IEMA Transforming the world to sustainability

Institute of Environmental Management & Assessment (IEMA) Guide:

Assessing Greenhouse Gas Emissions and Evaluating their Significance

2nd Edition

February 2022

Contents

Acknowledgements

Working group

This practitioner's guide has been developed by IEMA and EIA professionals working for organisations registered to the EIA Quality Mark (www.iema.net/qmark).

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About IEMA

The Institute of Environmental Management & Assessment (IEMA) is the professional home of over 18,000 environment and sustainability professionals from around the globe. We support individuals and organisations to set, recognise and achieve global sustainability standards and practice. We are independent and international, enabling us to deliver evidence to governments, information to business, inspiration to employers and great stories to the media that demonstrate how to transform the world to sustainability.

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List of Abbreviations / Glossary

BaU – Business as Usual

BIM – Building Information Modelling

BREEAM – Building Research Establishment Environmental Assessment Method

CEEQUAL – Civil Engineering Environmental Quality assessment scheme

CEMP – Construction Environmental Management Plan

CEN – European Committee for Standardization

Climate change – changes in general weather conditions over 30 years (seasonal averages and extremes)

Climate Change Adaptation – the process that a receptor or project must go through to ensure it maintains its resilience to climate change

Climate Change Resilience – a measure of ability to respond to changes in climate. If a receptor or project has a good climate change resilience, it is able to respond to the changes in climate in a way that ensures it retains much of its original function and norm

CCC – Climate Change Committee

DBEIS – Department for Business, Energy & Industrial Strategy

DEFRA – Department for Environment, Food & Rural Affairs

DfT – Department for Transport

EIA – Environmental Impact Assessment

EMP – Environmental Management Plan

EPD – Environmental Product Declaration

ES – Environmental Statement

F-gases – a group of greenhouse gases called fluorinated gases, consisting of HFCs, PFCs and SF6

GHG – Greenhouse Gases

GHG practitioner – an environmental consultant with specific experience and knowledge pertaining to GHG modelling and reporting; not to be confused with EIA practitioners who typical have a wider EIA delivery role overseeing the coordination of all environmental topics in an ES

IA – Impact Assessment

IEMA – the Institute of Environmental Management and Assessment

IPCC – Intergovernmental Panel on Climate Change

kWh – kilowatt-hour

LCA – Life Cycle Assessment is a cradle-to-grave or cradle-to-cradle analysis technique to assess environmental impacts associated with all the stages of a product's life, which is from raw material extraction through materials processing, manufacture, distribution, and use.

LICR – Large Infrastructure Carbon Rating

LPA – Local Planning Authority

LULUCF – Land Use, Land-Use Change and Forestry

TCFD – Task Force on Climate-related Financial Disclosures

tCO_2e – tonnes of carbon dioxide equivalent

UK – United Kingdom

UNFCCC – United Nations Framework Convention on Climate Change

WBCSD – World Business Council for Sustainable Development

WRI – World Resource Institute

I – Introduction

1.1 The aim of this guidance

The aim of this guidance is to assist greenhouse gas (GHG) practitioners (hereinafter referred to as 'practitioners') with addressing GHG emissions assessment, mitigation and reporting[1] in statutory and non-statutory Environmental Impact Assessment (EIA). It is a revision of the 2017 IEMA guidance on Assessing Greenhouse Gas Emissions and Evaluating their Significance[2] (Box 1 lists the key updates from the 2017 version of the guidance). It complements IEMA's latest guide on Climate Change Resilience and Adaptation[3] published in 2020 and builds on the Climate Change Mitigation and EIA overarching principles (as in the previous version of the GHG Guidance). The requirement to consider this topic has resulted from the 2014 amendment to the EIA Directive (2014/52/EU), the Town and Country Planning (Environmental Impact Assessment) Regulations 2017[4] and the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017[5], hereafter referred to as the 'EIA Regulations'.

A lot has changed since 2017. Climate change has moved up the national and international agenda with local authorities across the UK declaring a climate change emergency. The UK's legally binding Climate Change Act 2008[6] was amended in 2019[7] in response to the Paris Agreement, setting a new and challenging target to reduce UK GHG emissions to net zero by 2050, accounting for residual emissions which are offset. Devolved administrations in Scotland and Wales have also set net zero targets. In December 2020, the UK Government's independent advisors, the Climate Change Committee (CCC), set the sixth[8] carbon budget at 965 million tCO_2e from 2033 to 2037, which has since been enshrined in to law. There is a distinct requirement for deeper cuts in emissions across all sectors of the economy to meet the net zero target according to the CCC.

1 Note: Statutory EIA reports are called 'Environmental Statements' in England, Wales and Northern Ireland and 'Environmental Reports' in Scotland.

2 IEMA (2017) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance. Available at: https://www.iema.net/preview-document/assessing-greenhouse-gas-emissions-and-evaluating-their-significance

3 IEMA (2020) Climate Change Resilience and Adaptation. Available at: https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020

4 UK Legislation (2017) The Town and Country Planning (Environmental Impact Assessment) Regulations 2017. Available at: https://www.legislation.gov.uk/uksi/2017/571/contents/made

5 UK Legislation (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. Available at: https://www.legislation.gov.uk/uksi/2017/572/contents/made

6 UK Legislation (2008) Climate Change Act 2008. Available at: https://www.legislation.gov.uk/ukpga/2008/27/contents

7 UK Legislation (2019) The Climate Change Act 2008 (2050 Target Amendment) Order 2019. Available at: https://www.legislation.gov.uk/ukdsi/2019/9780111187654

8 UK Legislation (2021) The Carbon Budget Order 2021. Available at: https://www.legislation.gov.uk/uksi/2021/750/contents/made

Box 1: Key updates to the 2017 guidance

Mitigation has taken a much more prominent role within the EIA. It is no longer an element to be considered towards the later stages of the EIA process (after scoping, emissions assessment and significance determination). Instead, mitigation should be considered from the outset and throughout the project's lifetime, whilst also helping to deliver proportionate EIAs. Mitigation is addressed first in the guidance (Section II) but also as part of the GHG Assessment Methodology (Section V).

The guidance presents more nuanced levels of significance. The 2017 guidance stated that "...in the absence of any significance criteria or defined threshold, it might be considered that all GHG emissions are significant...". This update of the guidance does not change IEMA's position (or the science) that all emissions contribute to climate change, however specifically in the EIA context it now provides relative significance descriptions to assist assessments. Section VI describes five distinct levels of significance which are not solely based on whether a project emits GHG emissions alone, but how the project makes a relative contribution towards achieving a science-based 1.5°C aligned transition towards net zero.

In November 2021 Glasgow hosted COP26 – widely regarded as the most important climate summit since the 2015 Paris Agreement and acknowledging the urgency (as evidenced by latest IPCC reports), the Glasgow Climate Pact was agreed. This set the agenda on climate change for the next decade. Pledges made to further cut emissions, and a plan set to reduce the use of coal and phase-out fossil fuel subsidies are some of the commitments made at COP26. The nations present at COP26 collectively agreed to work to reduce the 'emissions gap' and to ensure that the world continues to advance during the present decade, so that the rise in the average temperature is limited to 1.5°C.

With climate change taking centre stage, projects are increasingly scrutinised and challenged for not mitigating GHG emissions in line with the net zero ambition and the associated required pace of reductions[9]. This critical change is known as the transition imperative. EIA Climate chapters are receiving a lot more attention with clients, project developers and stakeholders often asking: *'what do we need to do and how can we be net zero?'*. Addressing significance and contextualising projects' emissions is an increasingly challenging exercise, especially under a tapestry of national and sectoral carbon targets and budgets, regional and local plans and sectors all on different pathways. This guide aims to provide practitioners with the best advice on how to tackle these questions.

Through a working group facilitated by Arup on behalf of IEMA, this guidance helps practitioners take an informed approach to the treatment of GHG emissions within an EIA. It sets out areas for consideration at all stages of the assessment and offers methodological options that can be explored. It highlights some of the challenges to the assessment, such as establishing study boundaries and what constitutes significance. However, this guidance is not a prescriptive 'how to' guide and will be updated as the process of incorporating GHG assessment in EIA continues to mature.

1.2 EIA and project linkage

EIAs can often be undertaken in silo, separate from the full design process, resulting in an accounting exercise rather than realising the full potential of the GHG emissions reduction opportunity. This can be addressed by delivering the EIA in close cooperation with the project design team.

9 The pace of reduction should align with a credible 1.5°C transition scenario (for example Science Based Targets Initiative Net Zero or Tyndall Centre aligned carbon budget)

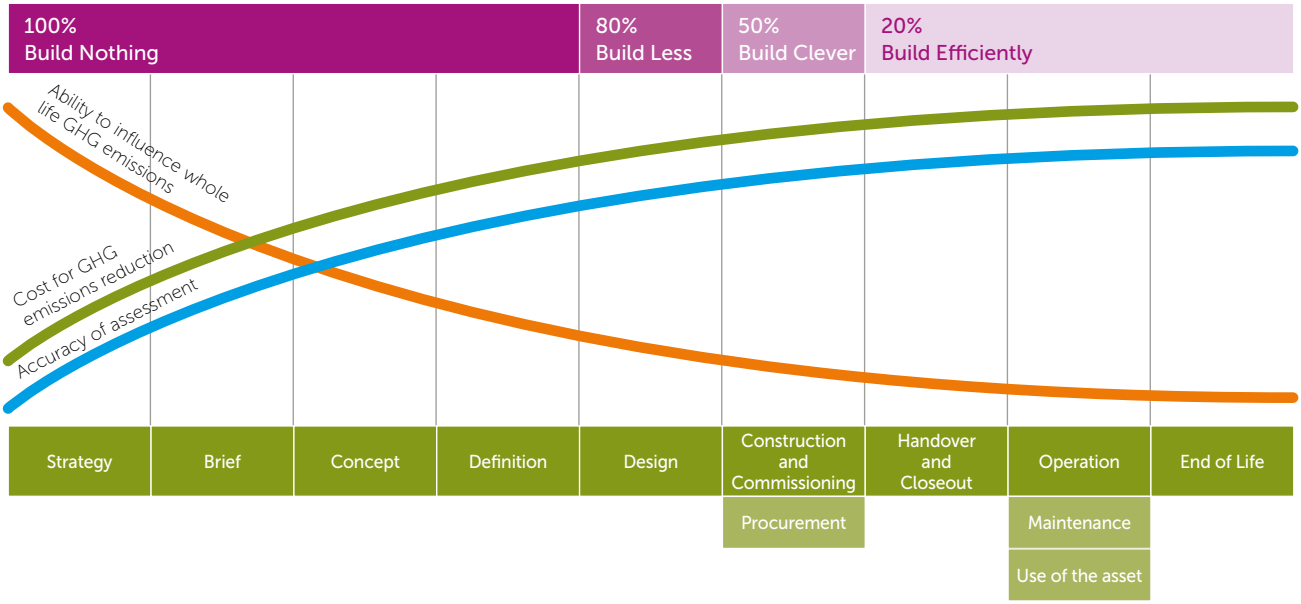


Figure 1: The ability to effect change to achieve GHG emissions reduction for the project reduces over time. This makes it important that the emissions reduction is considered from the outset or at the earliest practical point. (Source: Infrastructure Carbon Review & PAS 2080).

