

Scottish City Region and Growth Deals

Carbon Management Guidance for Projects and Programmes

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1. Introduction

This document provides guidance for Project Owners on managing carbon emissions associated with Scottish City Region and Growth Deal projects.

This approach may be considered to be an emerging form of 'Net Zero Test', whereby the effect of a project, policy or programme on climate change mitigation can be assessed using a proportionate, consistent and tiered approach.

The first iteration of this guidance was issued in August 2021 and it has since been applied widely across Scottish Deal projects. This second edition includes the following additional material:

1. Notable emerging decarbonisation approaches (Section 5.4);
2. Guidance on carbon benefits realisation (Section 7 & Appendix D);
3. A carbon checklist for business cases (Appendix A); and,
4. Department for Business, Energy and Industrial Strategy (BEIS) Carbon Values (Appendix B).

2. Purpose of Guidance

The guidance aims to achieve transparent and consistent carbon management across the Deals programme, ensuring that carbon is an influencing factor from the earliest project stage. It has been designed to accord with HM Treasury Green Book requirements and to support the achievement of the following three key goals for all Deal projects:

1. **Quantification** of whole life carbon using appropriate and authoritative sources;
2. **Minimisation** of whole life carbon using relevant best practice methodologies; and,
3. **Identification** of potential barriers to achieving net zero, e.g. skills, materials, technology.

Achievement of the above goals will ensure that the Deals programme continues to respond effectively to local and national climate emergency declarations, aligned with a corresponding just transition to net zero carbon emissions and the delivery of national climate change targets and commitments.

The consistent application of this guidance will accelerate low carbon innovation and the achievement of national sustainable development objectives across and beyond the Deals programme.

3. Definitions

The following definitions have been adopted for consistency. They are based on an internationally-recognised carbon management specification ([PAS 2080: Carbon Management in Infrastructure](#)) and are applicable to all Deal projects.

- **Carbon:** Shorthand for all greenhouse gases emissions as defined by the Kyoto Protocol, measured in kg or tonnes of carbon dioxide equivalent (CO₂e);
- **Capital Carbon:** Carbon associated with the creation, refurbishment and end of life treatment of a project, e.g. construction materials and processes. The related term 'embodied carbon' is usually used at a product or material level, whereas capital carbon will have greater relevance at a project level;
- **Operational Carbon:** Carbon associated with the operation of a project required to enable it to deliver its service or outcomes, e.g. electricity use or building heating;
- **Whole Life Carbon:** The sum of carbon from all stages of the life cycle of a project. For the purpose of this definition, this sum includes indirect changes in carbon expected to result from the project (decreases or increases), e.g. a reduction in atmospheric carbon or an increase in vehicular emissions (also referred to as End User carbon).
- **Carbon Emissions Impact:** The Green Book guidance equivalent to whole life carbon, which requires to be stated in the economic case for projects seeking public sector funding;
- **Net Zero Carbon:** Where the sum of the carbon emissions resulting from a project and the carbon it removes from the atmosphere equals zero. Noting that carbon savings against a 'business as usual' scenario do not necessarily represent carbon removed from the atmosphere;
- **Carbon Control:** Where project owners have the ability to manage, through direct requirement of project design and operational approach, specific objectives for capital and operational carbon emissions; and,
- **Carbon Influence:** Where the project may affect carbon emissions beyond carbon control, notably through the use of project buildings or infrastructure. For example, a project owner can 'control' the carbon associated with a new road (design, construction, maintenance, lighting, etc.) but can only 'influence' the carbon emitted by users of the road.

4. Green Book Carbon Requirements

Funding for City Region and Growth Deal projects is determined through the development of business cases that must follow HM Treasury Green Book guidance. A review of the Green Book was published by HM Treasury in November 2020 that included updated guidance on the appraisal of projects, programmes and policies based on their alignment with net zero carbon

emissions targets. Sections 3.6 to 3.7 of the updated guidance include the requirement to include the carbon emissions impact from all projects in the economic case:

“3.6 Furthermore, even where progressing the net zero target is not the primary objective of a proposal, appraisers should consider whether it acts as a relevant constraint. Any environmental or carbon emissions impacts should also be captured in the economic case.

