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Examination Principle Issues	• **Climate Change** • **Scope of Development and Environmental Impact Assessment** • **Lack of compliance with recent national legislative and policy changes on Climate Change, especially the Net Zero Strategy**

DfT Consultation 2: 5th September 2022

I am an independent scientist and environmental consultant, working at the intersection of science, policy, and law, particularly relating to ecology and climate change. I work as a consultancy called Climate Emergency Policy and Planning (CEPP). I have a Fellowship from the Foundation for Integrated Transport for research and study entitled "Exposing the flaws in carbon assessment and transport modelling for road schemes".

In so far as the facts in this statement are within my knowledge, they are true. In so far as the facts in this statement are not within my direct knowledge, they are true to the best of my knowledge and belief.

SUMMARY

As background before performing an assessment of the scheme against the Norfolk Local Transport Plan 4 (LTP4), this response provides an update since Deadline 10 of the examination on the Net Zero Strategy legal case and the CCC 2022 Progress Report. Then reasons why such a local and regional assessment should be done are provided by reference to the NPSNN, the EIA guidance and the IEMA guidance for best EIA practice. Then comments are made on the applicant's refusal to make an assessment against the LTP4 despite being asked to do by the DfT in the letter of July 25th.

Before making my assessment against the LTP4, I draw attention to major errors in the traffic modelling on the A47 schemes which need to be resolved before any final assessment can be made, and note the lack of transparency and engagement by the applicant on these matters which has blocked them being resolved much earlier (ie within the examination period). Then I assess the scheme against the LTP4 based on the available data from the applicant's Environmental Statement.

My assessment, in section 9, shows the A47THI is not compatible with the LTP4, and breaches it significantly. For example, if the A47THI is built and operated, then no remaining LTP4 IP budget available for any other part of the Norfolk transport network after 2032, and on an analysis scaled to the A47THI study area, 314% of the scaled LTP4 IP carbon target is used by the A47THI in 2037.

These impacts of the scheme pose a significant risk to the delivery of the national 6th carbon budget, and to delivery of the Climate Change Act. These impacts, increases in carbon emissions resulting from the proposed scheme, are so significant that they would have a material impact on the ability of
Government to meet its carbon reduction targets. **Therefore under NPSNN 5.18, the scheme should be refused consent.**

Contents

1 INTRODUCTION

1.1 Response to consultation, 5th September 2022

1 The Secretary of State (SoS) issued a first consultation letter on 25th July 2022, and item 1 was:

> ***"1 Climate Change***
>
> *The Secretary of State notes the Norfolk Local Transport Plan 4 ("the Plan") is due to be adopted in July 2022. In anticipation that is it adopted, the Secretary of State invites the Applicant to provide an assessment against the carbon targets contained within the Plan.*
>
> *The Secretary of State also requests that Norfolk County Council confirm if the Plan has been adopted, and if not when it is expected to be adopted."*

2 National Highways responded with "9.36 Applicant's Response to the Secretary of State's Request for Comments" which included a refusal to carry out the requested assessment against the carbon targets contained within the Plan.

3 I respond now to National Highways' response, and where relevant its previous submissions, and provide an assessment of the scheme against the LTP4.

4 My previous submission was at Deadline 10 in the examination [REP10-011] on March 18th 2022.

1.2 Scope

5 I refer to these documents from the PINS website for this scheme and other schemes:

Reference in document	
A47THI/NH_CONS1_9.36	National Highway's response to the SoS' first consultation letter of 25th July 2022
A47THI/APP-125	"7.1 Case for the Scheme"
A47THI/REP3-006	ES Chapter 14

1.3 Acronyms

AST	Appraisal Summary Table
EFT	Emissions Factor Toolkit
NDC	Nationally Determined Contribution
NPSNN	National Policy Statement for National Networks
NZS	Net Zero Strategy
TDP	Transport Decarbonisation Plan
LTP4 (Strategy)	The Local Transport Plan 4 adopted in part in November 2021 by Norfolk County Council (NCC)
LTP4 IP	The Local Transport Plan Implementation Plan adopted by NCC on July 19th 2022, and containing local transport carbon reduction targets
NWL	Norwich Western Link
LSB	Long Stratton Bypass
A47BNB	A47 Blofield to North Burlingham
A47NTE	A47 North Tuddenham to Easton
A47THI	This scheme. A47 - A11 Thickthorn Junction

1.4 Definitions

6 For scientific precision, I use the following additional definitions:

- **Absolute emissions** – *carbon emissions which are expressed in terms of **an absolute quantity** of emissions. The value of the absolute emissions, as released into the atmosphere, quantifies the real measure of the impact of greenhouse gases as an environmental factor (or receptor).*

- **Differential emissions** – *carbon emissions, with an associated value which has been **derived by differentiation of absolute emissions**. The differentiation is usually performed by the difference between two traffic scenarios, one with a transport intervention and one without. Differential values derived this way do not quantify the real impact of atmospheric greenhouse gases by the transport intervention within its transport system, and therefore do not represent the real global heating impact.*

2 UPDATE SINCE DEADLINE 10 (March 18th 2022)

2.1 Net Zero Strategy legal case

7 On July 18th 2022, the High Court issued a judgement[1] and an Order[2] in the legal case on the Net Zero Strategy against the Defendant, the Secretary of State for Business, Energy and Industrial Strategy (BEIS). Paragraphs 3 and 4 of the Court's Order are reproduced below:

> 3. In determining that the proposals and policies set out in the Net Zero Strategy will enable carbon budgets set under the Climate Change Act 2008 ("the Act") to be met, the Defendant failed to comply with section 13(1) of the Act by failing to consider (i) the quantitative contributions that individual proposals and policies (or interrelated group of proposals and policies) were expected to make to meeting those carbon budgets; (ii) how the identified c.5% shortfall for meeting the sixth carbon budget would be made up, including the matters set out at [216] of the judgment and (iii) the implications of these matters for risk to delivery of policies in the NSZ and the sixth carbon budget.
>
> 4. The Net Zero Strategy of 19 October 2021 failed to comply with the obligation in section 14(1) of the Act to set out proposals and policies for meeting the carbon budgets for the current and future budgetary periods (i) by failing to include information on the quantitative contributions that individual proposals and policies (or interrelated group of proposals and policies) were expected to make to meeting those carbon budgets and (ii) by failing to address the matters identified in [253] of the judgment.

8 The NZS judgement order highlights that the BEIS minister had not considered several things, especially **the risk to delivery of the policies** in the NZS (and TDP) for meeting the 6th carbon budget, and that he failed to include information of the quantitative contributions that individual proposal and policies were expected to make in meeting the 4th, 5th and 6th carbon budgets. Not knowing each policy's contribution meant he couldn't decide what the risk of non-achievement was, which was an obviously material consideration (Judgement 204). The same applies to the missing information around how the 5% shortfall would be achieved (Judgement 217).

9 The only conclusion is that until the above issues with the NZS are remedied, it is not legitimate to presume that the NZS, or the TDP whose policies are closely linked, will inevitably succeed. Instead, the risks of delivery of these policies were left unknown at publication of the NZS and remain unknown.

10 This judgement is now an obvious material consideration that the SoS must consider for the A47THI scheme. I have previously made submissions to DfT on the relevance of the NZS case to the carbon assessment for the A47NTE scheme. My comments have related both to the applicant's case and to the decision-making process, and apply to the A47THI too, and are summarised below.

[1] May be found at: [redacted]

[2] Published by Good Law Project at: [redacted]

2.2 NZS case implications for Applicant's case

11 The applicant makes reliance on the TDP and the NZS in various places, for example, A47THI/NH_CONS1_9.36 states "*The trajectory within the LTP4 is in line with the upper end of range under the Department for Transport's (DfT) Transport Decarbonisation Plan (TDP).*" Upper end corresponds to the trajectory of least reduction in carbon ie the lowest ambition TDP trajectory.

12 A47THI/NH_CONS1_9.36 also implies that there will be inevitable success in removing "*all emissions from road transport*" for the net zero target date of 2050. However, Government policy to decarbonise road traffic mostly depends on electrification of the entire car, van and HGV fleets. This will take until 2040 and beyond, and in the interim period, expanding road capacity and vehicle journeys will keep generating new emissions drastically in excess of the UK carbon budgets (ie the 4th, 5th, 6th and 7th carbon budgets). Then after 2040, all the TDP policies need to be implemented in full – a very significant assumption- to achieve Net Zero by 2050.

13 As far as the LTP4 in concerned, it is vital to assess road capacity enhancements against LTP4 budgets to understand their significance during the period before 2050; and in particular, their significance in the period to 2037 (the end of the sixth carbon budget). And as far as the NZS and TDP, full 100% implementation should not be presumed as a given – the NZS legal case shows that **the risk to delivery of the policies** in the NZS (and TDP) for meeting the 6th carbon budget are not well understood.

14 Further in its letter to Inspector Shrigley, the ExA, on final day of the examination, March 22nd, the applicant provided an appendix which introduced new figures called a "TDP Sensitivity test". The TDP policies are those in the transport sector for the NZS as TDP Figure 2 and NZS Figure 21 essentially plot the same data. The TDP Sensitivity test presumes that TDP policies will be 100% delivered, each year out to 2037, despite the TDP trajectory clearly not being secured, nor validated, given that the risks of delivering the NZS have not yet been considered.

15 Neither can the applicant rely upon the inevitable success of the TDP or NZS in presuming that the clear additional emissions created by the scheme will be offset up in other parts of the economy or by other geographical areas of the UK. The NZS judgement entirely supports my position, as the risks to inevitable success, or 100% implementation, have not been evaluated.

16 Overall, for all the above reasons, in considering the A47THI scheme, the SoST cannot make a reasoned conclusion, under the EIA Regulation 21(1)(b), on the significant effects of the proposed development on the environment if any presumption is made on the inevitable success of the NZS, and by implication the inevitable delivery of the TDP, NDC and 6th carbon budget, by the applicant in the Environmental Statement or the ExA in the recommendation report.

2.3 NZS case implications for the decision-making process

17 In my consultation response on one of the other Norfolk A47 schemes, the A47NTE, of June 15th 2022, section 3.1 made comments on the recent decision on the M54 to M6 Link Road (decision letter referred to here as M54-M6-DL). In particular, that:

- M54-M6-DL/31 incorrectly relies upon the inevitable success of the NZS (and TDP);
- M54-M6-DL/37 incorrectly relies upon the inevitable success of meeting the UK NDC (which itself depends upon the success of the NZS);
- Negative weight was given to increasing carbon emissions in the planning balance (M54-M6-DL/54); however, this was "offset" by the assertion that the Government could still meet their carbon reduction targets (ie under NPSNN 5.18). However, as above, it is premature to rely on this assertion.

18 The NZS judgement entirely supports my points above. In considering, the A47THI scheme, the SoST cannot make a reasoned conclusion and decision, under the EIA Regulation 21(1)(b), on the significant effects of the proposed development on the environment if he makes any presumption on the inevitable success of the NZS, and by implication the inevitable delivery of the TDP, NDC and 6th carbon budget.

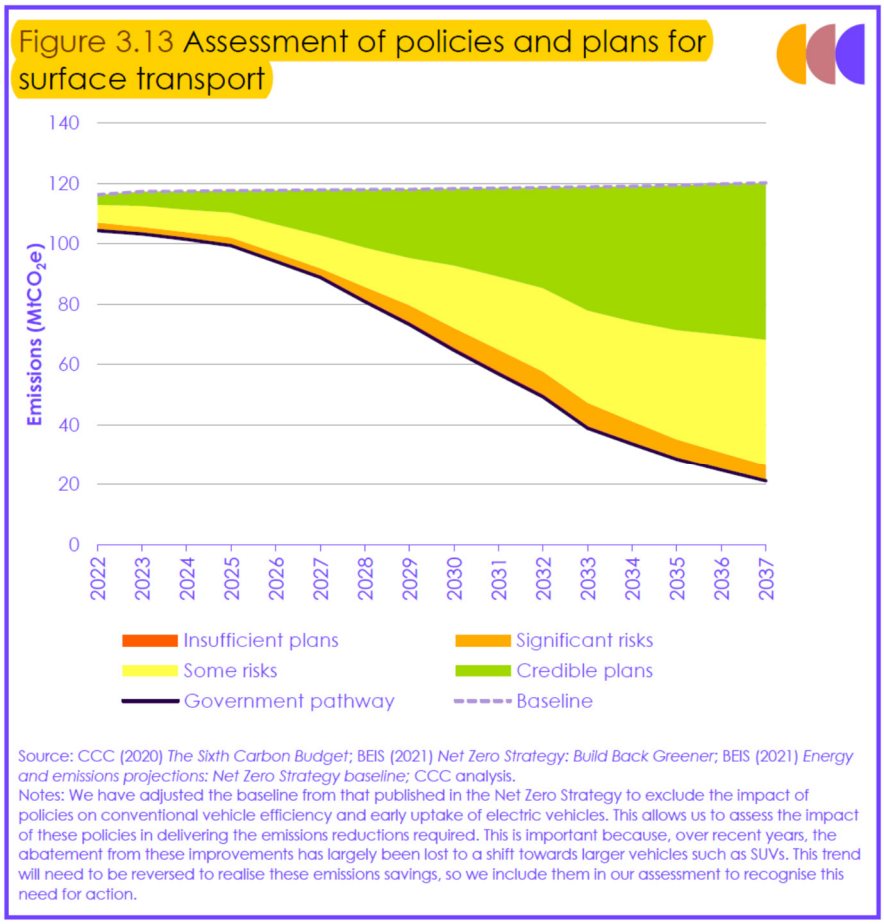
2.4 Climate Change Committee (CCC) Progress Report

19 On 29th June 2022, the Climate Change Committee (CCC) submitted its "Progress in reducing Emissions - 2022 Report to Parliament" (referred to as CCC _2022_PROG[3]).