Early stakeholder engagement is fundamental to maximising GHG emissions savings. GHG reductions are likely to be greater if mitigation is considered at project inception and throughout all subsequent work phases: planning, construction and operation stages – enabling mitigation measures to be identified and implemented throughout the life cycle of the proposed project. Examples of stakeholders can be found in Appendix A. Figure 1 illustrates how the potential to achieve GHG emissions reduction declines with time over a project life cycle.

The interaction between the design process and EIA process is underpinned by four key principles:

1. Early, effective and ongoing interaction
2. Appropriate stakeholder engagement
3. Managing consenting risk
4. A clear narrative

For further detail on these principles and ensuring that GHG mitigation measures are built in rather than bolted on at a later stage, refer to IEMA's EIA guide on Shaping Quality Development[10].

The need to ensure that GHG mitigation measures are implemented does not end at the pre-application EIA stage, but extends after consent has been granted to the proposed project. To ensure that GHG mitigation measures are carried forward, the development of Environmental Management Plans (EMP) and Construction Environmental Management Plans (CEMP) are the primary mechanisms. For further information refer to IEMA's EIA guide to Delivering Quality Development[11].

The scope of this document is presented in Figure 2.

10 IEMA (2015) Environmental Impact Assessment Guide to Shaping Quality Development. Available at: https://www.iema.net/download-document/7018

11 IEMA (2016) Environmental Impact Assessment Guide to Delivering Quality Development. Available at: https://www.iema.net/download-document/7014

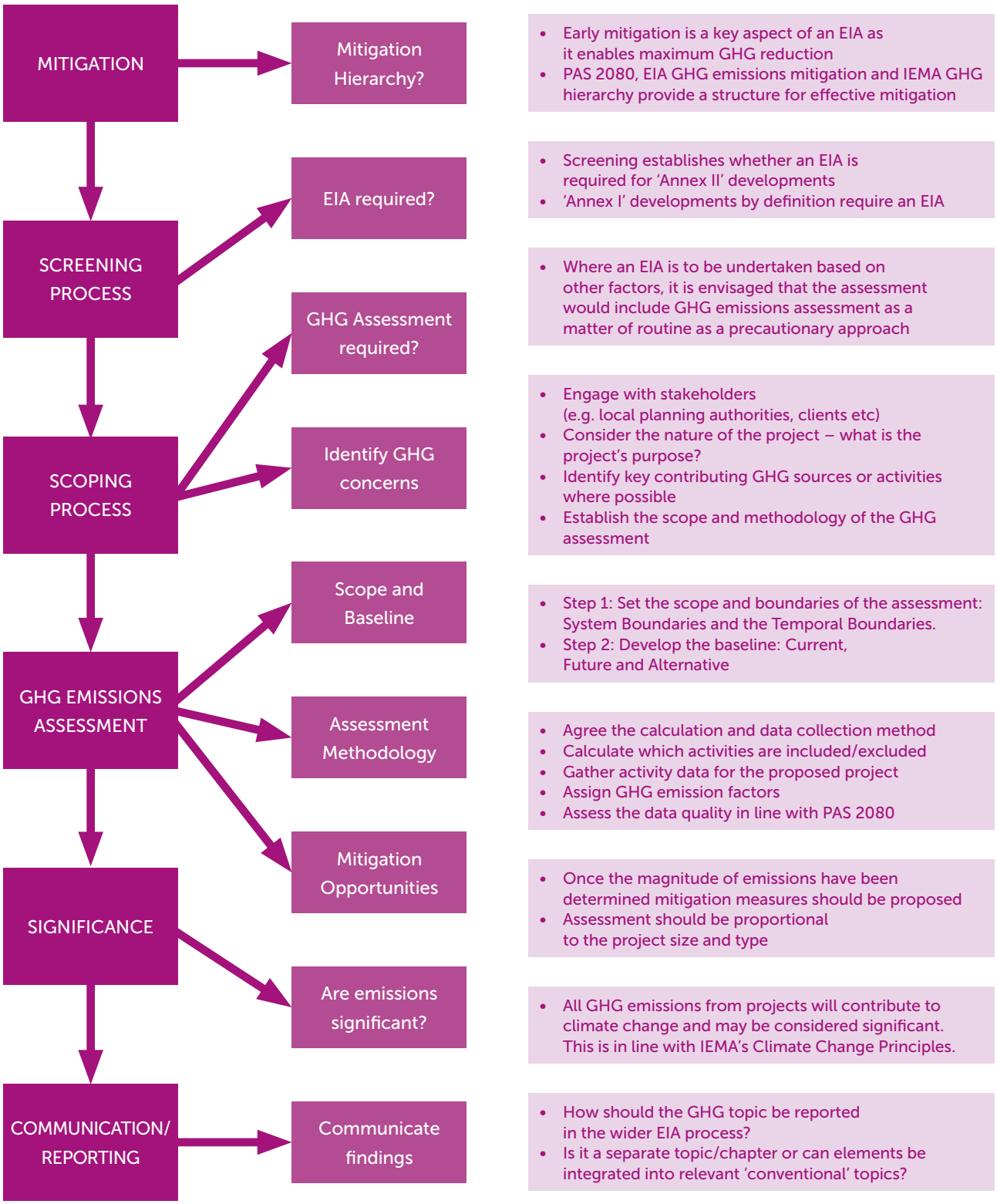


Figure 2: Scope of this guide

II – Mitigation

2.1 Early design mitigation

It is important that project designers incorporate measures to reduce GHG emissions at an early stage. This means evaluating what GHG emissions reduction measures may be appropriate to include in the design. Mitigation should be considered at all stages of design development – from optioneering through to detailed design, not just as a part of the EIA process (see Figure 1). To successfully address GHG emissions at an early stage, it is good practice to ensure there is a 'carbon coordinator' within the design team, who focuses on promoting GHG saving opportunities and ensures GHG reduction is a focus of the design team.

GHG mitigation is best achieved by taking a planned and focused approach following the IEMA GHG management hierarchy principles[12]. There are many different variations on the use of hierarchies in environmental management and assessment, with the commonality that they set out a graded structure of interventions with generally more favourable options presented over others. Such structures typically start with first avoiding or reducing harm, before suggesting compensations. Depending on the proposed project and contextual setting, the practical outcomes of this can be many and diverse. In addition to mitigations listed in IEMA's GHG Management Hierarchy, BS EN ISO 14064-1: 2019[13] on GHG quantification and reporting provides an example list of GHG mitigation interventions such as:

- Energy demand and use management
- Energy efficiency
- Technology or process improvements
- GHG capture and storage in, typically, a GHG reservoir
- Management of transport and travel demands
- Fuel switching or substitution
- Afforestation
- Waste minimisation
- Alternative fuels and raw materials (AFR) use to avoid landfilling or incinerating the wastes
- Refrigerant management

2.2 Mitigation hierarchy

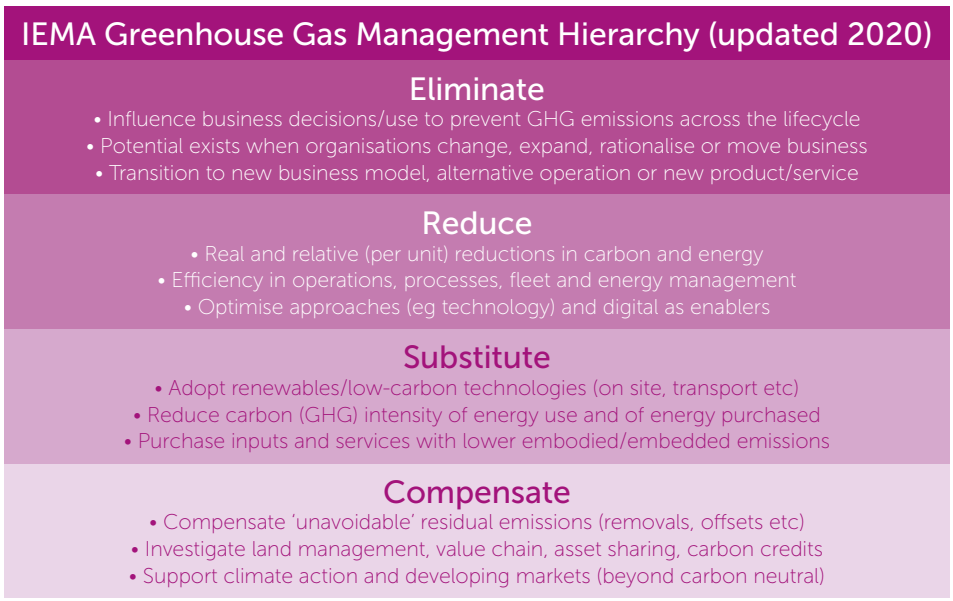
For EIA GHG emissions mitigation, PAS 2080 also provides a useful structure for working through and identifying potential opportunities and interventions. The IEMA GHG Management Hierarchy[14] (see Figure 3) provides a similar structure set out as **eliminate**, **reduce**, **substitute** and **compensate**. A variation of these steps is set out below and can be followed by practitioners in the EIA to identify opportunities that direct GHG mitigation action for a project:

- **Do not build:** evaluate the basic need for the proposed project and explore alternative approaches to achieve the desired outcome/s
- **Build less:** realise potential for re-using and/or refurbishing existing assets to reduce the extent of new construction required
- **Design clever:** apply low carbon solutions (including technologies, materials and products) to minimise resource consumption and embodied carbon during the construction, operation, user's use of the project, and at end-of-life
- **Construct efficiently:** use techniques (e.g. during construction and operation) that reduce resource consumption and associated GHG emissions over the life cycle of the project

12 IEMA (2020) Pathways to Net Zero: Using the IEMA GHG Management Hierarchy. https://www.iema.net/document-download/51806

13 BS EN ISO 14064-1: 2019 Greenhouse gases – Part 1: specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals.

14 IEMA (2014) Position Statement on Climate Change and Energy. Available at: https://www.iema.net/climate-emergency/position-statement



Updated from original IEMA GHG Management Hierarchy, first published in 2009

Figure 3: IEMA GHG Management Hierarchy

- **Offset and remove emissions:** as a complementary strategy to the above, adopt off-site or on-site means to offset and/or sequester GHG emissions to compensate for GHG emissions arising from the project

2.3 Offsetting residual emissions

Multiple terms are used to describe how offsets are used to mitigate residual emissions, and projects may sometimes be promoted as 'carbon neutral' or 'net zero'. It is important that the EIA is clear in defining any terms used. Figure 3 above sets out the position of carbon offsets (referred to as 'Compensate' in Figure 3) in the mitigation hierarchy. There is a distinction between carbon offsets that provide a financial payment to avoid emissions and offsets that remove and sequester atmospheric GHG emissions, and this should be communicated transparently where offsetting is assessed in an ES chapter.

