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Examination Principle Issues	• **Climate Change** • **Scope of Development and Environmental Impact Assessment** • **Benefit cost ratio (BCR) and case for scheme**

DEADLINE D2 SUBMISSION
(WRITTEN REPRESENTATION, Part 2)

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).

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

My D1 submission (Written Representation, part 1, REP1-027) addressed the "carbon quantification" part of "carbon quantification and assessment" and the question of how the Scheme's emissions should be quantified, and identified failures in the quantification including non-compliance with the EIA Regulations. REP1-027 alone showed the Environmental Statement is unlawful.

This submission (Written Representation, part 2) addresses the "carbon assessment" part of "carbon quantification and assessment". With the lack of any local carbon assessment by the Applicant, I make an indicative carbon assessment across the study area. My assessment compares the absolute carbon emissions associated with the scheme in the study area with national carbon budgets from the Climate Change Committee and the 2030 and 2035 delivery pathways from the Net Zero Strategy.

I show that the scheme has a significant impact on the ability to meet UK carbon emissions budgets and targets, and therefore is not compliant with the NPS NN, and wider climate change legislation and policy. This has been demonstrated in several ways. The scheme shows a huge emissions gap with respect to meeting both the 2030 and 2035 delivery pathways from the Net Zero Strategy; major overshoot of UK (CCC) budgets, for the relevant local area, from the 4th, 5th and 6th carbon budgets; and an ever-increasing share of the whole UK economy carbon budget.

The applicant has failed to report these impacts because it only provides a singular assessment which is at the extreme lowest end of the range of sensitivity in carbon assessment.

Contents

1 INTRODUCTION

1.1 Deadline 2 (D2) – relationship with D1 submission

1 This is my submission for Deadline D2. It comprises Part 2 of my written representation (WR). Part 1 of my WR [REP1-027] found that it is **without doubt** that the traffic model configuration leads to carbon quantities, which when processed by the differential DS-DM method, leads to a carbon assessment which is a solus only assessment, and not a cumulative assessment. This is inherent in the configuration of the traffic modelling. Further, the DM element of DS-DM differential quantity overestimates the DM carbon emissions, and therefore is an underestimate of the real "Do Something – Do Minimum", and of the true carbon emissions associated with the scheme.

2 Since an assessment of the cumulative GHG emission impacts of the Scheme is legally required under the EIA Regs, and is not provided anywhere else in the Environmental Statement, this failing alone renders the Environmental Statement unlawful.

1.2 Carbon Quantification and Assessment

3 There are two key questions (KQ-1 and KQ-2) that the ExA, and SoS, need to consider on carbon assessment:

> (KQ-1) How will the Scheme's emissions be quantified?
>
> (KQ-2) Against which "target(s)" or "budget(s)" should the Scheme's emissions be contextualised for assessment?

4 REP1-027 explained there are two key parts required for carbon appraisal of the scheme (1) carbon quantification, and (2) carbon assessment. Whilst acknowledging the unlawfulness, and inaccuracy of the carbon quantification stage, this submission examines the carbon assessment stage. It responds to recent policy (eg the Net Zero Strategy, and as below) and makes an indicative carbon assessment.

1.3 Recent changes to relevant policy

5 REP1-027, section 1.2 reported a significant number of changes to national policy and guidance since the application was published in June 2021. This D2 submission will consider the implications of:

(a) The Government's Transport Decarbonisation Plan[1] (TDP) and Net Zero Strategy[2] (NZS). The implications of this are expanded later, and an indicative assessment is made of the A417 scheme against the NZS.

(b) New carbon pricing data from the HM Treasury Green Book supplement on quantifying and valuing emissions of GHGs[3], as transposed into an updated version of the DfT's WebTAG guidance[4] and TAG data book (TAG Data Book November 2021 v1.17 (Table A3.4)). This is expanded in a later section, and it is shown that the BCR for the scheme needs to be recalculated, not just on the basis of new carbon price data, but on to correct problems with the existing BCR calculation.

1.4 Relevant documents from other DCO schemes beyond Norfolk

6 I draw the ExA's attention to these recent new consultations by the SoS on the following schemes:

A. A1 in Northumberland – Morpeth to Ellingham [TR010059] (Secretary of State Consultation 3, 22nd December 2021 requiring response by January 19th 2022)

B. M25 junction 10/A3 Wisley interchange improvement [TR010030] (Secretary of State Consultation 8, 22nd December 2021 requiring response by January 19th 2022)

C. M25 junction 28 improvements [TR010029] (Secretary of State Consultation 3, 22nd December 2021 requiring response by January 19th 2022)

D. A38 Derby Junctions [TR010022] (Secretary of State Consultation 3, 22nd December 2021 requiring response by February 4th 2022)

7 Each of these consultations requires additional information from the Applicant on the cumulative assessment of climate impacts, and specifically asks for:

"The Secretary of State invites the Applicant to update its response of [date] to provide (or, to the extent that it has already been provided, identify) ***its assessment of the cumulative effects of Greenhouse Gas emissions from the scheme with other existing and/or approved projects on a local, regional and national level*** *on a*

[redacted]

consistent geographical scale (for example an assessment of the cumulative effects of the Roads Investment Strategy RIS 1 and RIS 2 at a national level).

This should: take account of both construction and operational effects; identify the baseline used at ***each local, regional and national level****; and identify* ***any relevant local, regional or national targets/budgets*** *where they exist and how the assessment complies with these (including the carbon budgets, the 2050 zero target under the Climate Change Act 2008, and the UK's Nationally Determined Contribution under the Paris Agreement). It should be accompanied by reasoning to explain the methodology adopted, any likely significant effects identified, any difficulties encountered in compiling the information, and how the assessment complies with the Environmental Impact Assessment Regulations.*

The Secretary of State would also welcome confirmation that the response to all parts of this question has been prepared by a competent expert. Please can links be provided to any documents referenced and their relevance fully explained."

(my emphasis)

8 It is clear that the SoS is required to have significant regard, in decision making on road infrastructure, to:

- cumulative carbon emissions assessment
- local, regional and national assessment
- UK's national and international obligations on Climate Change
- EIA Regulations compliance

9 This is clearly relevant to the current DCO examination for the A417. This submission demonstrates an indicative carbon assessment, and addresses all of the above issues. I indicate where the Application does not meet the requirements being requested in these current DfT consultations.

10 These consultations are also clearly relevant to my previous submission REP1-027 which demonstrated, without doubt, that cumulative carbon emissions have not been assessed on the A417 scheme. No assessment has been made of carbon emissions in cumulation with other existing and/or approved projects on a local, regional and national level. In REP1-027, I lay out the necessary additional traffic model configurations which are required for carbon quantification that may then be carried forward to cumulative carbon assessment at the local level. The current Environmental Statement is unlawful [see REP1-027] and must be updated with the required information.

1.5 Definitions

11 For scientific precision, I use the following additional definitions as previously given in REP1-027.

- **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 CHANGES IN LOCAL AND NATIONAL POLICY

12 The section provides more detail on the TDP, the NZS and also a report from Chatham House.

2.1 Transport Decarbonisation Plan

13 On the 14th July 2021, the Government released its Transport Decarbonisation Plan[5] (TDP).

14 The Rt Hon Grant Shapps MP, Secretary of State for Transport states in the foreword:

> "*But **we cannot, of course, simply rely on the electrification of road transport**, or believe that zero emission cars and lorries will solve all our problems, particularly for meeting our medium-term carbon reduction targets to 2035. 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.***"
>
> (my emphasis)

15 On local transport challenges, the TDP states:

> *"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. Local Transport Plans (LTPs) are existing statutory requirements that set out holistic place-based strategies for improving transport networks, proposed projects for investment and, ultimately, lay out how key objectives will be achieved. **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."*

16 This indicates that the Government consider it essential to avoid car-led delivery, and are aware that electrification of road transport is not sufficient to tackle road-use emissions.