20 The report finds that overall "credible plans" exist for only 39% of the required emissions reduction to meet the Sixth Carbon Budget (CCC _2022_PROG/page 22). This means that **61% of the required emissions reductions for the 6th carbon budget are not even secured "on paper" yet**.

21 CCC _2022_PROG/Figure 3.13 reproduced below shows the relevant data for "credible plans" and other categories for the surface transport sector.

[3] Climate Change Committee, "2022 Progress Report to Parliament - The CCC's annual assessment of UK progress in reducing emissions",



22 The spreadsheet "Progress in reducing emissions – 2022 Report to Parliament – Charts and data" (referred to as CCC _2022_DATA[4]) provides the breakdown of the data behind Figure 3.13 above from the report. Delivery of the "Government pathway" requires a reduction of 99.03 MtCO2e against the "Baseline" of 120.23 MtCO2e by 2037. CCC identify credible plans for 51.97 MtCO2e of this (ie **only 52.5%** of the total). So in the surface transport sector **about half of the required emissions reductions for the 6th carbon budget are not even secured "on paper" yet**, revealing the true extent of the "delivery gap" in transport decarbonisation policy from the Government's own advisors on climate change delivery.

23 In identifying barriers to closing the delivery gap, the report is clear in identifying that there is currently no vision from the Government for traffic reduction, as it states at page 130 "*However, the Government has not yet set out a clear vision of the extent of traffic reduction that is desirable, nor a coherent set of policies to deliver this.*"

[4] Climate Change Committee, "Progress in reducing emissions – 2022 Report to Parliament – Charts and data", [redacted]

24 On page 139, the report identifies that "*the Scottish Government has committed to reducing overall car mileage by 20% by 2030*" and that "*the Welsh Government has also recently committed to reducing the car miles driven per person by 10% by 2030*". By contrast in England, £24 billion is still allocated for Roads Investment Scheme 2 (RIS2) and "*this still provides considerable funding for new roads* ***which will induce increased demand***".

25 In the section "Recommendations to the DfT" (CCC _2022_PROG/page 571), these recommendations are included:

> *"Set out, through Active Travel England, guidance for* ***what actions local authorities should take to realise the Transport Decarbonisation Plan's commitment to half of all journeys in towns and cities being walked or cycled by 2030****. This should be accompanied by the required funding."*
>
> *"****Set out measurable targets for the contribution that reducing car travel*** *will play in delivering transport's Net Zero pathway."*
>
> *"****Reform the Transport Appraisal Guidance to ensure that it enables practitioners to make decisions that are consistent with the Net Zero pathway****. ****DfT should consider whether a "vision and validate" approach to the future transport system might be more appropriate than a "predict and provide" one in this context****."*

26 These are just some of the recommendations which require solid and quantified plans to start to address the identified delivery gap in the surface transport policies in the NZS and the TDP. **The recommendations from the Government's advisors also make clear that policies to reduce traffic and set measurable targets for it do not exist, and that a new approach to road scheme appraisal is urgently needed.**

27 The CCC 2022 Progress Report is relevant here for several reasons, and my response below on Item 5 of the SoS' letter of June 27th 2022. **First**, because the applicant National Highways has, on other schemes, attempted to rely upon the inevitable success of the NZS (and TDP) policies. It has on the A47THI scheme too. It is premature for weight to be given to any claims based on the notion that the NZS, or the TDP, will inevitably succeed in securing the Government's carbon emissions reduction targets – as above, this applies to both Environmental Statements, and to DCO decisions. Such a proposition is clearly not true or evidenced. Following the CCC Progress Report that SoST cannot assume that this proposition holds with any credibility. **The Secretary of State is required to reach a reasoned conclusion on the significant effects of the proposed development on the environment under Regulation 21 of the 2017 Regulations (the EIA Regulations): he must do so in full consideration of extent to which national policies on climate change, include those of his own department, have been secured or not (as above, the delivery of half the carbon emission reductions of his own policies under the TDP remain unsecured and in doubt).**

28 In fact, the evidence from the CCC Progress Report is much more progress is required in securing the NZS trajectories for surface transport for the Sixth carbon budget and net-zero. **The CCC Progress Report has indeed shown that the success of the NZS and the TDP are by no means secured, and that no weight can be given to the proposition that they are.**

29 **Secondly**, the A47THI traffic model study area contains the urban area of Norwich. So effective decarbonisation of the study area required evidenced policy for reducing traffic and generating modal shift in the urban area. These policies are exactly those highlighted by CCC above in its recommendation as not being developed yet.

30 Further the case for the A47THI is based on expanding capacity to meet unconstrained traffic growth – the exact opposite of the SoS's own TDP policies. It would therefore be irrational, for the SoST to consider that a scheme predicated on promoting traffic growth can be consistent with his departments policies in the TDP for an overall approach that requires a reduction in traffic growth.

3 LOCAL & REGIONAL ASSESSMENT: NPSNN 4.3 & 4.4, "GENERAL PRINCIPLE OF ASSESSMENT"

31 Under NPSNN 4.3 and 4.4, "General Principle of Assessment", it is stated:

> *"4.3 In considering any proposed development, and in particular, when weighing its adverse impacts against its benefits, the Examining Authority and the Secretary of State should take into account:*
> *its potential benefits, including the facilitation of economic development, including job creation, housing and environmental improvement, and any long-term or wider benefits;*
> *its potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.*
>
> *4.4* ***In this context, environmental, safety, social and economic benefits and adverse impacts, should be considered at national, regional and local levels. These may be identified in this NPS, or elsewhere."***

32 Here the NPSNN is requiring that environmental impacts (which include greenhouse gas emissions) should be considered at national, regional and local levels. The targets and budgets which should be considered for local carbon impacts assessment have been identified in the LTP4 but ignored by the applicant in their response to the SoST's consultation letter of July 25th.

33 I now provide other reasons from the best practice guidance for EIA Assessment, as to why carbon emissions should be assessed and contextualised by local and regional assessment as part of good EIA. First, the EIA guidance itself, and then the IEMA guidance.

4 EIA GUIDANCE DOCUMENTS

34 The EU Commission website hosts an official webpage for the EIA Directive[5], which lists several Guidance documents.

35 Following the enactment of the reviewed EU EIA Directive "DIRECTIVE 2014/52/EU" in 2014, three guidance documents were published in 2017 on the screening[6], scoping[7] and EIA report writing[8] stages.

36 Each of these 2017 guidance documents state that they "*aim[s] to help Developers and consultants alike prepare good quality Environmental Impact Assessment Reports and to guide competent authorities and other interested parties as they review the Reports. It focuses on ensuring that the best possible information is made available during decision-making"*.

37 Under "Climate change mitigation: Project impacts on climate change" on page 39 of the EIA report writing guidance, it states:

> *"The assessment should take relevant greenhouse gas reduction targets at the* ***national, regional, and local levels*** *into account, where available. The EIA may also assess the extent to which Projects contribute to these targets through reductions, as well as identify opportunities to reduce emissions through alternative measures."*

38 Whilst for cumulative effects[9] at page 50:

> *"[They] can arise from … the interaction between all of the different Projects in the same area;"*
>
> *"… can occur at different temporal and spatial scales. The spatial scale can* ***be local, regional or global****, while the frequency or temporal scale includes past, present and future impacts on a specific environment or region.*" (my emphasis)

39 The guidance is promoted by the EU and identifies that Competent Authorities reviewing the EIA Report and using the information for decision-making, as one of its target audiences.[10]

[redacted]

[redacted] PDF page 52

[10] See "HOW TO USE THIS GUIDANCE DOCUMENT" section

40 From the same official webpage for the EIA Directive, further 2013 guidance is provided on "*Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment*". This guidance predates the 2014 Directive and was produced during the time of the 2011 EIA Directive "DIRECTIVE 2011/92/EU". The guidance was implemented for the European Commission under Study Contract No 07.0307/2010/580136/ETU/A3 with Members of the Commission Group of EIA/SEA National Experts and staff from three Directorate-Generals of the Commission[11]. It reflects the view of the Commission services of the best EIA practice, including those with transposed national regulations like the UK.

41 Section 4.4.2 of this guidance states:

> *"Judging an impact's magnitude and significance must be context-specific. For an individual project — e.g. a road project —* ***the contribution to GHGs may be insignificant on the global scale, but may well be significant on the local/regional scale, in terms of its contribution to set GHG-reduction targets.****"* (my emphasis)

42 The Applicant claims that the results of its appraisal of differential emissions against national budgets reveals an insignificant effect against national carbon budgets. The guidance rightly suggests that carbon emissions assessed at a local/regional scale may well be significant.

43 I have not been able to find any UK specific guidance relating to the EIA Regs that would provide different advice to the existing guidance on the official EU Commission webpage for the EIA Regs. And in fact, the next section shows how the recent IEMA Guidance does entirely support the EIA Guidance in strongly recommending local and regional carbon assessment. It is rational to apply guidance which was written to "*focus[es] on ensuring that the best possible information is made available during decision-making"* under the EIA Directive within the UK. **Failure to even consider such guidance, as is the case in the applicant's A47THI Environmental Statement, is irrational.**

[11] [redacted] The front-page states "This document benefited from Study Contract No 07.0307/2010/580136/ETU/A3, implemented for the European Commission by

Milieu Ltd, Collingwood Environmental Planning Ltd and Integra Consulting Ltd. The main authors were Jennifer McGuinn and Guillermo Hernandez from Milieu Ltd; Ric Eales, William Sheate and Jonathan Baker from Collingwood Environmental Planning; and Jiri Dusik from Integra Consulting. Maria Partidario of the Technical University of Lisbon and Helen Byron of the Royal Society for the Protection of Birds/Birdlife UK provided advice. Additional contributions about climate change were collected during the JASPERS workshops (March-April 2012). The text was also revised by Jiri Dusik. Members of the Commission Group of EIA/SEA National Experts (in particular, Paolo Boccardi, Susanna Eberhartinger-Tafill, Paul Fortuin, Aurora Hernando Garcinuno, Anna Kieniewicz, Gabrielle McKeown, Koen Maertens, Tadhg O'Mahony, Martine Moris, Kees Van Muiswinkel, Rainer Persidski, Claire Piens, Matthias Sauer, Roel Teeuwen, Adrian Vecino Varela) and staff of the European Commission's Directorate-General for Climate Action (Vaidotas Kuodys, Sami Zeidan), Directorate-General for Humanitarian Aid and Civil Protection (Yordanka Mincheva, Thomas de Lannoy) and Directorate-General for Environment (Stephanos Ampatzis, Szilvia Bosze, Marco Fritz, Milena Novakova and Przemyslaw Oginski) also Contributed"

5 UPDATED IEMA GUIDANCE ASSESSING GREENHOUSE GAS EMISSIONS AND EVALUATING THEIR SIGNIFICANCE

44 Following the examination, in February 2022, IEMA released version 2 of their "Assessing greenhouse gas emissions and evaluating their significance" guidance, supplied at Appendix B. The Institute of Environmental Management & Assessment (IEMA) state that they are the professional home of over 18,000 environment and sustainability professionals from around the globe.

45 The guidance is geared towards best practice in EIA compliance:

> *"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 in statutory and non-statutory Environmental Impact Assessment (EIA)."* [from the Introduction]

46 The IEMA guidance supports several broad issues which I have highlighted as missing in the applicant's Environmental Statement, as follows:

5.1 IEMA: Contextualising a project's carbon footprint

47 In the section above, I lay out how local, national and regional assessment of carbon emissions is supported by the guidance documents to the EIA Regulations. The IEMA guidance provides further support for this. The relevant section in this guide is section 6.4, "Contextualising a project's carbon footprint".

48 With respect to the applicant's Environmental Statement where only an assessment is made against the carbon budget for the entire UK economy, IEMA say:

> *"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 individual projects to national-level budgets will be small and so **this context will have limited value**."* [my emphasis]

49 The guide goes on to state:

> *"**It is good practice to draw on multiple sources of evidence** when evaluating the context of GHG emissions associated with a project."*
>
> And identifies "*local or regional carbon budgets developed by local authorities and researchers (e.g. the Tyndall Centre at the University of Manchester)*" as "***a more pertinent scale for individual projects** and local decision-making*", and reflective of "*regional factors such as concentration of industry*"). [my emphasis]

5.2 Local policies

50 The applicant has only undertaken the "starting point" in the IEMA guidance – assessment against national carbon budgets.