The October 2021 IEMA's Net Zero Explained report[15] summarises the concept of net zero, its origin and science behind the definition. The report also links to alternative sites providing some clarity behind evolving definitions, such as net zero, carbon neutral and zero carbon. The UNFCCC's Race to Zero Lexicon[16] provides the following definitions:

- Net Zero: *"When anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period."* Net zero is achieved where emissions are first reduced in line with a 'science-based' trajectory with any residual emissions neutralised through offsets.
- Carbon Neutral: *"When anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period... irrespective of the time period or magnitude of offsets required."*

15 IEMA (2021) Net Zero explained. Available at: https://s3.eu-west-2.amazonaws.com/iema.net/documents/knowledge/policy/climate-change-energy/Net-Zero-Explained-Oct-2021-4.pdf

16 UNFCCC (2021) Race to Zero Lexicon. Available at: https://racetozero.unfccc.int/wp-content/uploads/2021/04/Race-to-Zero-Lexicon.pdf

- Absolute Zero or Zero Carbon: *"When no GHG emissions are attributed"* to an activity or project without the need for offsets.

After following the mitigation hierarchy, projects can seek to compensate residual emissions by the use of either carbon credits (purchased from credible eligible schemes) or by removals within the organisation or entity itself (e.g. nature based solutions on owned land or land with partners). In order to avoid significant adverse effects, mitigation and compensation (if required) would need to be implemented at a magnitude and in a timescale that is consistent with measures required to achieve a 1.5°C compatible trajectories, as discussed in Section VI on determining significance of effects.

III – Screening

The purpose of screening is to establish whether or not an EIA is required for 'Schedule 2' developments (Schedule 1 developments by definition require an EIA). The EIA Regulations require specific information at the screening stage. This includes the consideration of likely significant effects of the proposed project on the environment, taking into account the following:

- The magnitude and spatial extent of the impact (e.g. the geographical area and size of the population likely to be affected)
- The nature of the impact
- The transboundary nature of the impact
- The intensity and complexity of the impact
- The probability of the impact
- The expected onset, duration, frequency and reversibility of the impact
- The cumulation of the impact with the impact of other existing and/or approved projects
- The possibility of effectively reducing the impact

Applying screening criteria (Schedule 3) will allow a judgement to be made on whether there is potential for likely significant environmental effects to arise which may trigger the need for an EIA. Occasionally, this may apply to only a very limited number of topics, for example in a sensitive location for a relatively small-scale project. Generally, however, where an EIA is required, it is common for there to be several topics that require assessment. As the assessment of most topic areas is well established (e.g. ecology, water, heritage), it is usually clear cut which topics trigger the need for EIA.

Sensitivity of receptor(s)

GHG emissions are not geographically limited. They have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The receptor for GHG emissions is the global atmosphere. The receptor has a high sensitivity, given the severe consequences of global climate change and the cumulative contributions of all GHG emission sources.

It is always good practice to consider whether the effects associated with GHG emissions are likely to be significant enough to trigger an EIA. At the screening stage, proposed mitigation measures that the developer has committed to which aim to avoid or prevent significant adverse effects, may be taken into account when determining whether significant effects are likely to occur.

It should be noted that, as with most environmental topics, there are likely to be only limited cases in which GHG emissions alone are the decisive factor in whether an EIA is needed for a particular project, but in almost all cases GHG emissions are likely to be a relevant factor at the screening stage.

For proposed projects where the need for an EIA has been screened out, it is still important that its GHG emissions are minimised wherever possible, as emissions of any scale contribute cumulatively to global climate change. Undertaking a proportionate assessment of GHG emissions on non-EIA projects is therefore good practice to support decisions that reduce GHG emissions.

IV – Scoping

4.1 Introduction

The scoping process should be used to determine the approach to considering GHGs within the ES. The approach should be proportionate[17] to the proposed project and may, in some cases, not require an ES chapter where it can be justified that GHGs can be addressed within upfront sections of the ES (see further detail in Section V: Methodology, Section VI: Significance and Section VII: Communication/ Reporting). Additionally, ES chapters may differ in scope or assessment detail on a project-by-project basis. The scoping process should therefore consider both the scope of the EIA and the scope of the GHG assessment.

The scoping process should provide an explanation of the likely significant effects of a proposed project. Section VI: Significance sets out the principles in determining likely significant GHG effects which should be reviewed at the scoping stage.

The following should be considered when determining a proportionate approach:

- The type, size, location and temporal scale of the proposed project
- Whether other assessment work has already considered life cycle GHG emissions
- Whether mitigation has already been agreed with the design team, particularly if this is beyond minimum policy requirements
- Whether the proposed project has specific goals or aspirations (e.g. achieving BREEAM certification)

In selecting or developing an approach for an EIA GHG emissions assessment, the aim should be to deliver a robust, proportionate, appropriate and consistent assessment.

During scoping, it is also important to set out in principle the methodological approach that will be taken to assessing project GHG emissions. This means documenting in outline aspects such as baseline setting, assessment approach, how significance will be determined and strategies for mitigation. These are commonly recorded in a project scoping report, and this can form a useful first record of the approach to delivering the GHG emissions assessment. Each of these steps for the EIA are addressed in the following sections, which should be consulted for further detail.

4.2 Stakeholder engagement

Stakeholder engagement is an important part of undertaking an EIA, especially during the scoping stage. It will provide useful information and support the goals of the GHG emissions assessment.

Stakeholder engagement will provide the practitioner better contextual understanding of the project including on key issues, opportunities, constraints and information pertinent to the assessment. Stakeholders will include clients, project developers and statutory consultees who all have an interest and influence on the project.

Depending on the nature of the proposed project, GHG emissions can be discussed during public consultation. Initial consultation with the project team and wider EIA topic specialists may also reveal parallel activities where input from the GHG assessment would be beneficial. For example, clients may wish to report on the sustainability performance of their projects using assessment schemes such as PAS 2080, CEEQUAL and BREEAM. Being able to report on the proposed project's GHG performance will help with such assessments. It may be sensible that a single GHG assessment is carried out which provides evidence for the EIA's GHG scope as well as CEEQUAL or BREEAM assessment requirements. Depending on contractual agreements there are efficiencies to be gained in minimising effort and avoiding duplication of work.

17 IEMA (2017) Delivering Proportional EIA. Available at: https://www.iema.net/resources/reading-room/2017/07/18/delivering-proportionate-eia

Other project management decisions may include the desire to manage the project in an integrated manner, combining 3D models with performance data (including environmental data) such as BIM (Building Information Modelling).

4.3 Benefits and challenges of raising GHG emissions as part of project scoping

By going through the scoping process, the practitioner gains an early and informed understanding of the project's impact and potential sources of GHG emissions. This provides an opportunity to influence and even mitigate GHG emissions early in the design process as well as consider emissions from alternative options.

The challenge at the scoping stage is that there is often limited project information available from the design team at this early stage, resulting in a qualitative-based decision and professional judgement from the practitioner. Nevertheless, by engaging with key stakeholders, the practitioner should be able to define the boundaries of the GHG assessment (see Section 5.3), as well as start to form a view of where the majority of emissions are likely to arise from and appropriate mitigation strategies.

Where the competent authority (e.g. LPA) provides a scoping opinion, the subsequent ES must be 'based on' the expectations set out in the opinion, including any reference to GHG assessment. This underlines the importance of the scoping stage; however, case law has established that the ES can also adapt to development design evolution that occurs post-scoping.

V – GHG emissions assessment methodology

5.1 Introduction

There are many different assessment methods available for measuring and quantifying GHG emissions associated with the built and natural environment. These range from general guidance to formal standards, and many will be appropriate for use in EIA depending on the goals and scope of the assessment required. There is ample GHG quantification guidance in the public domain. However, undertaking an EIA is different to other GHG assessments as the total net impact of the proposed project must be quantified. Therefore, any assessment should follow the principles set out below (see Section 5.2). A list of relevant methods can be found in Appendix B.

Given the wide variation of working situations and the particular aims and objectives of the EIA process, this guidance does not recommend a particular approach. Rather, it sets out advice for the key common components necessary for undertaking a GHG emissions assessment. This guidance does, however, outline a framework of six steps that an assessment should incorporate, which are set out in Section 5.3.

5.2 GHG quantification principles

- GHG quantification within EIA should follow the principles outlined in key documents such as the GHG Protocol Corporate Standard, BS EN ISO 14064-2 or PAS 2080 (see Appendix B) – Relevance, Completeness, Consistency, Transparency and Accuracy
- The assessment should seek to quantify the difference in GHG emissions between the proposed project and the baseline scenario (the alternative project/solution in place of the proposed project). Assessment results should reflect the difference in whole life net GHG emissions between the two options
- The assessment must include all material emissions (defined by magnitude, see Section 5.3, Step 3 *for the exclusion threshold*), direct or indirect (based on the point above), during the whole life of the proposed project. The boundary of the assessment should be clearly defined, in alignment with best practice
- The assessment should seek to present a reasonable worst case
- Any exclusions, limitations, assumptions and uncertainties should be justified and reported where appropriate

5.3 Six Steps of GHG emissions assessment

In developing the approach, the aim should be to deliver a robust, proportionate, appropriate and consistent assessment. The following six steps outline the framework a GHG emissions assessment should incorporate:

1. Set the scope and boundaries of the GHG assessment
2. Develop the baseline
3. Decide upon the emissions calculation methodologies
4. Data collection
5. Calculate/determine the GHG emissions inventory
6. Consider mitigation opportunities and repeat steps 4 & 5

The following sections explore these aspects in more detail. The contextualisation of emissions and determination of significance is addressed in Section VI: Significance.

