



National Infrastructure  
& Service Transformation  
Authority

# Whole Life Carbon Management Handbook for the Built Environment

March 2026



# Foreword

The decarbonisation of our economy is no longer a long-term aspiration but an immediate imperative. The infrastructure and construction sectors have an important role to play in helping meet it head on.

How we design, build and operate our transport networks, energy systems, digital backbones and social infrastructure over the next decade will determine not only whether we meet our climate commitments, but also how competitive, resilient and inclusive the UK's economy will be. It's a significant challenge, but it's one where the private and public sectors must collaborate effectively together to achieve.



The 10 Year Infrastructure Strategy recognises that the natural environment is one of the UK's most vital national assets and outlines the government's wider commitment to protect and improve the environment. At the same time, the government's growth mission requires also requires a step change in productivity and efficiency in the ways we plan, design, manufacture, construct and operate our infrastructure.

The Transforming Infrastructure Performance 2030 Roadmap, developed by the former Infrastructure and Projects Authority, also called for whole life approaches to measuring performance and a more holistic view of programme outcomes. As NISTA takes that work forward, a key step in achieving these goals, is the measurement of whole life carbon.

Given NISTA's role overseeing and implementing the Strategy, and as home to the Government Project Delivery Function, we have a responsibility to support the programmes we oversee meet the government's requirements and expectations on environmental management, reduce project risks, increase productivity and maximise their positive outcomes.

Acting as an intelligent client and understanding whole life costs, impacts and outcomes remains essential to any project's success. The Strategy identifies the need for a more consistent approach to the construction sector, including through compliance with the Construction Playbook. Whole life carbon assessments throughout the programme life cycle and the evaluation of options against baselines can drive project efficiency and increase productivity, in both the commissioning and operational phases.

This guidance brings together cross-government thinking and industry best practice to provide practical advice and solutions to empower our project delivery professionals and industry partners embarking on a whole life carbon assessment. Crucially, it will also aid in the valuable task of creating datasets for projects that will follow.

Supporting programmes to be both more productive and resilient is at the heart of NISTA's work to transform government's project delivery and ensuring what we design, build and operate serves the communities we work to deliver for. I am confident this new handbook offers programme teams a valuable tool to help them meet that goal.

## Becky Wood

NISTA CEO and Head of the Government Project Delivery Function



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### Glossary

|                                               |                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assessment                                    | The quantification of Whole Life Carbon (WLC) of a project or programme for the purpose of identifying opportunities for, and measuring progress of, WLC reductions.                                                                                                                                                                              |
| Asset owner                                   | An organisation that owns in whole or in part any infrastructure or built environment asset or facility connected to an infrastructure or built environment system.                                                                                                                                                                               |
| Baseline                                      | A scenario for what the WLC of a project or programme would have been in the absence of measures aiming to reduce emissions                                                                                                                                                                                                                       |
| Benchmark data                                | A reference value for the greenhouse gas (GHG) emissions from a completed activity, that can be utilised by others to inform early-stage decision making.                                                                                                                                                                                         |
| Business case                                 | A management tool that records the current state of evidence and thinking concerning the development approval and implementation of a proposal. It supports the processes of scoping, analysis, appraisal, planning, monitoring, evaluating, approval and implementation of a proposal and is the repository for the evidence base <sup>1</sup> . |
| Capital carbon                                | GHG emissions and removals associated with the creation and end-of-life treatment of an asset, network or system, and optionally with its maintenance and refurbishment.                                                                                                                                                                          |
| Carbon                                        | Used in this handbook to refer to carbon dioxide and other greenhouse gases (GHGs) which contribute to climate change. GHGs are the seven gases covered by the Kyoto Protocol, measured in units of carbon dioxide equivalent (CO <sub>2</sub> e).                                                                                                |
| Carbon budget                                 | Estimated amount of whole life carbon a system can emit. Carbon budgets are usually set at the system level and are aligned to national or international net zero targets or other decarbonization trajectories defined at the system level.                                                                                                      |
| Carbon dioxide equivalent (CO <sub>2</sub> e) | Unit for comparing the radiative forcing of a greenhouse gas to carbon dioxide.                                                                                                                                                                                                                                                                   |
| Carbon hotspots                               | An asset, material or operation responsible for an intense concentration of GHG emissions.                                                                                                                                                                                                                                                        |
| Decarbonisation                               | Process by which organizations, sectors or other entities aim to achieve zero fossil carbon emissions, typically referring to a reduction of the carbon emissions associated with key sectors, such as electricity, industry and transport.                                                                                                       |
| Emission factors                              | Amount of greenhouse gases emitted, expressed as CO <sub>2</sub> e and relative to a unit of activity.                                                                                                                                                                                                                                            |
| Environmental Product Declaration (EPD)       | A type III environmental declaration that is compliant with the ISO 14025 standard. It reports objective, comparable and third-party verified data about products' and services' environmental performances from a                                                                                                                                |

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<sup>1</sup> HM Treasury (2018) Guide To Developing The Project Business Case, available at [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/749086/Project\\_Business\\_Case\\_2018.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749086/Project_Business_Case_2018.pdf) (Last accessed Dec 2022)

|                             |                                                                                                                                                                                                                                                                                                                        |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             | lifecycle perspective.                                                                                                                                                                                                                                                                                                 |
| Estimating                  | To guess or calculate the cost, size or value of something. Particularly relevant in the carbon accounting space where complete datasets are rare.                                                                                                                                                                     |
| Lifecycle Stages            | Four stages in the life of a typical built asset as set out by BS EN 15978: <ul style="list-style-type: none"><li>• A1 – A5 (Product sourcing and construction stage)</li><li>• B1-7 (Use stage)</li><li>• C1-C4 (End of life stage)</li><li>• D (Benefits and loads beyond the system boundary)</li></ul>             |
| Net zero                    | Reduction of anthropogenic GHG emissions to zero or to a residual level that is consistent with reaching net zero emissions in eligible 1.5°C pathways (hence time bound) and neutralizing the impact of residual emissions (if any) by removing an equivalent quantity of GHG emissions.                              |
| Operational carbon          | Greenhouse gas emissions and removals associated with the operation of an asset, network and/or system required to enable it to operate and deliver its service.                                                                                                                                                       |
| Outcome                     | A result or effect of an action or situation. A clear and measurable outcome should be set at the outset of a project or programme. This will enable teams to identify and understand how their project will perform as part of a wider system of interdependencies.                                                   |
| PAS 2080:2023               | A standard for managing whole life carbon on built environment projects. It promotes reduced carbon, reduced cost project delivery and a culture of challenge across the value chain where innovation can be fostered.                                                                                                 |
| Qualified professional      | A person with experience and training in the assessment and management of Whole Life Carbon.                                                                                                                                                                                                                           |
| Reference Design Assessment | An important part of the project plan, the Reference Design Assessment (RDA) sets out the greenhouse gas emissions associated with the initial scope, budget and schedule of a project. By forming this baseline assessment for WLC, the progress of the project can be measured through comparison with the baseline. |
| Stranded assets             | Assets unable to earn their original economic return due to changes in the landscape in which they operate.                                                                                                                                                                                                            |
| System                      | Collection and interconnection of all physical facilities and human systems that are operated in a coordinated way to provide a particular service.                                                                                                                                                                    |
| User carbon                 | Greenhouse gas emissions associated with users' utilization of an asset, network and/or system, and the service it provides during operation.                                                                                                                                                                          |
| Value Chain                 | Organisations and stakeholders involved in creating, operating and managing assets and/or networks.                                                                                                                                                                                                                    |
| Whole Life Carbon (WLC)     | Sum of greenhouse gas emissions and removals from all work stages of a project and/or programme of works within the specified boundaries.                                                                                                                                                                              |

# Introduction



## Introduction

### Context

The UK has in place a legally binding target to reach net zero territorial greenhouse gas (GHG) emissions by 2050, as set out in the Climate Change Act 2008 (amended 2019).<sup>2</sup> To reach the 2050 target, and remain within the interim national budgets, all sectors within the UK need to measure, understand and reduce their greenhouse gas emissions.

The infrastructure and wider built environment sectors are of particular importance to decarbonise as their assets and systems are typically long-lived and influence the behaviour of their users across a significant timespan. In 2013, the Infrastructure Carbon Review<sup>3</sup> stated that the infrastructure sector is responsible for at least 50% of the UK's carbon emissions,<sup>4</sup> further adding that infrastructure was likely to account for 90% of the UK's carbon emissions by 2050. The importance of decarbonising the infrastructure sector cannot be overstated.

In carbon management terms, WLC emissions include capital carbon arising from the manufacture, construction and decommissioning of assets, operational carbon emissions resulting from the operation of the asset, and user carbon resulting from utilisation of the asset (e.g., car emissions on a road).

The built environment sector is under pressure to increase efficiency and productivity to support the UK growth mission. Understanding where the carbon hotspots are in a project provides an opportunity to reduce costs and increase productivity and so support the UK's growth mission.

To address the need for transparency and consistency, the National Infrastructure and Service Transformation Authority (NISTA), the government's centre of expertise for infrastructure and major project delivery, has developed this handbook to support project delivery practitioners and industry stakeholders to incorporate whole life carbon (WLC) management into common practice for the delivery of all projects. It also supports the development of trusted benchmarks for future programmes.

In many organisations, WLC management processes are already in place, but there are significant differences between individual organisations. Aligning practices for WLC management and building capabilities across all projects and programmes is key to delivering on net zero 2050.

Whilst WLC is a necessary metric for all projects and programmes to assess alignment with UK emissions targets, it must be considered alongside needs for climate resilience and natural capital preservation, and wider procurement objectives. Through core sustainability pillars emissions reduction, resilience, natural capital and social value and benefits, the infrastructure and built environment sector can contribute significantly to the transition to a sustainable future for the UK.

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<sup>2</sup> Climate Change Act 2008, amended 2019 ([legislation.gov.uk](https://www.legislation.gov.uk))

<sup>3</sup> HM Treasury, Department for Business, innovation and Skills (later BEIS) (2013), *Infrastructure Carbon Review* available at <https://www.gov.uk/government/publications/infrastructure-carbon-review> (last accessed Dec 2022)

<sup>4</sup> Institute of Civil Engineering (2020), *Zero Carbon and Infrastructure* (2010 data), available at <https://www.ice.org.uk/events/past-events-and-recordings/recorded-lectures/2020-unwin-lecture-zero-carbon-and-infrastructure> (last accessed Dec 2022)

## Whole Life Carbon Management in the UK Government

By showing consistent leadership across project delivery, procurement practices and policies, departments can provide a robust message to the market, leveraging the influential role they have in delivering the Government's Missions and deliver significant emissions reduction across UK infrastructure.

Reducing emissions from the construction and maintenance of transport infrastructure supports DfT's priority outcome to deliver greener, safer and healthier transport. DfT was an early adopter in supporting infrastructure decarbonisation, recognising its potential to encourage projects to build in a carbon and cost-efficient way while supporting the Industrial Strategy and the development of new sectors through adopting new technologies and products. To ensure DfT's infrastructure projects are measuring and reducing capital carbon emissions, DfT requires all transport infrastructure projects that it funds to produce carbon management plans. Carbon Management Plans include a comprehensive whole life carbon assessment, and a plan to reduce carbon across the project lifecycle in line with PAS2080.

The Environment Agency has extensive experience in whole life carbon assessment and is continuously developing its tools, processes, and expertise to reduce the whole life carbon (WLC) emissions from its construction and maintenance activities to meet its emission net zero targets. It promotes important ways to 'work with nature' including the use of nature-based processes to deliver flood and climate resilience that are lower carbon and enhance the environment.

NHS England has established a consistent whole life carbon approach through its Net Zero Building Standard. This requires all new healthcare buildings and major refurbishments, to undertake a whole life carbon assessment, covering both embodied and operational emissions. Aligned with PAS 2080 and RICS methodology, the standard integrates carbon management into design, procurement and assurance, helping to build a more capable low carbon supply chain and supporting the NHS to meet its net zero commitments.

The Department for Education's new Education Estates Strategy and Design Standards reaffirm their commitment to emissions reductions in support of the UK Government's net zero targets.

The DfE new Design Standards require whole life carbon reporting throughout project design and delivery using a carbon reporting template and supported with product-specific information from industry. It also considers circularity through targets for use of post-consumer waste in construction and reuse of materials at the end of the project life. The new standards are enabled to be incrementally updated to set more exacting future embodied carbon targets.

Last year, MHCLG published an independent research study examining the impacts to business of carrying out whole life carbon assessments.<sup>5</sup> The study was well received by industry and provides a useful evidence base for organisations as they consider how best to approach whole life carbon in practice. Homes England have published guidance on the appraisal of the environmental impacts of new housing development.<sup>6</sup> This includes an approach to the consideration of whole life carbon in the context of the economic appraisal of new housing development.

The MOD use the RICS (Royal Institute of Chartered Surveyors) Professional Statement on 'Whole life carbon assessment for the built environment' (referred to as the RICS WLCA Professional Statement going forward) and Publicly Available Standard (PAS) 2080:2023, making up the managerial framework and quantitative WLCA methodology for use across the industry.

These examples show the government's commitment to whole life carbon reporting is manifesting into departmental and public body standards and processes.

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<sup>5</sup> [MHCLG, Consideration of embodied carbon in new buildings, 2025](#)

<sup>6</sup> [Homes England, Measuring Social Value Paper 5: Environmental Impact of New Housing Development, 2024](#)

## Purpose of this handbook

The objective of WLC management is to drive holistic emissions reductions at the system level in the most efficient way. This is enabled by informing decision makers of the absolute impacts of the relevant options, and driving consistency in approaches across the built environment, as well as creating useful benchmarks for future projects.

To deliver on this objective, this handbook informs project teams and decision makers how to embed good practices in WLC Management, through overarching principles, key guidelines and application of existing industry standards and other guidance. The principles and guidelines in this document are set out to support a project outcome in line with PAS2080:2023. This handbook also identifies the key outputs of the process and how these integrate with the HM Treasury Project Business Case decision making process.

The process set out in this handbook should enable asset owners within government and arms' length bodies (ALBs) to practically incorporate WLC into decision making for all projects and programmes in a proportionate manner, and drive emissions reductions. This handbook does not include a definition of external influencing factors but does consider how these should be taken into consideration during the WLC process.

### Audience

This handbook provides support to specialists and those overseeing procurement of technical services in project teams within the government and organisations involved in designing, constructing, operating and maintaining built environment assets. This includes transport, public buildings, flood defences and nuclear decommissioning in the United Kingdom (UK). It is also relevant for non-technical staff to understand the process and how it links to the stages of development of the business case. This guidance is relevant across the value chain and will be of value to a multitude of organisations across the infrastructure and built environment sector.