51 Therefore, local policies and carbon budgets should be considered, and assessment of carbon impacts made against them, when they exist. IEMA provide helpful elaboration as below in the diagram clipped below:

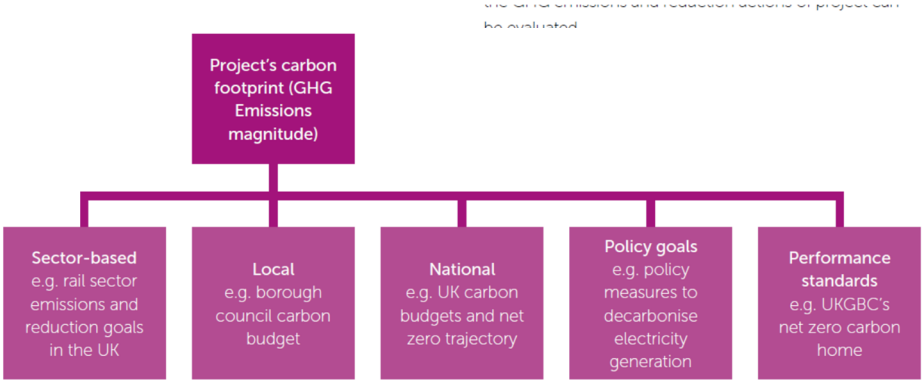


Figure 6: Good practice approaches for contextualising a project's GHG emissions

5.3 Aside on environmental factors under the EIA Regulations

52 At other NSIP DCO examinations (eg: the A57 Links road) the applicant has introduced a confusion in the discussion on local and regional policies and targets.

53 The confusion is between the environment impacts themselves (in this case global GHG emissions) and the measurement of them, and assessment against budgets or thresholds. With GHGs, the environmental receptor is the global atmosphere and there is no local receptor in that sense. Indeed the IEMA guidance makes this clear.

54 However, that does not mean that quantified budgets, targets or thresholds at local and regional levels are not important. As the guidance says, it is good practice to have multiple sources of evidence to contextualise a scheme's carbon footprint, and local or regional carbon budgets provide a more pertinent scale for individual projects. Clearly assessment against local targets and budgets is also more precise – first, numerically, in essence the signal is less "hidden in the noise", and second, that unique local transport characteristics and policies may be considered as part of the assessment process. The applicant has failed to grasp this, and to provide this more precise benchmarking, despite the IEMA guidance on this for EIA practitioners.

6 COMMENTS ON THE APPLICANT'S RESPONSE ON ITEM 1 (25th July consultation)

55 The applicant fails to respond to the SoS' invitation to provide an assessment against the carbon targets contained within the Plan (ie the Local Transport Plan 4).

6.1 Local and regional assessment

56 I have laid out above that local and regional carbon assessment is:

- required by NPSNN 4.4; and
- strongly recommended by the EIA guidance; and
- the IEMA version 2 guidance

57 The applicant has shown repeatedly that it is obstructive and fails to respond to genuine and best effort requests by parties for relevant information. Lamentably, it is, once again, purely uncooperative in refusing the SoST's invitation.

58 The issue of non-compliance with NPNSS 4.4, and the applicant refusal engage with it, goes deeper than the LTP4. As an interested party, I suggested sub-national targets from early in the DCO examination of the scheme. Further, it is beside the point that only 'emerging' rather than adopted or statutory budgets were available at a sub-national level during the examination which the applicant sometimes states. If, as I contend, and IEMA state in their guidance, such an assessment is necessary to understand the true significance of emissions from the development, then it has to be carried out, regardless of whether the budgets were finalised, or have a statutory underpinning or not. The applicant has had ample opportunity to make such an assessment, and was provided genuine pointers and assistance, via submissions, by me on how to do so.

59 At the outset of the examination, **three** different, and readily accessible sets of data existed, and I not only pointed out these data sets, but made indicative assessments against them across the relevant local authority areas of Broadland, Breckland, South Norfolk and Norwich ("BBSNN"). Please see my A47THI/REP1-029, sections 4, 5 and 6 in which a local indicative assessment was made against each of these data sets, and was provided early in the examination period on October 13th 2021. Two of the data sets were based on official Government data: the BEIS local authority carbon emissions data, showing carbon emissions trends across sectors and sub-sectors including road transport since 2005; and national carbon budgets scaled by population and the recent road transport emissions share in the local authority areas. The third dataset was a set of carbon budgets for local authorities to assess scientific compliance with the Paris Agreement, developed by the Tyndall Centre at the University of Manchester under financial support of BEIS.

60 Further NCC indicated in November 2021 that it would provide carbon budgets in its Fourth Local Transport Plan ("LTP4"), the LTP4 budget was thus a near-final one and suitable for the purposes of assessment. It is a significant omission that the applicant never even referred to this emerging set of sub-national carbon targets. The Secretary of

State has now been advised of the local carbon targets in the emerging Local Transport Plan (LTP4), which has now been formally adopted by Norfolk County Council on 19 July 2022, and this provides a **fourth** possible set of sub-national carbon targets for assessment.

61 The applicant makes lame excuses to avoid doing what it has been asked to do. In its submission, it says "*Although LTP4 sets out a non-statutory transport carbon budget, it has not presented a methodology to determine how this would be relevant in decision-making and there are many considerations that will need to be addressed in order for that to be the case, including how transport carbon effects would be taken into account alongside carbon effects in other sectors, the circumstances in which emission increases could be offset by reductions in other sectors and whether the transport carbon budget figures would be relevant in determining what may or may not be a significant impact for either EIA or planning purposes.*" This is a blatant attempt to "blind the SoST with science". The impacts are **quite obvious** as I lay out later in this document.

62 Moreover, the LTP4 targets **do** have a statutory underpinning because Local Transport Plans are required by section 108 Transport Act 2000, and by section108(2ZA)-(2ZB) to take into account Government policy on mitigation of climate change. Given that, and given the stark effect of the A47THI scheme on achieving those targets (as I show later in this document), the impact of the scheme on the LTP4 Implementation Plan carbon budgets amounts to **an obviously material consideration which the SoST must consider**.

63 The impacts are **so significant** that whilst a methodology might be desirable, it is not required to see the obvious truth. Of course, it is an Inconvenient Truth, which is the real reason for the applicant's obstructiveness.

7 MAJOR ERRORS IN TRAFFIC MODELLING ON A47 SCHEMES

7.1 Background: cumulative carbon assessment and requirement for consistent modelling

64 There are 5 major roads schemes planned in the Greater Norwich area for delivery around 2025. These are the Long Stratton bypass, the Norwich Western Link (NWL), and the 3 A47 schemes: A47BNB, A47NTE and A47THI.

65 From my relevant representations onwards, I called for cumulative assessment across three A47 schemes and the NWL (and, for these purposes, put the Long Stratton bypass to one side for the moment). On October 24th 2021, I wrote to each planning examiner requesting that they take this issue seriously [eg A47THI/AS-011] and requesting for cumulative carbon emissions to be considered together for the A47BNB, A47NTE and A47THI examinations. **This was a genuine and best effort to alert the examiners that the Environmental Statement for each scheme was inadequate under Reg 20 of the 2017 Regulations by highlighting missing information, particularly in relation to cumulative assessment of carbon.**

66 The traffic models for the three A47 schemes are all based on the same NATS 2015 model, and each include the three A47 schemes and the NWL in their DS case, **so cumulative assessment should be simple to do.** At each stage, National Highways claimed, falsely, that they were doing cumulative assessment (when in fact they had created a cumulative traffic model, but extracted solus only data from it, which led to only a solus assessment).

67 **However, cumulative assessment is only simple to do if the traffic models are consistent and coherent.** If they are inconsistent, then they need to be made consistent before quantifications of carbon emissions for cumulative assessment can be modelled and calculated. I laid this out in a simple, straightforward way in my letter of October 24th 2021.

7.2 Calibration and inconsistency errors in traffic modelling

68 It should be noted, first, that I have very clearly stated numerous times that the Applicant has not carried out any quantification or assessment of cumulative carbon emissions. I am **not** saying that there has been an "inadequate" cumulative assessment of carbon emissions from the A47THI, **I am saying that there has been no cumulative assessment.**

69 Whilst the principle of doing a cumulative assessment across the four schemes remains true as one way to comply with the 2017 Regulations, there is a serious error in the traffic models, which as above precludes it being done coherently until the errors are corrected.

Key data to show this is presented in Table 1 below: the key data is taken from the Environmental Statement Chapter 14 for each scheme (ie A47BNB/REP2-002; A47NTE/REP3-014; and A47THI/REP3-006).

	Operation emissions ONLY tCO2e	A47BNB	A47NTE	A47THI
A	Baseline (2015)	1,072,458	1,095,563	1,092,213
B	Opening Year (2025) – DM	1,065,487	954,647	961,430
C	Design Year (2040) - DM	978,328	875,102	881,015
D	Whole Appraisal Period (60 years cumulative) - DM	59,396,960	53,142,467	53,504,200[12]
E	**Whole Appraisal Period (60 years cumulative) - DS**	**59,530,297**	**53,651,530**	**53,642,005**
F	Norfolk LTP4 IP 2025	1,591,304	1,591,304	1,591,304
G=B/F	DM 2025 %Norfolk LTP4 IP 2025	66.96%	59.99%	60.42%
H=B/A	DM 2025 / Baseline (2015)	99.35%	87.14%	88.03%

Table 1

70 The traffic model is run over the same 60-year period, 2025-2084, in the same model NATS 2015, and over the same study area (eg: A47THI/APP-125/Figure 4.1 "The extent of the 2015 NATS model"). If the traffic model was configured identically, then it would be reasonable to expect that the DS figures, **row E**, would be identical.

71 The differences between A47NTE and A47THI are relatively small but still suggest some difference in configuration. However, the difference between those two schemes and the A47BNB is large. In Table 1, I have compared the DM 2025 Opening year emissions for each scheme model against the Norfolk LTP4 IP carbon target for that year (the source of the data will be explained in the next section). While the A47NTE and A47THI models, at DM[13], each use approximately 60% of the Norfolk budget for that year, the A47BNB model uses approximately 67% of the Norfolk budget (**row G**) indicating the scale of the inconsistency.

72 The difference for the A47BNB DM 2025 appears to be that its emissions have reduced by less than 1% from the 2015 baseline, whereas A47NTE and A47THI each decrease by around 12% between 2015 and 2025 (**row H**). There would appear to be a serious calibration issue with the A47BNB model.

73 The Applicant must produce traffic models which are consistent and coherent across the three A47 schemes. There is also a requirement more generally for the traffic model for the Norwich Western Link to be made consistent with those on the A47 schemes.

74 In a later main section, I go on to make an assessment of the A47THI scheme model against the LTP4 IP targets, as the DfT SoST requests at Item 5 of his letter. The error reported above casts doubt on the modelling carried out by National Highways. If the applicant can't get data over the same study area in the same model to reconcile, what

[12] Table 14-6 in A47THI/REP3-006 gives this as 53,504,200tCO2e whilst Table 14-10 as 53,504,201tCO2e, a presumed difference in rounding

[13] The DM 2025 figure would not be expected to be identical as each scheme is not included. I would expect the DS 2025 figures to be identical for the same reason as the 60-year DS figures should be identical. However, the DS2025 need calculating which I have done for the A47THI in the next section.

trust can be put in any of its data? It can be seen from row G in Table 1 that the 60-year DS models are considerably out of kilter, where they should produce identical results. This is significant for the LTP4 IP comparison being around a 7% difference in the use of the Norfolk lTP4 IP carbon budget.

7.3 EIA Regulation 14(2) and Schedule 4 (6)

75 **Further, it is now crucial that the applicant is asked to explain these differences between its traffic models on the three schemes, and that the traffic models are corrected, and the SoST holds a further consultation round to enable this.** The schemes, and their environmental issues, cannot be addressed in isolation as the applicant is attempting **in defiance** of the EIA regulations.

76 I am deeply concerned about the lack of transparency regarding the information and data about the traffic models on which the operational carbon emissions assessment is based. Very limited data is provided in the applicant's Chapter 14's. I have had to reverse calculate some of the data in the next section in order just to determine simple information like the 60-year DS trajectory for the A47THI. This is basic information which should have been provided to all parties in the first draft of the Environmental Statement.

77 **This lack of transparency has undermined the examination process on each of the A47 schemes.** That process should ensure that the SoST is satisfied that the material provided by the applicant is sufficient for him to reach a reasoned conclusion on the significant effects of the proposed development on the environment. Carbon emissions are a significant issue in recent DCO decisions, and the applicant has not made, nor engaged, satisfactorily in clarifying the issues involved. This is evidenced by my submissions, and the defensive and unhelpful responses to them by the applicant.

78 This lack of information limits the public's involvement in the EIA process which is important not just to ensure compliance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 ("EIA Regs"), which seek to ensure a process by which the public is given an opportunity to express their opinion on environmental matters (Lord Hoffmann)[14], but also the Aarhus Convention in respect of public participation[15].

79 In short, the public can only participate and give a reasonable opinion on environmental matters if sufficient background data and estimates of environmental effects is provided. The applicant in this case has not done this. In order to comply with the EIA Regs, the further information which I highlight is not only reasonably required to facilitate meaningful public engagement in the examination but to ensure that the SoST is able to satisfy his duties under the EIA Regs.

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[14] (See Berkeley v SSE [2001] 2 AC 603 (section 8 of Lord Hoffmann's speech) and Commission of the European Communities v Federal Republic of Germany (Case C-431/92) at [35])

[15] in particular Article 6 on public participation in decisions on specific activities, sub-paragraph (6) which requires public access to relevant information about a proposed project, including at least a "description of the significant effects of the proposed activity on the environment"

80 The requirements of EIA regulation 14(2) include the information set out in Schedule 4 which states at (6):

> *"**A description of the forecasting methods** or evidence, used to identify and assess the significant effects on the environment, **including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.**"*

81 The error highlighted above where the traffic models deviate so radically between schemes, are a clear example of an uncertainties which appears not to have even been seen by the applicant, let alone addressed and explained to parties.