Step 1: Set the scope and boundaries of the GHG assessment

In the first instance the assessment should set out the rationale for the assessment and its scope, as well as provide background and context. This will normally incorporate a description of the proposed project, its purpose and activities, the system boundary to apply and life cycle stages scoped in and out (including justification) of the assessment.

System boundaries

All material existing sources and removals of GHG emissions prior to project construction and operation (i.e. without the project) should be identified and clearly described.

EIAs should use data that is consistent with and report using the modular approach (Figure 4). A detailed and complete GHG emissions assessment typically covers all life cycle modules.

As projects vary in size, so does the scale of GHG assessments in the spirit of delivering proportionate EIAs. Certain life cycle modules (or stages) can be excluded if these exclusions are clearly highlighted and justified by the practitioner using professional judgement and in accordance with the materiality and cut-off guidance.

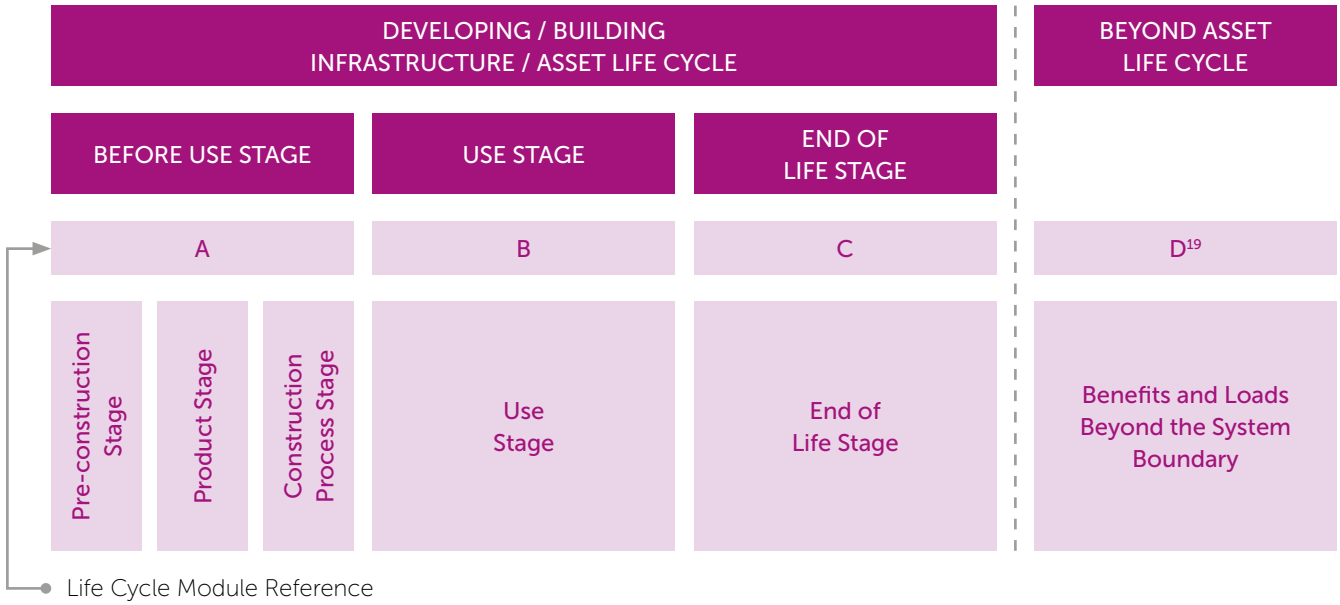


Figure 4: Modular approach of life cycle stages and modules for EIA GHG emissions assessment; the module references are widely used in construction GHG emissions assessment and reduction activities. The figure provides a simplified presentation of the modular approach that can be used for boundary definition and the gathering and reporting of information associated with the assessment. A more detailed presentation of this structure can be found in PAS 2080 and BS EN 15978[20].

18 'For clarity, Module D in Figure 4 (Benefits and Loads Beyond the System Boundary) refers to wider impacts that may not be appropriate to attribute (in part or whole) to the project when calculating net impacts within the study boundary but are nevertheless relevant context to consider. Examples include the benefits of a project sending waste materials for recycling rather than disposal (which is properly attributed to the user of recycled products, but still relevant to acknowledge) or where a major project such as an airport or rail line might affect regional or national travel patterns and emissions (properly attributable to a wider group of transport users, but relevant to acknowledge in the project context).'

19 BS EN 15978:2011 Sustainability of construction works, Assessment of environmental performance of buildings, Calculation method

Temporal boundaries

A reference study period shall be chosen as the basis for the GHG emissions assessment, and this should be based on the expected service life of the construction asset. Additional assistance is available in ISO 15686-1[20], RICS Whole life Carbon Assessment[21] and TAG GHG Assessment guidance[22].

Step 2: Develop the baseline

A baseline is a reference point against which the impact of a new project can be compared against; sometimes referred to as 'business as usual' (BaU) where assumptions are made on current or future GHG emissions. Baseline can take the form of:

A. GHG emissions within the boundary of the GHG quantification but without the proposed project; or

B. GHG emissions arising from an alternative project design and/or BaU for a project of this type.

The ultimate goal of establishing a baseline is being able to assess and report the net GHG impact of the proposed project.

Current baseline

The current baseline represents existing GHG emissions from the assessment prior to construction and operation of the project under consideration. This may include emissions from existing projects (e.g. energy consumption from a building which is scheduled for refurbishment, demolition or replacement) and infrastructure (e.g. current operational and end-user emissions of a road due to be upgraded).

Depending on the nature of the project, in addition to the project baseline, it may also be necessary to establish a sectoral baseline. For example, baseline emissions from BaU power generation would also be important to consider due to the interconnected nature of the electricity grid. This will equally apply to other project types that have wider interlinkages beyond a site level, e.g. many transport, industrial and waste projects.

It may not always be possible to report on current baseline emissions, particularly with projects situated in areas with no physical development or activity. In this instance there would be zero GHG emissions to report at a site level, although particular attention should be paid where changes in land use are expected. For example, land use and land-use change such as woodland creation can sequester carbon over their lifetime and therefore contribute to climate change mitigation. Their disturbance or removal through construction will release previously sequestered GHG emissions.

20 ISO 15686-1:2011Buildings and constructed assets — Service life planning — Part 1: General principles and framework

21 RICS (2021) Whole Life Carbon Assessment for the Built Environment, 1st edition. Available at: https://www.rics.org/uk/upholding-professional-standards/sector-standards/building-surveying/whole-life-carbon-assessment-for-the-built-environment

22 Department for Transport (2021) TAG unit A3 environmental impact appraisal. Available at: https://www.gov.uk/government/publications/tag-unit-a3-environmental-impact-appraisal

Future baseline

Future baseline should capture both operational[23] and user[24] GHG emissions irrespective of their source (i.e. direct and indirect emissions). The distinction between operational and user GHG emissions is important. For example, an existing motorway will have operational emissions (i.e. lighting, maintenance, upgrades) as well as user emissions associated with vehicles travelling along the route. Current baseline travel patterns should be assessed as projected change (e.g. changes in mode share, increased efficiency in vehicles and trip numbers). With regards to energy supply and demand (e.g. electricity use in a commercial building), future baseline should report on operational GHG emissions and how these may change over time (e.g. based on occupancy changes, UK grid decarbonisation projection scenarios or the adoption of renewables).

Box 2 lists potential sources of information which can be considered when establishing future baseline emissions.

Box 2: Potential sources of information on GHG and energy projections (see Appendix A for further details)

- Modelled or projected future scenarios and pathways to net zero published by authoritative bodies such as the CCC[25]
- The Department for Business, Energy & Industrial Strategy (previously DECC)[26]
- The Department for Transport (DfT) TAG (the Transport Analysis Guidance) – Data Book[27]
- BEIS Electricity emissions to 2100 factor projections[28]
- GHG emissions from the operation of existing buildings can be estimated using published benchmarks (e.g. CIBSE Guide F – Energy Efficiency in Buildings (2012) or BSRIA Rules of Thumb Guidelines for Building Services (5th Edition, 2011)) where primary data such as annual metered energy consumption is not available
- GHG emissions associated with other sources or activities such as playing fields may be harder to estimate. It may be appropriate to assume zero baseline GHG emissions in such cases to ensure a reasonable worse-case approach to establishing the net GHG effect of the project. It could in such cases be important to also quantify (estimate) emissions release from the land used change and soil disturbance

23 PAS 2080:2016 Carbon Management in Infrastructure defines operational carbon as GHG emissions associated with the operation of infrastructure required to enable it to operate and deliver its service

24 PAS 2080:2016 Carbon Management in Infrastructure defines user carbon as GHG emissions associated with Users' utilisation of infrastructure and the service it provides during operation

25 Climate Change Committee (2020) The Sixth Carbon Budget. Available at: https://www.theccc.org.uk/publication/sixth-carbon-budget

26 The Department for Business, Energy & Industrial Strategy. Available at: https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy

27 The Department for Transport (2021) Transport Analysis Guidance (TAG). Available at: https://www.gov.uk/guidance/transport-analysis-guidance-tag

28 The Department for Business, Energy & Industrial Strategy (2021) Energy and emissions projections – Net Zero Strategy Baseline. Available at: https://www.gov.uk/government/collections/energy-and-emissions-projections

Alternative baselines

Alternative baselines can be used to supplement the analysis and address uncertainty. For example, it may be unclear what baseline to adopt and compare a proposed project against if the site is 'empty' (i.e. the project is not replacing an existing development). For example: different locations, designs or layouts for building developments; or alternative energy generation options in the instance of a wind or solar farm proposal. However, a realistic worse-case baseline should still be used for assigning significance.

In many instances, alternatives may not have been considered by the developer. Ideally, alternatives would have been considered earlier in the project life cycle, and the EIA is viewed as the platform for improving the preferred design. Nevertheless, where alternative baselines were considered, even a qualitative assessment of their GHG impact would be acceptable as part of the overall assessment.

Step 3: Assessment methodology

Once the scope and baseline is set, the calculation method can be agreed along with data collection. The methodology should result in a relevant, complete, consistent, transparent and accurate assessment of the reasonable worst case. In most cases, the assessment should use activity data and emissions factors. However, where possible, it may be preferable to generate bespoke emissions factors (e.g. through mass balance calculations) or use actual monitored data. The methodology chosen should follow best practice guidance, such as the GHG protocol, and it is not the aim of this guidance to provide this.