### How to use this handbook

The handbook is structured into two sections: Understanding Whole Life Carbon and the Whole Life Carbon Management Process. The first section introduces the key themes and overarching principles of WLC management to enable effective understanding (Chapter 2). The second section provides guidance of the stages of the good practice WLC management process to inform asset owners on how to enact carbon reduction across the project lifecycle (Chapter 3).

As highlighted in PAS 2080:2023, the ability to influence WLC is greatest in the early stages of a project when the fewest parameters are fixed. As decisions are made through the optioneering and design stages, the ability to influence WLC reduces as the options available are narrowed down and parameters become fixed.

To maximise the emissions reduction on a project, NISTA recommend that WLC management is incorporated throughout the Project Business Case, following the framework set out in HM Treasury's 'Guide to Developing the Project Business Case'<sup>7</sup> (Figure 5 in Chapter 2), in a manner proportional to the size of the project.

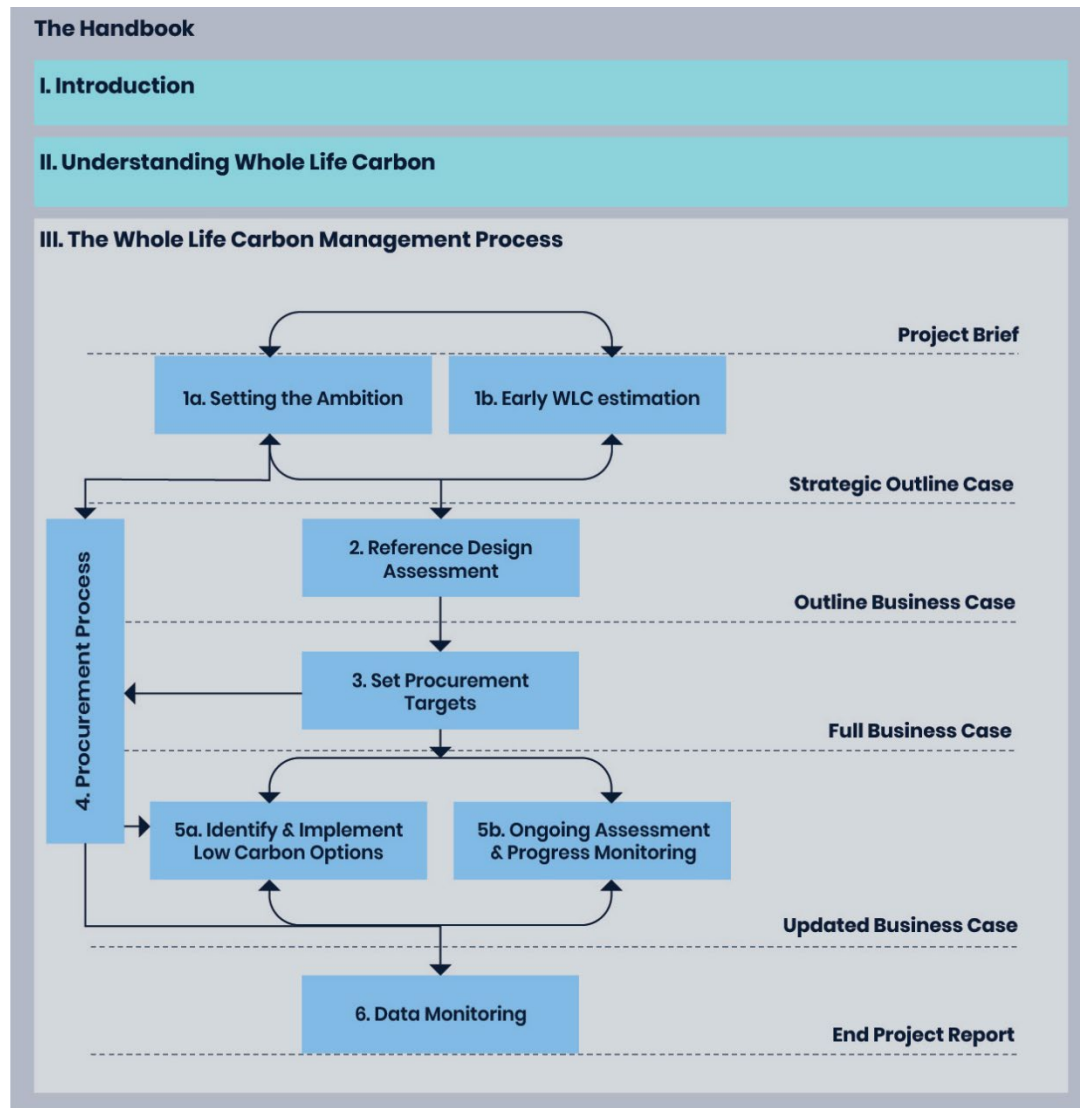
The good practice WLC management process, set out herein, works alongside existing project frameworks including the HM Treasury Project Business Case, the HM Government Delivery Stages,

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<sup>7</sup> HM Treasury (2018) Guide To Developing The Project Business Case, available at [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/749086/Project\\_Business\\_Case\\_2018.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749086/Project_Business_Case_2018.pdf) (Last accessed Dec 2022)

The Construction Playbook<sup>8</sup>, and the PAS 2080:2023<sup>9</sup> lifecycle stages. The anticipated alignment of this good practice WLC management process with the Project Business Case framework is set out in Figure 1 to provide a view of the timescales of the process.

**Figure 1: Mapping of WLC management Process to Existing Project Lifecycle Frameworks**



<sup>8</sup> Cabinet Office (2022) *The Construction Playbook* available at [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1102386/14.116\\_CO\\_Construction\\_Playbook\\_Web.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1102386/14.116_CO_Construction_Playbook_Web.pdf) (last accessed Dec 2022)

<sup>9</sup> British Standards Institute (2022), Publicly available standard 2080, revision available at <https://www.constructionleadershipcouncil.co.uk/news/consultation-pas-2080-revision/> (last accessed December 2022) – will be available in 2023.

## Guidance Structure

Each section of this handbook contains introductory text followed by sub sections on key aspects for project teams to follow to make sure WLC is integrated into decision making. Chapter 2, 'Understanding WLC', sets out key 'principles' that should underpin an organisation's approach. In chapter 3, 'The WLC Management Process' these are set out as 'guidelines' which detail how to carry out the process steps. In both chapters these aspects provide an explanation of why it is important, the role of the value chain, and key actions.

### Why is this important?

This will contain a description of the logic behind each principle/guideline and a justification for its inclusion in the handbook.

### Value chain engagement

This will reference specific activities that can be undertaken to engage organisations which operate across upstream and downstream activities associated with the planning, delivery and operation of the project/programme. These activities will contribute to achieving the principle/guideline.

### Key Actions

This identifies key actions to take place for each principle or guideline in question.

## **2. Understanding Whole Life Carbon**



# Understanding Whole Life Carbon

As the overarching objective of the whole life carbon (WLC) management process is to understand, integrate and drive emissions reductions, it is important to first understand some overarching principles, prior to undertaking any assessment and management activities. These should inform constraints and drive low-carbon outcomes as the solution is defined and delivered.

This chapter of the handbook will first cover an overview of the good practice WLC management process, before moving onto the principles for WLC management and assessment.

## Overview

This section outlines the fundamental principles underpinning the good practice WLC management process. It is an essential introduction for all readers of this handbook and provides an overview of the considerations needed before any WLC carbon assessment takes place.

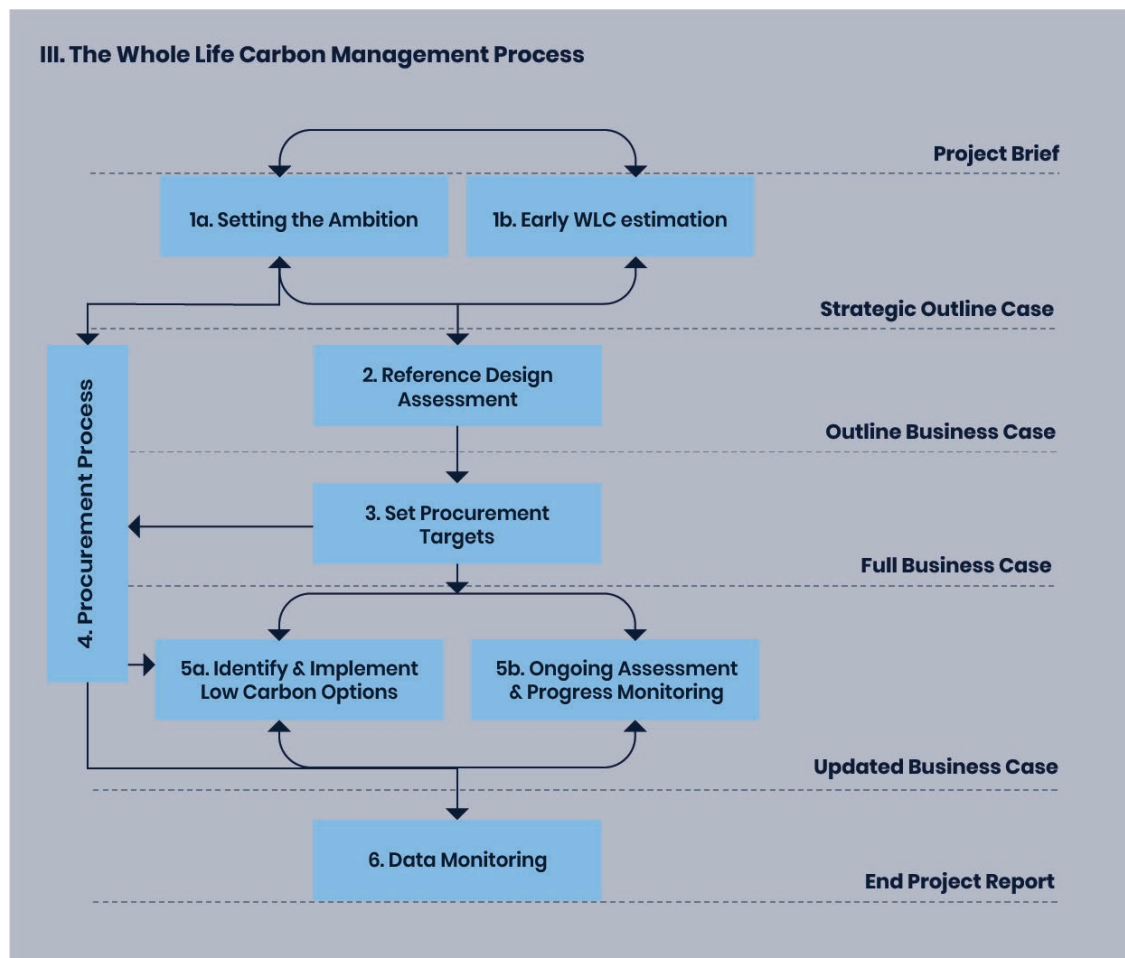
## Good Practice WLC Management Process

As projects and programmes of work progress through each business case stage, decisions will be made which can have an impact on carbon. This good practice WLC management process aligns with the business case framework to enable decisions to be made through a carbon lens, increasing the pace at which built environment sectors transition to net zero, and preventing costly retrofits.

The exact application of this process will be dependent on the goal, scope and intended use of any insights generated, which will vary by project type and business case stage. The goal, scope and intended use of WLC management should be established and communicated across the value chain through a carbon management plan (CMP), early in the process, and reviewed at each stage, to drive transparency and alignment, so that effective decisions can be made to reduce WLC.

The WLC management process is iterative across a project's lifecycle. As the availability and quality of data improve, so does the granularity of each assessment and associated targets. This helps to make sure the impacts of decisions on WLC can be understood, with any reduction opportunities appraised and embedded within the project, driving continuous improvement and whole life carbon reductions at scale.

This good practice process (Figure 2) is purposefully high-level to enable organisations to develop their own specific processes within the bounds of the framework. There are eight steps to the process and an overview of each is provided below. Guidelines associated with the implementation of each of the steps in the process are provided in Chapter III 'The Whole Life Carbon Management Process.'

**Figure 2: The good practice whole life carbon management process**

### 1a – Setting the Ambition

The order of steps 1a and 1b are interchangeable in this process. Setting a WLC reduction ambition at the start of the project (i.e. at the Project Brief stage) provides clear direction and communicates the level of ambition for WLC reduction, which can be cascaded across the value chain. The early-stage ambition can be informed from sector roadmaps and other system targets (whether national, sectoral or regional), performance of prior projects, or high-level reduction opportunities identified through early WLC estimation (see 1b). Further information on setting the target can be found in Chapter III, Section 1.a.

### 1b – Early WLC Estimation

An initial project WLC estimation may be used to set project ambitions to enable an appreciation for the broad range of WLC impacts. This will accommodate an understanding of the likely implications from a carbon perspective and allow decision makers to set considered reduction targets. These early assessments are typically developed through aggregation of as-built datasets from prior projects, using benchmark data where available (top-down)<sup>1</sup>. Further details of each assessment type are covered in Key Principle 6 (P.6).

<sup>1</sup> Note: In the absence of any top-down data, the assessment can be built up from first principles (bottom-up), though this is very laborious and will be based on very high level assumptions

## 2 – Reference Design Assessment

Once the solution has been selected at the end of the Outline Business Case (OBC), the process of WLC assessment will move from a top-down approach to a hybrid/bottom-up assessment approach. This quantification of WLC of the design at the OBC stage, the Reference Design Assessment (RDA), will be used throughout project delivery to monitor and manage performance from a WLC perspective<sup>1</sup>. Setting out how the RDA will be used to manage WLC performance should be set out in a carbon management plan (CMP).

Monitoring progress towards any targets (when compared to the RDA) should be done by undertaking further WLC assessments throughout the delivery process (see 5b). Some assessments will require a greater level of detail as the design and construction of the project progress.

## 3 – Set Procurement Targets

Once a reference design assessment has been undertaken and outputs agreed, the next phase of work is to make sure that the early-stage ambition (1a, above) is translated into relevant targets for specific packages of work for members of the value chain. These targets can be of a variety of forms and should take consideration of the parties' level of control and influence over WLC and the mechanisms in the procurement process.

Overarching early-stage project ambitions should be broken down into discrete elements, assigned to the value chain member who has direct control over these elements. This will enable the incorporation of targets into procurement requirements. The sum of any disaggregated targets should be aligned to the overall project or programme ambition.