7.4 Traffic modelling: Three key requests to the SoST

82 I respectfully recommend to the SoST that the current unacceptable situation concerning the Traffic Modelling can be resolved as follows:

> 1 The traffic modelling and its application should be subject to independent assessment (for example, by academics expert in the area) and there should then be further consultation rounds.
>
> 2 Prior to further consultation rounds, a full technical dialogue should be established with the independent assessors, the Applicant, and interested parties to the satisfaction of all parties and in line with professional Codes of Conduct.
>
> 3 Prior to further consultation rounds, a full WebTAG compliant Transport Appraisal, with models which are coherent between the A47THI, the other two A47 schemes, and the NWL scheme, and agreed by the independent assessors should be supplied by the Applicant.

8 LACK OF TRANSPARENCY OF DATA AND COMPUTER MODELLING

83 The Application, Environmental Statement, and the applicant's subsequent submissions contain data on traffic modelling, and calculations of carbon emissions, and assessments.

84 Further the Applicant produced a new data set derived by applying a nationally conglomerated "rate of improvement" based on TDP, Figure 2 (referred to by the applicant as "the TDP Sensitivity test") in a letter to the ExA on March 22nd, the final day of the examination.

85 In all cases, the full details of the assumptions, data and computer modelling underlying this data, and updates and changes to it, has not been provided. Further, the modelling behind TDP, Figure 2 has not been published. Consequently, the nationally conglomerated "rate of improvement" based on it, and as applied to the anticipated data figures from TDP Figure 2 have been applied as a black-box calculation. (More details on this are explained in Appendix A).

86 The lack of transparent information and data about the traffic models from which operational carbon emissions are calculated **places severe limitations on any independent review and scrutiny** of the high-level figures published in the Environmental Statement, and the applicant's anticipated consultation response. It is, therefore, not possible to fully respond to the current consultation, without publication of the full details of the assumptions, data and computer modelling involved.

87 This compounds the issues already laid out for the traffic modelling itself, and my three key requests above, for independent assessment of the traffic modelling.

88 **The applicant must provide the additional information required so that the SoS can, then, hold a further consultation round.**

89 The Government recently announced an "Algorithmic Transparency Standard" at https://www.gov.uk/government/collections/algorithmic-transparency-standard under the Central Digital and Data Office in the Cabinet Office. Under the new approach, government departments and public sector bodies will be required to explain where an algorithm was used, why it was used and whether it achieved its aim. There will also be an obligation to reveal the architecture behind the algorithm. Although, currently being piloted, it indicates the direction of travel for transparency on data, algorithms and modelling architectures. The current presentation of material falls far short of any standard of transparency.

9 ASSESSMENT AGAINST LOCAL TRANSPORT PLAN 4 (LTP4) CARBON TARGETS

9.1 Context in national policy

90 In July 2021, the SoST published the Transport Decarbonisation Pan (TDP) which made the commitment[16] "*we will drive decarbonisation and transport improvements at a local level by making quantifiable carbon reductions a fundamental part of local transport planning and funding*". As part of this, the TDP required:

> *"Going forward, LTPs will also need to set out how local areas will deliver ambitious quantifiable carbon reductions in transport, taking into account the differing transport requirements of different areas. This will need to be in line with carbon budgets and net zero."*

91 On 6 June 2022, the NCC Cabinet resolved to approve and recommend to Full Council that the Local Transport Plan, comprising the Local Transport Plan 4 Strategy (LTP4) and Implementation Plan (LTP4 IP) is adopted in July 2022. The LTP4 (IP) sets annual decarbonisation targets for Norfolk transport between 2019 and 2037 (the end of the Sixth carbon budget) to meet the national policy requirement above of the TDP.

92 The targets and pathways in the LTP4 IP now provide the crucial frame of reference for assessing the significance of the GHG emissions from the A47THI, and allows the assessment, given below, of meeting national carbon targets within the contextualisation of using local carbon budgets and trajectories.

93 Further, the assessment requested by the SoST consultation enables assessment of the A47THI scheme against both local carbon targets, and national policy as the LTP4 IP is part of delivering SoST's own TDP. The local carbon targets are aligned numerically with the NZS and TDP national trajectories as described below.

9.2 The LTP4 IP carbon targets – context within, and alignment with, national policy

94 The LTP4 IP, adopted by Norfolk County Council, provides annual carbon targets for road transport against a baseline of 2019, at "Table: Summary of targets for LTP4"[17].

[16] Transport Decarbonisation Plan, page 151.

[17] This is found on pages 303 to 305 of the Infrastructure and Development Select Committee agenda papers for Wednesday 25 May 2022, downloaded from:

The 2019 baseline figure for Norfolk road emissions is **1,717,709 tCO2e**, and this is derived from the BEIS "2005 to 2019 UK local and regional CO2 emissions" dataset[18].

95 To understand the LTP4 IP carbon targets in the context of wider related national policy (ie the NZS and the TDP), it is necessary to view the spreadsheet[19] given on the NZS webpage, from which the annual targets (reductions from 2019) for each year from 2020 to 2037 may be derived for the domestic transport sector. I have made this calculation in Table 2 below, which shows the reductions in the NZS Figure 21 ("Figure 21: Indicative domestic transport emissions pathway to 2037") and present it below for the upper bound and lower bound figures[20].

Reductions from 2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
NZS (Upper)	-10.79%	-0.41%	-3.52%	-4.74%	-5.89%	-7.36%	-11.37%	-15.37%	-21.67%
NZS (Lower)	-17.09%	-7.93%	-11.45%	-13.16%	-14.72%	-16.52%	-20.85%	-25.18%	-31.73%

(Continued)	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**
NZS (Upper)	-27.64%	-34.51%	-40.80%	-47.42%	-56.26%	-61.00%	-65.58%	-69.09%	-72.20%
NZS (Lower)	-37.94%	-44.97%	-51.43%	-58.22%	-67.21%	-72.12%	-76.86%	-80.54%	-83.89%

Table 2

96 The surface transport decarbonisation targets in the Net Zero Strategy and the Transport Decarbonisation Plan are for all intents and purposes the same, with NZS Figure 21 being a more refined version, but same trajectory, as TDP Figure 2.

97 This then allows the corresponding Norfolk figures to be calculated, as in Table 3 below.

[18] For Norfolk wide in 2019, the "Road Transport (A roads)" figure is 977,100 tCO2e and the Road Transport (Minor roads)" figure is 740,600 tCO2e. There are no motorways in Norfolk. Together these figures make the 1,717,709 tCO2e figure. See: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/996057/2005-19_UK_local_and_regional_CO2_emissions.xlsx

[19] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1066450/nzs-charts-tables-v1.1.xlsx

[20] The data is derived from "Net Zero Strategy: charts and tables (updated 5 April 2022)", tab "3v.Transport", data on rows 43 and 44 compared to cell AG40 (2019 emissions – central estimate).

tCO2e	2019		2025	2026	2027	2028	2029
NZS Lower	0.00%		-7.36%	-11.37%	-15.37%	-21.67%	-27.64%
NZS Central	0.00%		-11.94%	-16.11%	-20.28%	-26.70%	-32.79%
NZS Upper	0.00%		-16.52%	-20.85%	-25.18%	-31.73%	-37.94%
Norfolk_NZS_Lower = LTP4 IP targets Lower	1,717,709		1,591,304	1,522,483	1,453,662	1,345,515	1,242,986
Norfolk_NZS_Central	1,717,709		1,512,651	1,441,022	1,369,392	1,259,138	1,154,503
Norfolk_NZS_Upper	1,717,709		1,433,999	1,359,560	1,285,122	1,172,761	1,066,019

(continued)	2030	2031	2032	2033	2034	2035	2036	2037
NZS Lower	-34.51%	-40.80%	-47.42%	-56.26%	-61.00%	-65.58%	-69.09%	-72.20%
NZS Central	-39.74%	-46.12%	-52.82%	-61.73%	-66.56%	-71.22%	-74.82%	-78.05%
NZS Upper	-44.97%	-51.43%	-58.22%	-67.21%	-72.12%	-76.86%	-80.54%	-83.89%
Norfolk_NZS_Lower = LTP4 IP targets Lower	1,125,008	1,016,861	903,096	751,410	669,949	591,296	530,903	477,532
Norfolk_NZS_Central	1,035,120	925,568	810,399	657,308	574,442	494,386	432,587	377,109
Norfolk_NZS_Upper	945,231	834,276	717,702	563,206	478,936	397,475	334,272	276,687

Table 3

98 The figures in the LTP4 IP correspond to the line "Norfolk_NZS_Lower = LTP4 IP targets Lower" so they align with the lower NZS figures.

99 It should be noted that the Norfolk LTP4 IP carbon targets represents the **lowest possible ambition** for Norfolk's ambition to contributing to delivering the NZS and the TDP. Therefore, even if compliance could be demonstrated for the A47THI with the LTP4 IP targets, there would still need to be greater emissions cuts made in transport by other Transport Authority areas, or by other sectors of the economy to compensate. However, I shall show that the emissions associated with the A47THI considerably exceed the allocations in the table above for the LTP4 IP, so not even Norfolk's lowest possible ambition is achievable if the A47THI were to be consented by the SoST.

9.3 The Applicant's carbon data

100 I now summarise the data from the Applicant from the revised Environmental Chapter 14, issued at Deadline 3 [A47THI/REP3-006]. This revision updated the chapter, and it includes data for the 6th carbon budget period. This summary is provided in Table 4 below.

	4th Carbon Budget			5th Carbon Budget	
tCO2e	**2025**	**2026**	**2027**	**2028**	**2029**
DM	961,431	956,069	950,708	945,348	939,986
DM by CB			**2,868,208**		
DS	962,596	957,323	952,049	946,775	941,500
DS by CB			**2,871,968**		

(continued)				6th Carbon Budget				
tCO2e	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**
DM	934,625	929,264	923,902	918,542	913,181	907,820	902,459	897,097
DM by CB			**4,673,125**					**4,539,099**
DS	936,226	930,953	925,677	920,404	915,131	909,856	904,583	899,306
DS by CB			**4,681,132**					**4,549,279**

Table 4

101 The derivation of the DM[21] and DS[22] trajectories above, are given in the footnotes. The applicant's data in REP3-006/Table 14-10 is reproduced exactly by my calculations.

102 It is also worth noting that the DS is a cumulative figure which includes the two other A47 schemes (ie A47BNB and A47NTE) and the NWL (as described at APP-125/Table 4.3 "DM/DS network assumptions") with the A47THI scheme itself.

103 This is, in contrast, to the differential DS-DM figure(s) which has been used for the **only** assessment that the Applicant has made in its Environmental Statement. (These are the "Difference (DS-DM)" line of figures from REP3-006/Table 14-10 which the applicant compares to the whole economy carbon budgets at REP3-006/14.8.9 for its assessment). I have explained repeatedly this quantification is **solus**, and therefore does **not** give rise to an EIA Regulations compliant cumulative assessment.

104 Use of the cumulative DS trajectory figures against the LTP4 IP carbon budgets enables a cumulative assessment to be made at the local/regional level. By making an assessment of the DS trajectory against the LTP4, **two aspects of assessment which are absent in the applicant's existing Environmental Statement** may be addressed. These are:

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[21] A47THI/REP3-006/Table 14-6 gives the DM emissions at opening year 2025 as 961,430 tCO2e, and at design year 2040 as 881,015 tCO2e. Within a rounding error** of 2tCO2e, this corresponds to trajectory shown with an **annual (linear progression) decrement of 5,361 tCO2e**. After 2040, the DM trajectory flat lines at 881,015 tCO2e to 2084. Using these numbers (and assumptions), the carbon budget totals at the "Baseline (DM)" line at REP3-006/Table 14-10 are reproduced exactly in the "DM by CB" line in Table 4 above, including the figure not shown above for the full 60-year appraisal period of 53,504,201tCO2. ** The rounding errors are due to decimal numbers in the Applicant's traffic model outputs being rounded in Tables 14-6 and 14-10. These rounding differences are not significant.

[22] For the DS trajectory, **the annual decrement is 5,274 tCO2e between 2025 and 2040**. This also precisely reproduces the carbon budget totals from the "Operation DS" line at REP3-006/Table 14-10 in the "DS by CB" line in Table 4. Again, there are some rounding errors (of less than 2tCO2e on each figure) which once accounted for reproduces the applicant's data precisely.

A. Cumulative carbon assessment as required by the EIA Regulations (and by the NPSNN which invokes the EIA Regulations); and

B. Local and regional carbon assessment, which is required by NPSNN 4.4, and also strongly recommended by the EIA guidance, and the IEMA guidance as above.

9.4 Assessment against LTP4 IP at the Norfolk level

105 Figure 1 shows the Applicant's carbon data (DS and DM series as derived above) displayed against the LTP4 IP carbon targets. It can be seen by 2032 that the A47THI scheme, and the other elements in the Applicant's traffic model, use 100% of the annual Norfolk LTP4 IP budget – as indicated by the red ring on the figure.

106 The implication of this is that, at this date, **there is then no remaining annual LTP4 IP budget available for any other part of the Norfolk transport network.** On other words, all traffic would need to come to a stop across the rest of Norfolk for compliance with the LTP4 IP budget to be delivered.