3.7 Carbon emissions should be assessed using the approach set out in BEIS Carbon Values. These values are calculated as the cost of removing an additional tonne of emissions from the atmosphere calibrated to a path of emissions consistent with meeting the UK’s legal targets.”

[HM Treasury Green Book Review 2020](#)

The Green Book update in March 2022 incorporated recent associated HM Treasury guidance on valuing carbon, including the following clarification:

“Greenhouse gas (GHG) emissions occur as a result of many decisions to create assets or provide public services, particularly where direct energy consumption is required. They may also result from the energy required to produce basic input materials used in construction. The creation of GHGs has a social cost based on its contribution to climate change.

To estimate the social cost of an intervention it is necessary to include the costs of emitting GHGs. Energy efficiency has a direct social value, in addition to the value of a reduction in GHGs, as the energy saved itself has a direct benefit to society (similarly, activities that create extra demand for energy have a direct energy cost).”

[HM Treasury Green Book, Section 6.6 - Specific Approaches to Valuation](#)

The following important points are drawn from these Green Book requirements:

1. The whole life carbon emissions impact from all proposed programmes, policies and projects should be assessed and quantified, e.g. in tonnes of carbon dioxide equivalent. The level of detail will increase from Strategic to Full Business Case, however **carbon estimation is expected at all stages (whenever cost can be estimated, so can carbon to a similar degree of accuracy)**;
2. The carbon emissions impact should be converted to an economic value using the approach set out using the [BEIS Carbon Values](#). This calculated value, herein referred to as the “*Carbon Emissions Impact Cost*”, represents the cost of removing the carbon emissions predicted to result from the project from the atmosphere, also known as the ‘abatement’ cost;

3. The carbon emissions impact cost for all options appraised within the business case should be included in the Economic Case; and,
4. Where a project, or an option within a project, can be qualitatively demonstrated to have a negligible carbon emissions impact, no quantification will be necessary and there will be no requirement to include an associated carbon emissions impact cost. This is only likely to apply to revenue projects that will demonstrably have no measurable influence on carbon emissions.

The above requirements should be followed for all new project or programme business cases within the Deals, regardless of financial value. Although programme business cases may not be able to estimate carbon emissions until projects are confirmed, the minimisation of carbon should still form a demonstrable part of the decision making process.

The carbon emissions impact of project and programme business cases will be reviewed at every stage (Strategic, Outline and Full). The carbon emissions impact of existing projects with approved Full Business Cases may also be subject to review.

A 'carbon checklist' for project owners and business case reviewers is included as **Appendix A**.

4.1 BEIS Carbon Values

The carbon values published by the UK Government's Department for Business, Energy and Industrial Strategy (BEIS) in September 2021 represent the monetary value that society places on one tonne of carbon dioxide equivalent (£/tCO₂e). The values are used to estimate a monetary value of the greenhouse gas impact of policies, projects and programmes and are included as **Appendix B**.

The values were published by BEIS with details of their origin and how they should be applied, including the following overview:

"Incorporating a value of carbon into the appraisal of projects and policies ensures proper account of greenhouse gas emissions across government. By comprehensively and systematically using carbon valuation across appraisal in a consistent manner, it is intended that government should seek out cost-effective opportunities for reducing emissions across policies and projects – not only in areas such as energy and transport policies where emissions reductions are of primary or secondary importance, but also where this is not the case. Having consistent values across government also provides transparency and consistency for business.

A policy or project that increases or decreases GHG emissions domestically or internationally relative to a "business as usual" scenario is required to quantify the change in emissions, and then apply the carbon values. This

calculation feeds into the overall cost benefit analysis to be considered alongside other quantitative and qualitative evidence in the overall policy appraisal.”