## 4 – Procurement Process

The procurement process is a critical enabler for accelerating WLC reductions in the value chain. Procurement is not solely the development of a contract; it is a mechanism that will incentivise the right behaviours across project delivery to meet the project's carbon reduction targets. Asset owners should engage the value chain at the earliest opportunity, through appropriate mechanisms, to make sure low-carbon outcomes are maximised throughout the project delivery process. Having a CMP in place by this stage, for sharing across the project stakeholders, will greatly aid in consistency and understanding.

Product/material suppliers should be selected with consideration of their own quality of carbon data reporting. Constructors should also be able to demonstrate how they will identify and implement low-carbon solutions under an accepted risk level, while providing regular updates of performance against the reference design.

To assist in understanding how all these steps work together, an illustrative example of how the outputs of the good practice WLC Management Process develops through a project is provided in Figure 3.

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<sup>1</sup> Note: Any significant change to scope should trigger a re-assessment to make sure the baseline remains an accurate tool for carbon management.

### **5a – Identify and Implement Low-carbon Options**

Application of the carbon reduction hierarchy, as set out in PAS 2080:2023, is key to maximise the WLC reductions identified and implemented throughout the process. This spans from selection of the solution at concept stages, through to decisions on site by constructors. Early engagement of designers is encouraged to inform and incentivise the value chain on innovative low-carbon solutions through the solution refinement.

Designers and constructors should identify carbon hotspots and communicate opportunities of carbon reduction to the value chain throughout the design process and programme of work.

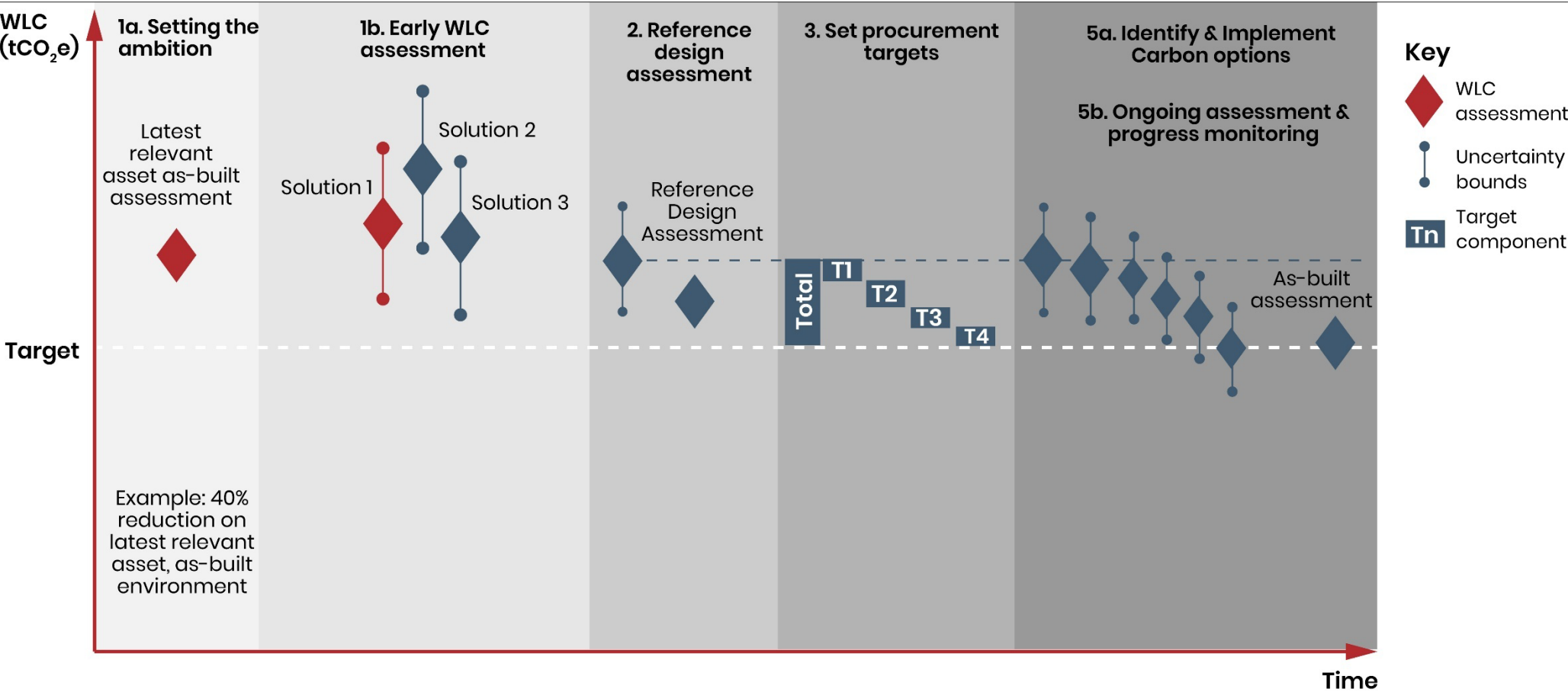
### **5b – Ongoing Assessment and Progress Monitoring**

Reviewing and reporting progress is key to confirm the robustness of WLC assessments undertaken. Consistency of reporting assures progress can be tracked and compared to the reference design assessment. How and when assessment and monitoring will be undertaken through the project should be set out in the CMP, which should also clearly define the role and responsibilities for these actions.

## **6 – Data Sharing**

During the latter stages of project delivery, more granular as-built data will likely become available. Providing the data is traceable and shown to be an accurate reflection of the project, the datasets can be utilised to produce a bottom-up assessment, components of which can be aggregated into industry benchmarks for future projects to utilise. This step is important for driving continuous improvement in the management of WLC across the built environment and projects are encouraged to make relevant data available through industry forums at appropriate stages in the project.

Figure 3: Illustrative example of how the WLC assessment outputs of the good practice WLC management process develop through a project



## WLC Management and the Project Business Case Framework

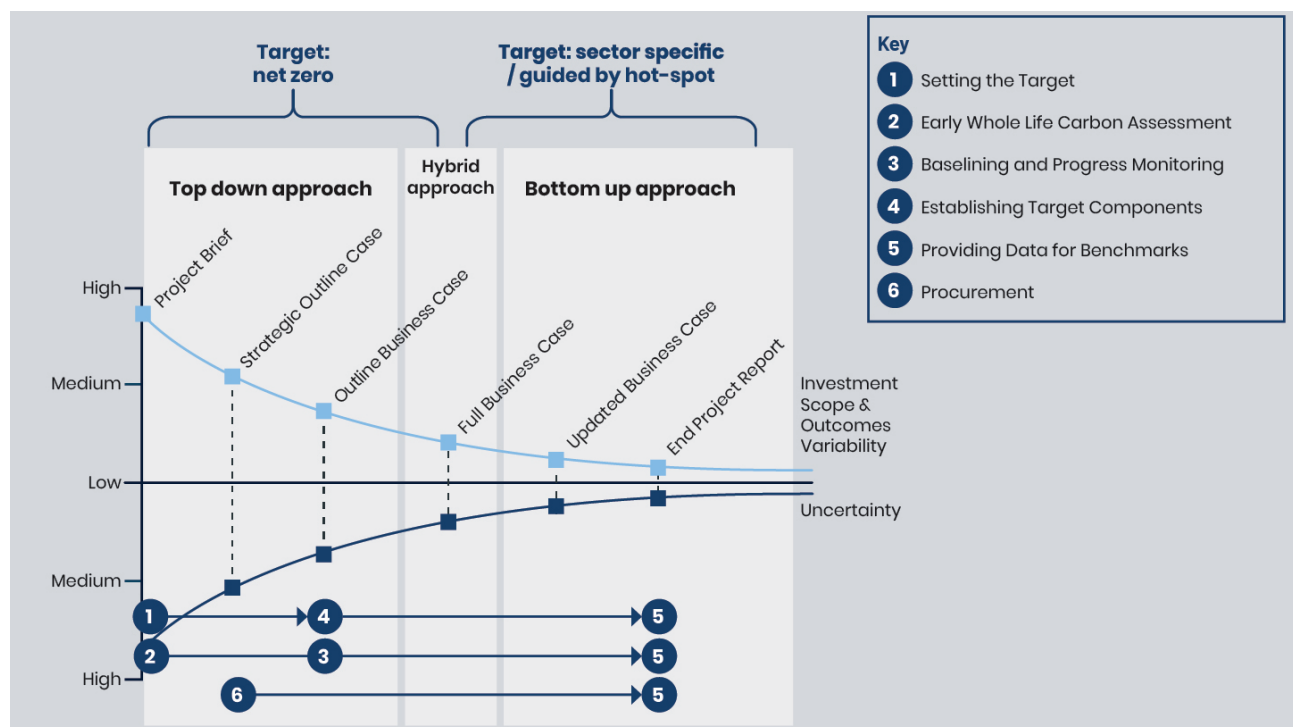
The good practice WLC management process is aligned with each stage of HM Treasury's<sup>1</sup> Project Business Case framework and builds upon NISTA's cost benchmarking process. This consistency will enable effective integration through familiarity and streamlining. The nomenclature of Figure 4 will be utilised through the remainder of this handbook for ease of reference.

**An inverse relationship exists between uncertainty and influence across a project's delivery process. It is critical that each of the five business cases present evidence demonstrating how projects have sought to reduce carbon impacts at all stages of delivery.**

As shown in Figure 5, the WLC management process evolves dynamically as a project progresses through each business case (Appendix C). This dynamic approach responds to the development of the Project Business Case to enable robust decision making relating to WLC reduction throughout the project lifecycle.

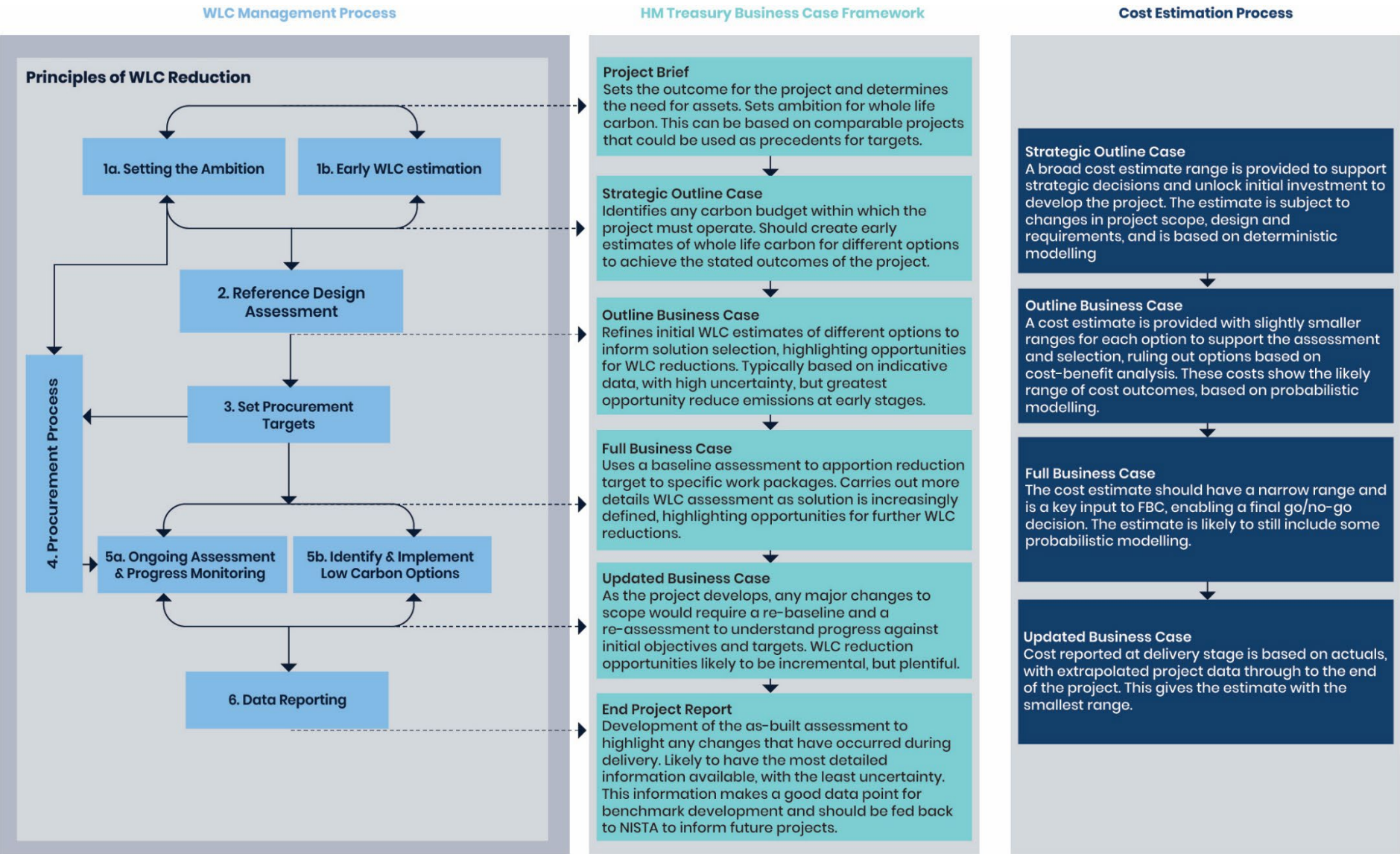
At the Strategic Outline Case (SOC) and Outline Business Case (OBC) stages, a large amount of uncertainty exists, as shown in Figure 4. At this stage, the opportunity to reduce carbon is at its greatest, so it is critical that a high-level assessment of different options is undertaken to make sure WLC impacts factor into early decision making and to confirm that projects support UK carbon targets.