2.2 Net Zero Strategy

17 Published later in 2021, the Government's Net Zero Strategy (NZS) backed the urgent need for ambitious quantifiable carbon reductions in transport, at the local level, with this statement:

"We are driving decarbonisation and transport improvements at a local level by making quantifiable carbon reductions a fundamental part of local transport planning and funding. Local Transport Plans (LTPs) – statutory requirements that set out holistic place-based strategies for improving transport networks and proposed projects for investment – will need to set out how local areas will deliver ambitious carbon reductions in line with carbon budgets and net zero."

18 Critically, the NZS also sets out delivery pathways which link to existing carbon budgets and targets, and define indicative targets based on the pathways for each sector. For example, as far as the Paris Agreement and International Emissions Targets, the NZS Technical Annex states at page 307:

"International emissions targets

7. The 2015 Paris Agreement under the UN established the goal of keeping the global mean temperature rise to well below 2°C, whilst pursuing efforts to limit the rise to under 1.5°C. Under the Kigali amendment to the Montreal Protocol, the UK has also committed to reducing F-gas emissions by 85% on 2011-2013 levels by 2036.

8. Under the Paris Agreement, the UK announced its Nationally Determined Contribution (NDC) in December 2020, which commits the UK to reduce net greenhouse gas (GHG) emissions by at least 68% by 2030 compared to 1990 reference year levels. This represents an increase of ambition on the fifth carbon budget, which covers the years 2028-2032.

9. ***The UK will therefore need to overachieve on the fifth carbon budget to meet its international climate targets and stay on track for the sixth carbon budget. Accordingly, the policies and proposals, delivery pathway, deployment assumptions and any other analysis presented in the Net Zero Strategy for the fifth carbon budget period are consistent with the action required to meet the UK's 2030 NDC.****"*

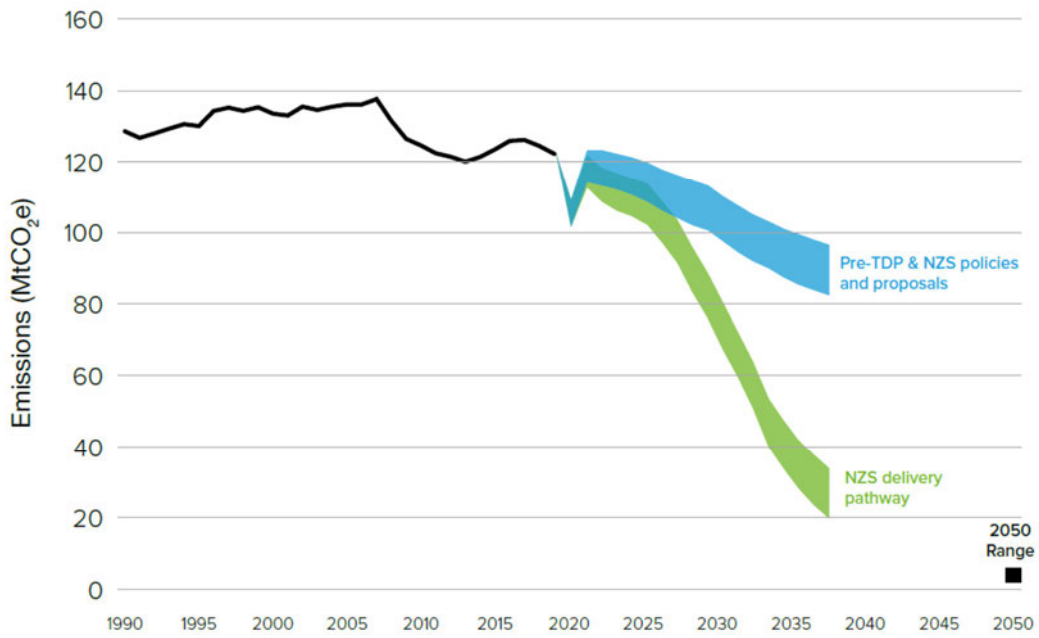
(my emphasis)

19 And for UK carbon budgets:

> ***"Climate Change Act***
>
> *… In 2019, on advice of the CCC, the UK committed to reaching net zero emissions by 2050 and consequently the target reduction in the Act was increased to at least 100%.*
>
> *3. To keep the UK on a pathway to achieving the 2050 target, the Government is obliged to set legally binding, five-year caps on emissions – carbon budgets – twelve years in advance and then to publish a report setting out policies and proposals for meeting that budget and those budgets previously set.*
>
> *4.* ***The Net Zero Strategy is the means by which we satisfy the requirements of the Act in relation to policies and proposals for meeting the current carbon budgets****.*
>
> *…*
>
> ***6. To show how we will meet our climate targets, including legislated carbon budgets up to and including the sixth carbon budget, the Net Zero Strategy contains both an indicative delivery pathway and illustrative 2050 net zero scenarios. The pathway, which stretches to the end of the Sixth Carbon Budget period in 2037, provides an indicative trajectory of emissions reductions which we aim to achieve through the Strategy and through delivery of the policies and proposals outlined. <u>It therefore indicates the timescales over which we expect those policies and proposals to take effect to deliver our targets.</u>*** *The pathway is designed to be broadly consistent with all three of the illustrative 2050 scenarios set out in the Journey to Net Zero chapter of the Net Zero Strategy. There is uncertainty associated with our decarbonisation pathway through to 2037 and the 2050 scenarios – the exact path we take to meet our climate targets is likely to differ and must respond flexibly to changes that arise over time."*
>
> (my emphasis)

20 The NZS delivery pathway, related to road transport, in the Figure below corresponds to a fall in residual emissions from domestic transport emissions (excluding aviation and shipping) by around 34-45% by 2030 and 65-76% by 2035, **relative to 2019 levels** (see Figure 21 from the NZS reproduced below).

Figure 21: Indicative domestic transport emissions pathway to 2037



Source: BEIS analysis

21 Later, I will make an assessment of the absolute carbon emissions associated with the study area for the scheme against the delivery pathway, lower and upper bounds, for both 2030, indicative of meeting the UK NDC under the Paris agreement, and 2035, indicative of meeting the 6th carbon budget, and therefore net zero by 2050.

22 The policy interventions on the NZS and TDP, such as electric vehicles and modal shift, only effect operational road-user emissions, and do not address construction emissions which have a large impact in the period to 2030. Construction emissions are absolute emissions generated on top of the usual road-user emissions, and therefore add emissions to the transport sector whilst it already has the extremely challenging targets as above for 2030 and 2035. I also note that the economic cost of construction emissions has not been factored into the BCR calculations, and should be at the new carbon price data from the Treasury.

2.3 Chatham House Report

23 In September 2021, Chatham House, The Royal Institute of International Affairs,[6] published its "Climate change risk assessment 2021" with the strapline "the risks are compounding, and without immediate action the impacts will be devastating. The summary report is attached at Appendix D, and the lead's author biography is in footnote[7]. The summary report intended for heads of government is based on research from Professor Nigel Arnell and team at the University of Reading.