107 This is equally true for both the DM and DS trajectories (the DM line is under the DS line on the graph) indicating that there is a fundamental inconsistency with the road developments, land-based developments, and the traffic growth projection built into the traffic model, and case for the Scheme, and the requirements of the NZS, TDP and LTP4 IP. This is not surprising as APP-125, "7.1 Case for the Scheme" promotes traffic growth in contrast with the overall approach of the TDP and NZS that requires a reduction in traffic growth. The scheme, and its traffic model, work in the opposite direction of the policies in the TDP. It is no surprise, then, that the assessment of the A47THI against the LTP4 IP which is based on TDP and NZS trajectories do not remotely align graphically.

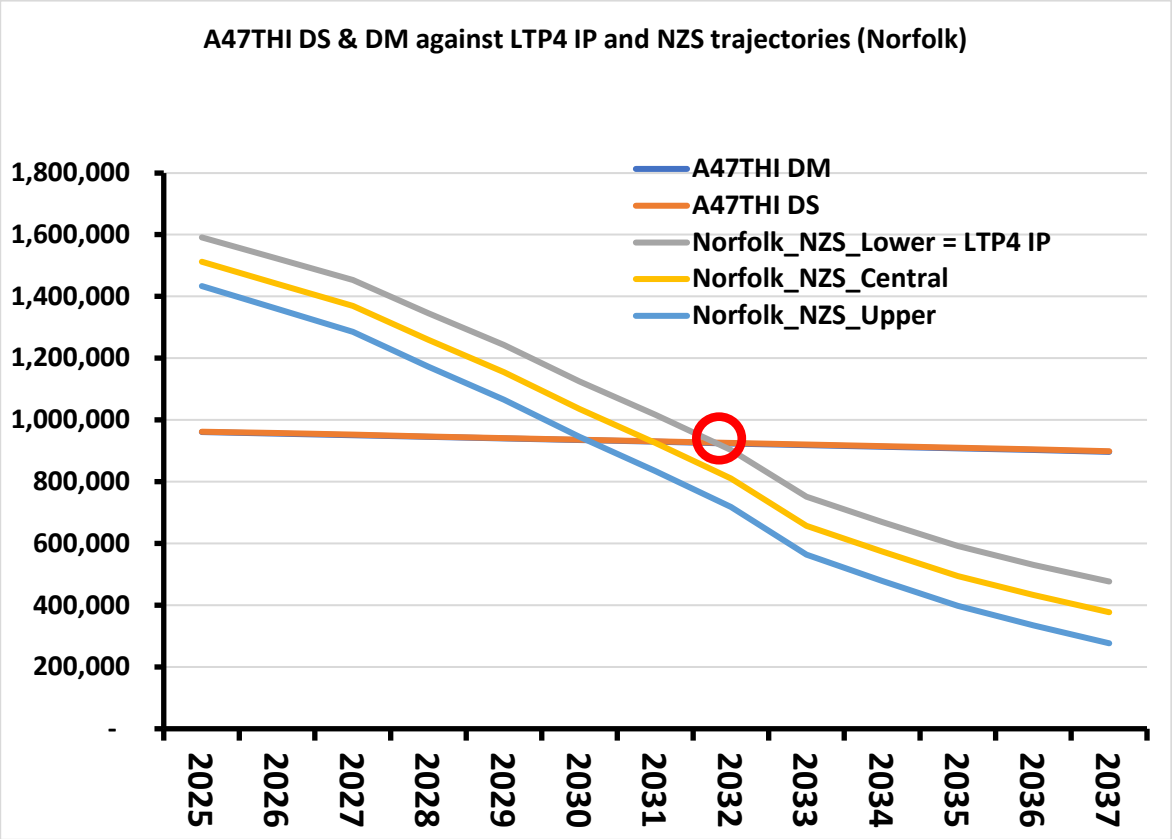

Figure 1

108 Geographically, the extent of the NATS 2015 traffic model being used for the Applicant's carbon data is given at APP-125/Figure 4.1. This is actually a relatively small part of Norfolk with much of North, South and West Norfolk not included within it. The clear finding of this assessment is that **by 2032, these substantive areas have no remaining transport carbon budget**.

109 At each year after 2032, the A47THI scheme requires more than 100% of the LTP4 IP carbon budget for the whole of Norfolk.

9.5 Assessment against LTP4 IP scaled to the A47THI traffic model study area

110 Additional assessment, and contextualisation, may be gained by scaling the data across the NATS 2015 traffic model study area rather than the whole of Norfolk. This may be done by normalising the data to the opening year of the A47THI, 2025. The 2025 DM figure of 961,431 tCO2e for the A47THI study area, as from Table 14-6, may be taken as the 100% reference base for the year 2025 for the study area. This figure is in fact using 60% of the LTP4 IP Norfolk budget in 2025, so it corresponds to 60% of the Norfolk LTP4 IP budget in that year. Then a scaled LTP4 IP trajectory can be generated which is based on this reference starting place at 2025, as in Table 5 below. The full Norfolk LTP4 IP carbon targets are shown at row E below for reference (the ratio of D/E is 60.42% for each year).

A	tCO2e	2025	2026	2027	2028	2029
B	A47THI DM	961,431	956,069	950,708	945,348	939,986
C	A47THI DS	962,596	957,323	952,049	946,775	941,500
D	SCALED LTP4 IP	961,431	919,851	878,271	812,931	750,985
E	Norfolk_NZS_Lower = LTP4 IP	1,591,304	1,522,483	1,453,662	1,345,515	1,242,986

(continued) tCO2e	2030	2031	2032	2033	2034	2035	2036	2037
A47THI DM	934,625	929,264	923,902	918,542	913,181	907,820	902,459	897,097
A47THI DS	936,226	930,953	925,677	920,404	915,131	909,856	904,583	899,306
SCALED LTP4 IP	679,705	614,365	545,631	453,986	404,768	357,248	320,760	288,514
Norfolk_NZS_Lower = LTP4 IP	1,125,008	1,016,861	903,096	751,410	669,949	591,296	530,903	477,532

Table 5

111Rows C and D are now plotted in Figure 2 below.

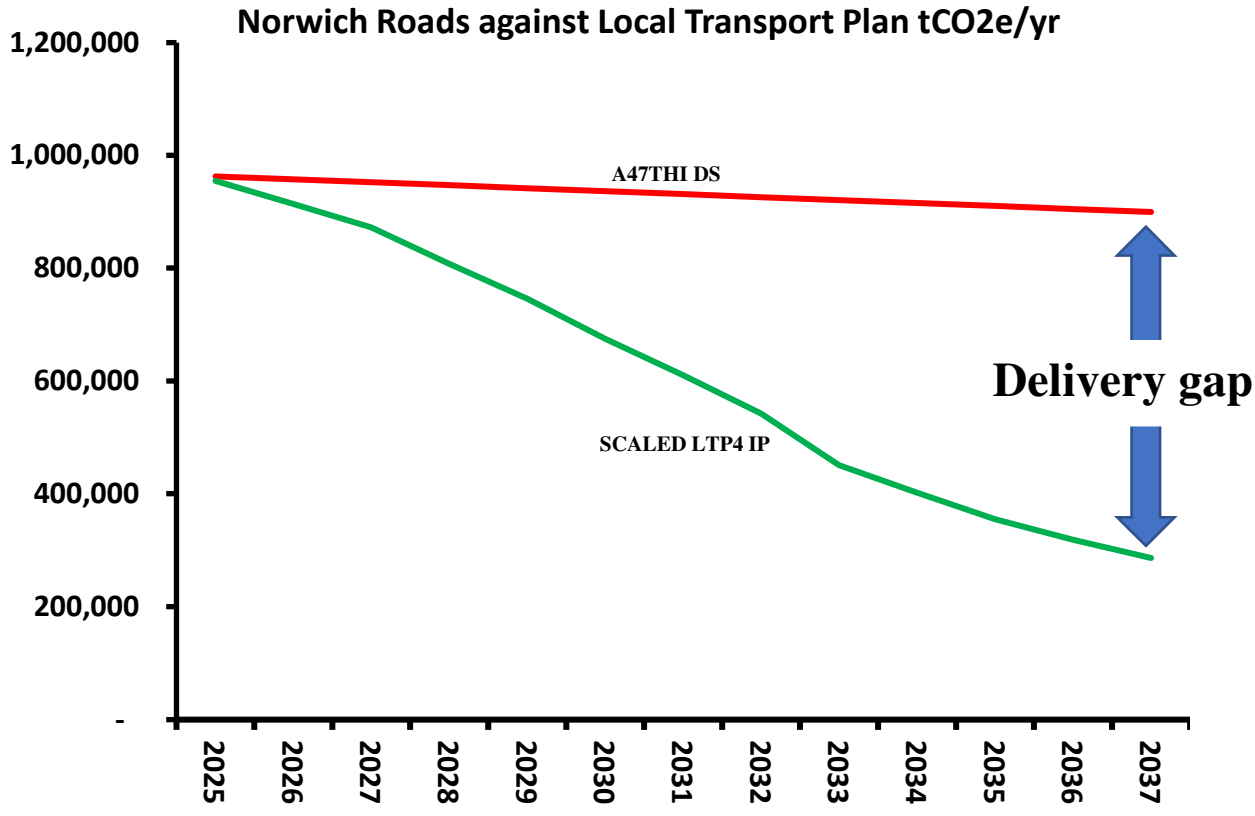

Figure 2

112 By 2037, the A47THI DS uses **314%** of the scaled LTP4 IP carbon target for that year (the scaled LTP4 IP budget for 2037 is 288,514 tCO2e, the DS figure is 899,306 tCO2e, see Table 5). **Neither the carbon emissions associated with the DS, nor the DM, as assessed annually remotely fit within the bounds of the LTP4 IP**. There is a huge delivery gap, as shown, between the DS and DM traffic models and the requirements of the LTP4 IP carbon targets.

113 **The conclusion from this assessment of the Environmental Statement against the LTP4 IP must be that the A47THI scheme is not consistent with the LTP4 IP, and that should National Highways construct the scheme, then the LTP4 IP carbon targets for Norfolk are undeliverable.** The LTP4 IP targets have been aligned with the lowest ambition of the TDP itself, and if Norfolk is unable to deliver its LTP4 IP targets, then this in turn means that the Government will be unable to deliver the TDP and the NZS. The emissions associated with the A47THI scheme are therefore **so significant** as to have a material impact on the ability of Government to meet its carbon reduction targets, and the scheme is not compliant with NPS NN 5.18. **The SoST therefore must not consent the A47THI scheme. As well as undermining his own TDP, to do so would not meet the requirements of NPNSS 5.18 as the scheme demonstrably has a material impact on the ability of Government to meet its carbon reduction targets**.

9.6 Comparison over the 2025-2037 LTP4 IP carbon budget

114 The assessment so far is on a year-by-year basis. However, with carbon, a further valuable contextualising assessment is to consider the overall impact of the scheme between the years 2025 and 2037. The total carbon generated for these years is effectively the "area under the graph" and is calculated from the data in Table 4 above as follows

tCO2e	AREA UNDER GRAPH (2025-2037) Cumulative carbon between 2025-2037
A47THI DM	12,080,432
A47THI DS	12,102,379
SCALED LTP4 IP	7,988,448
Norfolk_NZS_Lower = LTP4 IP	13,222,005

Table 6

115 This shows that, after opening in 2025, by 2037 the A47THI scheme will have overspent the scaled LTP4 IP carbon budget by 51.5%, corresponding to an additional 4,113,931 tCO2e over budget (12,102,379-7,988,448). Further, the A47THI scheme uses 92% of the available 2025-2037 transport carbon budget for the whole of Norfolk.

116 Note that the NZS trajectory in NZS, Figure 21 corresponds to annual national budgets[23] for 2037 between 34.0 MtCO2e (corresponding to the LTP4 IP low ambition targets) and 19.7 MtCO2e (high ambition). By that year, the A47THI scheme will have overspent its study area scaled allocation by over 4MtCO2e.

117 Such a significant overrun just from a small area of Norfolk (**60% of Norfolk)** by 2037 poses a significant risk to the delivery of the national 6th carbon budget, and to delivery of the Climate Change Act. The local overrun of 4MtCO2e needs to be consider against the national targets for surface transport in 2037 of 34MtCO2e at low ambition, and 19.7 MtCO2e at high ambition.

118 **Further, it is not a reasonable proposition that such a year-on-year overspend of carbon budget can be somehow "clawed back" by making very significant compensations between 2025 and 2037 from other Transport Authority areas and other sectors of the economy.** It would be an unreasonable and irrational proposition to consider: these other Transport Authorities and sectors already have their own very stretching targets to try to meet before being able to compensate for other areas.

119 The emissions associated with the A47THI scheme are therefore **so significant** as to have a material impact on the ability of Government to meet its carbon reduction targets, and the scheme is not compliant with NPS NN 5.18. **The SoST therefore must not consent the A47THI scheme – to do so would be to undermine his own TDP.**

120 All of this is based solely on the scheme's operation emissions ie before considering the construction emissions associated with the scheme and its study area.