**Figure 4: The evolution of uncertainty in whole life carbon throughout the project lifecycle**



<sup>1</sup> HM Treasury (2018) *Guide to developing the project business case* available at [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/749086/Project\\_Business\\_Case\\_2018.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749086/Project_Business_Case_2018.pdf) (last accessed Dec 2022)

Figure 5: The good practice whole life carbon management process integration with the HM Treasury Business Case Framework



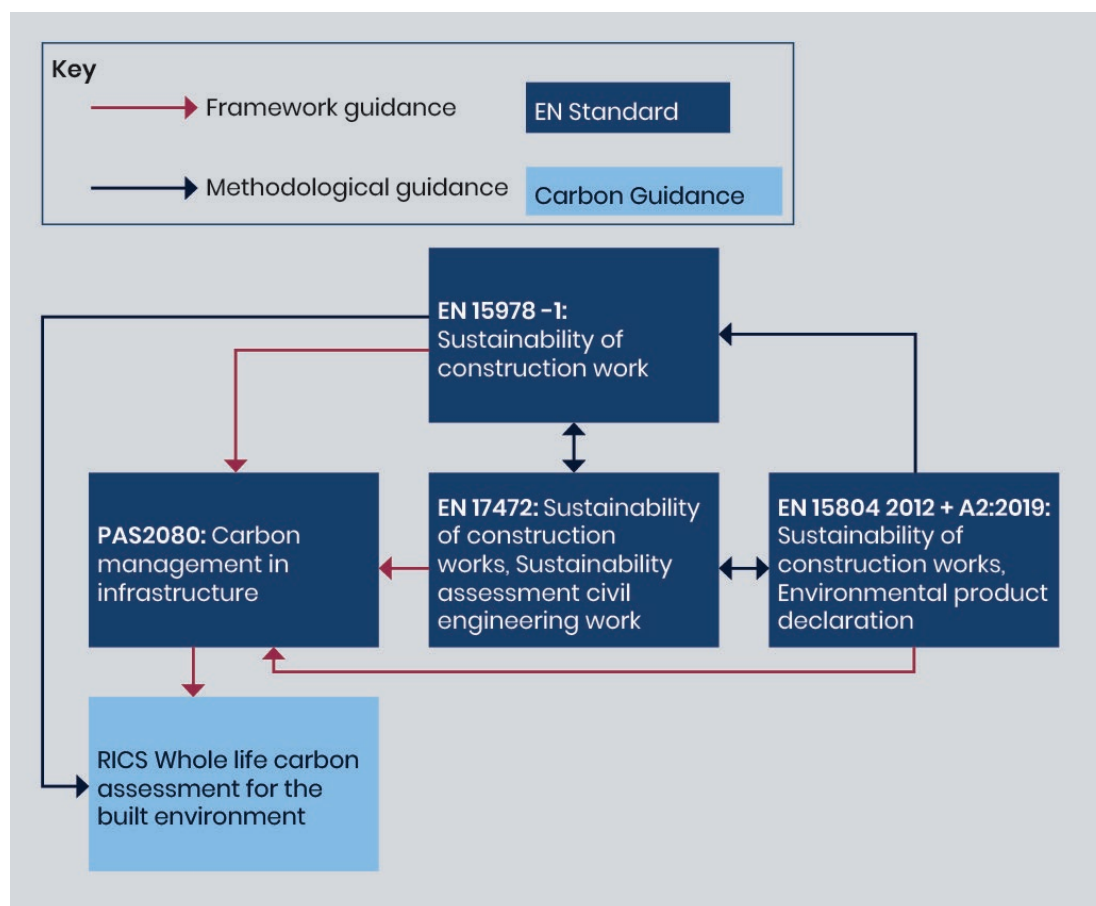
## Relevant Guidance and Standards

This handbook is not intended to take the place of any industry standards, but rather to help projects to understand how the various standards and specifications come together in a practical good practice WLC management process.

Figure 6, below, presents an overview of the key interlinkages between relevant standards for assessments and WLC management in buildings and infrastructure generally. These should be applied at relevant stages across the process and specifically where explicit reference is made in the body of the document.

The following sections provide an overview of key requirements, relevant across WLC assessment exercises for all business case stages. Where relevant specific standards and clauses are referenced, it is important that the standards and guidance are applied and adhered to in their entirety across the process.

**Figure 6: Interlinkages between relevant carbon assessment standards and guidance**



## Key Principles of WLC Management

There are several key principles to be considered initially at project brief stage and continually as further definition is built around the preferred solution. These principles are not specific to a particular step in the WLC management process but rather are fundamental to the concept of reducing WLC and therefore are relevant to all readers. The principles intend to help projects progress in alignment with the broader sector context to maximise WLC reduction potential from the outset.

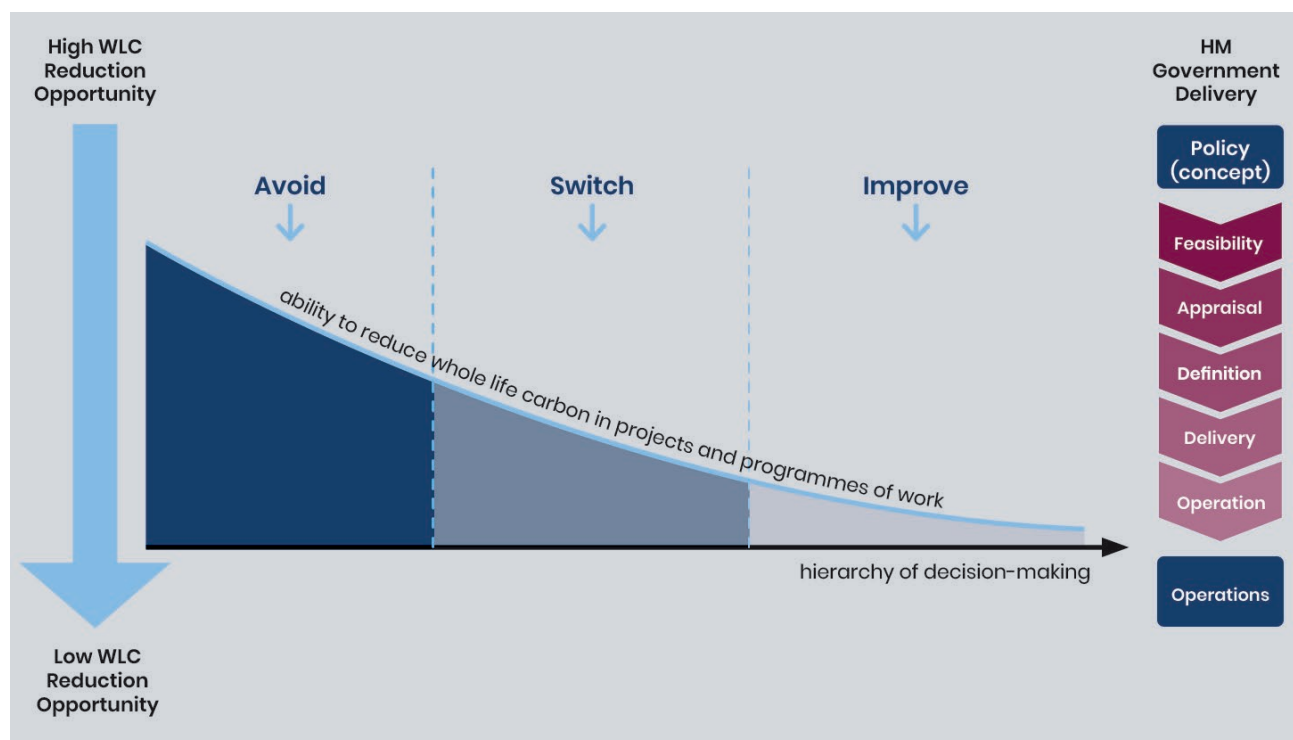
Table 1 summarises the key principles in this chapter, which should be considered throughout decision making processes to improve the WLC performance of the project and broader systems. Further detail on each principle is set out in this chapter.

**Table 1: Key principles of whole life carbon management**

| Reference  | Section                                        | Principle                                                                                                                                                                                                                                                                                        |
|------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>P.1</b> | P.1 The Emissions Reduction Hierarchy          | Assess and document the Whole Life decarbonisation opportunities, using the emissions reduction hierarchy, from the 'Concept' stage of delivery, where the emissions reduction opportunity is greatest, and check that the opportunities follow the PAS 2080:2023 emissions reduction hierarchy. |
| <b>P.2</b> | P.2 Alignment with Net Zero Legislation        | Review decarbonisation opportunities for alignment with the wider UK net zero legislation, strategy and plans.                                                                                                                                                                                   |
| <b>P.3</b> | P.3 Systems Thinking                           | <p><b>3a:</b> Evaluate the emissions impact of project choices at the system level.</p> <p><b>3b:</b> Identify carbon reduction opportunities at the system level within which the asset exists, covering emissions that are both under the control and the influence of the asset owner.</p>    |
| <b>P.4</b> | P.4 Aligning with Green Book principles        | Compare options on the basis of WLC, as a means of assessing monetizable and unmonetizable benefit, as set out in Chapter 6 and Annex A1 of The Green Book.                                                                                                                                      |
| <b>P.5</b> | P.5 Consideration of sector-wide opportunities | Evaluate cross-sector carbon reduction opportunities where the project can contribute to wider objectives through collaboration and engagement with the value chain.                                                                                                                             |

### P.1 The Emissions Reduction Hierarchy

**Consider whole life decarbonisation opportunities, using the emissions reduction hierarchy in PAS 2080:2023, from the 'Concept' stage of delivery, where the emissions reduction opportunity is greatest, throughout the project.**

**Figure 7: Emissions reduction hierarchy****Why is it important?**

The emissions reduction hierarchy (Figure 7), sets out a priority order for decarbonisation actions and can be applied before any project data is available. It enables the asset/programme developer to ask pertinent questions that identify, prioritise and embed decarbonisation opportunities across the lifecycle of the project, to all emissions (capital, operational and user).

**Value chain engagement**

Appendix A contains a challenge checklist that should be utilised by the value chain to check that key WLC reduction opportunities have been considered at each stage. This checklist has been formulated based on guidance in PAS 2080:2023.

Any WLC reduction opportunities that asset owners and the value chain identify should be considered and taken forward to subsequent stages in the decision-making process, as set out in step 5a of the good practice WLC Management Process.

**Key Actions**

- Apply the challenge checklist to identify mitigation opportunities from the outset and continue to use across the project lifecycle.
- Embed requirements to apply the carbon reduction hierarchy to maximise mitigation opportunities across the project lifecycle.
- Require bidders to put forward carbon mitigation considerations.

## P.2 Alignment with Net Zero Legislation

**Review project outcomes and decarbonisation opportunities for alignment with the wider UK net zero legislation, strategy and plans.**

### Why is it important?

The Climate Change Act 2008 (amended 2019) legislates for a net zero emissions outcome for the UK by 2050. The Act is underpinned by economy-wide carbon budgets which are calibrated so that net zero emissions can be achieved in a measured manner which preserves the utility the public has come to expect.

Each new project is a node within a broader system. Not considering the impact of each new 'node' on the overarching 2050 net zero objective risks locking in emissions and compromising the UK's ability to meet its legislative requirement, potentially creating stranded assets in the process.

Consideration should also be given to the UK's Nationally Determined Contributions (NDCs) for which a legal level is set for both 2030 and 2035, and the recently published Carbon Budget and Growth Delivery Plan.<sup>1</sup>

Further definition on net zero can be found in IWA42:2022 (Net zero guidelines)<sup>2</sup>.

### Value chain engagement

As early as possible, to minimise these risks, asset owners should consider whether the project/asset will still be a beneficial 'node' within the broader system in 2050 and beyond, or whether the system is likely to evolve, leaving the asset obsolete or sub-standard. Examples of how systems could be expected to evolve to 2050, can be found in the Climate Change Committee's latest advice to Government on setting Carbon Budget 7<sup>3</sup>.

### Key Actions

- Consider sector visions for system operating conditions aligned to net zero in 2050 on a per project basis.
- Assess the role of potential solutions in that 2050 system.
- Communicate the contribution the project will make to the decarbonisation of the broader system in which it will sit.

## P.3 Systems-thinking

**Evaluate the emissions impact of project choices at the system level. Identify carbon reduction opportunities at the system level within which the asset exists, covering emissions that are both under the control and the influence of the asset owner.**

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<sup>1</sup> Carbon Budget and Growth Delivery Plan available at Carbon budget and growth delivery plan – GOV.UK

<sup>2</sup> IWA 42:2022 Net Zero Guidelines available at

[IWA 42:2022\(en\), Net zero guidelines \(iso.org\)](#) (last accessed Dec 2022)

<sup>3</sup> Climate Change Committee (2025) *Seventh Carbon Budget*, available at

<https://www.theccc.org.uk/publication/the-seventh-carbon-budget/> (last accessed August 2025)

### Why is it important?

Setting a narrow assessment scope at the concept stage can exclude consideration of the cumulative impacts the development may have on the broader system, resulting in unintended consequences. The aim is to reduce emissions at the global level, so it is critical the impact of the asset on its associated system is understood.

By moving to a way of thinking that considers the project as part of a wider system, asset owners will encourage project-related decisions which provide a greater societal benefit. To achieve this system-level alignment, it is important for the practitioner to assess considerations beyond the project boundary and not limiting WLC management by only looking at emissions within the project boundary. Refer to Clause 7 of PAS 2080:2023 for further guidance on systems level thinking.

### Value chain engagement

During the 'concept' stage, a study of carbon reduction impacts and opportunities should be undertaken for the whole system. This will open opportunities not just for WLC reductions but can also unlock cost, operational and maintenance efficiencies. Engagement can occur across the value chain to help gather insights and data; and identify hotspots from a wider range of sources. It will also enable relationships to be built with the value chain which will help with data sharing and collaboration when a more detailed solution is needed.

### Key Actions

- When exploring solutions, take action to encourage systems thinking, such as investigating the impact of modal shift in transport.
- Define a system boundary for assessing impacts, which addresses a wide range of impacts but is aligned with the level of data available.
- Assess high-level constraints, opportunities and impacts at the system level.
- Identify key emissions sources in the system within which the asset exists.
- Identify whether the asset, and the way it is delivered, could reduce these emissions sources.
- Document these opportunities for consideration within the asset definition.

## P.4 Aligning with Green Book principles

**Compare options on the basis of WLC, as a means of assessing the monetizable and unmonetizable benefit of greenhouse gas emissions reductions, as set out in Chapter 6 and Annex 1 of The Green Book.**

### Why is it important?

The Green Book<sup>1</sup> has a framework for considering financial, social and environmental benefits and disbenefits and provides guidance for the quantification of carbon impacts for consideration in business cases. Refer to supplementary guidance relating specifically to the valuation of energy use and greenhouse gas emissions<sup>2</sup>. It is important to align the business case parameters with those of the WLC assessment, so that they have a consistent basis of preparation.

### Value chain engagement

Aligning with the decision-making principles of the Green Book will support a project design in optimising the social and public value created by the project over its design-life. This will enable collaboration between planners and the rest of the value chain to develop a deeper appreciation of the value and limitations which may arise from different project options, driving closer alignment between the WLC performance and other costs and benefits of a project.

### Key Actions

- Check that latest WLC assessment values have been provided within Green Book economic appraisal.
- Outline strategic reasoning for WLC management to realise WLC benefits included in the economic appraisal.

## P.5 Consideration of sector-wide opportunities

**Consider cross-sector carbon reduction opportunities where the project can contribute to wider objectives through collaboration and engagement with the value chain.**

### Why is it important?

There are wider carbon reduction opportunities that apply across multiple projects, such as the decarbonisation of steel and concrete value chains. Some of these wider collaborations rely on projects to develop, implement and share knowledge on the emerging areas to accelerate the required change.