24 Some of the headline points of carbon emissions, carbon budgets and emissions reductions are reproduced below:

> ***"Current emissions and temperature pathways***
>
> ***Central estimate 2.7ºC, plausibly higher***
>
> *Global efforts to reduce CO2 emissions are dangerously off track. Current nationally determined contributions (NDCs) indicate a 1 per cent reduction in emissions by 2030, compared with 2010. If policy ambition, low-carbon technology deployment and investment follow current trends, 2.7°C of warming by the end of the century is the central estimate, relative to preindustrial levels, but there is a 10 per cent chance of warming of 3.5°C. These projections assume that countries will meet their NDCs; if they fail to do so, the probability of extreme temperature increases is non-negligible. A global temperature increase greater than 5°C should not be ruled out.*
>
> ***Net zero pledges***
>
> *Many countries are currently focusing on net zero pledges, with an implicit assumption that these targets will avert climate change. However, net zero pledges lack policy detail and delivery mechanisms, and the gap between targets and the global carbon budget is widening every year. Unless NDCs are dramatically increased, and policy and delivery mechanisms are commensurately revised, many of the impacts described in this summary report will be locked in by 2040, and become so severe they go beyond the limits of what nations can adapt to.*
>
> ***Consequences for reaching the Paris Agreement goals***

[6] Chatham House is a world-leading policy institute with a mission to help governments and societies build a sustainably secure, prosperous and just world.

[7] Dr Daniel Quiggin is a senior research fellow with the Environment and Society Programme at Chatham House. He has expertise in the modelling, analysis and forecasting of national and global energy systems, having modelled various UK and global energy scenarios. As a senior policy adviser at the UK Department for Business, Energy & Industrial Strategy in 2018–20, Daniel led work on the post-Brexit policy implications for the energy sector's trade of goods and services, and helped shape effective strategies for the energy and climate package of the UK–EU FTA negotiations. He also previously worked as an analyst at Investec Asset Management within a commodities and resources investment team. Daniel holds master's degrees in particle physics and climate science, and a PhD in energy system modelling.

> *If emissions follow the trajectory set by current NDCs, there* ***is a less than 5 per cent chance of keeping temperatures well below 2°C****, relative to preindustrial levels, and* ***a less than 1 per cent chance of reaching the 1.5°C Paris Agreement target.****"*
>
> (my emphasis)

25 The report covers much more on heat, productivity and health; food security; water security; flooding; and tipping points and cascading risks. Whilst all of these are of extreme important to the future of sustaining wellbeing of this planet, I do not reproduce further clips on these topics, given the concerns here are about carbon emissions.

26 This report highlights that there is a huge gulf between extremely credible scientific assessments, such as the one providing the foundation of the Chatham House report, and the Applicant's ES and response. Transition to net-zero requires a heavy investment, and no credible pathway to mobilising that level of investment has been demonstrated. The NZS sets out target-compliant "indicative delivery pathways" for each sector until 2037, such as the Figure 5.2 reproduced above, but Carbon Brief have pointed out that the NZS[8] fails to quantify the impact of the new plans and policies it contains, meaning it is not possible to say if the government is now doing – or spending – enough to meet its legally binding goals.

27 Whilst the Chatham House report is not policy, it is important research that should underwrite policy and should be at the forefront of the minds of policy makers and decision makers. I include it here as relevant as it shows that the TDP and NZS are totally inadequate to the scale of the problem that is faced in the Climate Emergency. My assessment of the carbon impacts of the scheme in this statement shows that meeting the TDP and NZS targets will be severely impacted if the Scheme goes ahead.

28 In this context, the Chatham House report, provides an alarming risk assessment on how these targets in the more global context of net-zero targets around the globe and the chances of staying below 1.5°C and 2°C is already extremely unlikely. Therefore, the Precautionary Principle must be considered. Any scheme which increases emissions, then impacts the TDP and NZS targets, and when these policies are unlikely to deliver anyway, must be tested against the precaution of not creating additional harm to the existing catastrophic situation.

29 The history of climate change in the last 30 years is littered with promises which have been broken, or not delivered. The Chatham House report puts this into fine focus. In making planning decisions on carbon-intensive infrastructure, like the A417, no reliance should be placed on unactioned paper plans, such as the NZS.

[redacted] 21st October 2021

30 **The findings within Chatham House report and other reports such as the IPCC 6th Assessment report[9] (Code Red), provide a clear context for decision making. And the TDP and NZS, by requiring local transport carbon budgets and targets, insist that regard must be given of the full extent of the carbon impacts on any transport project. That can only be fulfilled, by a detailed, and scientifically congruent, consideration of the carbon impacts involved.** On the basis of the NPS NN, the EIA Regs and guidance, and the DMRB, this requires both a solus and cumulative assessment across all sub-types of carbon emissions and against local, regional and national carbon budgets is required.

3 LOCAL AND REGIONAL ASSESSMENT

31 First, it is necessary for me to introduce the EIA guidance which relates to this.

3.1 EIA Guidance documents

32 The EU Commission website hosts an official webpage for the EIA Directive[10], which lists a number of Guidance documents.

33 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[11], scoping[12] and EIA report writing[13] stages.

34 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"*.

35 Under "Climate change mitigation: Project impacts on climate change" on page 39 of the EIA report writing guidance (as supplied at Appendix B), 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."*

[9] Summary for Policymakers (SPM), AR6 Climate Change 2021: The Physical Science Basis, h[redacted]

[redacted]

36 Whilst for cumulative effects[14] 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.*" (our emphasis)

37 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.[15]

38 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-General of the Commission[16]. It reflects the view of the Commission services of the best EIA practice, including those with transposed national regulations like the UK. This guidance is provided at Appendix C.

39 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)

The Applicant claims that the results of its appraisal of differential emissions against national budgets is an insignificant effect. Without prejudice to my position that the

[14] [redacted] PDF page 52

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

[16] [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"

Applicant is wrong on this point, even if that is the Applicant's view, the guidance rightly suggests that carbon emissions assessed at a local/regional scale may well be significant. Later, I show that appraisal of absolute emissions against both national budgets and local budgets is significant.

40 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. It is therefore 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 Environmental Statement, would be irrational.

41 At REP1-027, section 3.1 and 3.4 I show that the NPS NN invokes the EIA Regs at NPS NN sections 4.15 and 4.16.

42 The Applicant has not attempted any local or regional assessment of carbon emissions associated with the scheme, and has, therefore, ignored two separate guidance documents, hosted on the official EU Commission EIA Regs webpage, which each recommend assessment of carbon emissions at the local and regional level, as well as national level, within Environmental Statements. **In not even considering, nor giving regards to, this guidance, the Applicant has failed to comply with NPS NN 4.15 and 4.16.**

43 The EIA guidance advocates strongly that carbon assessment is done for the scheme itself and cumulation of effects of the scheme with other existing and/or approved projects, at the local and regional scale, as well as at the national scale. The guidance aims to ensure "*that the best possible information is made available during decision-making"*.

44 This is further supported by the guidance to use more than one criterion in environmental assessment. This is wholly consistent with the usual approach of scientists is to find as wide a variety of criteria as possible to confirm an assessment. The EIA Guidance[17] advocates using more than a singular criterion for significance determination:

> *"At the same time, significance determinations should not be the exclusive prerogative of 'experts' or 'specialists': significance should be defined in a way that reflects what is valued in the environment by regulators and by public and private stakeholders. A common approach used in EIA is the application of a multi-criteria analysis. Common criteria used to evaluate significance include the magnitude of the predicted effect and the sensitivity of the receiving environment:"*

45 The Applicant has not given regard to considering using multi-criteria appraisal which increases the sensitivity of assessment by, for example, making local and regional scale assessments, for both solus and cumulative carbon emission. This submission makes an indicative assessment which addresses these points.

[17] Paragraph 1.4.2, page 49, Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report, 2017 – European Union

3.2 Local and regional study areas

46 Local and regional assessment requires a choice of study area which aligns to carbon budget baseline data. Local authority areas provide such an area.

47 Local authority areas have their own carbon budgets, targets, and monitoring, and the Dept of Business and Industrial Strategy (BEIS) have historic emissions records by sector (ie Industrial, Domestic, Transport, and Land-use) since 2005. Further, indicative allocations can be made to local authorities from national carbon budgets by grandfathering or dividing up the national carbon budget by population, and emissions sector proportions.