[UK Government Department for Business, Energy and Industrial Strategy, Valuation of Greenhouse Gas Emissions in Policy Appraisal](#)

5. Carbon Management Procedure

An appropriate methodology for managing and minimising whole life carbon emissions resulting from projects should be applied from the earliest possible stage, i.e. the [Royal Institute of British Architects \(RIBA\) Stage 1 \(Preparation and Briefing\)](#). The intended carbon management methodology should be stated within the Management Case section of the business case.

Where carbon reduction targets are set, they should promote carbon reduction on a whole life basis. A reduction target is a value lower than a baseline, as distinct from a ‘project target’ which is the principal value included in financial or economic calculations. The project owner can choose to set separate targets for Capital, Operational or User Carbon, or a single Whole Life Carbon target. For example, projects in the [North Wales Growth Deal](#) are required to target a 40% reduction in embodied carbon and net zero operational carbon.

The following two methodologies are internationally acknowledged as best practice approaches for managing whole life carbon for buildings and infrastructure projects. They are mutually compatible and provide a ‘level playing field’ for the assessment and management of projects across the Deals programme. Both approaches originate from the need to minimise whole life carbon in the built environment to meet national statutory climate change targets.

5.1 Infrastructure: PAS 2080

For infrastructure projects, *PAS 2080: Carbon Management in Infrastructure* should be applied. This document stems from HM Treasury’s Infrastructure Carbon review in 2013, which identified that most carbon emissions in the UK (53% in 2013) are associated with the construction, operation, maintenance and use of infrastructure.

PAS 2080 emphasises the importance of all parties involved across the value chain working collaboratively towards a common carbon reduction goal and the achievement of the following outcomes:

- Reduced carbon, reduced cost infrastructure;
- More collaborative ways of working that promote innovation, delivering benefit to society and communities served by economic infrastructure;

- Effective carbon management in infrastructure that makes an important contribution to tackling climate change and leaves a positive legacy for future generations; and,
- The delivery of more sustainable solutions, at lower cost, that will enhance the reputation of the infrastructure industry, generating pride for those who work in it and attracting new people and skills.

5.2 Buildings: RICS Professional Statement

For building projects, The [Royal Institution of Chartered Surveyors \(RICS\) Whole Life Carbon Professional Statement](#) should be applied. This document addresses the emerging understanding of the importance of embodied carbon in building projects and is compatible with other approaches to building sustainability, e.g. [BREEAM](#) and the recent Net Zero Public Sector Buildings Standard (described within Section 5.4).

The RICS whole life carbon approach identifies the best overall combined opportunities for reducing carbon and helps to avoid any unintended consequences of focusing on operational emissions alone. The specific objectives of the RICS Professional Statement are to:

- Provide a consistent and transparent whole life carbon assessment implementation plan and reporting structure for built projects in line with [EN15978](#) (Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method);
- Enable coherence in the outputs of whole life carbon assessments to improve the comparability and usability of results;
- Make whole life carbon assessments more 'mainstream' by enhancing their accessibility and therefore encourage greater engagement and uptake by the built environment sector;
- Increase the reliability of whole life carbon assessment by providing a solid source of reference for the industry;
- Promote long-term thinking past project practical completion, concerning the maintenance, durability and adaptability of building components and the project as a whole; and,
- Promote circular economic principles by encouraging future repurposing of building components, as well as of the project as a whole, through quantifying their recovery, reuse and/or recycling potential.

5.3 Revenue Projects

The approach to managing carbon on projects where no construction is planned will depend on the objectives of the project and its purpose in relation to addressing the climate emergency.

The carbon emissions impact of some revenue projects will not be possible to meaningfully quantify according to Green Book requirements. However, such projects may still support the achievement of the transition to net zero emissions, e.g. through raising awareness or carbon literacy training. If this is possible and intended, it should be described in the Management Case.

Where any quantifiable carbon emissions impact from a revenue project is expected, this should be estimated in accordance with Green Book requirements and included in the economic case. In all such quantifiable cases, the same general best practice carbon management approach described in PAS 2080 (and RICS) should be applied, i.e. quantification, baselining, reduction targeting, and proactive management.