9.7 Construction emissions

121 So far, the analysis has not included construction emissions. If the several concurrent road schemes programmed in Norfolk for construction during the 4th carbon budget were to go ahead, then a significant increment of carbon emissions will result in the years 2023, 2024 and probably 2025 (due to planning overruns) would result. This is additional the operational carbon emissions associated with the schemes as above. Known construction emissions are:

[23] The data is derived from "Net Zero Strategy: charts and tables (updated 5 April 2022)", tab "3v.Transport" – at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1066450/nzs-charts-tables-v1.1.xlsx

	tCO2e
A47BNB	25,765[24]
A47NTE	87,727[25]
A47THI	25,946[26]
Norwich Western Link	100,000[27]
Long Stratton Bypass	?
Other Norfolk schemes	?
TOTAL	239,438

Table 7

122If these construction emissions are assessed against the 2023 and 2024 budgets in the LTP4 IP (1,636,248 tCO2e and 1,616,585 tCO2e respectively), then they are 7.36% of the (whole Norfolk) budget for these two years. Note that these figures are an underestimate as they do not include construction emissions from other schemes in Norfolk in the same period[28].

123The Applicant has not indicated how these emissions would be compensated by reductions in emissions in the rest of the Norfolk LTP4 area in order for the LTP4 IP carbon targets to be met.

9.8 Emission factors – little impact on assessment

124I understand that the Applicant's data in REP3-006 was modelled to include the impacts of electric vehicles beyond 2030. This is because the applicant addressed this in their letter to Inspector Shrigley, the ExA on 22nd March 2022. Point E of the applicants Annex is reproduced below:

[24] Section 14.8.3, A47 BLOFIELD TO NORTH BURLINGHAM DUALLING, Environmental Statement Chapter 14 [TR010040/APP/6.1, REP2-002]

[25] Section 14.8.3, A47 NORTH TUDDENHAM TO EASTON DUALLING, Environmental Statement Chapter 14 Climate [TR010038/APP/6.1, APP-053]

[26] Section 14.8.3, A47/A11 THICKTHORN JUNCTION, Environmental Statement Chapter 14 Climate [TR010037/APP/6.1, APP-051]

[27] "The total amount of carbon emitted during the construction of the NWL, based on an initial assessment of quantities of materials required to construct the NWL, is likely to be in the order of 100,000 tCO2e.", page 58, Norfolk County Council Cabinet agenda, July 4th 2022. See:

[redacted]

[28] For example the Long Stratton bypass, West Winch Housing Access Road; and the A47/A17 Pullover Junction.

> With regards to CEPP's comments in Section 6 of REP8-013, the assessment undertaken for ES Chapter 14 [REP3-014] did not use earlier versions of the DEFRA Emission Factor Toolkit (EFT) due to the limitations in earlier versions (for example, lack of electric vehicles information and no data beyond 2030). For this reason, data was taken straight from the DFT WebTAG data tables for the end user assessment. The assessment for this Scheme had already assessed beyond 2030 so there was no need to update for EFT v11.

125 I understand from this that the Applicant's position is then the effects of electric vehicles both before and after 2030 has been fully modelled in the data in the Environmental Statement with what the applicant considers to be the latest available data.

9.9 TDP Sensitivity test – unproven and inconsistent with traffic modelling assumptions and the case for the scheme

126 In its March 22nd letter to the ExA, the applicant included what it refers to as a "TDP sensitivity test".

127 This so-called "TDP Sensitivity test" is an unproven methodology and it is **not** a sensitivity test.

128 It applies factors. However, the factors involved require that the TDP policies are guaranteed to succeed. In a section above, I show how the recent CCC 2022 Progress Report shows that at best around 50% of TDP policies are achievable at the national level. This means that the factors applied are not just what scientists call "fudge factors", but that **they are "fudge factors" that are not even remotely reliable**.

129 There is a more fundamental problem that the TDP policies are inconsistent with the A47THI traffic modelling, as built on the case for the Scheme (APP-125). They act in different directions. The traffic models of the scheme which as enumerated contain the baseline highway network, the scheme itself, other schemes promoted by the applicant, foreseeable developments promoted by third parties, and national government regional growth rates. This is "predict and provide" traffic planning. However, the TDP policies require avoiding a car-led recovery, a significant modal shift to non-motorised journeys, and a contraction of the overall need for vehicle movements.

130 If the TDP is properly applied to the A47THI, and the A47THI traffic model study area, **then the TDP policies need to be integrated into the traffic models.** Note the "TDP sensitivity test" just applies the factors to the traffic model outputs as a post-processing step. If the TDP policies were integrated into the traffic model itself, then this would change the traffic forecasts on which the "need" for the scheme has been predicated.

131 This explicit contradiction between the case made for the "need" of the scheme, and the policies in the TDP and the application of TDP Policy factors to the scheme, has been succinctly described by transport expert emeritus Professor Phil Goodwin and colleagues recently for another scheme (A303 Stonehenge):

"There are two incompatible assumptions made by NH, namely that the high traffic growth in its original forecast will continue to cause congestion which will be relieved by the scheme, and the lower traffic growth, or decline, which is inherent to the decarbonisation strategy to deliver lower carbon emissions. If the decarbonisation strategy were indeed successful as planned, there would be less traffic and the scheme would produce less time savings.

We consider that this contradiction seriously compromises the appraisal calculations. To claim simultaneously the carbon benefit calculated from lower levels of traffic as well as the decongestion benefit calculated from higher levels of traffic is a form of cherry-picking assumptions which gives appraisal a bad name."

132I provide further critical analysis of the TDP Sensitivity test at Appendix A.

10 CONCLUSIONS

133The CCC 2022 Progress Report shows that Government's policies (eg in the TDP and NZS) to reduce traffic, and set measurable targets for it, do not exist, and that a new approach to road scheme appraisal is urgently needed. Further the CCC Progress Report has indeed shown that the success of the NZS and the TDP are by no means secured, and that no weight can be given to the proposition that they are.

134The Court order in the recent NZS legal case order highlights that the BEIS minister had not considered several things, especially **the risk to delivery of the policies** in the NZS (and TDP) for meeting the 6th carbon budget, and that he failed to include information of the quantitative contributions that individual proposal and policies were expected to make in meeting the 4th, 5th and 6th carbon budgets. Not knowing each policy's contribution meant he couldn't decide what the risk of non-achievement was, which was an obviously material consideration (Judgement 204). The only conclusion is that until the issues in the NZS are remedied, it is not legitimate to presume that the NZS, or the TDP whose policies are closely linked, will inevitably succeed. The risks of delivery of these were left unknown at publication of the NZS, and remain unknown.

135**The above are important background considerations to the assessment of the A47THIscheme against the LTP4 IP as requested by the SoS.**

136I report in this response major errors in traffic modelling on the A47 schemes, and in the calibration between the three schemes. Cumulative assessment of carbon does **not** exist in the A47THI Environmental Statement. However, cumulative assessment should be simple to do, but **only if** the traffic models between the A47 schemes are consistent and coherent. However, they are not consistent or coherent due to major errors reported in this document. **It is now crucial that the applicant is asked to explain these differences between its traffic models on the three schemes, and that the traffic**

models are corrected, and the SoST holds a further consultation round to enable this.

137 A serious calibration problem for the traffic model for A47BNB scheme is noted.

138 There is also a requirement more generally for the traffic model for the Norwich Western Link to be made consistent with those on the A47 schemes.

139 Section 9 contains my assessment of the A47NTE against the LTP4 IP. The Norfolk LTP4 IP carbon targets represents the **lowest possible ambition** for Norfolk's contribution to delivering the NZS and the TDP. Therefore even if the LTP4 IP targets were to be met, other regions and other sectors would need to compensate with deeper emissions cuts than Norfolk is prepared to commit to making.

140 The assessment which I have made against the LTP4 IP is 1) a cumulative assessment with other schemes in the study area (ie local assessment), and 2) assesses meeting national carbon targets with the contextualisation of using local carbon budgets. Both these aspects of assessment **are absent in the A47THI Environmental Statement rendering it unlawful with respect to the 2017 Regulations and not compliant with the EIA and IEMA guidance**.

141 Conclusions of my assessment are:

A. If the A47THI is built, there is **then no remaining annual LTP4 IP budget available for any other part of the Norfolk transport network for each year after 2032.**

B. When the analysis is scaled to the A47THI study area, then **314%** of the annual scaled LTP4 IP carbon target is used by the A47THI in 2037.

C. This assessment of the Environmental Statement against the LTP4 IP shows that the A47THI scheme is not consistent with the LTP4 IP, and that **should National Highways construct the scheme, then the LTP4 IP carbon targets for Norfolk are undeliverable**.

D. By the 2037, the A47THI scheme will have overspent the scaled LTP4 IP carbon budget by 53%, corresponding to an additional 4MtCO2e in the A47NTE study area. This overspend must be seen in context for the national NZS targets for transport of 34.0 MtCO2e (low ambition targets) and 19.7 MtCO2e (high ambition). **This poses a significant risk to the delivery of the national 6th carbon budget, and to delivery of the Climate Change Act.** It is not a reasonable proposition that such a year-on-year overspend of carbon budget can be somehow "clawed back" by making very significant compensations between 2025 and 2037 from other Transport Authority areas and other sectors of the economy. Nor has any evidence been provided by the Applicant as to how this might be achieved.

E. The above is for operation emissions only. Construction emission for the A47THI and other schemes in the study area use 7.36% of the (whole Norfolk) LTP4 IP budget for 2024 and 2025.

F. **As well as undermining the SoST's own TDP, and the local LTP4 IP, the Environmental Statement for the A47THI does not meet the requirements of NPNSS 5.18 as the scheme <u>demonstrably</u> has a material impact on the ability of Government to meet its carbon reduction targets**.

G. The emissions associated with the A47THI scheme are therefore **<u>so significant</u>** as to have a material impact on the ability of Government to meet its carbon reduction targets. **The SoST therefore must not consent the A47THI scheme – to do so would be to undermine his own TDP and national climate targets.**

142The application should be refused on all these grounds.

Dr Andrew Boswell,
Climate Emergency Policy and Planning, September 5th, 2022

11 APPENDIX A: TDP SENSITIVITY TEST (actually TDP FACTOR TEST)

11.1 TDP Sensitivity test

143 The applicant has stated elsewhere (eg on A303 Stonehenge) that they have been advised by the DfT that "a sensitivity test based on the impact of the policy measures set out in TDP can now be undertaken for schemes", and that "the DfT has approved a sensitivity test based on the rate of improvement shown in Figure 2 of the TDP which can be applied to CO_2e emissions calculated for the Scheme assessment". The applicant has provided numbers which they refer to as a "TDP Sensitivity test" for the A47THI in a table in their Match 22nd 2022 letter to the ExA.

144 I first raise two issues with the overall method which the applicant refers to as the "TDP Sensitivity test".

145 The **first** is that what has been performed - applying the TDP Figure 2 rate of improvement to the CO_2e emissions calculated for the Scheme – is not what is normally understood as a sensitivity test. Sensitivity analysis is the study of how the uncertainty in the output of a mathematical or computer model can be understood and proportioned statistically to different sources of uncertainty in its inputs.

146 However, the so-called "TDP Sensitivity test", by contrast, just applies numerical values from a graph of some desirable, future, but not proven, outcome (ie the TDP Figure 2) to existing data. This makes **no** test of how the carbon emission outputs change depending on inputs to the modelling[29]. Further, the "rate of improvement" represented by TDP Figure 2 is a conglomeration of national data, and therefore takes no account of the specific, and local, conditions which determine the carbon emissions in the traffic model study area.

147 The method is falsely called a "TDP Sensitivity test". It would be more accurately described as applying a "TDP policy factor", and I will use that descriptor from now on.

148 The **second** is that even **if** applying a TDP Policy factor was technically sound and reliable, and I don't agree that it is without the full publication and scrutiny of the method, **then** it could only be justified where the case for the scheme fully aligned with the TDP, and NZS, policies.

149 Further, as above, applying a TDP Policy factor assumes that the policies being applied are guaranteed to succeed. As explained above, there is no evidence that the policies in the Net Zero Strategy (NZS) have been designed to secure the outcome claimed. The Court has heard, in the NZS legal case, how the NZS has not been fully quantified to demonstrate that it succeeds, nor designed to secure the Government's carbon targets and

[29] This is further demonstrated by the fact that the so-called TDP Sensitivity test is just a post-processing calculation applied to the **outputs** of the traffic model

budgets under sections 13 and 14 of the Climate Change Act. And the Court highlighted that the BEIS minister had not considered several things, especially **the risk to delivery of the policies** in the NZS (and TDP) for meeting the 6th carbon budget, and that he failed to include information of the quantitative contributions that individual proposal and policies were expected to make in meeting the 4th, 5th and 6th carbon budgets. Not knowing each policy's contribution meant the BEIS minister couldn't decide what the risk of non-achievement was, which was an obviously material consideration (Judgement 204). The same is true for the TDP which is based upon the NZS projections.

150 Even if there was certainty of policy success (which there is not), the case for the A47THI scheme was developed many years in advance of the TDP and NZS, and did not even foresee these key policy documents of the current legal framework, let alone attempt to align with them. Compliance and alignment with the TDP and NZS cannot just be retrofitted to the A47THI scheme – a complete revisit of the scheme's design and rationale is required to align with the objectives of the TDP and NZS.