48 It is rational, then, for transport schemes to be assessed within the local authority boundaries where existing benchmark information is available ie based on these local authority areas. A meaningful local, or regional, assessment is only possible if it is based on a spatial scale and area which corresponds to known and reliable carbon budgets.

49 Alignment with local authority boundaries has not been done in the study area for carbon emissions in the Environmental Statement, and I address how to still do an indicative assessment at the local level despite this in the next section.

4 CARBON ASSESSMENT

4.1 The Study Area

50 It is fundamental to the assessment stage to understand the study area or study model. Section 14.6 of the Environmental Statement [APP-045] describes study areas for a number of different emission sources. I am largely concerned here with section 14.6.8 which describes "Road user carbon emissions (during operation)" which states:

> "*The study area for operational road user carbon is consistent with the Affected Road Network (ARN), as defined by the scheme's traffic model. The ARN is described in Section 5.6 Study area of ES Chapter 5 Air quality (Document Reference 6.2) and shown in ES Figure 5.1 Affected Road Network (Document Reference 6.3). This includes emissions from vehicles using the scheme and those in the wider road network which have been positively or negatively influenced by the scheme.* ***The assessment of road user carbon includes the total emissions across the ARN model****, as described in ES Chapter 5 Air quality (Document Reference 6.2) and shown in ES Figure 5.1 Affected Road Network (Document Reference 6.3).*"

I believe the Applicant means *ES Figure 5.2* [APP-074] rather than ES Figure 5.1.

51 Section 5.6.11 of the Environmental Statement [APP-036] defines the operational traffic study area is the affected local ARN, and the scheme and major roads: the scheme alignment; A417 between Gloucester and Cirencester; A419 between Cirencester and

Swindon; M5 between Tewkesbury and Falfield (J14); M4 J14-J15; A40 between Gloucester and Burford; and Local roads joining the highways outlined above. This appears to tally with *ES Figure 5.2.*

4.2 Issues with the Study Area

52 The study area for carbon emission assessment has therefore been appropriated from the air quality chapter. I have major concerns with this choice of study area for carbon assessment for the following reasons:

- Despite the increasing requirement, and good sense, in being able to assess to against relevant local carbon budgets and targets (for example, those set by local authorities and local transport plans), this choice of study area does not align to local authority boundaries.

- The Applicant has made no attempt to develop a study area for road-user carbon emissions as a unique environmental factor, and instead a model which is appropriate for one type of pollution has been adopted for another type of pollution with very different characteristics[18].

53 However, although it is not possible to align precisely with local authority boundaries, it is possible to make an indicative assessment at the local level. To do this, I scale the Applicant's reported emissions against the local Tewkesbury Borough (the area in which the scheme is proposed) in the next section. This creates a proxy local area which can then by assessed against various local and national carbon budgets.

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[18] **Air pollutants and carbon emissions have completely different physical characteristics, environmental and health impacts, and accounting requirements, so the same criteria for choice of study area do not apply.** This is a long-standing error in assessment methodologies where carbon assessment is viewed as a sub-set of air quality assessment, when in fact carbon assessment requires its own very specific methodology. This error has both scientific and regulatory repercussions.

Air pollutant gases, such as NO2, have very short-range effects whereas **greenhouse gases such as CO2 have effects which are range-less**. Pollutants like particulates (eg PM 2.5) may disperse over a wider area, but their effects are still attributable and proximal to their source, rather than range-less as in the case of CO2.

Air pollutants have their environmental effect in the immediate short-range area where they impact human and ecological receptors directly. The human health impact is also short-range in this sense, and results from interaction of people directly with the pollutants, close to their source. By contrast, the environmental effect of carbon emissions is range-less – a gramme of CO2 emitted in Norfolk or in New Zealand essentially has the same environmental effect. Similarly, the health effects of a unit of carbon emissions are range-less – so emissions in Norfolk, or New Zealand, have the same health impact on a person, for example, in the global south subsequentially suffering an extreme heat or flooding event.

The critical factor for attributing carbon emissions is the point of source, and this is an accounting issue. The vehicle carbon emissions from the A417 would be emitted in the Tewkesbury Borough area, and therefore are accountable to the carbon budgets and targets of that area.

Carbon emissions assessment need their own specific "study area" which is developed on the basis of their unique physical characteristics, environmental and health impacts, and accounting requirements. Appropriating a study area developed for pollutants with very different characteristics and requirements is irrational.

54 The traffic model area is actually larger geographically than Tewkesbury Borough because it extends along A roads beyond the boundaries of Tewkesbury Borough. However, it is smaller in terms of carbon emissions as the roads modelled are selected as shown in ES Figure 5.2, and only represent a fraction of the transport infrastructure in the study area. Therefore, the proxy generated is both larger (in area) and smaller (in representative transport infrastructure) than Tewkesbury Borough.

55 The proxy allows use of the traffic modelling projections to generate an indicative assessment at the local level which is neutral to the exact nature of the study area. First, the study area data needs to be deconstructed for generate key values which are useful later.

4.3 Deconstruction of 60-year DM and DS timeseries between 2026 and 2085

56 Table 1 provides a deconstruction of 60-year timeseries between 2026 and 2085 for the Do Minimum ("*DM (Perf, baseline)*" in my terminology from REP1-027, Table 1 and text narrative) and Do Something ("*DS (Perf, all)*" in my terminology) carbon emissions. I also provide a back cast to 2019 to provide DS and DM values for 2019 corresponding to the proxy study area. As the latest local authority carbon emission data is for 2019, this allows me later to scale against the local authority carbon emissions to generate further attributes of the proxy.

57 The starting place for this deconstruction is the time-series between opening year 2026 and design year 2041 as given in Table 14-8 of the Environmental Statement [APP-045] for the DM data, and Table 14-16 for the DS data. These source figures are in bold and underlined.

Do Minimum "DM (Perf, baseline")									
tCO2e/yr	**2016 Baseline**	**2019 Proxy**		**2026**		**2041**		**2085**	**60 years (2026-2085)**
Road user	180,107	170,438	←← Annual increment 1,173	**178,650**	→→ Annual increment 1,173	**196,247**	→→ Annual increment 0	196,247	*11,634,044*
Operation (maintenance)		858		858		858		858	
LULUCF		-166		-166		-166		-166	
Total absolute (DM) Operational	180,800	***171,131***		179,343		196,940		196,940	
Do Something "DS (Perf, all)"									
tCO2e/yr	**2016 Baseline**	**2019 Proxy**		**2026**		**2041**		**2085**	**60 years (2026-2085)**
Road user	n/a	179,090	←← Annual increment 1,494	**189,546**	→→ Annual increment 1,494	**211,952**	→→ Annual increment 0	211,952	*12,537,872*
Operation (maintenance)		858		858		858			
LULUCF		-180		-180		-180			
Total absolute (DS) Operational		***179,768***		190,224		212,630		212,630	

Table 1

58 The deconstruction of the DM and DS road user data is validated by the 60-year italic figures which are within rounding errors of the total produced in Tables 14-8[19] and 14-16[20]. The other 2026 and 2041 data in the table is consistent with Table 14-17[21].

59 The total absolute carbon quantifications are taken forward into further tables below. The DM 2019 figure of 171,131 tCO2e/yr is now used to scale against the local authority emissions. I note that the Applicant's 2016 baseline figure is larger at 180,107 (180,800 adjusted for maintenance operation emissions and land-use (LULUCF) emissions): this figure is out of kilter with the annual increments in emissions which the traffic model implies between 2026 and 2041 (and as back cast above from 2026). The Applicant should explain this discrepancy in its data.