5.4 Notable Emerging Decarbonisation Tools and Methodologies

Many improvements to the assessment and management of carbon towards net zero are emerging across and beyond the construction industry. The following is a selection of particularly relevant approaches and information either recently made available or likely to be issued by 2023. They are listed here to raise awareness of emerging industry best practice in achieving the wider carbon management objectives described within this guidance.

- [PAS 2080:2022 - Carbon Management in Buildings and Infrastructure](#): Due for publication in late 2022, this updated and enhanced version of the original PAS 2080 will provide additional information on procurement and system-level carbon management. Its applicability widens to the entire built environment (not just infrastructure) and it is set to become the industry standard approach for managing carbon across the UK.
- [International Cost Management Standard \(ICMS\) 3](#): Published in November 2021, ICMS3 provides a common reporting framework for life cycle costs and carbon emissions. It allows their interrelationship to be explored and provides the opportunity to make decisions about the design, construction, operation and maintenance of the built environment to minimise carbon and enhance environmental sustainability.
- [Built Environment Carbon Database \(BECD\)](#): The BECD is expected to become the main source for carbon estimating and benchmarking for the UK construction sector and will be a practical instrument to support the decarbonisation of the built environment. Due for issue by 2023 and intended to be open source and freely accessible, the database is being developed to collect and supply both 'product' and 'entity' level data to the industry through its own portal, interacting with existing databases and software solutions.
- [New Engineering Contract \(NEC\) X29 Clause](#): Achieving net-zero emissions is recognised principally a technical issue that can be addressed through a project scope. This additional NEC contract clause is the result of a growing industry view that standard contract conditions can be used to further support the reduction of the carbon emissions impact of built assets.

- [Net Zero Public Sector Buildings Standard](#): This voluntary Standard supports public bodies in Scotland in meeting their net zero commitments for new build and major refurbished infrastructure projects. The Standard was developed by the Net Zero team at the Scottish Futures Trust in collaboration with Zero Waste Scotland and Health Facilities Scotland with input from across the construction and public sectors in Scotland.
- [Transition Engineering](#): This is an emerging field that recognises the multi-disciplinary engineering approach required to reach net zero. It is based around a pragmatic methodology that drives innovation and increases the likelihood of identifying opportunities to address complex problems.
- [Carbon in Procurement Case Study](#): The Cross Tay Link Road project is applying PAS 2080, including the inclusion of carbon metrics in contractor selection. The process is outlined in a case study included on the Scottish Government's Sustainable Procurement Tools portal.
- [Heat in Buildings Strategy](#): Published in October 2021, this Scottish Government document sets out a vision for the future of heat in buildings and the actions government are taking in the buildings sector to deliver climate change commitments, maximise economic opportunities, and ensure a just transition, including helping to address fuel poverty.
- [Building Regulations & Technical Handbooks](#): Building regulations in Scotland are set to change in December 2022, including the avoidance of direct emissions from heating (notably gas boilers) in all new buildings from 2024. In advance of this change, where the heat demand in a new building is met using direct emissions heating systems, information must be provided to detail how a non-direct emission heat source can be retrofitted to the building. These new requirements were published in a series Technical Handbooks in June 2022.

6. Project Carbon Categorisation

The Deals programme includes a range of project types of differing scales and in a variety of delivery stages, with many early stage projects having not yet quantified their likely whole life carbon emissions impact.

In this context, to enable a consistent and transparent national approach to assessing and managing the carbon emissions impact of the Deals and their projects, a simple categorisation system has been developed using existing carbon terminology, benchmarked by the likelihood of a project to accord with [Scotland's Climate Change Plan](#).

This categorisation system is based on the concepts of **control** and **influence**, i.e. the likely controllable carbon emissions impact of a project and the influence a project will have on carbon emissions beyond its control boundary. The system is suitable for a non-specialist Project Owner, based on project information expected to be available at RIBA Stage 1.