151 The applicant's case for the A47THI is based on the needs of traffic and future traffic growth, and is not easily aligned with the policies in the NZS and TDP. For example, page 156 of the NZS states:

> *"We cannot simply rely on the electrification of road transport, or believe that zero emission cars and lorries will solve all our problems.* ***As we build back better from the pandemic, it will be essential to avoid a car-led recovery.*** *Alongside road vehicle decarbonisation, we must increase the share of trips taken by public transport, cycling and walking. We want to make these modes the natural first choice for all who can take them. As more journeys are cycled or walked, and taken by public transport, the carbon, air quality, noise and congestion benefits will be complemented by significant improvements in public health and wellbeing."*

152 Whilst page 6 of the TDP says:

> *"Road traffic, even on pre-pandemic trends, was predicted to grow by 22 percent from 2015 to 2035 much of it in cities, where new roadbuilding is physically difficult and disadvantages communities.–*
> *We cannot pile ever more cars, delivery vans and taxis on to the same congested urban roads. That would be difficult for the roads, let alone the planet, to tolerate.* ***As we build back better from the pandemic, it will be essential to avoid a car-led recovery.****"*

153 The A47THI scheme is predicated on increasing capacity of the strategic road network in response to the future needs of traffic. Whilst at the policy level, the TDP and NZS do not support unbridled increase of capacity and provide policy support against a car-led recovery from the pandemic. This is a clear example of how TDP compliance cannot be retrofitted to the A47THI scheme, and therefore **it is clearly incoherent to attempt to apply a generic TDP factor to the carbon emissions for the scheme**, as the Applicant does.

154 When this discrepancy is taken to the numerical level of quantifying carbon emissions, as the applicant does with the TDP Policy factor, it is clear that the different data being applied is not internally consistent. First, there are the traffic models of the scheme which as enumerated contain the Baseline Highway network, the scheme itself, other schemes promoted by the applicant, foreseeable developments promoted by third parties, and national government regional growth rates. And second, the TDP policies which require avoiding a car-led recovery, a significant modal shift to non-motorised journeys, and a contraction of the overall need for vehicle movements. The different elements within the existing traffic model expand vehicles using the network and with the express intent of expanding capacity, and model the effects of this to produce a carbon quantification. The TDP Policy factor applies numbers based on very different, and in some cases quite opposing, policy directions to the carbon quantification output from the models. **The approach is simply incoherent.**

155 The **genuine TDP Sensitivity test** would be to apply the individual TDP policies in the local context of the study area in the traffic models themselves. For example, the "foreseeable developments promoted by third parties" could be remodelled to align with the policies in the TDP for modal shift in new developments[30]. This would give a clear indication of the effect of remodelling land-based developments for TDP compliant modal shift against the approach incorporated in the traffic model which is based on unconstrained traffic growth, and car-based development, as conceived quite a few years ago. This has not been attempted by the applicant, despite the TDP, and NZS, now being part of the policy and legal framework.

156 In summary, "TDP Sensitivity test" is a misnomer, and it is nothing more than a non-project specific TDP Policy factor that is applied post the traffic modelling to the carbon emissions data. However, the TDP policies - the basis for the TDP Policy factor - do not align with the assumptions in the existing traffic model. The result is an incoherent method which produces numbers to which no value, nor weight, can be given in determination of the DCO.

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[30] See TDP, page 8 "We must also do better at joining up our transport, decarbonisation, and planning goals in both urban and rural areas. Too many new developments – not just by housebuilders, but by public-sector bodies – are difficult to reach without a car. But if we do development in a greener way, and if we join it to existing places, we can make it lower-carbon, lower-emission and lower-traffic – and more acceptable to local communities. We will also support local areas to decarbonise by linking local infrastructure funding to solutions that cut emissions – aligning billions of pounds of investment to our net zero mission.", and

TDP, page 156 "**We will embed transport decarbonisation principles in spatial planning and across transport policymaking**", and "The government wants walking, cycling or public transport to be the natural first choice for journeys. Where developments are located, how they are designed and how well public transport services are integrated has a huge impact on whether people's natural first choice for short journeys is on foot or by cycle, by public transport or by private car. The planning system has an important role to play in encouraging development that promotes a shift towards sustainable transport networks and the achievement of net zero transport systems. Traffic issues have often caused opposition to housebuilding. There is a legacy of developments that give people few alternatives to driving, are difficult to serve efficiently by public transport and are laid out in ways which discourage walking and cycling. Developments which are planned to minimise car use, promote sustainable transport choices, and are properly connected to existing public transport could help make new building more publicly acceptable."

11.2 TDP Factor test – data issues

157 Where the applicant has presented the so called TDP Sensitivity test, as in its letter to the ExA of Match 22nd, there are two further fundamental problems with the new data introduced into Environmental Statements:

i. No explanation as to the assumptions and modelling used to generate TDP Figure 2 is provided, either in the data table produced, or elsewhere since the TDP was published. The same is true for NZS Figure 21 which is a refinement of TDP Table 2. This is despite various Freedom of Information requests[31] and a parliamentary question[32] being raised. Therefore, the anticipated application of a TDP Policy factor based on the rate of improvement shown in TDP Figure 2, is presented as a black-box calculation, and algorithmically untransparent. I present further questions on this below.

ii. Despite the new data table introduced to Environmental Statements, **no assessment or conclusions are made** by the applicant from the data. The data is left hanging. The presentations, seen so far for various schemes, relating to the so-called "TDP Sensitivity test" therefore fail to achieve what they set out to do which is to describe "how an assessment ..." was undertaken.

158 On point i, I draw attention to my statement in my submission to the previous consultation on "Lack of Transparency of Data and Computer Modelling" and the Algorithmic Transparency Standard (see section above on this). In applying a nationally conglomerated "rate of improvement" based on TDP, Figure 2 to figures derived directly from traffic modelling without explaining how the TDP figures are derived, the applicant has made no attempt to explain the data, algorithms and method transparently. **For data and algorithmic transparency, a full explanation of how these figures are derived is required.** The presentation of this new material, and the lack of transparent information and data relating to it places severe limitations on the independent review by interested parties and other such as myself. A further consultation round following full data transparency, with independent assessment, is required.

11.3 TDP Factor test – further Data and algorithmic transparency issues

159 In making the TDP Factor test on the A47THI and other schemes, the applicant has **applied** a black box approach which it describes as "a sensitivity test based on the rate of improvement shown in Figure 2 of the TDP which can be applied to CO_2e emissions calculated for the Scheme assessment". All TDP policies are assumed to be working as a conglomerate mass, based on a model at the national level, the details of which have not been made public.

[31] For example, by the New Scientist "UK refuses to release document showing Net Zero Strategy CO2 savings", 1 December 2021, [redacted]

[32] Kerry McCarthy, MP, 18th October 2021 to Trudy Harrison, MP - [redacted]

160 The approach of applying a nationally conglomerated "rate of improvement" to carbon quantities which are derived from a specific traffic model for a specific study makes no account of:

A. **which** TDP policies are having an effect, and

B. **how, and by how much,** they are having an effect on the transport carbon emissions associated with the scheme in the study area

161 As such, applying the TDP Policy factor is a blunt tool which eliminates the gathering of useful information rather than generating it.

162 **The applicant must provide a complete breakdown of the calculations behind TDP Figure 2**, showing for each policy how it has been modelled and what its contribution towards the decarbonisation path in TDP Figure 2 is. The applicant must provide any analysis, if there is any, on how each potential TDP policy may impact and apply **to the particular situation in the study area** of the A47THI scheme.

163 **The applicant must also make available a wide range of data involved in the traffic modelling.** For the study area, this would include the highway and public transport matrices, changes in walking and cycling modelled, and automatic TUBA outputs for each of the three traffic models. These will also be useful in analysing how each potential TDP policy, for example those on modal shift in new developments, impacts the study area. Further, the 60-year appraisal spreadsheets for GHGs should be provided for each of these traffic models. The Economics Table and new BCRs should also be calculated, including the new appraisal carbon pricing data from Government.

164 **As the TDP Factor test is applied to data after its extraction from the traffic model, it is not clear how a corresponding 60-year appraisal GHGs spreadsheet can be generated. This is contrary to the TAG Methodology.**

11.4 TDP factor test - Potential double counting

165 Further, I have concerns that there may be **double counting** between emission reductions in the EFT v11 and the application of the TDP factor test. Data from EFT v11 traffic model runs will already have emissions outputs for the years 2031-2050 with updated fleet and engine efficiency adjustment factors. The applicant has claimed in their letter to the ExA that they already correctly account for electric vehicles after 2030, although it is not clear which EfT version is used in the Environmental Statement.

166 The DEFRA EFT webpage states "the 'Output CO2 Summary' sheet provides a summary of direct CO2 emissions from tailpipe and indirect CO_2e emissions associated with the

charging of the batteries of electric and plug-in hybrid cars and LGVs, in tonnes/annum"[33].

167 As significant policies in the TDP relate to electric vehicle (eg: "A zero emission fleet of cars, vans, motorcycles, and scooters", and "Zero emission buses and coaches" in the "Summary of commitments", TDP, Part 2a, for "Decarbonising all forms of transport"), decarbonisation from electric vehicles can be expected to be part of the nationally conglomerated "rate of improvement" implied by TDP Figure 2".

168 This risk of double counting may extend to other policies too, such as modal shift: electric vehicles is just the most obvious example.

169 **The Applicant must provide a breakdown of all the adjustments for carbon reduction values made in the EFT v11 and the TDP Figure 2, and demonstrate that there is a clear demarcation of which contribute to the EFT v11 and which to the emission reductions implied by the TDP Policy factor.** There should also be a clear demonstration that DEFRA and DfT are working to ensure that this demarcation and apportionment of emissions reduction effects between versions of the EFT and the TDP modelling is fully understood. The resolution of this issue may require work between DEFRA and the DfT.

170 The applicant has presented carbon emission quantities calculated first from model runs which they claim correctly model electric vehicles after 2030 (REP3-006 as qualified by letter to ExA, March 22nd) and second by the application of the TDP Policy factor (Table in letter to ExA, March 22nd), then **the applicant must provide a very clear explanation of, and demarcation between, the effects contributing to each of the reduction effects on their data, so it can be entirely clear if double counting has occurred or not.**

11.5 Missing TDP Factor test – All the data is based on solus, not cumulative, quantification and assessment

171 I just repeat for emphasis and clarity that all the data presented by the Applicant, on all the schemes which I have examined, from different traffic model runs (with different EFT versions, and with the TDP Policy factor) for operation emissions data are **only solus** quantifications, and the **wrong solus** quantifications, as described earlier. This is the case for the A47THI too.

172 On all schemes, no assessment is possible of the cumulative carbon impacts of the scheme with other developments, as these cumulative impacts have not been quantified as explained earlier. In making the TDP Factor test, **the applicant does not make the application, or Environmental Statement, EIA compliant**.

[33] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/, "Emissions Factors Toolkit", accessed Mar 18th 2022,

12 APPENDIX B: IEMA GUIDANCE, ASSESSING GREENHOUSE GAS EMISSIONS AND EVALUATING THEIR SIGNIFICANCE

Version 2, February 2022

Supplied as separate document

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

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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)

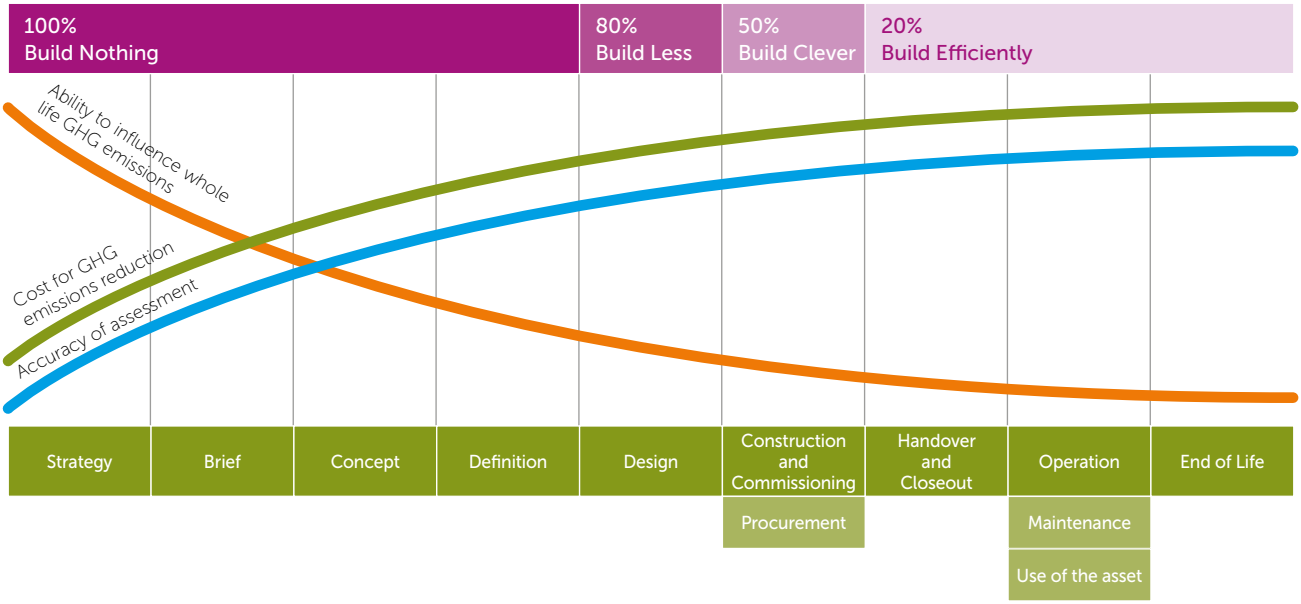


Figure 1: The ability to effect change to achieve GHG emissions reduction for the project reduces over time. This makes it important that the emissions reduction is considered from the outset or at the earliest practical point. (Source: Infrastructure Carbon Review & PAS 2080).