### Value chain engagement

Given the scale and timeline of projects, there is a need for collaboration and influence across multiple schemes and value chains to accelerate innovative carbon reduction opportunities by the time of delivery of specific projects. Projects can provide useful insight and evidence to the wider organisation or industry to support collective decarbonisation efforts, such as advance market commitments for low-carbon materials.

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<sup>1</sup> HM Treasury (2022) *The Green Book* available at [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1063330/Green\\_Book\\_2022.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1063330/Green_Book_2022.pdf) (Last accessed Dec 2022)

<sup>2</sup> DESNZ (2023) *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*, available at [Valuation of energy use and greenhouse gas emissions \(publishing.service.gov.uk\)](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1163330/Green_Book_supplementary_guidance_valuation_of_energy_use_and_greenhouse_gas_emissions_for_appraisal.pdf) (Last accessed October 2025)

### Key Actions

- Consider sector-wide decarbonisation opportunities, through purposeful engagement.
- Collaborate with other projects to share efforts and insights.

## Key Principles of Whole Life Carbon Assessments

The last two principals refer specifically to the process required to deliver effective WLC assessments. When undertaking a WLC assessment it is essential to define a clear goal, scope, assessment type and the intended use of results, as this will change depending on the business case stage.

**Table 2: Key principles of whole life carbon assessments**

| Reference  | Section                                 | Principle                                                                                                                                                                                                                                                                                                                                              |
|------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>P.6</b> | P.1 The Emissions Reduction Hierarchy   | Multiple carbon assessments will need to be made in alignment with the maturity of the project design and associated level of data. Typically, a top down, and bottom-up assessment will be made, with a hybrid assessment between these two assessments. An as-built assessment will also be required to assess actual carbon reduction achievements. |
| <b>P.7</b> | P.2 Alignment with Net Zero Legislation | Modelling and scope uncertainty should be made transparent to ensure uncertainty is considered.                                                                                                                                                                                                                                                        |

## P.6 Aligning assessment type with business case stage

### Top-down assessments

During the initial stages, when the solution is being defined and data is sparse, a top-down, input-output style assessment should be undertaken to inform early decision making. This approach will provide a high-level insight into overall emissions of different options under consideration and can enable some initial high-level identification of carbon hotspots and potential mitigation opportunities.

Top-down assessments for option appraisal through initial stages will typically utilise high-level sector, industry average, or existing project data to assess WLC. More detail on recommendations for using top-down assessments as early WLC assessments can be found in Chapter III 1b.

### Hybrid assessments

As the project progresses through Outline Business Case (OBC) and into Full Business Case (FBC) the preferred option will become more defined in terms of attributes such as project length, scope and performance. These attributes can be utilised to generate a hybrid (combination of bottom-up and top-down) WLC assessment for the project.

This approach enables a more in-depth analysis to determine carbon hotspots and guide design interventions focused on mitigation of carbon impacts, while also working with the data sparsity expected in some areas of the assessment at this stage.

At FBC, this type of assessment can be used for the Reference Design Assessment (RDA), if data required for a bottom-up assessment is not yet available, although this is not the preferred approach.

### **Bottom-up assessments**

As more project detail is built up, the WLC assessment should evolve so that design decisions can be informed at each design iteration. The bottom-up assessment for the approved design at OBC should be set as the RDA, against which optioneering occurs and targets are set.

Having set the RDA, further bottom-up reassessment should be undertaken as the design evolves, in order to track progress towards reduction targets. This will be particularly important for illustrating compliance with procurement targets in the value chain.

### **As-built assessments**

Once the project is complete, as-built data should be collated with associated carbon impacts quantified. As-built assessments will form data points within carbon databases to enable benchmarking of performance of future projects. This is a critical step in the process as, over the course of multiple projects, the utility of benchmark data in decision making will be enhanced significantly, and uncertainty of top-down assessments will decrease, driving improved carbon performance of infrastructure assets.

The as-built assessment may also be an appropriate means for procurement target compliance validation for constructors and other construction suppliers.

## **P.7 Managing uncertainty**

Figure 4 highlights how uncertainty relating to WLC impacts should reduce through each of the business case stages. When assessing WLC, it is important to understand the level of uncertainty in the calculations in order to inform decision making. During the early stages (Pre Strategic Outline Case) of delivery, it is likely that there will be a high level of uncertainty in asset and activity data sets, as with whole life costing.

There is currently no recognised methodology to quantify uncertainty in WLC at early stages, but it is still important to understand the sources of uncertainty in order to be able to target their reduction. There are two main types of uncertainty within WLC assessment, modelling uncertainty (emissions factors, how to model emissions), and scoping uncertainty (material quantities at an asset level, and scope of the scheme, i.e. number and type of assets).

The modelling uncertainty is likely to be comparable between options, when a consistent modelling methodology and underlying emissions factor data set is used. Scoping uncertainty can be high in early stages and vary between options, as with cost assessments. Despite the level of uncertainty, it is still important to quantify the WLC in the early stages so some scoping assumptions need to be made and quantification of the scoping uncertainties, in the absence of a methodology, should follow those associated with costing uncertainty.

Refer to Section 4.10 “Addressing uncertainty in WLCAs” of the RICS WLCA Professional Statement for more information.

### **3. The WLC Management Process**



# The WLC Management Process

## Overview

The purpose of this section is to provide more detailed guidance on the steps involved in carrying out good practice WLC management. These guidelines have been organised in relation to the good practice WLC management process outlined in Chapter II, to aid understanding of the actions to be undertaken and the timeline of implementation with regard to the business case.

### 1a Setting the ambition

The order of steps 1a and 1b are interchangeable in this process. Setting a WLC reduction ambition at the start of the project (i.e. at the Project Brief stage) provides clear direction and communicates the level of ambition for WLC reduction, which can be cascaded across the value chain. The early-stage ambition can be informed from sector roadmaps and other system targets (whether national, sectoral or regional), performance of prior projects, or high-level reduction opportunities identified through early WLC estimation (see 1b).

**Table 3 – Summary of guidelines for Section 1a of the good practice WLC management process**

| Reference | Guideline              |
|-----------|------------------------|
| G.1       | Role Definition        |
| G.2       | Ambition Level         |
| G.3       | Carbon Management Plan |

### G.1 Role Definition

**Define roles and responsibilities for assessing carbon, monitoring performance and delivering on targets throughout the value chain.**

#### Why is it important?

Clearly defined roles and responsibilities relating to WLC assessment and management during each business case stage is critical to the successful delivery of emissions reductions across the project life cycle. These roles will empower value chain members to challenge decisions made and to make their own decisions based on the principles of WLC reduction.

PAS 2080:2023 sets out high-level roles across the value chain in Section I “Scope” and uses these roles throughout the standard to help apportion responsibilities. Refer to PAS 2080:2023 for further information on role definition.

#### Value chain engagement

Asset owners are ultimately accountable for integration of WLC requirements into decision making processes and for meeting targets. Effective project oversight and clear communication, such as through a Carbon Management Plan (CMP), will aid all value chain members involved in understanding their respective responsibilities. This will streamline project developments and improve the overall efficiency of WLC assessment and management.

Asset owners should also monitor and manage the performance of value chain members that contribute to the project's total WLC emissions. This will allow prompt intervention, should suboptimal behaviours become evident, therefore reducing the likelihood of missed carbon reduction opportunities. This can be achieved by apportioning roles and responsibilities in a way which will allow WLC requirements to be met. An effective way to do this is to create a RACI matrix of Responsible, Accountable, Consulted and Informed stakeholders.

### Key Actions

- Clearly set out roles and responsibilities for each business case stage, including these in the CMP.
- Define performance metrics and monitoring processes for each business case stage.
- Establish a system to monitor progress and enable reporting across the value chain.

## G.2 Ambition level

**Set targets for an ambitious level of emissions reduction feasible on the project at the time of delivery, stretching the value chain to deliver.**

### Why is it important?

The target needs to be stretched at the early stages of a project or programme in order to drive the right behaviours and encourage innovative solutions, while considering alignment with national and sectoral carbon budgets.

### Value chain engagement

An assessment of significance relative to relevant carbon budgets should be undertaken to understand alignment with wider carbon ambitions, such as sectoral budgets or organisation-level targets. If the works have high capital emissions but bring down emissions elsewhere in the system this should be reflected in the ambition level. See PAS 2080:2023 Section 8 "Target setting and baselines" for further guidance on the level of ambition.

The ambition level of the target should be used to engage the value chain on innovative solutions for reducing WLC and establishing the importance of WLC within the decision-making process. This can help to build the strategic case for lower WLC solutions and encourage the value chain to push the boundaries in the early design stages.

### Key Actions

- Undertake a high-level assessment of emissions reduction opportunities in collaboration with the value chain.
- Broadly quantify possible impacts of reduction opportunities on any initial WLC estimate (see 1b).
- Undertake an exercise to compare mitigation options to organisation or sector-level ambitions.
- Set a carbon target that is aligned with broader ambitions and stretches the value chain to realise WLC reduction opportunities.

## G.3 Carbon Management Plan

**Create a carbon management plan (CMP), in partnership with the value chain, aligned with PAS 2080:2023 requirements. The plan must include assessment and reporting requirements at each stage of the project lifecycle and should be a live document that evolves with the project.**

### Why is it important

A robust carbon management plan codifies the key WLC management requirements for a project or a programme. It is critical for providing a single source of truth relating to the construction of the reference design, exclusions, assumptions, scope and boundary of the assessment. It will also include the process for identifying and integrating mitigation opportunities.

### Value chain actions

This should be developed early, possibly in collaboration with relevant value chain members, and communicated to the full value chain. The plan should be used to inform decision making in relation to the management of WLC as well as provision of information for delivering continuous improvement and should be a live document that evolves as the project develops.

### Key Actions

- Develop a robust carbon management plan for the value chain to adhere to
- Communicate plan to value chain, including through contracting mechanisms where appropriate

## 1b Early WLC Estimation

The order of steps 1a and 1b are interchangeable in this process. An initial project WLC estimation may be used to set project ambitions to enable an appreciation for the broad range of WLC impacts. This will accommodate an understanding of the likely implications from a carbon perspective and allow decision makers to set considered reduction targets. These early assessments are typically developed through aggregation of as-built datasets from prior projects, using benchmark data where available (top-down)<sup>1</sup>.

Refer to RICS WLCA Professional Statement for further guidance on WLC assessment.

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<sup>1</sup> Note: In the absence of any top-down data, the assessment can be built up from first principles (bottom-up), though this is very laborious and will be based on very high-level assumptions

**Table 4 – Summary of guidelines for Section 1b of the good practice WLC management process**

| Reference  | Section                                                   |
|------------|-----------------------------------------------------------|
| <b>G.4</b> | Take a whole life approach covering all life cycle stages |
| <b>G.5</b> | Establish a calculation methodology                       |
| <b>G.6</b> | Set carbon data requirements                              |
| <b>G.7</b> | Use consistent metrics                                    |
| <b>G.8</b> | Produce and test the early WLC assessment                 |

## **G.4 Take a whole life approach covering all lifecycle stages**

**Include all carbon sources (as per existing standards<sup>1</sup>) in the WLC assessment at each project stage. For any emissions sources excluded, provide sufficient justification on the basis of materiality. Where detailed data is not available, the likely magnitude of WLC should be provided as a minimum.**

### **Why is it important?**

Using a whole life approach will make sure a carbon assessment is useful for decision making at each stage of the business case framework, driving continuous improvement, without creating risks relating to burden shifting of emissions across lifecycle modules.

For example, if a rail scheme focused solely on capital carbon emissions when designing a rail tunnel, the aim would be to reduce the diameter as far as practicable to minimise this category of emissions. This would have the unintended consequence of significantly increasing operational emissions as the rolling stock would require a much greater amount of energy, and therefore carbon, to get through the tunnel due to increased air pressure.

When assessing WLC it is important to also understand the impact beyond the project boundary, as mentioned in P.3.

### **Value chain actions**

RICS WLCA Professional Statement defines life cycle stages required for a WLC assessment as shown in Figure 8 (below). All WLC assessment exercises across each business case should be comprised of each lifecycle stage at the best available granularity, contingent upon data availability. This will guide decision making and enable active management of emissions to be undertaken and tracked when reduction potential is greatest.

Due to limitations in the specificity of PAS 2080:2023, concerning assessment boundaries, it should be used in conjunction with BS EN 15978 or BS EN 17472 (clause 7). These are more specific standards and will provide the level of rigour required to inform decision making at each business case stage. Asset owners should adopt this approach to drive consistency in scope and boundary rules. This approach should be cascaded through the value chain.