Inclusions & exclusions

The project boundary should include its spatial extent and life cycle stages relevant to the scope of the assessment.

Activities that do not significantly change the result of the assessment can be excluded where expected emissions are less than 1% of total emissions, and where all such exclusions total a maximum of 5% of total emissions; all exclusions should be clearly stated.

Step 4: Data collection

Project activity data

To calculate GHG emissions of a proposed project it is necessary to gather data on the activities occurring and associated GHG emissions factors. It is important that data for both these aspects, and particularly the activity data, is specific to the proposed project.

Activity data consists of information that defines and describes the size, magnitude and physical nature of the proposed project. It will take many different forms, including material specifications and quantity, energy and water demand, waste generation, transportation distances and modes, and works techniques/ technologies.

GHG emission factors

GHG emission factors are a value for 'GHG emissions per unit of activity'. Examples of this are:

- HGV: kg CO_2e / tonne.km
- UK electricity grid: kg CO_2e / kWh
- Concrete: kg CO_2e / tonne

GHG emission factors vary in their scope and coverage and will be representative of a single process/activity or multiple of these, sometimes incorporating multiple life cycle stages. Care should be taken to select and reference the right factors for the proposed project.

When undertaking a study, it is often necessary to apply multiple GHG factors for the same activity or material particularly when the assessment is studying a life cycle with a long time period. This may be appropriate when future GHG emissions for that activity are expected to

change; this might occur, for example, when accounting for reduced GHG emissions associated with a national electricity grid and the benefit this brings to demand side GHG emissions of using electric trains.

For examples of sources of GHG factors refer to Appendix A.

Data quality

The following aspects, in line with PAS 2080[29], should be considered when collecting assessment data:

- Primary (measured), secondary (estimated) or benchmarks
- Age (age of data, and the period over which they have been collected)
- Geography (the region or country from where the data have originated)
- Technology (whether the data are specific to a particular technology or mix of many)
- Methodology (the approach applied to gather or calculate the data)
- Competency (proficiency of entity that developed the data)

Baseline GHG emissions from the operation of existing buildings can be estimated using published benchmarks (e.g. CIBSE Guide F – Energy Efficiency in Buildings (2012) or BSRIA Rules of Thumb Guidelines for Building Services (5th Edition, 2011)) where primary data (e.g. annual metered energy consumption) is not available.

Baseline GHG emissions associated with other sources or activities such as agricultural fields may be harder to estimate. It may be appropriate to assume zero baseline GHG emissions in such cases to ensure a reasonable worse-case approach to establishing the net GHG effect of project proposals.

Types of data

The type of data used by the practitioner will vary depending on how detailed the project design is. Most assessments are based on design-stage information, hence activity data specific to the project should in theory be available from the engineering and design teams. If this is not the case, an alternative approach would be to fall back on generic or publicly available information that best represents the project and its activities.

Studies undertaken as part of the planning application for the proposed project outside of EIA process can provide a useful source of information for GHG assessments, for example:

- BREEAM Pre-assessment (especially RIBA 2 evidence for Mat 01 Construction Materials LCA)
- Energy Statement
- Whole Life Carbon Assessment (e.g. London Plan)
- Circular Economy Statement (e.g. London Plan)
- Sustainability Statement

Step 5: Calculate GHG emissions inventory

GHG emissions calculation method

Quantification of the GHG emissions for an EIA may be associated with either a measured or calculated approach or a combination of both for the emissions associated with the project. It is expected that in almost all cases a calculated approach for quantifying GHG emissions will be taken because an EIA is completed in advance of supply chain mobilisation and associated construction works.

29 PAS 2080:2016 Carbon Management in Infrastructure.

When undertaking a quantification calculation the formula for determining a GHG emission (or removal value), associated with the construction works, should have the following structure:

GHG emission factor × Activity data = GHG emission or removal

Calculations may be taken at different scales reflecting specific activities, components or elements of construction. Therefore, individual calculations should be summed to form a GHG emissions inventory for the quantification as a whole.

Study uncertainty

Uncertainty can arise from quality of data, study boundaries and period of assessment, and can never be eliminated from a study. Uncertainty should be considered and if it significantly affects the outcome of the study, additional steps should be taken to reduce it and provide confidence in results. As a reminder, a relevant, complete, consistent, transparent and accurate assessment of the reasonable worst case must be undertaken despite uncertainties.

Uncertainty can be considered by:

- Testing upper and lower limits
- Testing for different inclusions and exclusions
- Modifying study period
- RAG (red, amber, green) rating input data based on data quality criteria presented above
- If the scale of uncertainty provides findings that are likely to change any decision based on the data, then it should be appropriately reduced.

Cumulative GHG emissions

The atmospheric concentration of GHGs and resulting effect on climate change is affected by all sources and sinks globally, anthropogenic and otherwise. As GHG emission impacts and resulting effects are global rather than affecting one localised area, the approach to cumulative effects assessment for GHGs differs from that for many EIA topics where only projects within a geographically bounded study area of, for example, 10km would be included.

For example, air pollutant emissions are dispersed and diluted after emission and only the cumulative contributions of other relatively nearby sources contribute materially to the pollutant concentration, and hence effect, at a particular sensitive receptor in the study area. Due to the persistence of GHGs in the atmosphere, that same dispersion effect contributes to the global atmospheric GHG emissions balance. There is no greater local climate change effect from a localised impact of GHG emission sources (or vice versa).

All global cumulative GHG sources are relevant to the effect on climate change, and this should be taken into account in defining the receptor (the atmospheric concentration of GHGs) as being of 'high' sensitivity to further emissions.

Effects of GHG emissions from specific cumulative projects therefore in general should not be individually assessed, as there is no basis for selecting any particular (or more than one) cumulative project that has GHG emissions for assessment over any other.

The contextualisation of GHG emissions, as discussed in Section 6.4, should incorporate by its nature the cumulative contributions of other GHG sources which make up that context. Where the contextualisation is geographically – or sector-bounded (e.g. involves contextualising emissions within a local authority scale carbon budget, or a sector level net zero carbon roadmap), then the consideration of cumulative contributions to that context will be within that boundary.

Step 6: Mitigation opportunities

Once the magnitude of emissions has been determined (as discussed in Section 5.3, Step 4), mitigation measures (as discussed in Section 2) should be proposed. Any mitigation measures that are committed to need to be included within the assessment. This means recollecting new activity data where this has changed due to mitigation measures, and new emissions calculations need to be undertaken. Steps 4 & 5 should be repeated as necessary.

5.4 GHG assessment and proportionality

GHG emissions should be assessed and reported as part of a good practice approach to EIA.

Projects will vary by type and size, and so will GHG emissions. An effective scoping exercise ensures that a balance is struck between the amount of GHG emissions emitted or saved by the project and the effort committed to the actual GHG assessment. For example, if most impacts occur during a project's construction phase and operational impacts are negligible, then the GHG assessment can reflect this. A high-level or qualitative GHG assessment for certain project elements or activities can be carried out as long as it is justified and agreed during the scoping stage with stakeholders. This will help contribute towards delivering a proportionate assessment.

It should also be recognised that qualitative assessments are acceptable, for example: where data is unavailable or where mitigation measures are agreed early in the design phase with design and engineering teams.

VI – Significance

6.1 Introduction

IEMA's 2010 principles on climate change mitigation and EIA identify climate change as one of the defining environmental policy drivers and that action to reduce GHG emissions is essential. Specifically, three overarching principles are particularly relevant in considering the aspect of significance[30]:

1. The GHG emissions from all projects will contribute to climate change, the largest interrelated cumulative environmental effect
2. The consequences of a changing climate have the potential to lead to significant environmental effects on all topics in the EIA Directive (e.g. human health, biodiversity, water, land use, air quality)
3. GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit[31]; as such any GHG emissions or reductions from a project might be considered to be significant[32]

This document builds on those principles as follows:

- When evaluating significance, all new GHG emissions contribute to a negative environmental impact; however, some projects will replace existing development or baseline activity that has a higher GHG profile. The significance of a project's emissions should therefore be based on its net impact over its life time, which may be positive, negative or negligible
- Where GHG emissions cannot be avoided, the goal of the EIA process should be to reduce the project's residual emissions at all stages
- Where GHG emissions remain significant, but cannot be further reduced, approaches to compensate the project's remaining emissions should be considered

The guidance in this document provides further detail of how those principles can be applied, particularly how the net effect of a project and its beneficial or adverse effects can be evaluated in the context of emission reductions on a trajectory towards net zero.

6.2 Background to significance

The goal of the Paris Agreement is to limit global temperature rise to well below 2°C, aiming for 1.5°C, compared with pre-industrial levels, in order to stand a greater chance of avoiding severe adverse effects from climate change.

The UK has set a legally binding GHG reduction target for 2050 with interim five-yearly carbon budgets which define a trajectory towards net zero. The 2050 target (and interim budgets set to date) are, according to the CCC, compatible with the required magnitude and rate of GHG emissions reductions required in the UK to meet the goals of the Paris Agreement, thereby limiting severe adverse effects. Further budgets are set by the devolved administrations in Wales and Scotland, which are also in line with advice from the CCC. Carbon budgets allow for continuing economic activity, including projects in the built environment, in a controlled manner.

To meet the 2050 target and interim budgets, action is required to reduce GHG emissions from all sectors, including projects in the built and natural environment. EIA for any proposed project must therefore give proportionate consideration to whether and how that project will contribute to or jeopardise the achievement of these targets.

30 IEMA (2010) Climate Change Mitigation & EIA. Available at: https://www.iema.net/document-download/33006

31 There is a global GHG emission budget that defines a level of dangerous climate change, and any GHG emission that contributes to exceedance of that budget or threatens efforts to stay within it can be considered as significant.

32 The third principle is related to the IPCC carbon budget definition. The IPCC's Sixth Assessment Report (WG1: The Physical Science Basis, Table SPM.2) indicates that the remaining global carbon budget from 2020 that provides a two-thirds likelihood of not exceeding 1.5°C heating is 400 $GtCO_2$; for an 87% likelihood it is 300 $GtCO_2$.

However, it is important to note that:

(a) The UK's and devolved administrations' GHG targets incorporate a staged set of reductions between the present day and 2045 or 2050, defined by five-yearly carbon budgets. A continuing, but, over time, reduced level of GHG emissions is compatible with national and international climate change commitments. Going above and beyond these commitments and achieving net zero at an earlier date is strongly desirable and a high priority.