[19] My figure of 11,634,044 corresponds to Table 14-8 11,634,050 (difference = -6)

[20] My figure of 12,537,872 corresponds to Table 14-16 12,537,861 (difference = 11)

[21] Identical or within a rounding error of 1 in the case of the figure 179,343 for Total DM, 2026.

4.4 Scaling to the Tewkesbury Borough

60 Table 2 shows the latest BEIS published local authority carbon emissions data as extracted from "UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2019" by BEIS[22] for Tewkesbury Borough, and for reference Gloucestershire.

tCO2e	BEIS 2019 A-roads	BEIS 2019 Motorways	BEIS 2019 Minor roads	BEIS 2019 Roads total
Tewkesbury Borough	97,830	191,477	73,810	363,116
Gloucestershire	489,582	442,085	463,154	1,394,821
"DM (Perf, baseline") (2019 Proxy)				171,131
2019 Tewkesbury Proxy carbon-based Scaling factor				47.13%

Table 2

61 In 2019, the total roads transport carbon is 363,116 tCO2e for Tewkesbury Borough. The 2019 Proxy for the DM emissions from Table 1 is 171,131 tCO2e (47.13%).

62 As noted above, the Affected Road Network (ARN) extends beyond Tewkesbury Borough but only contains a sub-set of roads in the area. Table 2 shows that the emissions from the scheme when back cast to 2019 and compared with the national BEIS data for 2019 is equivalent to 47.13% (on an emissions basis) of the Tewkesbury Borough. This then gives a proxy local area to make a local assessment.

63 Another way of looking at this, is that the data from the Applicant is based on the study area. The proxy area allows to consider the emissions for the study area 2019 and then assess the impact of them as they are forecast by the traffic models, and against the targets in for example the NZS. This is on the basis that emissions from any area (or representation of an area as in the case of the study area) can be considered equally against the NZS with all other areas in the UK. Where there is any divergence from the NZS in the proxy study area in the increase or decrease of emissions, the implication, and the reality, is that it has to be accommodated by other areas or sectors to meet the NZS pathways.

[redacted]

4.5 Local and national assessment based on Tewkesbury Borough (scaled)

64 Based on 47.13% of Tewkesbury Borough being a proxy for the transport carbon emissions study area based on 2019 BEIS data, a local and national assessment can be made as in Table 4 below.

65 Two other factors/assumptions are calculated to feed into Tables 3 and 4. These are:

- The total (whole economy) emissions of Tewkesbury Borough were 690,426 tCO2e in 2019, of which 363,116 tCO2e were road transport (see Table 2 above), so road transport is 52.6% of the Tewkesbury Borough total emissions in 2019. This is a very large percentage, largely due to the M5 motorway running through the Borough (this can be seen in Table 2 above where motorway emissions are nearly 200,000 tCO2e). I use the 52.6% percentage to calculate the transport sector from other budgets below. The assumption here is that the proxy study area will be assessed on the share of transport sector versus the whole economy as it is in 2019. This is reasonable, as a theoretical and approximate step[23], given the M5 is also part of the ARN model.

- I have already shown that the study area has 47.13% of the transport emissions of Tewkesbury Borough. Tewkesbury Borough is 0.14% of UK population. The assessment below assumes that the study area also reflects 47.13% of the Tewkesbury Borough population[24], the study area is 0.07% of the UK population. This is not an ideal assumption but enable a population share to calculate of national[25] carbon and local[26] budgets.

66 These assumptions and their limitations make the point that study areas which align to local and regional areas for which carbon budgets exists would be far preferable. The Applicant's traffic modelling has not facilitated this, so I have had to develop this proxy method with its assumptions. The purpose is an indicative assessment, and it serves that purpose if the limitations are borne in mind.

[23] We might in reality wish to reduce emissions from the transport sector more rapidly than other sectors given its extremely high share, but I am not concerned with this here in what is theoretical numerical model.

[24] On other words, the assumption that each person in the study area uses the same emissions.

[25] Climate Change Committee carbon budgets

[26] Tyndall Centre science-based carbon budgets

67 Based on the above, the following budgets for comparison are calculated.

tCO2e	4CB (2023-2027)	5CB (2028-2032)	6CB (2033-2037)
UK Budget (Climate Change Committee)	**1,950,000,000**	**1,725,000,000**	**965,000,000**
CCC Study Area budget (all sectors) by 2019 pop split (0.07%)	1,307,292	1,156,450	646,942
Study area CCC based Transport budget by 2019 pop split & 2019 52.6% transport split	687,545	608,213	340,247
Tyndall budget = Tewkesbury Borough	1,400,000	700,000	300,000
Study Area Tyndall all sectors	659,798	329,899	141,385
Study Area Tyndall transport budget, 2019 trans split	347,008	173,504	74,359

Table 3

68 Appendix E provides more background information on Carbon Budgets, and Appendix F gives the Tyndall Centre budget for Tewkesbury Borough.

69 The assessment is now calculated in Table 4 based on these budgets.

tCO2e		4CB (2023-2027)	5CB (2028-2032)	6CB (2033-2037)
UK Budget		**1,950,000,000**	**1,725,000,000**	**965,000,000**
Study area (ARN model, APP-045, 14.6.8)				
Absolute Emissions (Construction and Operation)/ Do-Something		**456,056**	**980,995**	**1,018,338**
Study Area Population % of UK (2019)	**A**	0.07%	0.07%	0.07%
% of UK CCC carbon budget	**B**	0.023%	0.057%	0.106%
% of Study Area CCC budget (all sectors)	**C**	34.89%	84.83%	157.41%
% of Study Area CCC budget (transport sectors)	**D**	66.33%	161.29%	299.29%
% of Study Area Tyndall budget (all sectors)	**E**	69.12%	297.36%	720.26%
% of Study Area Tyndall budget (transport sectors)	**F**	131.43%	565.40%	1369.49%
(Undervalued "solus") Differential DS-DM emissions - Table 14-18		**96,302**	**61,196**	**69,211**
% of UK CCC carbon budget	**G**	0.0049%	0.0035%	0.0072%
% of Study Area CCC budget (all sectors)	**H**	7.37%	5.29%	10.70%
% of Study Area CCC budget (transport sectors)	**I**	14.01%	10.06%	20.34%
% of Study Area Tyndall budget (all sectors)	**J**	14.60%	18.55%	48.95%
% of Study Area Tyndall budget (transport sectors)	**K**	27.75%	35.27%	93.08%

Table 4

70 The difference between the Climate Change Committee (CCC) and Manchester Tyndall Carbon budgets is explained in Appendix E. The CCC budget[27] is focussed more on

[27] Latest version is given in the 6th Carbon Budget document set: [redacted]

meeting the national, politically set, net zero-target of 2050 via an array of policy interventions. The Manchester Tyndall budget translates the IPCC global carbon budgets for a "well below 2°C and pursuing 1.5°C" global temperature target, and the equity principles enshrined in the United Nations Paris Agreement, and splits it between sub-national areas using different allocation regimes. It provides a science-based budget that is aligned to compliance with the Paris agreement.

71 Key results from the assessment table (Table 4) are:

- By the 6th carbon budget, absolute transport emissions in the study area account for 157% of the available 6th CCC carbon budget across all sectors in the study area (row C). **This comparison shows that road transport consumes more than the entire available proportioned CCC budget, and there is no emission space is left for any other sectors such as industry, domestic, agriculture and land-use in the study area.** Very considerable amounts of carbon (impossible amounts) would need to be offset somewhere else. The transport sector (row D) is using three times its share of the 6th carbon budget (299%) as compared to 161% for the 5th carbon budget.