6.1 Carbon Control

Five project carbon emission impact **control** categories have been developed to enable the initial qualitative assessment of Deal projects. These categories are based on the potential of a project to either directly increase or decrease carbon emissions, as follows:

- **Category 1: Whole life carbon negative** - the project directly results in less atmospheric carbon.
- **Category 2: Whole life carbon net zero** - the project has no measurable effect on atmospheric carbon.
- **Category 3: Capital carbon increase then operationally net zero** - the project will release carbon at the construction stage but will then stop emitting carbon in accordance with relevant net zero targets.
- **Category 4: Capital and operational carbon increase** - the project will release carbon at the construction stage then continue to emit carbon, e.g. by burning fossil fuels for heating.
- **Category 5: Operational carbon increase** - no construction is planned but the project will result in an increase in operational carbon emissions.

6.2 Carbon Influence

Three project carbon emission impact **influence** categories have been developed, based on the potential of a project to indirectly influence carbon emissions beyond its control boundary, as follows:

- **Category A: Carbon emissions reduction** - the project leads to wider carbon savings through reduced use of fossil fuels.
- **Category B: Negligible effect on wider carbon emissions** - the project has no measurable effect on wider carbon emissions.
- **Category C: Carbon emissions increase** - the project leads to a wider carbon increase through increased use of fossil fuels.

Project Owners should record the categorisation of their projects using the form contained in **Appendix C**, to be submitted to the Scottish Government's City Region and Growth Deals Sustainable Development Manager (SDM) for approval.

Project Owners with projects in any of the following categories should investigate the feasibility of improving their carbon categorisation and ensuring alignment with Scotland's Climate Change Plan. This will involve liaison and engagement with the Deals SDM.

- Control Category 4 (Capital & Operational Carbon Increase);
- Control Category 5 (Operational Carbon Increase); or,

- Influence Category C (Indirectly leads to a Carbon Increase).

6.3 Example Project Categories

A selection of hypothetical project examples and their associated carbon emissions impact categories is provided below.

- Deployment of a new technology for extracting carbon from the atmosphere that extracts more carbon than was emitted to create it. Its success leads to the accelerated uptake of this technology across the country (Category 1A).
- A skills programme with no specific carbon objectives that involves no construction and is intended to enhance the employability of individuals within a region (Category 2B).
- A new research centre building that is designed to be operationally net zero (i.e. no fossil fuels will be required to operate it) but will have no measurable bearing on wider carbon emissions (Category 3B).
- A road that will be operationally net zero, e.g. by using renewable electricity for lighting, but will lead to an increase in vehicle km and associated 'tailpipe emissions' across the region (Category 3C).
- A building that will have no measurable bearing on wider carbon emissions that is designed to be heated by a gas fired system (Category 4B).
- An investment programme that results in the growth of a business that is already releasing carbon emissions with no carbon mitigating measures. The success of that business leads to other similar businesses' success (Category 5C).

7. Monitoring and Evaluation

Central to Deals funding is the requirement for evidence to support the achievement of objectives set out within business cases. As part of this benefits realisation process, monitoring and evaluation of project performance is required to ensure successful outcomes. Information from this process is collated by the Programme Management Office (PMO) at a Deal level and reported to government Deal Leads.

For legislative context, the [Climate Change \(Scotland\) Act 2009](#) was amended by the [Climate Change \(Emissions Reduction Targets\) \(Scotland\) Act 2019](#), increasing the ambition of Scotland's emissions reduction targets to net zero by 2045 and revising interim and annual emissions reduction targets in accordance with the [Paris Agreement](#).

Although national net zero carbon targets (i.e. 100% carbon reduction or removal) have only been in place since 2019, an 80% carbon reduction target has been UK and Scottish Government policy since 2009. The carbon emissions impact of a

Deal is therefore considered to be a key output and needs to be included in each Deal's Benefit Realisation Plan (BRP). Example carbon benefits realisation outputs are included in **Appendix D**.

The carbon performance of projects will be based upon the achievement of carbon commitments set out in the Full Business Case (FBC). For any project, even projects in the delivery phase with no carbon commitments in their FBC, Scotland's whole life carbon emissions trajectory towards net zero by 2045 will be the carbon performance benchmark, with examples of better performance being the achievement of net zero more quickly (a 'control' benefit) or the demonstration of wider carbon benefits of the project (an 'influence' benefit).