(b) The necessary level and rate of GHG emission reductions will be unevenly distributed across different economic sectors, activities and types of projects. Net zero for the UK in 2050 (and in the interim) will include some activities with net negative emissions and some with residual emissions greater than zero.

A key goal of EIA is to inform the decision maker about the relative severity of environmental effects such that they can be weighed in a planning balance. Therefore, it is essential to provide context for the magnitude of GHG emissions reported in the EIA in a way that aids evaluation of these effects by the decision maker.

The crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050[33].

Often a project will cause a change in GHG emissions compared to the baseline which should be assessed, as discussed in Sections 5.3. When setting this impact into context to determine significance, it is important to consider the net zero trajectory in line with the Paris Agreement's 1.5°C pathway[34].

The timing of reductions is critical due to the cumulative effect of GHG emissions in the atmosphere. Achieving net zero or very low emissions by 2025 instead of 2040 would avoid 15 years of cumulative heating.

The specific context for an individual project and the contribution it makes must be established through the professional judgement of an appropriately qualified practitioner, drawing on the available guidance, policy and scientific evidence[35].

The following principles are a guide to determining significance.

6.3 Significance principles and criteria

Figure 5 illustrates how to determine significance depending on the project's whole life GHG emissions and how these align with the UK's net zero compatible trajectory. The following section provides further explanation on the different levels of significance and should be read in conjunction with Figure 5.

33 (or other date as defined in targets for devolved administrations or as may be defined for the UK or specific economic sectors in future).

34 IEMA (2021) Net Zero explained. Available at: https://s3.eu-west-2.amazonaws.com/iema.net/documents/knowledge/policy/climate-change-energy/Net-Zero-Explained-Oct-2021-4.pdf

35 At the time of publication, the applicable evidence is that provided by the IPCC and UNFCCC, supporting the commitments defined in the Paris Agreement, and in the UK that provided by the CCC with regard to GHG budgets and policies that are compatible with the UK's Paris Agreement commitments. Evidence will continue to be developed, for example, through the IPCC's Sixth Assessment Report, future international treaty negotiations and further advice of the CCC or other expert bodies, and the practitioner must evaluate the prevailing evidence at the time.

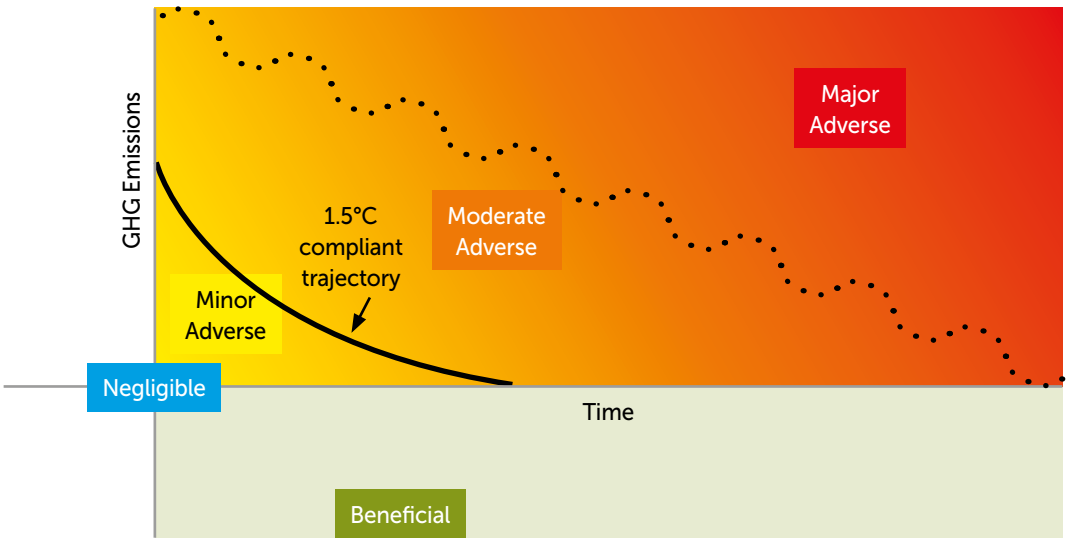


Figure 5: Different levels of significance plotted against the UK's net zero compatible trajectory[36]

A project that follows a 'business-as-usual' or 'do minimum' approach and is not compatible with the UK's net zero trajectory, or accepted aligned practice or area-based transition targets, results in a **significant adverse** effect. It is down to the practitioner to differentiate between the 'level' of significant adverse effects e.g. '**moderate**' or '**major**' adverse effects (see Box 3 for an example of such a differentiation).

A project that is compatible with the budgeted, science-based 1.5°C trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures to achieve that has a **minor adverse** effect that is **not significant**. It may have residual emissions but is doing enough to align with and contribute to the relevant transition scenario, keeping the UK on track towards net zero by 2050 with at least a 78% reduction by 2035[37] and thereby potentially avoiding significant adverse effects.

A project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory, and has minimal residual emissions, is assessed as having a **negligible** effect that is **not significant**. This project is playing a part in achieving the rate of transition required by nationally set policy commitments.

A project that causes GHG emissions to be avoided or removed from the atmosphere has a **beneficial** effect that is **significant**. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect.

36 Ideally, the curve will be quantitative, derived from a set of carbon budgets that show the rate of reduction to be achieved; but where this is not available, it will need to be evaluated qualitatively based on policy goals and advice of expert guidance bodies on the actions needed to achieve the necessary rate of reductions.

37 or other science-based 1.5°C compatible trajectory as may be defined for a specific sector or local area, as applicable

For the avoidance of doubt, a 'minor adverse' or 'negligible' non-significant effect conclusion does not necessarily refer to the *magnitude* of GHG emissions being carbon neutral (i.e. zero on balance) but refers to the likelihood of avoiding severe climate change, aligning project emissions with a science-based 1.5°C compatible trajectory, and achieving net zero by 2050[38]. A project's impact can shift from significant adverse to non-significant effects by incorporating mitigation measures that substantially improve on business-as-usual and meet or exceed the science-based emissions trajectory of ongoing but declining emissions towards net zero.

A 'minor adverse' effect or better is therefore a high bar and indicates exemplary performance where a project meets or exceeds measures to achieve net zero earlier than 2050. However, in the context of the severe threat of climate change, such an effect cannot be judged as significant beneficial – this category is reserved for projects with effects that directly or indirectly remove or avoid GHG emissions in the without-project baseline.

An example of how these principles may be applied in practice is given in Box 3.

Box 3: Examples of significance criteria

For the avoidance of doubt IEMA's position that all emissions contribute to climate change has not changed. This Box 3 provides practitioners with examples of how to distinguish different levels of significance. Major or moderate adverse effects and beneficial effects are **considered to be significant**. Minor adverse and negligible effects are **not considered to be significant.**

Major adverse: the project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.

Moderate adverse: the project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.

Minor adverse: the project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.

Negligible: the project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.

Beneficial: the project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

38 or other date as defined in targets for devolved administrations or as may be defined for the UK or specific economic sectors in future.

A modification to this approach is required for the very largest-scale developments, those that in themselves have magnitudes of GHG emissions that materially affect the UK's or a devolved administration's total carbon budget. An indicative threshold of 5% of the UK or devolved administration carbon budget in the applicable time period is proposed, at which the magnitude of GHG emissions irrespective of any reductions is likely to be significant. A project that meets this threshold can in itself materially affect achievement of the carbon budget.

Practitioners should note that existing policy and regulation may in some cases lag behind the necessary levels of GHG emission reductions (or types of actions to achieve those) that are compatible with the UK's or devolved administrations' targets and with a science-based 1.5°C compatible trajectory towards net zero. Meeting the minimum standards set through existing policy or regulation cannot necessarily be taken as evidence of avoiding a significant adverse effect, and it is recommended that practitioners consider and have reference also to emerging policy/standards and the guidance of expert bodies such as the CCC on necessary policy developments, particularly for multi-phased projects with long timescales. This must be evaluated by the practitioner as part of the evidence base used in the assessment of effects. References to 'existing' and 'emerging' policy in the principles of significance and example criteria above must be interpreted with this in mind.

In following this guidance, the practitioner is contextualising the project to understand whether committed mitigation represents best endeavours, to avoid significant adverse effects in line with the principles and example criteria defined above.

The assessment process for GHG emissions will therefore require a review of the current and emerging policy/regulatory position together with a review of expert scientific advice from bodies such as the CCC or IPCC about where existing policy or regulation is insufficient or not, relative to the science.

It bears reiterating that an ES should inform decision makers about both adverse and beneficial effects, so that all significant effects can be weighed in decisions. Where the fundamental reason for a proposed project is to combat climate change (e.g. a wind farm or carbon capture and storage project) and this beneficial effect drives the project need, then it is likely to be significant.

6.4 Contextualising a project's carbon footprint

The context of a project's carbon footprint determines whether it supports or undermines a trajectory towards net zero. Determining that trajectory and the position of a project within it, however, is the challenge for practitioners.

It is down to the practitioner's professional judgement on how best to contextualise a project's GHG impact.

The UK has a defined national carbon budget and budgets set by devolved administrations which have been determined as being compatible with net zero and international climate commitments. The starting point for context is therefore the percentage contribution to the national or devolved administration carbon budget as advised by the CCC. However, the contribution of most indivdual projects to national-level budgets will be small and so this context will have limited value.

The available contextual information base is rapidly developing and will continue to grow in the coming years as developments such as sector initiatives, locally set carbon budgets and the Task Force on Climate-Related Financial Disclosures (TCFD) and transition risk scenario analysis progress.

Existing government policy will in many cases define goals and necessary action for GHG emissions reduction that is compatible with national climate commitments. However, it is also essential to evaluate this in the context of expert advice/commentary on policy gaps and emerging policy recommendations.

Industry bodies for many sectors crucial to reducing GHG emissions have published analyses, strategies and net zero compatible reduction trajectories for their sectors. This can provide useful and highly specific evidence of what constitutes the necessary type and rate of GHG reduction actions for a particular project type.

For example, the Green Construction Board[39] has calculated carbon budgets for each of the UK built environment sectors. Similarly, the CCC[40] has determined a UK wide carbon budget broken down into the following key sectors: surface transport, buildings, manufacturing and construction, electricity generation, fuel supply, agriculture and land use, land-use change and forestry (LULUCF), aviation, shipping, waste, F-gases, and greenhouse gas removals. Researchers at the Tyndall Centre at the University of Manchester have proposed local authority scale carbon budgets that are compatible with the UK's commitments under the Paris Agreement[41]. Further examples of sectoral strategies and budgets are given in Figure 6 below.