  The Transport Assessment at APP-426, 5.1.2 lists areas of traffic growth (from development assumptions, NTEM growth factors, growth of freight traffic, and forecast traffic growth at the primary airports and seaports within the south-west region). In other words, an assumption in the traffic modelling and the case for the scheme is that traffic growth across the study area amasses into the future, and from multiple drivers. **The Applicant has provided no policies to mitigate against the corresponding rise in emissions, and although some may be expected in the Transport Decarbonisation Plan, these are inadequate to deal with the traffic and carbon emissions growth projected by the modelling.**

- The science-based carbon budgets from the Tyndall Centre provide a much more realistic model of the carbon budgets necessary to comply with the Paris Agreement than those from CCC (see Appendices E and F). As can be seen from Table 4, the available carbon in the budgets reduces rapidly in the period up to 2037: the rate of year-on-year reduction is -13.8% in Tewkesbury Borough[28]. These budgets indicate that even, soon after the opening of the scheme, during the 5th carbon budget, the transport demands in the study area use 565% of the available science-based transport budget, and by the 6th carbon budget this has increased to 1369% (row F).

- The absolute transport emissions in the study area increase to consume an ever-larger proportion of the national CCC carbon budget. This may be seen by comparing row A, the study area population % which stays at a constant 0.07%,

with row B which shows the overall percentage of the national carbon budget of the A417 scheme's transport emissions. By the 6th carbon budget, the scheme's transport emissions consume significantly more (0.106%) than the population share of the national CCC budget across all sectors, not just transport, of 0.07%.

72 The Applicant's assessment of differential emissions against the whole UK economy is given at row G. The same budget comparisons to the differential DS-DM emissions (rather than absolute DS emissions), a similar method to that used by the Applicant but in this case against the study area rather than the entire UK economy, are given for contrast at rows H-K. It can be seen how the sensitivity of the assessment is severely limited when differential emissions are used. Much greater real-world information like the actual impact on the budgets for the study area is gained by using absolute carbon emissions.

73 A further issue for the Applicant is that the single assessment that it has carried out corresponding to row G is, anyway, **the wrong solus quantification** and overestimates the DM case**, so that the DS0 – DM calculation underestimates the incremental effect of the A417.** I explained in REP1-027 how this solus quantity underestimates the real carbon emissions, and therefore the carbon assessment, of the scheme (see REP1-027, bullets 62, 63, 65, 76, 92, 93).

4.6 Sensitivity of assessment

74 A large range of assessment percentages is calculated in Table 4. There are four key factors contributing to the range of sensitivity:

- Area: local vs national economy
- Sector: transport vs all sectors
- Quantification: absolute vs differential emissions
- Carbon budget: policy-based vs science based

75 When all four factors are considered, for the 6th carbon budget, the Tyndall study area transport budget against absolute study area emissions is 1369% of budget (row F) [*local, transport, absolute, science-based*], and the Applicant's assessment is 0.0072% (row G) [*national, whole economy, differential, policy-based*]: the sensitivity difference is a factor of 190,946, or 5 orders of magnitude.

76 If the comparison is done with CCC budgets, 299% (row D) is compared with 0.0072% (row G): the sensitivity difference is a factor of 41,730.

77 **The Tables, and these factor figures, show that the Applicant's method is on the extreme, lowest end of the sensitivity range.** It is for this reason that the Applicant is not picking up the very serious impacts on the ability to meet UK carbon emissions budgets and targets. Quite simply, the Applicant misses seeing the signal in the noise.

4.7 Local assessment of cumulative impacts of absolute carbon emissions against the Net Zero Strategy

78 The Net Zero Strategy provides a delivery pathway for domestic transport which specifies the necessary carbon emissions reductions for 2030 and 2035 from 2019. The 2030 figures relates to an "increase of ambition" on the 5th carbon budget 2028-203229 which is consistent "with the action required to meet the UK's 2030 NDC".

79 From the deconstruction of the DM and DS road user data in Table 1, figures can be generated for 2019, 2030 and 2035, and for the DS and DM timeseries. The EIA-compliant modelling [see REP1-027] is shown with "empty" data in the table as these traffic model configurations have not been provided by the Applicant.

Nomenclature in REP1-027		2016	2019 Proxy	2026	2030	2035	2041
"DM (GHG, baseline)"	Baseline with no other development (current environment) – not provided by Applicant						
"DS (GHG, scheme)"	Scheme assessed against current environmental baseline – not provided by Applicant						
"DS (GHG, all)"	Scheme assessed cumulatively - not provided by Applicant						
"DM (Perf, baseline")	DM	180,800	171,131	179,343	184,036	189,901	196,247
"DM (Perf, baseline") against 2019	DM against 2019				7.54%	10.97%	
	NZS lower bound		171,131		112,947	59,896	
	NZS lower bound against 2019				-34.00%	-65.00%	
	NZS upper bound		171,131		94,122	41,071	
	NZS higher bound against 2019				-45.00%	-76.00%	
"DS (Perf, all)"	DS		179,768	190,224	196,199	203,668	212,630
"DS (Perf, all)" against 2019	DS against 2019				9.14%	13.29%	
	NZS lower bound		179,768		118,647	62,919	
	NZS lower bound against 2019				-34.00%	-65.00%	
	NZS upper bound		179,768		98,872	43,144	
	NZS higher bound against 2019				-45.00%	-76.00%	

Table 5

80 The performance-oriented modelling data from ES, Chapter 14 would indicate that road transport emissions are due to increase by a 7.5% and 11% for the years 2030 and 2035, respectively, relative to 2019 levels, across the study area even without the scheme (DM case above). With the scheme, emissions rise by 9% and 13% (DS case above).

81 The NZS delivery pathway is the Government's most recent policy for delivery of both the UK NDC under the Paris Agreement and the 6th carbon budget. The assessment

[29] Net Zero Strategy, technical Annex, page 307 of main NZS document, bullets 8 and 9

above would indicate that the shortfall – an emissions gap - in meeting the 2035 target is between (lower bound) 78% (65%+13%) and (upper-bound) 89% (76%+13%) of the entire 2019 transport footprint across the study area.

82 Policies in the Transport Decarbonisation Plan (TDP), and some local policies, might contribute some reductions towards closing the emissions gap identified. However, it is clear that the emissions gap is of such a quantum that projected policies will get nowhere near to closing it.

83 Table 5 also shows the absolute emissions required to meet the NZS pathways. These depend on the exact starting place in 2019. By 2035, the NZS would require the transport sector in the study area to be between 41,071 and 62,919 tCO2e/yr whereas the Applicant's DS model is at 203,668 tCO2e/yr for 2035.

84 It is also wholly unreasonable to expect that the identified emissions gap can be offset by extra emission reductions from other sectors in the study area, or from transport in other areas, either in Tewkesbury Borough and Gloucestershire themselves, or wider nationally.

4.8 Conclusions on assessment

85 I conclude that the scheme in the transport model study area <u>does have a very significant impact on the ability to meet UK carbon emissions budgets and targets</u>. This has been demonstrated in several ways in this section:

- **The huge emissions gaps demonstrated with respect to meeting both the 2030 and 2035 delivery pathways from the Net Zero Strategy (Table 5 above).**
- **Major overshoot of both "all sector" and "transport sector" UK (CCC) budgets, for the relevant local area, from the 4th, 5th and 6th carbon budgets (Table 4 above).**
- **Increasing share of the whole UK economy budget (Table 4 above).**
- **The applicant only reports the extreme lowest sensitivity assessment.**

5 QUANTIFICATION OF ECONOMIC COSTS OF CARBON

5.1 Background to carbon pricing for appraisal

86 This section gives a very brief overview of the relevant methodology. Table 5-4 of the Case for the Scheme document [APP-417] provides a summary of the results of the economic appraisal of the A417. This includes the cost of "Greenhouse Gases (Carbon)"

as £39.284million, or a negative "benefit" of -£39.284million. This figure derives from carbon pricing as explained below.