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

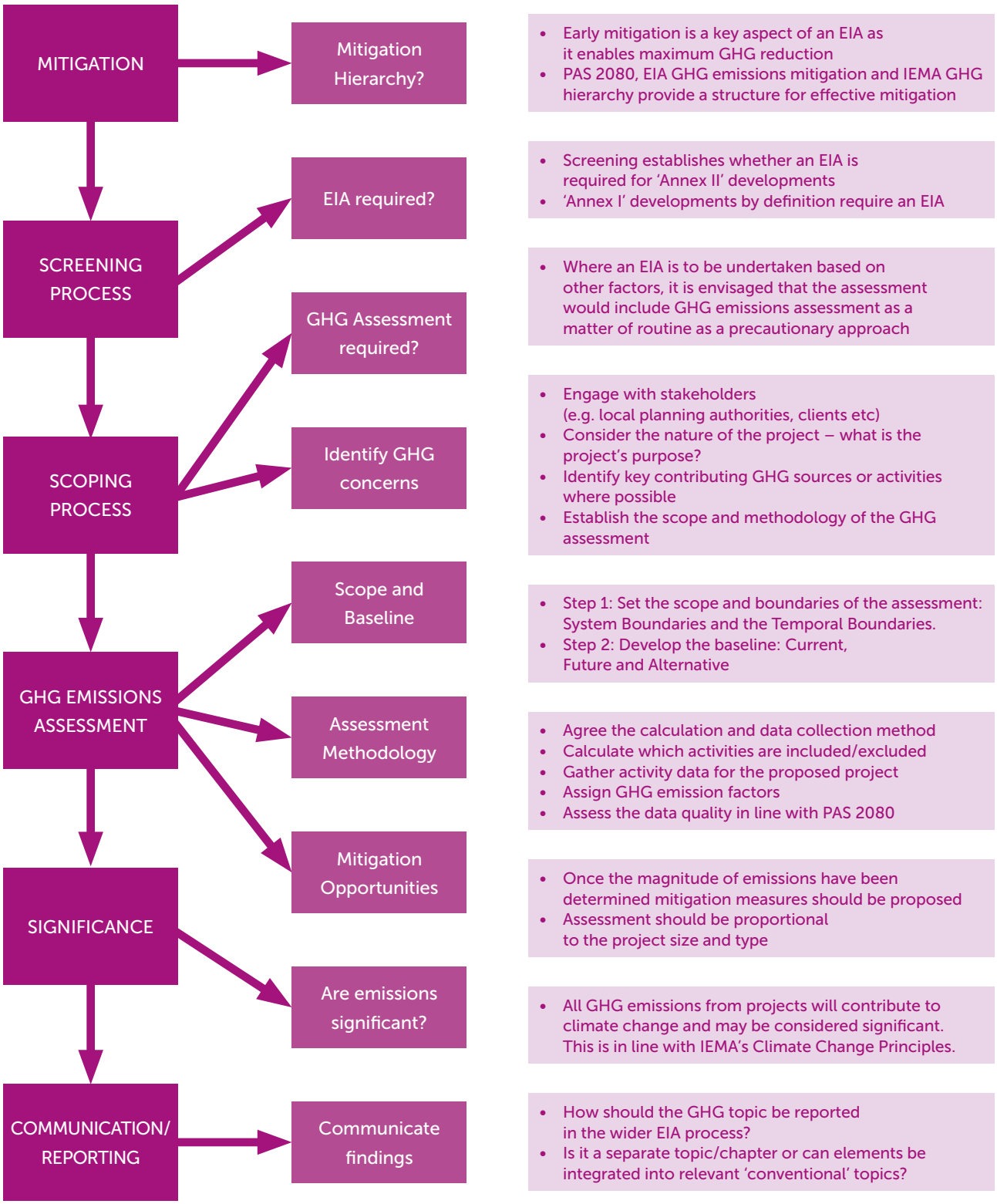


Figure 2: Scope of this guide

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

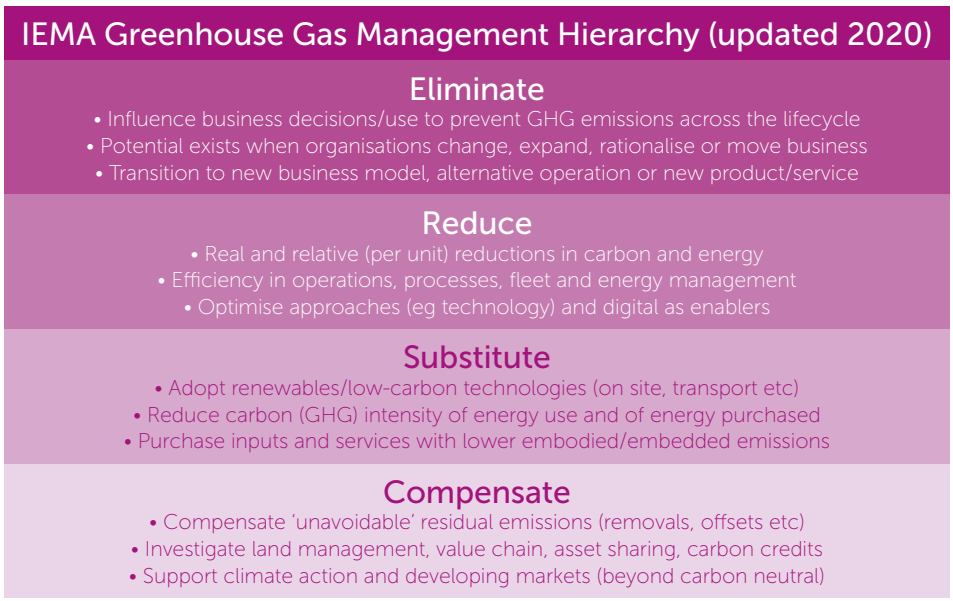
For EIA GHG emissions mitigation, PAS 2080 also provides a useful structure for working through and identifying potential opportunities and interventions. The IEMA GHG Management Hierarchy[14] (see Figure 3) provides a similar structure set out as **eliminate**, **reduce**, **substitute** and **compensate**. 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.

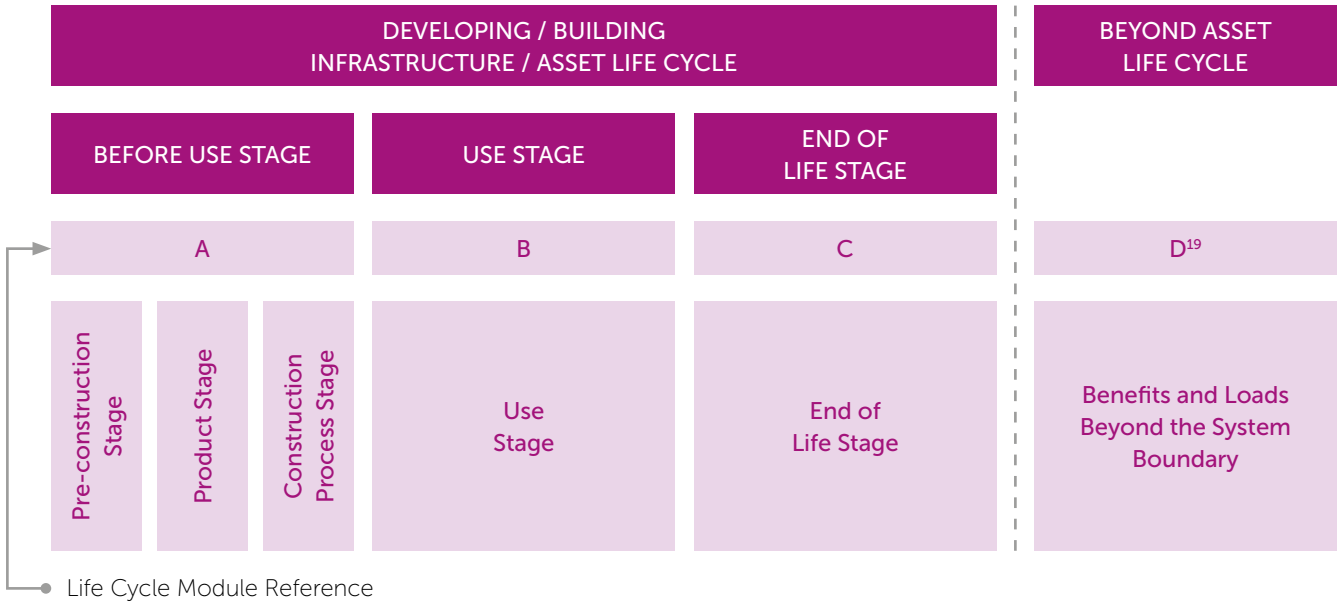


Figure 4: Modular approach of life cycle stages and modules for EIA GHG emissions assessment; the module references are widely used in construction GHG emissions assessment and reduction activities. The figure provides a simplified presentation of the modular approach that can be used for boundary definition 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.

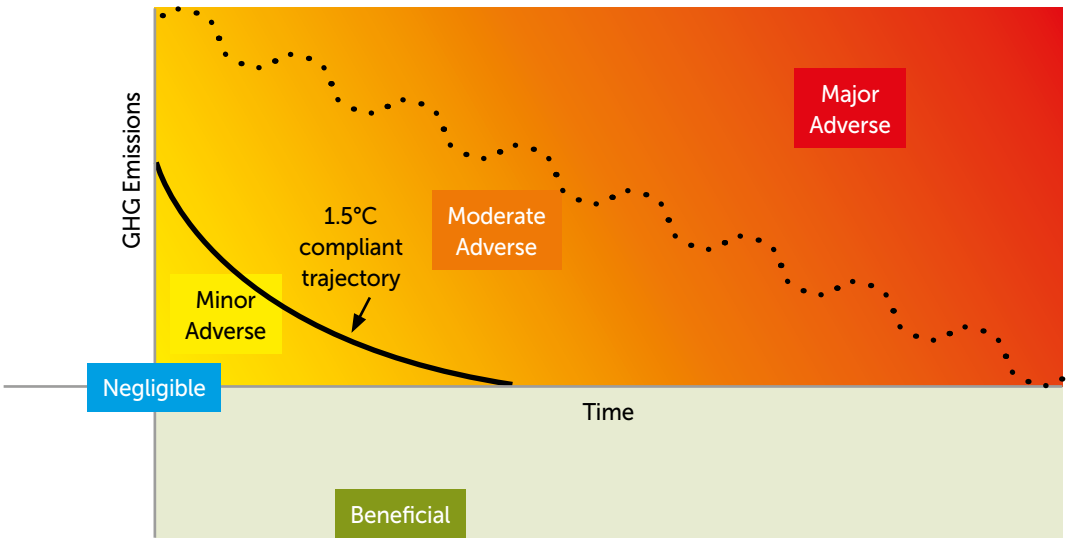


Figure 5: Different levels of significance plotted against the UK's net zero compatible trajectory[36]

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.

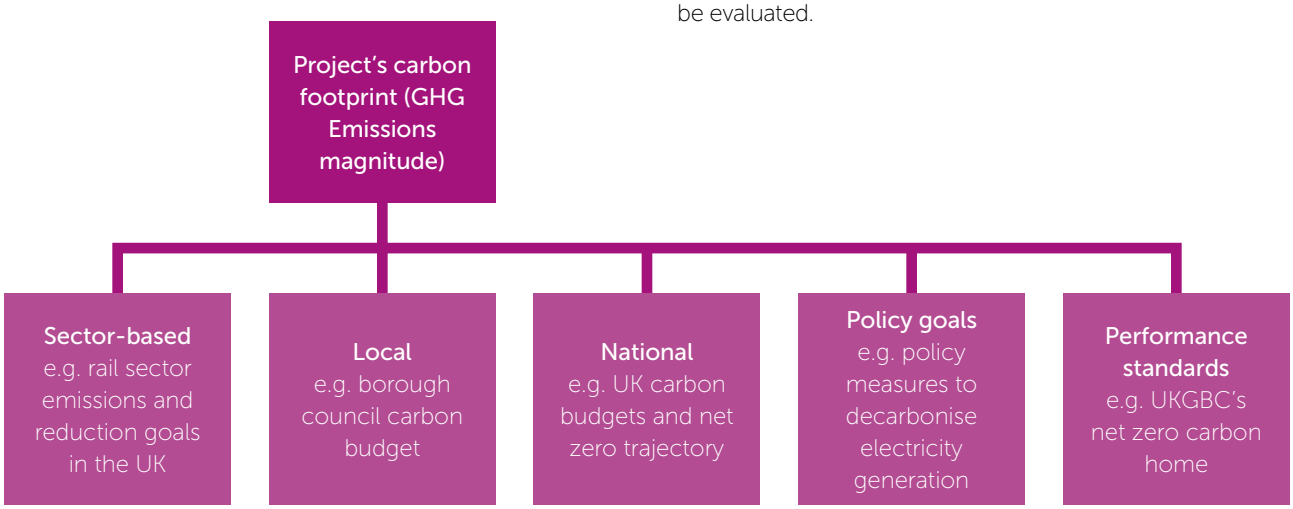


Figure 6: Good practice approaches for contextualising a project's GHG emissions

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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