NR4 7TJ -
- WWF-UK, Living Planet Centre -
- Mirvac's one Darling Island, Australia -
- Sirius House, 23 Furzer Street, Woden, Australia -
- Sky Believe in Better Building -