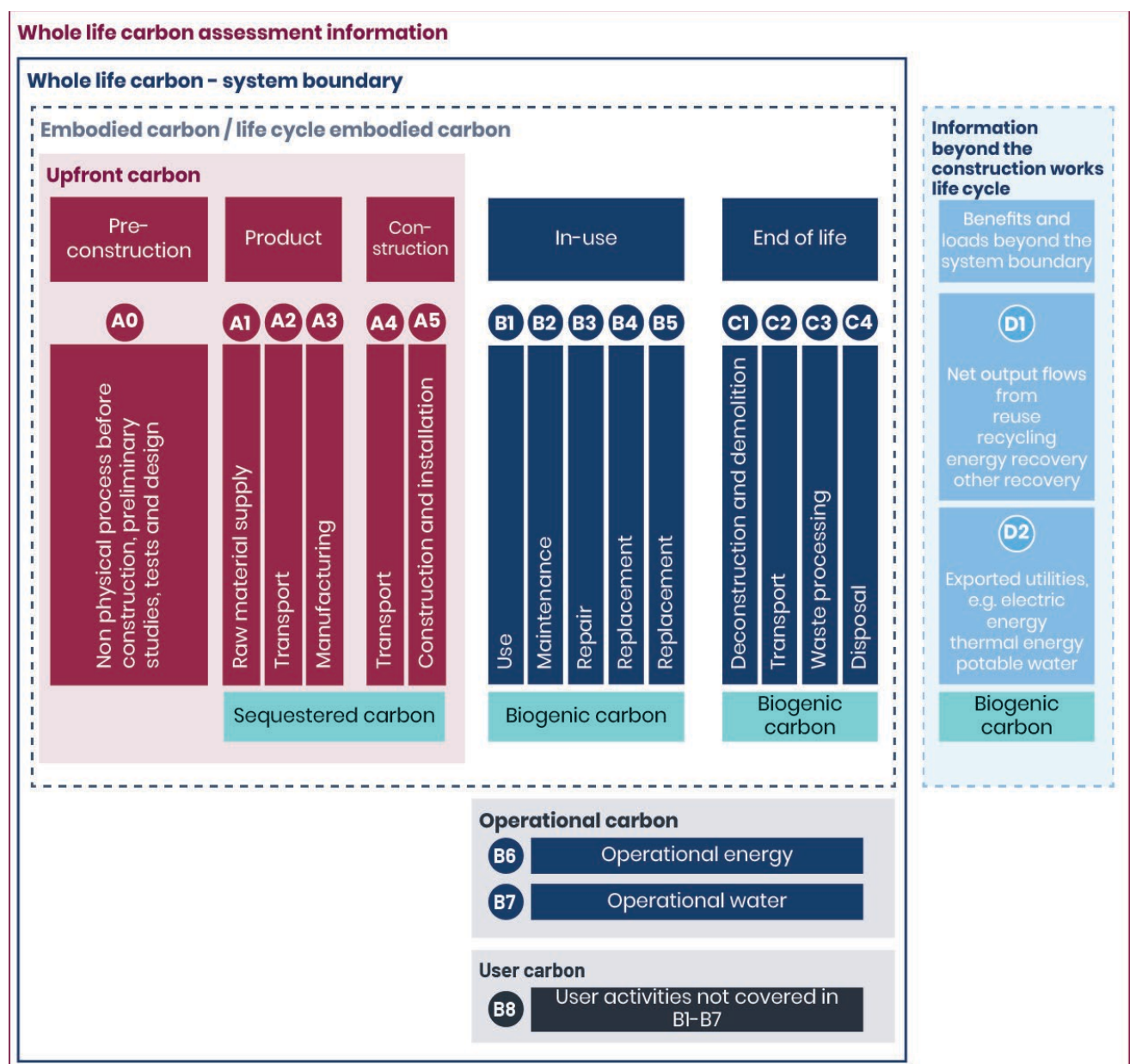
Where project life cycle stages have been excluded from the assessment, justification should be provided with a qualitative assessment of the likely scope and scale of impact to enable effective decisions at the relevant business case stage.

<sup>1</sup> RICS “Whole life carbon assessment for the built environment”, 2023

## Key Actions

- Confirm that WLC assessments undertaken at each stage include each lifecycle stage within their scope.
- If life cycle stages are omitted from an assessment, gather justification and a qualitative assessment of the impact this will likely have on overall emissions.
- Identify any emissions sources not included in each assessment and assess the likely magnitude, and therefore materiality, of the excluded emissions sources, based on most suitable precedent data.

**Figure 8: Building and infrastructure life cycle stages and information modules (adapted from EN 15978, EN 17472 and EN 15643, with additions to illustrate biogenic carbon). Reproduced from RICS “Whole life carbon assessment for the built environment”, 2023**



## G.5 Establish a calculation methodology

**Any assessment methodologies used must adhere to the relevant standards and guidance for the project type and business case stage.**

### Why is it important?

Establishing a calculation methodology will make sure that a consistent approach is followed across all stages in the project lifecycle. This will enable accurate comparisons against the reference design and tracking progress towards the target to be undertaken.

This will also aid the development of future benchmark data which can be used for decision making, over the course of multiple projects, subsequently decreasing uncertainties and driving improved carbon performance of assets across the industry.

### Value chain actions

PAS 2080:2023 identifies EN 15978:2011 (whole building LCA), EN 17472:2020 (civil engineering works) and EN 15804:2012 (individual product EPDs) as comprehensive and consistent WLC assessment methods for measuring, analysing and reporting the WLC impacts of projects from a life-cycle perspective. The RICS WLCA Professional Statement is a standard for WLC assessment, recognised in the UK as being compliant with the requirements of PAS2080:2023.

These standards outline scope, boundary setting, calculation rules, impact indicators, and data quality and quantity requirements for infrastructure and built environment projects and assets covering the whole life cycle. Asset owners should adhere to these standards for WLC calculation, and this should cascade through the value chain.

### Key Actions

- Identify most applicable standard for WLC assessment based on project type.
- Determine the most appropriate assessment method, where several exist. This may require consultation with an appropriate expert where in-house expertise is not available.
- Set out in the CMP a requirement for WLC assessments to adhere to the selected standard.

## G.6 Set carbon data requirements

**Define common data requirements for the assessment of WLC, that are relevant to the different business case stages and work to improve data quality as the project develops.**

### Why is it important?

Having a consistent set of rules in place relating to data quality, reporting requirements and transparency for all calculation exercises across the five business cases is key. This will drive data-based decision making, leading to a greater chance of decarbonisation being embedded across the project lifecycle, driving continuous improvement on subsequent projects.

### Value chain actions

EN 15978:2011 and EN 17472:2020, as well as the practical implementation of these in the RICS WLCA Professional Statement, contain guidance on methods for carbon assessment, data requirements, calculation rules, following a lifecycle approach. These should be adopted and

followed as the project progresses.

The Built Environment Carbon Database (BECD) has been developed in the UK to provide a source of data for carbon estimating and benchmarking. The BECD should be reviewed for applicable data that can be utilised in early WLC estimation and later WLC assessments.

For bottom-up assessments and development of as-built benchmarks EN 15804:2012 for Environmental Product Declaration (EPD) should be utilised, this standard provides information on WLC impacts of construction products and services that feed into asset construction. Relevant clauses of this standard are highlighted in Table 5.

**Table 5: EN15804:2012 Guidance on EPDs**

| Section                         | Clause  |
|---------------------------------|---------|
| Asset definition                | 7       |
| System Boundaries               | 7       |
| Module Coverage                 | 8       |
| Data Requirements               | 10      |
| Procedure of inventory analysis | 11      |
| Quality for reporting results   | 12 & 13 |

Table 6 provides guidance on the different types of data which should be considered acceptable for each stage. **This table should be referred to with relevant data types being utilised for WLC assessment at specific project phases.**

**Table 6: Relevant data types for benchmarking and baselining at specific project phases.**

| Preferred data                                                                                                       | Selected work and business case stages |                        |                                |                            |                                                |                    |
|----------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------|--------------------------------|----------------------------|------------------------------------------------|--------------------|
|                                                                                                                      | Concept                                |                        | Planning                       |                            | Development                                    | Handover           |
|                                                                                                                      | Project brief                          | Strategic Outline Case | Outline Business Case          | Full Business Case         | Updated Business Case                          | End Project Report |
|                                                                                                                      | 1a. Setting the ambition               |                        | 2. Reference design assessment | 3. Set procurement targets | 5a. Implement & identify low carbon options    | 6. Data reporting  |
|                                                                                                                      | 1b. Early WLC estimation               |                        | 4. Procurement process         |                            | 5b. Ongoing assessment and progress monitoring |                    |
| Generic: Data typical of the type of component, product and/or material used                                         | X                                      | X                      | O                              | O                          | O                                              | O                  |
| Specific: Data specific to a manufacturers or production sites/lines for the same product and /or material           | O                                      | X                      | X                              | X                          | X                                              | X                  |
| Average: Data averaged across different manufacturers or production sites/lines for the same product and/or material | X                                      | X                      | X                              | X                          | X                                              | X                  |
| Collective: Data created according to BS EN 15804 representing a category of products                                | O                                      | X                      | X                              | X                          | X                                              | X                  |

Note: Cross (X) represents the preferred use of data; Circle (O) represents alternative sources if available

**Key Actions**

- Confirm that data utilised is relevant to the business case stage which the project sits at, as set out in Table 6.
- Establish a process to improve data quality in line with project development.

**G.7 Use consistent metrics**

**Establish appropriate metrics to create consistency and transparency and communicate this to the value chain at each project phase.**

**Why is it important?**

Consistency in use of metrics and datasets is critical to effective decision making on a WLC basis across the project lifecycle. It also enables effective comparison between options, benchmarks, and projects, which drives interrogation and continuous improvement.

**Value chain actions**

Across WLC assessment standards and guidance the standard metric for carbon measurement should be kgCO<sub>2</sub>e or multiples thereof (e.g., tCO<sub>2</sub>e). The RICS WLCA Professional Statement defines and recommends the functional unit that should be adopted for reporting WLC for specific types of built assets. These are highlighted in Table 7, below.

**Key Actions**

- Check utilisation of appropriate emissions factors for all WLC assessments, based on the project stage and asset type.
- Where robust emission factors are unavailable, engage with the value chain to identify and test alternative data sources, such as the BECD.
- Establish a process to create transparency of value chain data-related assumptions.

**Table 7: Recommended functional units for reporting WLC across asset types, based on RICS Professional Statement on 'Whole life carbon assessment for the built environment'.**

| Project type          | Asset type                                                           | Normalisation metric                                                            |
|-----------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <b>Buildings</b>      | Planning use classes A1–A5, B1, C1–C4, D1–D2                         | kgCO <sub>2</sub> e/m <sup>2</sup> Net Internal Area (NIA)                      |
| <b>Buildings</b>      | Planning use classes B2–B8                                           | kgCO <sub>2</sub> e/m <sup>3</sup> of internal building volume                  |
| <b>Infrastructure</b> | Bridges, Roads, Railway lines, Power lines, Water and Fuel pipelines | kgCO <sub>2</sub> e/km                                                          |
| <b>Infrastructure</b> | Waste and water treatment, water supply                              | kgCO <sub>2</sub> e/m <sup>3</sup> of waste produced and kgCO <sub>2</sub> e/ML |
| <b>Infrastructure</b> | Power stations incl. dams, oil rigs, wind turbines                   | kgCO <sub>2</sub> e/kWh produced                                                |
| <b>Infrastructure</b> | Transport hubs                                                       | kgCO <sub>2</sub> e/passenger and kgCO <sub>2</sub> e/m <sup>2</sup> NIA        |
| <b>Infrastructure</b> | Telecommunication                                                    | kgCO <sub>2</sub> e/Megabits per second                                         |

## G.8 Produce and test the early WLC assessment

**Utilise benchmark data for whole life carbon. Where primary data does not exist, this has to be developed from first principles.**

### Why is it important?

At this stage it is important to have confidence in the validity of any benchmark data utilised. This will help improve the usefulness for decision making of industry and project benchmark data through initial business case stages, enabling effective comparison of different options from a carbon perspective and making sure the lowest carbon solution can be progressed.

Robustly tested as-built data can be aggregated over multiple projects to comprise a benchmark database, such as BECD, helping drive continuous improvement in carbon performance of future projects through increased legitimacy of the underlying data sets.

### Value chain actions

For the early WLC assessment, it is advisable to undertake an exercise to compare and contrast with pre-existing industry benchmarks for elements of projects with similar characteristics, checking alignment with relevant standards and specifications (Chapter II, Figure 6).

### Key Actions

- Gather benchmark data from projects with similar characteristics, both at the project level and broken down into key elements, where possible, to undertake a comparison activity.
- Create a format for gathering asset and carbon data throughout the project lifecycle, considering the types of data that may be available at each stage.

## 2 Reference Design Assessment

Once the solution has been selected at the end of the Outline Business Case (OBC), the process of WLC assessment will move from a top-down approach to a hybrid/bottom-up assessment approach. This quantification of WLC of the design at the OBC stage, the Reference Design Assessment (RDA), will be used throughout project delivery to monitor and manage performance from a WLC perspective<sup>1</sup>. Setting out how the RDA will be used to manage WLC performance should be set out in a carbon management plan (CMP).

Monitoring progress towards any targets (compared to the RDA) should be done by undertaking further WLC assessments throughout the delivery process (see 5b). Some assessments will require a greater level of detail as the design and construction of the project progress.

**Table 8 – Summary of guidelines for Section 2 of the good practice WLC management process**

| Reference | Section                            |
|-----------|------------------------------------|
| G.9       | Whole life carbon Reference Design |
| G.10      | Transparent Reporting              |

### G.9 Whole Life Carbon Reference Design

**Set out requirements for WLC assessment development in the value chain, aligned with P.6 and P.7.**

#### Why is it important

The WLC Reference Design Assessment, is the starting point from which decarbonisation progress is measured in each work package. In other terms, it is the design that would be used should no carbon reductions be taken into consideration. It is informed by either, or both, of the previous stages, 1a and 1b. It is critical for managing performance and driving continual improvements within the project and across the built environment.

#### Value chain actions

The reference design should include data, assumptions, scope and boundary used to complete the assessment, to allow fair comparison and avoid unjustified claims being made.

The reference design should reflect best practice construction methods, materials and scheduling, and include low carbon solutions already widely adopted by the market to enforce continual improvement.

#### Key Actions

- Quantify a WLC assessment of the reference design at the Full Business Case stage, to create the Reference Design Assessment
- Re-assess WLC through each business case stage to identify reductions made compared to the RDA and communicate the outcomes to the value chain

<sup>1</sup> Note: Any significant change to scope should trigger a re-assessment to make sure the baseline remains an accurate tool for carbon management.

## G.10 Transparent Reporting

**Make sure all assessments are fully transparent about their build-up including assumptions made, calculation methodologies and data sets used.**

### Why is it important

Transparent data reporting facilitates quality assurance of data within the value chain. Where assessments are being used to evidence compliance with contractual obligations, transparency is key.

In addition, transparent reporting of assessments will facilitate the sharing of data across the sector (see Step 6), and the development of shared databases, such as the BECD.

### Value Chain Actions

**Asset owners can set out requirements relating to transparency of assessments in the CMP and through contracting mechanisms where WLC assessments are provided by suppliers.**

### Key Actions

- Check that the process, data and assumptions have been codified and recorded.
- Report RDA and underlying assumptions to value chain.
- Establish a process for review of RDA assumptions to account for scope changes.

## 3 Set Procurement Targets

Once a reference design assessment has been undertaken and outputs agreed, the next phase of work is to make sure that the early-stage ambition (1a, above) is translated into relevant targets for specific packages of work for members of the value chain. These targets can be of a variety of forms and should take consideration of the parties' level of control and influence over WLC and the mechanisms in the procurement process.

Overarching early-stage project ambitions should be broken down into discrete elements, assigned to the value chain member who has direct control over these elements. This will enable the incorporation of targets into procurement requirements. The sum of any disaggregated targets should be aligned to the overall project or programme ambition.

**Table 9 – Summary of guidelines for Section 3 of the Management Process**

| Reference | Section                       |
|-----------|-------------------------------|
| G.11      | Establish value chain targets |

## G.11 Establish value chain targets

**With each value chain member, set out specific targets to achieve decarbonisation in line with the overall project target. Calculate target components in tCO<sub>2</sub>e. These can be expressed as percentage reduction on the baseline for ease of communication but must be in conjunction with the absolute value**

### Why is it important?

A suite of targets against key components of the disaggregated RDA will focus efforts of the value chain and drive performance across the project's lifecycle. These should be constrained to specific work packages, value chain members and/or material types to enable them to be effectively baked into contractual requirements.