7.1 Benefits Realisation Plans

The following carbon emissions impact performance indicators are expected to be included in BRPs. It is noted that these elements already form part of Scottish City Region & Growth Deals Carbon Guidance business case requirements.

Carbon Performance Indicators: Full Business Case

1. Categorise projects according to the Scottish City Region & Growth Deals Carbon Guidance, e.g. 3B, 2A, etc. Any potential worsening of a project's carbon categorisation (e.g. from a 3B to a 4B) should be reported to the Deal PMO at the earliest opportunity.
2. Report the estimated whole life carbon emissions impact in tonnes CO_{2e} in accordance with this guidance, referring to the corresponding appraisal timeline (this should match the economic appraisal period).

Carbon Performance Indicators: Operational / Post-Construction

1. Report the actual embodied carbon value compared to the baseline and comment on significant changes (i.e. over +/- 10%)
2. For operational building projects, report at least 12 months of operational carbon data (from fuel / energy usage) compared to the predicted annual average operational carbon performance at Full Business Case stage and comment on significant changes (i.e. over +/- 10%)

Any carbon emissions from operational projects should reduce towards zero by 2045 in accordance with Scotland's net zero trajectory and [Climate Change Plan](#).

Actual post-construction whole life carbon values are unlikely to be available until the end of the economic appraisal period and are therefore not usually expected in Deals Benefits Realisation, although they are likely to require reporting through other organisational mechanisms, e.g. the [Greenhouse Gas Protocol](#).

7.2 Example Project Carbon Performance

A simplified example of the inclusion and application of carbon performance indicators on a project is as follows.

Predicted

For an example proposed building project, the **embodied carbon** associated with construction is estimated as **2,000 tCO_{2e}**. The **operational carbon** over a 10 year economic appraisal period is estimated to be **1,000 tCO_{2e}**. Therefore the **whole life carbon** emissions impact of the building over the 10 year economic appraisal period is **3,000 tCO_{2e}**.

Operational carbon emissions are expected to decline towards zero (e.g. through the decarbonisation of grid electricity), however an **annual average of operational carbon** emissions over the 10 year economic appraisal period of **100 tCO_{2e}/year** is included in the business case.

These predictions are contained within the Full Business Case and included in the economic assessment using the BEIS carbon values, resulting in a carbon emissions impact cost of £800,000.

Actual

Once constructed, the '**as-built**' **embodied carbon** value is reported as **2,200 tCO_{2e}**, the 10% increase being due to additional materials and activities associated with encountering unforeseen ground conditions.

After a 12 month period of normal building operations, the operational carbon emissions are obtained from the energy provider and compared with the predicted annual average operational carbon emissions (100 tCO_{2e}/year). The **actual carbon** emissions over the first year of normal building operations are **90 tCO_{2e}**, i.e. 10% less than predicted at the Full Business Case stage. This decrease is considered to be due to improved building energy performance.

Reported

The carbon performance indicators to be reported by the Project Owner to the PMO are as follows:

- Predicted embodied carbon (2,000 tCO_{2e})
- Predicted operational carbon over appraisal period (1,000 tCO_{2e})
- Predicted whole life carbon over appraisal period (3,000 tCO_{2e})
- Predicted annual average operational carbon over appraisal period (100 tCO_{2e}/year)
- Actual embodied carbon (2,200 tCO_{2e})
- Actual operational carbon over 12 months of normal operation (90 tCO_{2e})

7.3 Sharing Lessons Learnt

The comparison between Full Business Case predictions and Operational / Post-Construction carbon emissions impact performance will provide valuable information that can be used to improve future projects across the construction industry.

It is recognised that whole life carbon estimation is not yet widely understood across the construction sector, however the consistent application of this guidance and the methodologies contained herein will help to accelerate its adoption through the sharing of lessons learnt across and beyond the Deals. This will help to drive consistent and transparent decision-making in the context of a Climate Emergency.