The good practice approach included in Figure 6 below provides an example of how to contextualise your project's carbon footprint against pre-determined carbon budgets or against emerging policy and performance standards where a budget is not available.

Where quantified carbon budgets or a net zero trajectory is lacking, a more qualitative or policy-based approach to contextualising emissions to evaluate significance may be necessary. In these instances, uncertainty and the likelihood of effect should be discussed.

It is good practice to draw on multiple sources of evidence when evaluating the context of GHG emissions associated with a project. The practitioner should be aware that sources of evidence are still emerging, subject to revision as understanding develops and innovation occurs, and in some cases will be contested and conflicted. Professional judgement will therefore be vital in integrating these sources of evidence and evaluating them. Table 1 sets out further sources of contextual information against which the GHG emissions and reduction actions of project can be evaluated.

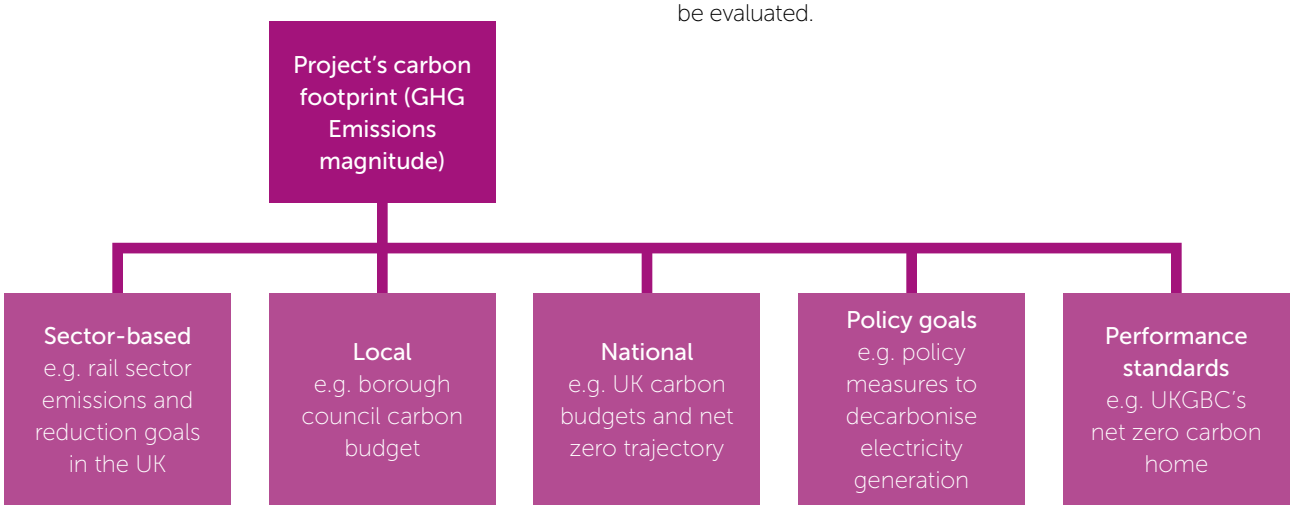


Figure 6: Good practice approaches for contextualising a project's GHG emissions

39 The Green Construction Board (2015) Green Construction Board Low Carbon Routemap for the Built Environment. Available at: http://www.hwa.uk.com/site/wp-content/uploads/2020/10/CD-17.13-Low-Carbon-Routemap-for-the-Built-Environment-Technical-Report-Green-Construction-Board-2015.pdf

40 Climate Change Committee (2020) The Sixth Carbon Budget: The UK's path to Net Zero. Available at: https://www.theccc.org.uk/publication/sixth-carbon-budget

41 Tyndall Centre for Climate Change Research (2022) Quantifying the implications of the United Nations Paris Agreement for local areas. Available at https://carbonbudget.manchester.ac.uk

Table 1: Sources of contextual information against which projects can be evaluated.

Context	Advantages	Limitations
National or devolved administration carbon budget and NDC	• Clearly defined and based on robust scientific evidence	• Too high level for most individual projects
Local or regional carbon budgets developed by local authorities and researchers (e.g. the Tyndall Centre at the University of Manchester[42])	• A more pertinent scale for individual projects and local decision-making • Will reflect regional factors such as concentration of industry	• Effects of GHG emissions are not geographically circumscribed, so a geographic budget (below a national budget defined based on negotiated NDCs to commitments to a global budget agreed through the UNFCCC) is not very meaningful • Displacing GHG emissions from one local authority or region to another within the UK has no benefit • It's unclear whether emerging local authority or regional budgets will add up coherently to the UK budget
Sectoral budgets or reduction strategies	• These are available for many crucial sectors (e.g. the Energy Transitions Commission[43] presents net zero strategies for a wide range of sectors) • They often contain detailed, staged measures (and several scenarios) for GHG reductions with interim targets, providing a clearly defined trajectory	• There is a risk that some sectoral strategies represent a lobbying position rather than science-based target setting
Current and future GHG emissions intensity of an activity	• This provides useful context in cases where a project is meeting an established demand, such as for electricity generation, and may have a GHG benefit by displacing a legacy source (e.g. renewable generators displacing gas-fired baseload)	• This would not be applicable context for absolute emissions changes, (e.g. construction emissions or land-use change at a site level), so would need to be combined with other sources of information
Existing and emerging national and local policy or regulation	• This is extensive, providing context for all development types • It will often provide relatively detailed and specific goals and implementation measures • Policy should be compatible with the UK's national GHG commitments and actions to achieve those	• There can be significant policy gaps or policy lag • It will not always be clear that compliance with policy measures, or a subset of them, amounts to a net zero carbon compatible trajectory
Expert advice of guidance bodies Voluntary performance standards (e.g. the UK Green Building Council's 'Net Zero Carbon Building' framework[44])	• Extensive publications and strategies are available, providing context for all development types • Considerable reliance can be placed on the advice of the CCC, which has the statutory duty of advising the government on policy that is necessary to achieve national climate commitments • Expert advice of guidance bodies can identify existing policy/regulatory gaps • Expert advice of guidance bodies can be used as a source to define what constitutes achievable best practice for many development types • Voluntary performance standards provide a framework for evaluating what constitutes best practice for emissions performance, and the means to predict and then monitor this	• Guidance and advice may be contested or conflicting • There is a risk that some guidance represents a lobbying position rather than science-based GHG reductions
Company-specific TCFD reporting, transition risk assessments or Science-Based Targets	• This can provide context that is highly specific to the project in question, where the developer has already set science-based targets and/or undertaken climate risk assessments with scenario analysis that includes a best practice measures / minimum climate risk scenario	• This may not be available for the majority of projects

42 Tyndall Centre for Climate Change Research (2022) Quantifying the implications of the United Nations Paris Agreement for local areas. Available at: https://carbonbudget.manchester.ac.uk

43 Energy Transitions Commission (2022) A global coalition of leaders from across the energy landscape committed to achieving net zero emissions by mid-century. Available at: https://www.energy-transitions.org

44 UKGBC (2019) Net Zero Carbon Buildings: A Framework Definition. Available at: https://ukgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2019/04/05150856/Net-Zero-Carbon-Buildings-A-framework-definition.pdf

6.5 Embedded or committed mitigation

When determining significance, any embedded/committed mitigation measures that form part of the design should be considered.

It is valuable and strongly encouraged for GHG emissions mitigation to be considered and embedded at the earliest stages of design, where the greatest influence can be achieved, as discussed in Section II and in IEMA's 'Pathways to Net Zero: GHG Management Hierarchy' guidance[45].

Where embedded/committed mitigation is relied upon in the assessment of effects, the practitioner must form a clear judgement that this mitigation is:

1. Evidenced in the design for the project
2. A committed goal that is secured, e.g. forming part of the description of development, a specific planning condition/requirement, or a legal agreement
3. Realistic and achievable to deliver

In some cases, mitigation commitments (especially in the form of targets or commitments to actions at a later design stage) may not offer sufficient certainty at the time of undertaking the assessment that the practitioner can rely upon in judging the significance of effects.

In this case, the significance of effects should initially be stated without this mitigation, and it should then fall into the assessment of additional mitigation and residual effects.

6.6 Additional mitigation and residual effects

Where the initial assessment identifies significant adverse effects, additional mitigation should be considered to reduce these effects to an acceptable and non-significant level where feasible.

As a matter of good practice, available mitigation to reduce non-significant effects or further enhance beneficial effects should also be considered where possible.

As noted above, where there is embedded mitigation in the form of project commitments to GHG emission reductions but the details of this are not secured within the project design at the time of assessment, further detail of the potential mitigation measures to achieve that commitment can also be considered within the additional mitigation section and assessment of residual effects.

The assessment of potential residual effects, with incorporation of additional mitigation, must be expressed in conditional terms. The residual effects would depend on the additional mitigation recommendations being accepted, secured and delivered in practice. An example of appropriate wording would be:

"Residual effects: with the implementation of [the additional mitigation measures as set out above] and the achievement of [measurable GHG emissions goal] the residual effect could be [reduced to not significant / negligible / beneficial]".

45 IEMA (2020) Pathways to Net Zero: Using the IEMA GHG Management Hierarchy November 2020. Available at: https://www.iema.net/resources/reading-room/2020/11/26/pathways-to-net-zero-using-the-iema-ghg-management-hierarchy-november-2020

VII – Communication / Reporting

When reporting on GHG emissions assessment in EIA, the text should conform to Schedule 4: Information for inclusion in environmental statements, of the EIA Regulations document.

7.1 Where should GHG emissions be reported within an ES chapter?

There are three main ways in which GHG emissions can be reported on within an ES chapter. These are as follows:

- Within a GHG emissions ES chapter that focuses on the effects of the proposed project on climate change only
- Within an integrated climate change ES chapter that focuses on both the effects of the proposed development on climate change and of the effects of climate change on the proposed development (i.e. climate change resilience and adaptation)
- It may be proportionate for a section in the project description or an appendix to provide information on GHG emissions to support a conclusion about whether these are significant, without a full ES chapter

Regardless of where GHG emissions are reported within the ES chapter, it is crucial that the assessment is transparent and a conclusion on the significance of effects is reached and clearly stated.