### Value chain actions

Asset owners have the responsibility to disaggregate targets at project and programme level to enable the value chain to focus their efforts on delivering to those requirements. The combination of targets should relate to defined outcomes based on the functional unit set for the project and be appropriate in scope to the element of the project to which they are relevant.

There are a range of target types which should be considered and utilised based on the specific context, a percentage reduction, an absolute reduction or an emissions intensity reduction target.

Targets should be communicated to the value chain, accompanied by any assumptions, data sets, scope and boundary limits. This will enable transparency and effective challenge and avoid any potential issues relating to shifting the burden.

### Key Actions

- Where possible these targets should be absolute WLC reductions in tCO<sub>2</sub>e, however, if this is not feasible, targets should encourage best practice behaviours to reduce carbon emissions, e.g., a target to reduce fuel use.
- Where helpful, convert the reduction targets into a percentage of baseline WLC and communicate this alongside the absolute value.

## 4 Procurement Process

The procurement process is a critical enabler for accelerating WLC reductions in the value chain. Procurement is not solely the development of a contract; it is a mechanism that will incentivise the right behaviours across project delivery to meet the project's carbon reduction targets. Asset owners should engage the value chain at the earliest opportunity, through appropriate mechanisms, to make sure low-carbon outcomes are maximised throughout the project delivery process. Having a CMP in place by this stage, for sharing across the project stakeholders, will greatly aid in consistency and understanding.

Product/material suppliers should be selected with consideration of their own quality of carbon data reporting. Constructors should also be able to demonstrate how they will identify and implement low-carbon solutions under an accepted risk level, while providing regular updates of performance against the reference design.

**Table 10 – Summary of guidelines for Section 4 of the Management Process**

| Reference | Section                            |
|-----------|------------------------------------|
| G.12      | Embed within procurement processes |

## G.12 Embed WLC within procurement processes

**Include WLC reduction targets in contracts to effectively incentivise the right behaviours. Enable effective communication channels in procurement to manage non-conformance reporting.**

### Why is it important?

Embedding targets within procurement processes will provide a mechanism to effectively incentivise the right behaviours. This is a critical step for driving the acceleration of whole life carbon reductions across the value chain when delivering projects.

Procurement contracts should facilitate effective value chain communication, allowing efficient problem solving in the event of non-conformance claims. Any changes to the design outcome should align with carbon targets or be transparently communicated in reporting data as a result of any adjustments to the WLC assessment.

### Value chain actions

This action is inherently tied to the value chain. With the large spending power afforded to projects, there is a real scope to drive positive change. The value chain can respond to balanced scorecards and specific supplier targets to improve carbon assessment and subsequently achieve a WLC reduction.

### Key Actions

- Confirm that contracts have clear targets which value chain members can be held accountable against.
- Factor in frequent reporting (proportionate to project timeline) on these objectives to check that progress is being made.

## 5a Identify and Implement Low Carbon Options

Application of the carbon reduction hierarchy, as set out in PAS 2080:2023, is key to maximise the WLC reductions identified and implemented throughout the process. This spans from selection of the solution at concept stages, through to decisions on site by constructors. Early engagement of designers is encouraged to inform and incentivise the value chain on innovative low-carbon solutions through the solution refinement.

Designers and constructors should identify carbon hotspots and communicate opportunities of carbon reduction to the value chain throughout the design process and programme of work.

**Table 11 – Summary of guidelines for Section 5a of the Management Process**

| Reference | Section                         |
|-----------|---------------------------------|
| G.13      | Implementing Low Carbon Options |

## G.13 Implementing Low Carbon Options

**Check that carbon-reducing solutions identified by WLC assessments are successfully delivered in the built project. Value chain members responsible for procuring and delivering low-carbon solutions should have accredited capabilities to deliver on proposed designs.**

### Why is it important?

Designers and constructors have a pertinent role in influencing the design of a project and should therefore be involved as early as possible to help realise opportunities for carbon reduction in the design.

The efforts of establishing a carbon management process are futile if the value chain members responsible for delivering the physical outcomes of a project cannot implement the low-carbon solutions.

### Value chain engagement

The designers, constructors and material/product suppliers involved in delivering the project should have their own carbon management processes in place to limit value chain project emissions. Relevant parties should accept the risk allocation involved in delivering the carbon ambitions.

### Key actions

- Engage design-influencing value chain members early in project life cycle to identify carbon hotspots and opportunities for low-carbon options in the design.
- Confirm that the value chain members responsible for delivering low-carbon solutions have appropriate capability, accreditation and practices for implementation.

## 5b Ongoing Assessment and Progress Monitoring

Reviewing and reporting progress is key to confirm the robustness of WLC assessments undertaken. Consistency of reporting assures progress can be tracked and compared to the reference design assessment. How and when assessment and monitoring will be undertaken through the project should be set out in the CMP, which should also clearly define the role and responsibilities for these actions.

Refer to RICS WLCA Professional Statement for further guidance on WLC assessment.

**Table 12 – Summary of guidelines for Section 5b of the Management Process**

| Reference   | Section                                              |
|-------------|------------------------------------------------------|
| <b>G.14</b> | Quantify WLC Assessment for each Business Case Stage |
| <b>G.15</b> | Claim Reductions                                     |
| <b>G.16</b> | Quality Assurance                                    |

### G.14 Quantify WLC Assessment for each Business Case Stage

**Quantify a WLC assessment at each business case stage, or relevant equivalent project stage to demonstrate carbon reduction potential compared to the reference design. This is to be aligned with data and modelling requirements established by the asset owner and embedded within the carbon management plan for the project.**

### Why is it important

To understand how changes to the design impact the WLC of the project, regular quantification through WLC assessment is necessary. Each iteration of the WLC assessment provides an opportunity to check progress of the design towards the WLC target and identify opportunities for further reductions.

In addition, as the project progresses, the level of information available regarding the design will increase, enabling uncertainty in the WLC assessment to be reduced through improved precision of underlying data.

### Value Chain Actions

**In line with the CMP, the value chain must provide the necessary information to those undertaking the WLC assessment. This could include design information, EPDs, bills of materials, or WLC assessments undertaken by suppliers themselves for parts of the project scope.**

**It is important that the outcome of the WLC assessment is communicated to the value chain, so that progress towards targets is understood by those responsible for delivering on the targets.**

### Key Actions

- Carry out WLC assessments at each stage of the business case, or relevant equivalent project stage, in line with the CMP.
- Establish process for data sharing for the development of the WLC assessments.
- Communicate WLC assessment outcomes to the value chain to develop understanding of progress towards targets and identify opportunities for further WLC reduction.

## G.15 Claim Reductions

**Demonstrate the actions that have resulted in any reductions claimed and provide transparency. Undertake re-baselining of WLC when a significant change in project scope/outcome or underlying data occurs, before claiming any carbon reductions.**

### Why is it important?

As the objective of WLC management is to achieve real emissions reductions, it is important to confirm that apparent reductions are due to decarbonisation actions, rather than inaccuracies or changes in project outcome, baselines, emissions factors or assumptions.

A significant change to project scope/outcome will have a material impact on the WLC associated with the project. Understanding the impact of outcome changes and re-baselining (recalculation of the RDA) accordingly will make sure any claims of reduction are robust. A significant change in outcome should result in an updated reference design, from which to calculate emission reductions. This re-baselining should occur every time there is a material change in project outcome.

### Value chain actions

Collaboration between the asset owner and key value chain partners is required to drive accuracy, transparency and consistency in WLC calculations and claimed emissions reductions.

In the event of a significant scope change, asset owners should re-assess the project's WLC to reflect the new scope so that an accurate assessment can be made. A significant scope change is one which will likely yield a meaningful change in the WLC of the project, such as those resulting in large-scale changes to materials, operating procedures or user behaviours.

By making sure all reductions are reported against specific quantified actions, asset owners can reduce data manipulation to achieve targets and drive real emissions reductions.

### Key Actions

- Put requirements in place to drive reporting of carbon impacts against specific actions taken, including a change in design or construction plan.
- Put requirements in place for the recording of any changes in assumptions and their impacts on WLC
- Suppliers should be made aware of any changes to the project outcome in a timely fashion to enable adjustments to WLC assessment.
- Undertake reassessment of WLC if any changes in the underlying data used have changed significantly.

## G.16 Quality assurance

**Provide sufficient capability to assess the suitability of WLC assessments and put in place quality controls to be undertaken by qualified professionals.**

### Why is it important?

Asset owners will be reliant on value chain outputs for WLC assessments in some situations. Where this occurs, it is important that the asset owner can rely on a level of quality equal to that expected in other areas of delivery.

The NISTA expectation is that carbon assessments, mitigations embedded and associated targets are included within each business case stage. It is therefore important that all WLC data and related outputs have been adequately checked and approved to the same standard as other elements of the business case at each stage.

### Value chain engagement

Deliverables across infrastructure, such as designs and construction works, have quality assurance processes depending on the delivery organisation. WLC is no different and requires the supplier to have suitable capabilities to provide quality assurance on their outputs. There are schemes that can be used as a basis for such processes, such as implementation of PAS 2080:2023 principles in an organisation, or even PAS 2080:2023 certification.

As WLC management is an emerging practice, with some organisations hosting more mature capabilities than others, it is important that asset owner organisations understand their capabilities and where development is required to effectively deliver WLC emissions across their portfolio.

### Key Actions

- Undertake assessment of WLC capability in asset owner organisation.
- Identify skills gaps in organisation and establish plan for skills development and provision.

## 6 Data Sharing

During the latter stages of project delivery, more granular as-built data will likely become available. Providing the data is traceable and shown to be an accurate reflection of the project, the datasets can be utilised to produce a bottom-up assessment, components of which can be aggregated into industry benchmarks for future projects to utilise, such as in the BECD. This step is important for driving continuous improvement in the management of WLC across the built environment and projects are encouraged to make relevant data available for others to learn from at appropriate stages in the project.

**Table 13 – Summary of guidelines for Section 6 of the Management Process**

| Reference | Section         |
|-----------|-----------------|
| G.17      | Sharing of data |

### G.17 Sharing of data

**Share data in relation to project baselines and as-built assessments at appropriate points in the project, for other projects to learn from.**

#### Why is it important?

Project benchmarking in some infrastructure sectors is not publicly available, making early WLC estimation difficult and increasing the uncertainty at early stages of a project. Developing a public benchmark dataset for infrastructure assets, such as the BECD, will increase the accuracy of WLC assessment and could accelerate the rate of decarbonisation.

To this end, data transparency is key to the robustness of early WLC assessments undertaken and therefore the consistency and adequacy of data provided for benchmarks.

Over time, the more project data is reported and made publicly available, the easier and more accurate benchmarking processes will become. This stage is crucial to facilitate carbon ambition setting (Step 1a), to accelerate industry-wide carbon reporting and reduction strategies towards net zero.

#### Value chain engagement

As the industry strives for WLC reductions across the board, it is important that the value chain is leveraged to facilitate this through the provision of baselines and as-built project benchmark assessments which can be used to inform future assessments, identify hotspots and drive further emissions reductions.

To achieve this, data sharing from projects to the wider industry, such as through the BECD, is necessary. Information shared should also be fully transparent about data used including assumptions made, how figures were calculated and how missing data was accounted for.

**Key Actions**

- Record early WLC estimation, RDA and ongoing WLC assessment methodologies, data sources and assumptions, and any changes throughout project
- Record as-built assessment methodology, data sources and assumptions
- Share information regarding the assessment undertaken at relevant project stages.

# Annexes



## A. Carbon Reduction Hierarchy

|            |  | Carbon reduction challenge checklist                                                                                                                                                                            |
|------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Avoid   |  | i) Is the required infrastructure (or part of it) needed? Is there an alternate approach to meeting the needs of the identified issue? Are all or parts of the infrastructure required to fully meet the needs? |
|            |  | ii) Can any of the existing asset be utilised? Can the desired outcomes be achieved by maximising the use of other assets?                                                                                      |
|            |  | iii) Have you engaged with suppliers early on alternative solutions?                                                                                                                                            |
|            |  | iv) Are there any other ways to meet the required outcome?                                                                                                                                                      |
|            |  | v) Has topography and need for excavation works been considered as part of the option program                                                                                                                   |
| 2. Switch  |  | i) Is there any spare operational capacity in existing assets that could be used?                                                                                                                               |
|            |  | ii) Has the asset been assessed for optimal operation during use phase?                                                                                                                                         |
|            |  | iii) Have maintenance requirements been minimised?                                                                                                                                                              |
|            |  | iv) Has optimal longevity of assets been achieved to minimise replacement vs initial upfront carbon?                                                                                                            |
|            |  | v) Can you design for disassembly and re-use during end of life of the asset?                                                                                                                                   |
|            |  | vi) Have you engaged with potential suppliers early to fully understand low carbon solutions that would enable optimised whole life carbon? (especially operational carbon)                                     |
|            |  | vii) Can you integrate cost-effective small scale renewable energy systems to reduce operational carbon?                                                                                                        |
|            |  | viii) Have you considered lowest carbon materials for the carbon hotspots?                                                                                                                                      |
|            |  | ix) Have you optimised material use in detailed design?                                                                                                                                                         |
|            |  | x) Have standard unit sizes been considered in design to minimise cut offs and waste                                                                                                                            |
| 3. Improve |  | i) Has offsite manufacture been considered to minimise waste                                                                                                                                                    |
|            |  | ii) Have you considered material sourcing from recycled materials or reuse of materials from other sites?                                                                                                       |

|  |  |                                                                                                                                                                                             |
|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | iii) Has near site assembly/manufacture been considered to minimise transport requirements                                                                                                  |
|  |  | iv) Have you considered optimal material logistics to reduce unnecessary transport during construction?                                                                                     |
|  |  | v) Have you considered alternative low-carbon energy sources for construction plant?                                                                                                        |
|  |  | vi) Have you considered energy efficient site cabins?                                                                                                                                       |
|  |  | vii) Has packaging been optimised with the value chain i.e. re-usable/returnable packaging                                                                                                  |
|  |  | viii) Have you developed site materials management plans to result in optimal use of all ordered materials and reduce waste? E.g. Design for Manufacturing assembly                         |
|  |  | ix) Have you considered new construction techniques that minimise construction time, result in less temporary works or reduce fuel consumption?                                             |
|  |  | x) Have you adequately planned for re-use and/or recycling of on-site aggregates and spoil?                                                                                                 |
|  |  | xi) Has the asset been assessed for optimal operation during use phase?                                                                                                                     |
|  |  | xii) Have maintenance requirements been minimised?                                                                                                                                          |
|  |  | xiii) Has optimal longevity of assets been achieved to minimise replacement vs initial upfront carbon?                                                                                      |
|  |  | xiv) Can you design for disassembly and re-use during end of life of the asset?                                                                                                             |
|  |  | xv) Have you engaged with potential suppliers early to fully understand low carbon solutions that would enable optimised whole life carbon? (especially operational carbon)                 |
|  |  | xvi) Can you integrate cost-effective small scale renewable energy systems to reduce operational carbon?                                                                                    |
|  |  | xvii) Have you developed comprehensive asset management plans to monitor and record asset operational carbon performance and feedback lessons learnt?                                       |
|  |  | xviii) Are there processes in place to extend asset lifecycle?                                                                                                                              |
|  |  | xix) Have you put systems in place to monitor and record asset operational performance against design values and inform design teams and product/material suppliers for future improvement? |