87 I have noted above that new guidance and carbon pricing values for appraisal were published by the Government in September and October 2021, followed by an update of the DfT WebTAG guidance and TAG data book.

88 In 2011, the previous approach (before the policy changes outlined above, and reflected in the Application) of working towards a fully working carbon market was outlined by BEIS' predecessor department DECC[30].

> *"In the short term (up to 2030), different targets in the Traded (ETS) and Non-Traded (non–ETS) sectors imply that emissions in the two sectors are essentially different commodities and the approach to valuing carbon needs to reflect this reality. Therefore, traded and non-traded carbon values will be used over the 2008-2030 period (Chart 1). Beyond 2030, a fully working global carbon market is assumed implying a single carbon value for economic appraisal over the 2031-2050 period ...*

Chart 1: Traded and Non Traded carbon values (2008-2050)

"

89 The latest Green Book supplement updates the method to recent Government policy on climate change, and the UK Emissions Trading Scheme, and "to give equal weight to emissions from the traded and non-traded sectors"[31]. This means that from 2020 traded and non-traded emissions are equally valued, as shown in the graph below, in the latest carbon pricing figures are shown below graphically as clipped from the policy paper guidance (reproduced in Appendix A).

[30] DECC publication, 2011, "*Guidance on estimating carbon values beyond 2050: an interim approach*",

[31] See "*Traded and non-traded carbon*" under "*Valuation of greenhouse gas emissions: for policy appraisal and evaluation*", September 2nd 2021 at

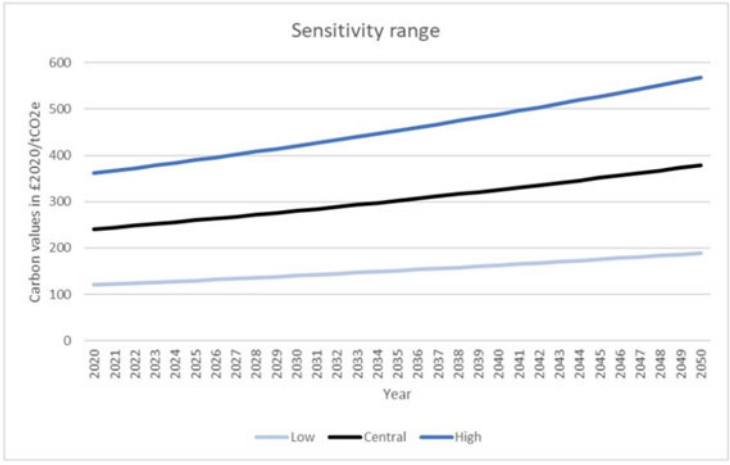


Figure 3: Sensitivity range of the updated carbon values.

90 Note that previously 60-year appraisals of road schemes have split the carbon emissions into the traded and non-traded sectors, with fossil fuel vehicles being non-traded and electric vehicles being traded. The fossil fuel vehicle / non-traded sector has been the numerically predominant sector in the appraisal data.

91 It can be seen that the new carbon prices are significantly greater than the previous ones. For example, for the predominant non-traded sector, the 2020 carbon price in the new policy data is c. £240/tCO2e compared to of c. £60/tCO2e on the previous data (ie 4 times greater).

92 The rationale for the change in carbon price is given in the policy paper, from Department of Business, Energy and Industrial Strategy (BEIS) "*Valuation of greenhouse gas emissions: for policy appraisal and evaluation*", published 2 September 2021 and provided in Appendix A. BEIS has conducted a review and update of the carbon values because several factors have changed since the last review, the most significant of which are the following:

i. Changes in international climate change targets, especially the Paris Agreement of 2015 and the new temperature target to limit global overheating to 1.5ºC.

ii. Changes in national targets including the UK 2050 net-zero target.

iii. The introduction of a UK Emissions Trading Scheme (UK ETS) in January 2021 following Brexit.

5.2 Further issues with the economic valuation of carbon

93 The changes in carbon pricing outlined about require a revision of the Case for the Scheme [APP-417]. However, there are further issues which also need addressing as follows.

94 The Applicant has not included the **construction emissions** in the BCR calculation. These should be included on the cost side of the BCR. Table 14-15 calculates these as 74,114 tCO2e. An indicative calculation shows that with the new TAG Data Book November 2021 v1.17 (Table A3.4), and with discounting and inflation adjustment from 2010, these construction emissions are costed at over £9million for 2025[32] (central carbon price). This increases the Total Present Value Cost (PVC) in Table 5-4 to over £214.5million.

95 The 60-year timeseries of DS-DM values used in the calculation of the existing -£39.284m carbon benefit is the **wrong solus differential quantity**. I explained in REP1-027 how this solus quantity underestimates the real carbon emissions, and therefore the real carbon pricing, of the scheme (see REP1-027, bullets 62, 63, 65, 76, 92, 93). The remedy is for additional transport modelling to be done which can generate a more realistic solus differential for the carbon emissions associated with the scheme, as outlined at REP1-027, section 3.8. When the traffic modelling required to be compliant with the EIA Regs has been done [REP1-027, section 3], and a realistic DS-DM timeseries generated [referred to as *ΔSolus (GHG)* at REP1-027, 63], the negative economic benefit of the GHGs will increase significantly.

96 For the full economic cost of the greenhouse gases associated with the road requires that a **cumulative differential value** is taken forward into the calculations. This is *ΔCumulative (GHG)* referred to at REP1-027, 63. Again, the negative economic benefit of the GHGs will increase significantly.

5.3 Requirement for revisions to case for scheme

97 The BCR requires recalculation on the basis of i) the new carbon prices ii) including construction emissions on the cost side iii) using correct solus differential iv) using cumulative differential. The case for the scheme then needs to be reviewed on the basis of the reductions in value of the BCR following these steps.

98 I respectfully request the ExA to require the Applicant to recalculate the BCR on this basis and update the Case for the Scheme.

[32] This is an underestimate as some of the emissions will fall in previous years eg 2024 with less discounting.

6 INTERPRETATION OF THE NPS NN

99 I note that the term "*material impact*" is not defined in the NPS NN. It must, therefore, be a matter of (rational) judgment as to what having a "*material impact on the ability of Government to meet its carbon reduction targets*" means at NPS NN 5.18.

100 I submit[33] that "*material*" means anything that is non-negligible ie: if a project's carbon impacts will have a non-negligible impact on the ability of Government to meet its carbon reduction targets, then this can – according to the NPSNN – be a reason to refuse development consent.

101 There is a very wide spectrum of sensitivity of carbon assessment depending on the variables used – both (i) how carbon is quantified (KQ-1) and (ii) against what budget/target the emissions is compared to (KQ-2).

The Applicant has used the entire UK national carbon budget which **dilutes the effects** of the carbon emissions associated with the A417 Missing Link into the entire UK economy.

The single assessment that the Applicant has carried out is, anyway, **the wrong solus quantification** and overestimates the DM case, so that the DS – DM calculation underestimates the incremental effect of the A417 Missing Link

102 The resulting 0.0072%[34] of the 6th carbon budget **is wrong and an underestimate**. In any case, even if it were correct and it is not, the figure is at the most extreme (lowest) end of this spectrum. An assessment should be made using absolute carbon quantities to show the real impact of the road system including the A417 Missing Link against the relevant carbon budgets, as I show in Table 4. The ExA and SoS should appreciate that a full range of assessment values is required to properly assess whether the Scheme will have a material impact on the Government's ability to meet its carbon reduction targets.