Appendix A: Business Case Checklist

Strategic / Executive Summary

1. The relationship between the project and a just transition to net zero according to [Scotland's Climate Change Plan](#) is referenced and clearly conveyed.
2. The project has identified other relevant local or national carbon policies and strategies and demonstrated project alignment, e.g. accordance with a local authority net zero target date.
3. The project has been categorised following Scottish City and Growth Deal Carbon Guidance according to its Control (1-5) and Influence (A-C) over carbon in a Carbon Emissions Impact section or appendix.

Economic / Financial

4. The whole life Carbon Emissions Impact associated with the project, including embodied carbon from construction, has been estimated in tonnes CO₂e over the economic appraisal period.
5. The Carbon Emissions Impact has been assigned an economic value using the BEIS carbon values (£/tonne per year, with workings appended) and included in the cost / benefit calculations.
6. Whole life carbon has been used as a differentiating factor in options appraisal. This may not necessarily be through full quantification of all options, provided that sufficient explanation is given as to why potentially viable lower carbon options have been discounted.
7. The Project has considered and incorporated financial requirements relating to the assessment and management of carbon. This includes voluntary carbon reductions and meeting foreseeable carbon-related requirements, e.g. avoiding direct carbon emissions from the use of fossil fuels in heating. If not explicitly stated, any such costs are assumed to be included in the Business Case.

Commercial / Management

8. The methodology used to manage carbon in this and subsequent project stages is clearly set out, e.g. implementing PAS 2080: Carbon Management in Infrastructure.
9. The project will include carbon as a differentiating factor in procurement through the supply chain.
10. The mechanism by which carbon performance will be demonstrated once the project is operational is explained, e.g. 12 months building performance carbon data reviewed against design predictions. Monitoring and reporting periods should be included in the Full Business Case, according to the carbon management methodology used and project characteristics.

Appendix B: BEIS Carbon Values

Year	Low	Central	High
2020	£120	£241	£361
2021	£122	£245	£367
2022	£124	£248	£373
2023	£126	£252	£378
2024	£128	£256	£384
2025	£130	£260	£390
2026	£132	£264	£396
2027	£134	£268	£402
2028	£136	£272	£408
2029	£138	£276	£414
2030	£140	£280	£420
2031	£142	£285	£427
2032	£144	£289	£433
2033	£147	£293	£440
2034	£149	£298	£447
2035	£151	£302	£453
2036	£153	£307	£460
2037	£156	£312	£467
2038	£158	£316	£474
2039	£161	£321	£482
2040	£163	£326	£489
2041	£165	£331	£496
2042	£168	£336	£504
2043	£170	£341	£511
2044	£173	£346	£519
2045	£176	£351	£527
2046	£178	£356	£535
2047	£181	£362	£543
2048	£184	£367	£551
2049	£186	£373	£559
2050	£189	£378	£568

The origin of the BEIS carbon values and further information on their application following the Green Book process is available here: [Valuation of greenhouse gas emissions: for policy appraisal and evaluation - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/publications/valuation-of-greenhouse-gas-emissions-for-policy-appraisal-and-evaluation)

Appendix C: Project Carbon Categorisation Form

The following information is to be submitted to the Scottish Government's City Region and Growth Deals Sustainable Development Manager for approval. A tabular version in Microsoft Word is [available upon request via this link](#).

1. Project Name

2. Deal Region

3. Brief Description of Project

4. Expected Carbon Emissions Impact CONTROL Category (1-5)

5. Expected Carbon Emissions Impact INFLUENCE Category (A-C)

6. Justification of Expected Carbon Emissions Impact Category

e.g. a short narrative outlining the key carbon emission sources and their relationship to capital and operational net zero following the Deals Carbon Emissions Impact Categorisation Process.

7. How could the Carbon Emissions Impact Category be improved?

e.g. from Category 4B to Category 3A

8. How could the carbon performance of the project be improved?

e.g. reducing emissions further, achieving net zero faster.

9. How will carbon be managed?

e.g. through PAS 2080: Carbon Management in Infrastructure for infrastructure projects or the RICS Whole Life-Cycle Carbon Professional Statement for buildings projects.