## B. Example data template

RICS also has produced a series of Reporting Templates for Whole Life Carbon Assessment, that could be used as an alternative<sup>1</sup>.

|                                                                                                                         |  |
|-------------------------------------------------------------------------------------------------------------------------|--|
|                                                                                                                         |  |
| Scheme name                                                                                                             |  |
| Delivery body                                                                                                           |  |
| Business case stage                                                                                                     |  |
|                                                                                                                         |  |
| Carbon manager                                                                                                          |  |
| Carbon manager - email                                                                                                  |  |
|                                                                                                                         |  |
| Advise if you are using a carbon planning/ calculator tool in developing your options for your project.                 |  |
| If yes, which one(s)?                                                                                                   |  |
| If no, please advise if you will                                                                                        |  |
|                                                                                                                         |  |
| Has the whole life carbon impact of this scheme been quantified?                                                        |  |
| If so, when was this conducted?                                                                                         |  |
| Provide an indication of confidence levels in the accuracy of the most recent assessment                                |  |
| When is the next whole life carbon quantification expected to take place                                                |  |
|                                                                                                                         |  |
| What is the start date of the carbon impact assessment period?                                                          |  |
| What is the end date of the carbon impact assessment period?                                                            |  |
| What is the timeframe for this baseline (e.g. assessment period)?                                                       |  |
| What is the total assessed whole life carbon impact of the scheme over this period?                                     |  |
| When was this baseline/benchmark set?                                                                                   |  |
| Does this constitute a re-baselining?                                                                                   |  |
| If yes, please provide a reason for the re-baselining (e.g. a change in project scope, design, or improved assessment). |  |

<sup>1</sup> <https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment/whole-life-carbon-assessment-implementation-guides-and-supporting-documents>

|                                                                                                                 |                                                      |        |                   |                    |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--------|-------------------|--------------------|
|                                                                                                                 |                                                      |        |                   |                    |
| What is the primary carbon reduction target against that baseline as a percentage figure?                       |                                                      |        |                   |                    |
| What are the total carbon savings that this reduction target aims to achieve?                                   |                                                      |        |                   |                    |
| Describe the scope of the reduction target                                                                      |                                                      |        |                   |                    |
| What is the timeframe for this reduction target?                                                                |                                                      |        |                   |                    |
| What are the principal risks that may prevent achieving this target?                                            |                                                      |        |                   |                    |
|                                                                                                                 |                                                      |        |                   |                    |
| What is the current forecasted whole life carbon impact of the scheme?                                          |                                                      |        |                   |                    |
| Express this performance against the baseline as percentage                                                     |                                                      |        |                   |                    |
| Provide a narrative explaining why the current forecast is expected to meet or miss the carbon reduction target |                                                      |        |                   |                    |
|                                                                                                                 |                                                      |        |                   |                    |
| What was the total assessed carbon impact of the scheme, as registered at SOBC stage?                           |                                                      |        |                   |                    |
| What was the total assessed carbon impact of the scheme, as registered and submitted at OBC stage?              |                                                      |        |                   |                    |
| What was the total assessed carbon impact of the scheme, as registered and submitted at FBC stage?              |                                                      |        |                   |                    |
| What was the total assessed carbon impact of the scheme, as registered and submitted at pre-construction stage? |                                                      |        |                   |                    |
| What was the total assessed carbon impact of the scheme, as registered and submitted at post-construction stage |                                                      |        |                   |                    |
|                                                                                                                 |                                                      |        | Scheme level data | Project level data |
| Project stage information                                                                                       | Construction                                         | Years  |                   |                    |
|                                                                                                                 | Design life                                          | Years  |                   |                    |
|                                                                                                                 | Business case stage                                  | Text   |                   |                    |
|                                                                                                                 | Pre-construction cost                                | £      |                   |                    |
|                                                                                                                 | Construction cost                                    | £      |                   |                    |
|                                                                                                                 | Primary entity size                                  | Km/m2  |                   |                    |
|                                                                                                                 | Total scheme cost                                    | £      |                   |                    |
| Module A                                                                                                        | A0 – Preconstruction stage                           | kgCO2e |                   |                    |
|                                                                                                                 | A1–A3 – Raw material supply, transport & manufacture |        |                   |                    |

|          |                                          |                     |  |  |
|----------|------------------------------------------|---------------------|--|--|
|          | A4 – Transport to works site             |                     |  |  |
|          | A5 – Total Construction                  |                     |  |  |
|          | Module A Total                           |                     |  |  |
| Module B | B1 – Use                                 | kgCO <sub>2</sub> e |  |  |
|          | B2 – Maintenance                         |                     |  |  |
|          | B3 – Repair                              |                     |  |  |
|          | B4 – Replacement                         |                     |  |  |
|          | B5 – Refurbishment                       |                     |  |  |
|          | B6 – Operational energy use              |                     |  |  |
|          | B7 – Operational water use               |                     |  |  |
|          | B8 – Other operational processes         |                     |  |  |
|          | B9 – Users utilisation of infrastructure |                     |  |  |
|          | Module B Total                           |                     |  |  |
| Module C | C1 – Deconstruction                      | KgCO <sub>2</sub> e |  |  |
|          | C2 – Transport                           |                     |  |  |
|          | C3+C4 Waste processing and disposal      |                     |  |  |
|          | Module C total                           |                     |  |  |
| Module D | Module D total – including mode shift    | KgCO <sub>2</sub> e |  |  |
|          | Sequestered (or biogenic) carbon         |                     |  |  |

## C. The Carbon Management Plan

Asset owners should create a carbon management plan (CMP), in partnership with the value chain, aligned with PAS 2080:2023 requirements. This will provide effective project oversight. Including this in procurements and sharing across the project stakeholders will greatly aid in consistency and understanding. It should be a live document that evolves with the project.

It should include:

1. The goal, scope and intended use of WLC management.
2. How the Reference Design Assessment will be used to manage WLC performance.
3. Assessment requirements at each project stage and equivalent business case stage.
4. Selected standard/calculation methodology for WLC assessments to adhere to.
5. Requirements relating to transparency of WLC assessments. This could include design information, EPDs, bills of materials, or WLC assessments undertaken by suppliers themselves for parts of the project scope.
6. Reporting requirements at each project stage and equivalent business case stage.
7. Roles and responsibilities for each business case stage.

## D. Relevant Guidance

**Table 14 Relevant Guidance**

|                                                                                                                                                                                                   |                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                   |                                                                                              |
| Use: Key policies and guidance for how public works projects/programmes are assessed, procured and delivered.                                                                                     | <a href="#">The Construction Playbook</a>                                                    |
|                                                                                                                                                                                                   |                                                                                              |
| Use: Key policies and guidance for how public works projects/programmes are assessed, procured and delivered.                                                                                     | <a href="#">Promoting Net Zero Carbon and Sustainability in Construction - Guidance Note</a> |
|                                                                                                                                                                                                   |                                                                                              |
| Use: Sets out procurement requirements for carbon reduction plans as part of suppliers' bids for government contracts.                                                                            | <a href="#">PPN: Carbon Reduction Plans</a>                                                  |
|                                                                                                                                                                                                   |                                                                                              |
| Use: This note sets out how to take account of social value in the award of central government contracts by using the social value model.                                                         | <a href="#">PPN: Taking Account of Social Value</a>                                          |
|                                                                                                                                                                                                   |                                                                                              |
| Use: Supplementary guidance to the Green Book on establishing a clear 'golden thread' from government priorities to the development of strategies and business cases for programmes and projects. | <a href="#">Project / Programme Outcome Profile (POP) Tool &amp; Guide</a>                   |
|                                                                                                                                                                                                   |                                                                                              |
| Use: The principles of a commercial approach that defines the roles, capabilities, and responsibilities of the key stakeholders in Project 13's new enterprise model.                             |                                                                                              |

|                                                                                                                                |                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Use: Outlines the six key commercial principles which are critical to creating the right commercial environment for the model. | <a href="#">Project 13: Commercial Handbook</a>                                     |
| Use: Enables value-based decision making focused on driving better environmental, social and economic outcomes.                | <a href="#">Value Toolkit</a>                                                       |
| Use: Independent review of public sector construction frameworks. Outlines a “gold standard” for procurement frameworks.       | <a href="#">Constructing the Gold Standard</a>                                      |
| Use: Provides recommendations for collaborative procurement on key themes and case studies.                                    | <a href="#">Procurement Strategies for Incentivising Collaborative Delivery.pdf</a> |
|                                                                                                                                | <a href="#">Green Public Procurement 2022</a>                                       |

## E. Summary of Principles

| Reference  | Principle                                                                                                                                                                                                                                                                                |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>P.1</b> | <p>The Emissions Reduction Hierarchy</p> <p>Consider whole life decarbonisation opportunities, using the emissions reduction hierarchy in PAS 2080:2023, from the 'Concept' stage of delivery, where the emissions reduction opportunity is greatest, throughout the project.</p>        |
| <b>P.2</b> | <p>Alignment with Net Zero Legislation</p> <p>Review project outcomes and decarbonisation opportunities for alignment with the wider UK net zero legislation, strategy and plans.</p>                                                                                                    |
| <b>P.3</b> | <p>Systems-thinking</p> <p>Evaluate the emissions impact of project choices at the system level. Identify carbon reduction opportunities at the system level within which the asset exists, covering emissions that are both under the control and the influence of the asset owner.</p> |
| <b>P.4</b> | <p>Aligning with Green Book principles</p> <p>Compare options on the basis of WLC, as a means of assessing the monetizable benefit of greenhouse gas emissions reductions, as set out in Chapter 6 and Annex 1 of The Green Book.</p>                                                    |
| <b>P.5</b> | <p>Consideration of sector-wide opportunities</p> <p>Consider cross-sector carbon reduction opportunities where the project can contribute to wider objectives through collaboration and engagement with the value chain.</p>                                                            |
| <b>P.6</b> | <p>Aligning assessment type with business case stage</p>                                                                                                                                                                                                                                 |
| <b>P.7</b> | <p>Managing uncertainty</p>                                                                                                                                                                                                                                                              |

## F. Summary of Guidelines

| Reference                                                           | Guideline                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>G.1 Role Definition</b>                                          | Define roles and responsibilities for assessing carbon, monitoring performance and delivering on targets throughout the value chain.                                                                                                                                                                                      |
| <b>G.2 Ambition Level</b>                                           | Set targets for an ambitious level of emissions reduction feasible on the project at the time of delivery, stretching the value chain to deliver.                                                                                                                                                                         |
| <b>G.3 Carbon Management Plan</b>                                   | Create a carbon management plan (CMP), in partnership with the value chain, aligned with PAS 2080:2023 requirements. The plan must include assessment and reporting requirements at each stage of the project lifecycle and should be a live document that evolves with the project.                                      |
| <b>G.4 Take a whole life approach covering all lifecycle stages</b> | Include all carbon sources (as per existing standards) in the WLC assessment at each project stage. For any emissions sources excluded, provide sufficient justification on the basis of materiality. Where detailed data is not available, the likely magnitude of WLC should be provided as a minimum.                  |
| <b>G.5 Establish a calculation methodology</b>                      | Any assessment methodologies used must adhere to the relevant standards and guidance for the project type and business case stage.                                                                                                                                                                                        |
| <b>G.6 Set carbon data requirements</b>                             | Define common data requirements for the assessment of WLC, that are relevant to the different business case stages and work to improve data quality as the project develops.                                                                                                                                              |
| <b>G.7 Use consistent metrics</b>                                   | Establish appropriate metrics to create consistency and transparency and communicate this to the value chain at each project phase.                                                                                                                                                                                       |
| <b>G.8 Produce and test the early WLC assessment</b>                | Utilise benchmark data for whole life carbon. Where primary data does not exist, this has to be developed from first principles.                                                                                                                                                                                          |
| <b>G.9 Whole Life Carbon Reference Design</b>                       | Set out requirements for WLC assessment development in the value chain, aligned with P.6 and P.7.                                                                                                                                                                                                                         |
| <b>G.10 Transparent Reporting</b>                                   | Make sure all assessments are fully transparent about their build-up including assumptions made, calculation methodologies and data sets used.                                                                                                                                                                            |
| <b>G.11 Establish value chain targets</b>                           | With each value chain member, set out specific targets to achieve decarbonisation in line with the overall project target. Calculate target components in tCO <sub>2</sub> e. These can be expressed as percentage reduction on the baseline for ease of communication but must be in conjunction with the absolute value |

**G.12 Embed WLC within procurement processes**

Include WLC reduction targets in contracts to effectively incentivise the right behaviours. Enable effective communication channels in procurement to manage non-conformance reporting.

**G.13 Implementing Low Carbon Options**

Check that carbon-reducing solutions identified by WLC assessments are successfully delivered in the built project. Value chain members responsible for procuring and delivering low-carbon solutions should have accredited capabilities to deliver on proposed designs.

**G.14 Quantify WLC Assessment for each Business Case Stage**

Quantify a WLC assessment at each business case stage, or relevant equivalent project stage to demonstrate carbon reduction potential compared to the reference design. This is to be aligned with data and modelling requirements established by the asset owner and embedded within the carbon management plan for the project.

**G.15 Claim Reductions**

Demonstrate the actions that have resulted in any reductions claimed and provide transparency. Undertake re-baselining of WLC when a significant change in project scope/outcome or underlying data occurs, before claiming any carbon reductions.

**G.16 Quality Assurance**

Provide sufficient capability to assess the suitability of WLC assessments and put in place quality controls to be undertaken by qualified professionals.

**G.17 Sharing of data**

Share data in relation to project baselines and as-built assessments at appropriate points in the project, for other projects to learn from.