7.2 How does reporting on GHG emissions fit with related EIA topics?

The effects of potential future climate change based on the net GHG impact from a project are likely to be interrelated with other key EIA topics. To ensure consistency is provided throughout the ES, the GHG team will need to liaise with other key EIA topics including (but not limited to):

- Logistics/Transport (Transport Assessment)
- Resources and waste management (construction and demolition)
- Noise/vibration and air quality (construction activities, hours of work, fuel uses, list of plant and energy use)
- Ecology, landscaping and Sustainable Urban Drainage Systems (green infrastructure and land-use change)

7.3 What should be included when reporting on GHG emissions within an ES chapter?

Consistent reporting of GHG emissions in EIA will highlight the importance of accounting for GHG emissions from project inception. It will encourage clients, project developers and engineering design teams to consider the impacts of GHG emissions during early design stages. It is suggested that a brief introduction to climate change and the role of GHG emissions as a contributing factor is included where the effects of GHG emissions are reported within the ES chapter. This will help explain the interrelationship between GHG emissions and climate change with other relevant topics to the readers. This may further be supported with relevant links to documents and information on the topic.

When reporting on GHG emissions and mitigation in EIA, the following steps should be presented where available:

- Baseline emissions: the existing and future emissions within the assessment boundary without construction and operation of the project
- Net emissions (Year 1 and lifetime): the direct and indirect emissions of the project during the first year of operation and for the full lifetime of the project expressed as a change compared to the current and/or future baseline
- Significance: a significance value should be assigned to effects based on the criteria set out
- Further mitigation: the GHG reductions that could be achieved through the application of further mitigation (this will be expressed conditionally and may be quantitative or qualitative)
- Residual effects: a new significance value is assigned to effects taking account the further mitigation measures that have been outlined

7.4 What are the challenges associated with reporting on GHG emissions in EIA?

There are a number of challenges, difficulties and opportunities associated with integrating GHG assessment into EIA practice. These challenges and ways to overcome them are presented below:

- The possible effects identified from a GHG emissions assessment can be interlinked with other EIA topic chapters. Therefore, it is important to liaise with other EIA topic specialists where necessary (e.g. transport, waste management, air quality) – and indeed with practitioners providing assessments such as energy modelling and BREEAM/CEEQUAL. This also needs to be considered when reporting on significant effects within the ES.
- GHG emissions associated with a proposed project are often reported as a whole life figure that takes account of both construction and operation. This whole life approach is often at odds with the sub-headings set out in ES chapter templates provided by EIA co-ordinators. However, due to the nature of GHG emissions, it is good practice to include a section that reports on the whole life GHG emissions associated with the proposed project, alongside the sections that assess construction and operation effects in isolation. Additionally, if there is other data or information that needs to be included that doesn't fit into the provided ES chapter template, then additional sub-sections should be added in order to present all the data from the GHG emissions assessment; to inform the EIA and account for the possible effects on future climate change.
- It is challenging to identify fixed numerical thresholds against which to identify the significance of a proposed project regarding the net change in GHG emissions. The GHG assessment should therefore present context for the GHG emissions as discussed in Section VI: Significance.
- Where GHG assessment is used to inform early design stages, it is vital to get stakeholders to understand the importance of minimising the GHG contribution of a project and designing a project that will limit the net change in future GHG emissions.

Appendix A – Potential Stakeholders and Sources of GHG Information

A1 Potential stakeholders, sources of environmental information and carbon tools

Source	Description
Climate Change Committee (CCC) – The Sixth Carbon Budget[46]	The CCC reports on UK carbon budgets, by sector, and reductions that need to be achieved if the UK is to achieve its carbon reduction target of net zero by 2050. This includes reports for GHG emissions by UK industrial sector: surface transport, buildings, manufacturing and construction, agriculture & LULUCF, aviation, shipping, waste, F-gases and GHG removals. Reports for the UK's electricity and fuel supply are also reported.
The Department for Business, Energy & Industrial Strategy (previously DECC)[47]	The UK Government regularly reports on UK energy and emissions projections by source: agriculture, business, energy supply, industrial processes, land-use change, public, residential, transport and waste management. Currently, GHG emissions reach back to 1990 and project into the future up until 2035 and 2040 (for the 2019 projections).
The Department for Business, Energy & Industrial Strategy (previously DECC)[48] UK greenhouse gas emissions statistics	The UK Government also reports on GHG emissions from a geographical perspective, by UK local authority. Current and historical emissions are available which may be used to establish current baseline emissions.
The Department for Transport (DfT) TAG (the Transport Analysis Guidance) – Data Book[49]	TAG provides UK transport modelling values and information including projections on how the UK's modal mix (diesel, petrol, electric) is expected for change over time, current and future fuel efficiency projections (litres or kWh per kilometre travelled) up to 2050. Also reported are carbon dioxide emissions per litre of fuel burnt or kWh used for: petrol, diesel, gas oil and electricity used on road and rail travel.

46 Climate Change Committee (2020) Sixth Carbon Budget. Available at: https://www.theccc.org.uk/publication/sixth-carbon-budget

47 Department for Business, Energy & Industrial Strategy (2021) Energy and emissions projections. Available at: https://www.gov.uk/government/collections/energy-and-emissions-projections

48 Department for Business, Energy & Industrial Strategy (2018) UK greenhouse gas emissions statistics. Available at: https://www.gov.uk/government/collections/uk-greenhouse-gas-emissions-statistics

49 Department for Transport (2021) TAG data book. Available at: https://www.gov.uk/government/publications/tag-data-book

Source	Description
The Green Construction Board – Infrastructure Carbon Review, Technical Report[50]	The GCB has developed a tool that allows stakeholders to model policy changes associated with the built environment and visualise what this means in terms of GHG emissions. Also available is the Low Carbon Routemap report[51] which explores various GHG emissions projections for both building and infrastructure at the UK level.
Inventory of Carbon and Energy (ICE) – University of Bath: Sustainable Energy Research Team[52]	The Inventory of Carbon and Energy (ICE) database is a leading embodied energy and carbon database for building materials.
The Department for Business, Energy & Industrial Strategy (previously DECC)[53] – Government emission conversion factors for greenhouse gas company reporting	The Government conversion factors for greenhouse gas reporting are suitable for use by UK based organisations of all sizes, and for international organisations reporting on UK operations.
Examples of publicly available carbon assessment tools. The list of carbon tools is non – exhaustive and constantly changing. It is up to the practitioner's professional judgement to decide which tool is most appropriate for the project at hand. It is perfectly appropriate to develop bespoke assessment sheets which may provide more flexibility and transparency.	• Scottish Government Windfarm Carbon Assessment tool[54] • Environment Agency Carbon Planning Tool[55] • RSSB Carbon Tool[56] • National Highways Carbon Tool[57] • MacKay Carbon Calculator[58] • Transport Scotland: Carbon Management System (CMS)

50 The Green Construction Board (2013) Infrastructure Carbon Review Technical Report. Available at: https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2019/06/Infrastructure-Carbon-Review-Technical-Report-25-11-13.pdf

51 Institution of Civil Engineers (nd.) Low Carbon Concrete Routemap. Available at: https://www.ice.org.uk/getattachment/knowledge-and-resources/briefing-sheet/low-carbon-concrete-routemap/low-carbon-concrete-roadmap.pdf.aspx

52 Circular Ecology (2019) Embodied Carbon – The ICE Database. Available at: https://circularecology.com/embodied-carbon-footprint-database.html#.WMO7PYXXLD4

53 Department for Business, Energy & Industrial Strategy (2021) Government conversion factors for company reporting of greenhouse gas emissions. Available at: https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

54 Scottish Government (2018) Carbon calculator for wind farms on Scottish peatlands: factsheet. Available at: https://www.gov.scot/publications/carbon-calculator-for-wind-farms-on-scottish-peatlands-factsheet

55 Environment Agency (2016) Carbon planning tool. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/571707/LIT_7067.pdf

56 RSSB (2021) Rail Carbon Tool. Available at: https://www.rssb.co.uk/sustainability/Rail-Carbon-Tool

57 National Highways (2021) Carbon emissions calculation tool. Available at: https://nationalhighways.co.uk/industry/carbon-emissions-calculation-tool

58 Department for Business, Energy & Industrial Strategy (2020) Carbon calculator. Available at: https://www.gov.uk/guidance/carbon-calculator

Appendix B – List of Standards*

- BRE IMPACT LCA standard – allows the embodied carbon, life cycle environmental (LCA) and life cycle cost (LCC) performance of buildings to be measured and compared in a standardised way.
- BS EN 15686-1:2011 – Buildings and construction assets – service life planning, general principles and framework.
- BS EN 15804:2012 – Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products.
- BS EN 15978:2011 – Sustainability of construction works, Assessment of environmental performance of buildings, Calculation method.
- BS EN ISO 14021:2016 – Environmental labels and declarations. Self-declared environmental claims (Type II environmental labelling).
- BS EN ISO 14025:2006 – Environmental Labels and Declarations. Quantified environmental performance declarations (Type III Environmental Labelling) – guiding principles and procedures.
- BS EN ISO 14044:2006 – Environmental Management. Life cycle assessment. Requirements and guidelines.
- BS EN ISO 14064-1:2018 – guidance on reporting GHG emissions at an organisational level.
- BS EN ISO 14065:2020 – guidance on principles and requirements for bodies performing validation and verification of environmental information statements.
- BS EN ISO 14604-2:2018 – guidance on reporting GHG emissions at the project level.
- ENCORD: the European Network for Construction Companies for Research and Development – a network for active members from the construction industry who have published a 'Construction CO_2e Measurement Protocol'.
- Greater London Authority – draft Whole Life-Cycle Carbon Assessments Guidance.
- PAS 2050:2011 – Specification for the assessment of the life cycle greenhouse gas emissions of goods and services.
- PAS 2070:2013 – Specification for the assessment of greenhouse gas emissions of a city.
- PAS 2080:2016 – Carbon Management in Infrastructure – the world's first standard for managing infrastructure GHG emissions.
- PD CEN ISO/TS 14067:2018 – Greenhouse gases. Carbon footprint of products. Requirements and guidelines for quantification and communication.
- RICS (2021) Whole Life Carbon Assessment for the Built Environment, 1st edition.
- UK Green Building Council – Net Zero Carbon Buildings: A Framework Definition.
- WRI GHG Protocol – the World Resource Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) partnered to develop internationally recognised guidance and standards on GHG accounting and reporting, and includes advice on:
  - Corporate Standards;
  - Corporate Value Chain (Scope 3);
  - Product Life Cycle assessments;
  - Project Protocol (The GHG Protocol for Project Accounting);
  - GHG Protocol for Cities; and
  - Agricultural Guidance.

*Please note this list is not exhaustive, and subject to updates

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