10. What other carbon savings are expected to result from the project?

e.g. wider carbon savings across the economy resulting from project output.

Appendix D: Example Project Carbon Benefits Realisation Outputs

Embodied Carbon

Definition

Embodied carbon includes emissions caused by extraction, manufacture/processing, transportation and assembly of every product and element in an asset.

In some cases, depending on the boundary of an assessment, it may also include the maintenance, replacement, deconstruction, disposal and end-of-life aspects of the materials and systems that make up the asset. Suitably authoritative carbon factor sources should be used in embodied carbon calculations, e.g. ICE Carbon Inventory, Environmental Product Declarations (EPDs), CESSM4, etc.

Evidence

The level of evidence detail will depend on the phase of the project. At concept stage an estimate based on major project elements (e.g. steel, concrete, floor area, etc) will suffice. As a bill of quantities develops, so will the embodied carbon estimate. Evidence will be in the form of a simple calculation with clear workings and assumptions that should be broadly as accurate as the associated cost estimate.

Minimisation of Embodied Carbon

Definition

A description of the techniques used to arrive at the embodied carbon figure.

Evidence

Evidence could include referring to the carbon management process used (e.g. PAS 2080, RICS Whole Life Carbon Assessment for the Built Environment, BREEAM, etc) and associated procurement mechanisms to minimise carbon. Evidence could also include the use of low carbon materials or construction techniques with associated estimated carbon savings. Circular economy contributions, including waste minimisation and materials re-use, should be included here.

Annual Operation Carbon

Definition

Operational carbon emissions result from the operation of a built asset. This includes carbon emissions associated with heating, hot water, cooling, ventilation, and lighting systems, as well as those associated with cooking, equipment, and lifts (i.e. both regulated and unregulated energy uses).

Evidence

Predicted or actual data should be provided in relation to energy use, using best practice carbon conversion factors, e.g. the BEIS Greenhouse Gas Reporting factors or local equivalents where relevant.

Minimisation of Operational Carbon

Definition

A description of the techniques used to arrive at the operational carbon figure.

Evidence

Evidence could include referring to the carbon management process used (e.g. PAS 2080, RICS Whole Life Carbon Assessment for the Built Environment, BREEAM, , etc). Evidence could also include the use of renewable energy technologies or low carbon heating systems, etc). Evidence could also include the use of renewable energy technologies or low carbon heating systems.

Whole Life Carbon

Definition

Whole life carbon is the sum of a project's embodied carbon and operational carbon over a specified period, e.g. its design life or 60 years

Evidence

Evidence would be a calculation showing the sum of the embodied and operational carbon values.

Whole Life Carbon Savings

Definition

Savings can only be demonstrated against a legitimate carbon baseline, i.e. what carbon emissions would have resulted from the project had active carbon reduction measures not been in place.

Evidence

Justification of the carbon resulting from the business as usual scenario, then a calculation showing the difference between this value and the project's whole life carbon emissions.

Net Zero Alignment

Definition

A net zero asset may be defined as one that achieves a level of energy performance in line with national climate change targets that does not burn fossil fuels and that is 100% powered by renewable energy. Net zero is the

achievement of a balance of zero greenhouse gas emissions by taking actions to remove the same quantity of greenhouse gases from the atmosphere as all of the activities under consideration generate.

Evidence

Evidence could include an outline description of how the project will feasibly decarbonise over time, e.g. by introducing new renewable technologies or following electricity grid decarbonisation (if the asset is powered only by electricity). Potential barriers to achieving net zero (e.g. financial, technological, skills, etc) should be highlighted.

Transportation / End User Carbon

Definition

An important gauge in the environmental sustainability of a transport network is the carbon emissions it generates. Carbon emissions quantification usually requires traffic modelling, although this may not always be necessary, depending on the project.

Evidence

Evidence will be project-dependent, from a qualitative description for negligible carbon impact projects, to quantification based on traffic modelling for potentially significant carbon impact projects (e.g. sizable roads projects).



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