103 This is further supported by the EIA Regulation guidance to use more than one criterion in environmental assessment. **This is also wholly consistent with the usual approach of scientists is to find as wide a variety of criteria as possible to confirm an assessment.** The EIA Guidance[35] advocates using more than a singular criterion for significance determination:

> *"At the same time, significance determinations should not be the exclusive prerogative of 'experts' or 'specialists': significance should be defined in a way that reflects what is valued in the environment by regulators and by public and private*

[33] I am grateful to the recent legal submission to A38 Derby Junctions scheme, here and in subsequent paragraphs [redacted]

[34] Not shown under Chapter 14, Table 14-18 but calculated by me

[35] Paragraph 1.4.2, page 49, Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report, 2017 – European Union

stakeholders. A common approach used in EIA is the application of a multi-criteria analysis. Common criteria used to evaluate significance include the magnitude of the predicted effect and the sensitivity of the receiving environment:"

104 The Applicant has not given regard to considering using multi-criteria appraisal which increases the sensitivity of assessment by, for example, making local, regional and national scale assessments, and absolute and differential quantities, for both solus and cumulative carbon emission.

105 Much more information is required to make a rational and science-based assessment. The traffic models need to be run in the additional configurations which I have laid out at REP1-027, Table 2, and absolute as well as differential carbon emission quantities need to be taken forward to the assessment. Assessment should also be done against local and regional carbon budgets. My indicative calculations shows that when assessed locally, and with a range of sensitivities, that there is a huge emissions gap with respect to meeting both the 2030 and 2035 delivery pathways from the Net Zero Strategy.

106 <u>I request that ExA requires that cumulative, and local, regional and national assessments are made by the Applicant as part of making the Environmental Statement legal under an EIA Reg 20 process.</u>

107 The ExA and SoS need to consider all relevant carbon reduction targets that apply to the Scheme's operation. This will require a consideration of the Net Zero target and the impact that the Scheme's non-negligible emissions contribution will have on achieving that target. The SoS can only sensibly conclude that a Scheme of this size and impact *will* have a material impact on the Government's ability to meet the Net Zero target (because it will make that target substantially harder to meet) even if the target can still technically be met (through compensatory action taken elsewhere).

108 The ExA and SoS must also consider any assessment of carbon impacts within the context of the parliamentary declared Climate Emergency, particularly in which a considerable amount of the Scheme's expected emissions (including all its construction emissions) will take place within the next 10 years – a period which the scientific community now accepts will be crucial in addressing climate change.

109 Notwithstanding the need to rework the Environmental Statement for the modelling configurations at REP1-027, Table 2 above so that EIA Regs compliance may be demonstrated, the ExA and SoS cannot rely on the limited information provided by the Applicant in its Environmental Statement to conclude that the Scheme will not materially impact on the Government's ability to achieve its carbon reduction targets. Local and regional assessment is required too.

110 In light of all of the above, and notwithstanding the need to rework the Environmental Statement by the Applicant, the Scheme clearly will have a material impact on the Government's ability to achieve its carbon reduction targets and **<u>this impact represents a clear reason for refusal.</u>**

7 CONCLUSIONS

111 The evidence is compelling that the Environmental Statement breaches the EIA Regulations in its assessment of carbon emissions. It is **without doubt** that only a solus carbon assessment has been made, and then on the wrong solus calculation which underestimates the carbon impacts of the schemes, and its impact of national and international climate change laws and targets. Further traffic modelling is required.

112 Local and regional carbon assessment has not been carried out by the Applicant. When it is, as I have done in an indicative way, the Scheme is shown to have a very significant impact on the ability to meet UK carbon emissions budgets and targets. Once further traffic modelling has been done to produce EIA compliant carbon quantification data, the assessment of the scheme needs to be made across a full range of sensitivities outline at section 4.6.

113 I have identified four ways in which the BCR of the scheme should be recalculated, including to reflect new Government carbon pricing data. When these are accounted for the BCR for the scheme will be reduced. The Case for the Scheme must be reviewed against a recalculated BCR.

I respectfully request that the ExA gives serious consideration to suspending the Examination under EIA Reg 20 so that the missing data and necessary traffic modelling can be carried out, along with a wide sensitivity assessment on carbon, to complete the Environmental Statement. Further economic assessment is required too.

Dr Andrew Boswell,
Climate Emergency Policy and Planning, January 13th, 2022

8 APPENDIX A: BEIS CARBON PRICING POLICY PAPER

Policy paper, Department of Business, Energy and Industrial Strategy (BEIS)
"Valuation of greenhouse gas emissions: for policy appraisal and evaluation"
Published 2 September 2021

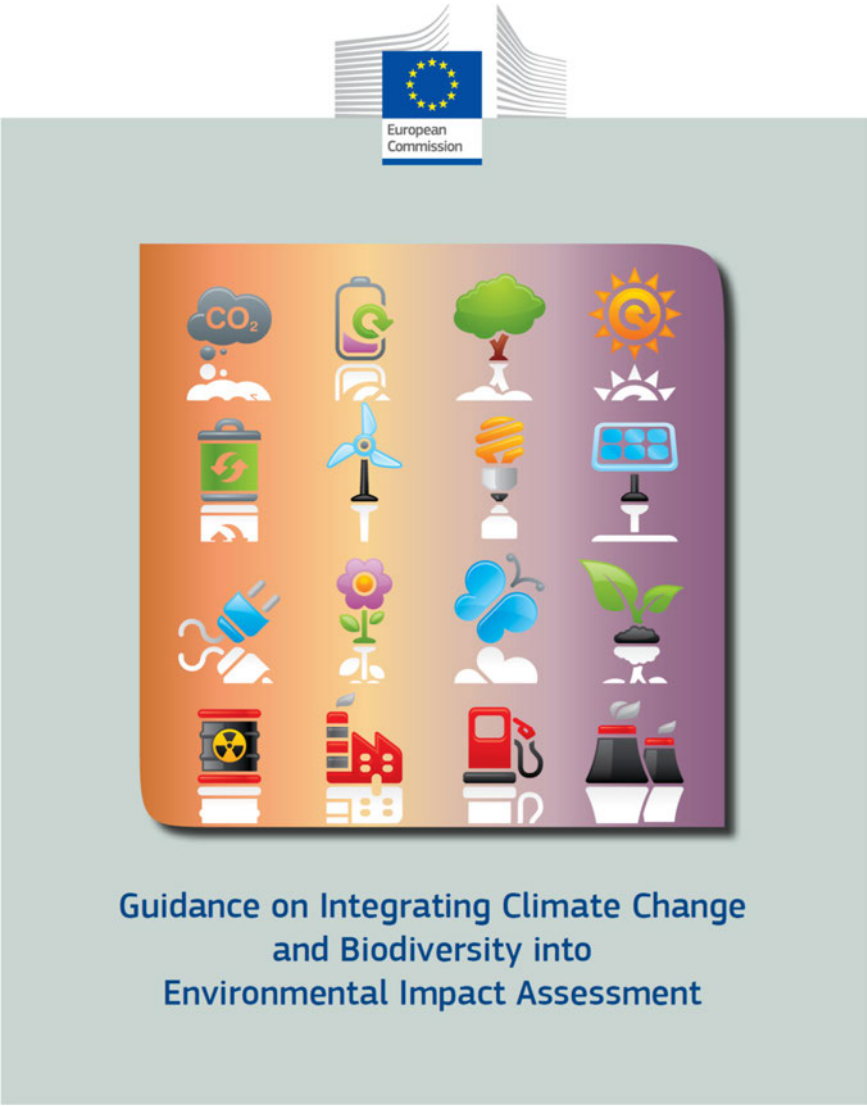
Supplied as separate document

9 APPENDIX B: GUIDANCE ON THE PREPARATION OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Supplied as separate document

10 APPENDIX C: GUIDANCE ON INTEGRATING CLIMATE CHANGE AND BIODIVERSITY INTO ENVIRONMENTAL IMPACT ASSESSMENT

Supplied as separate document



11 APPENDIX D: CHATHAM HOUSE, CLIMATE CHANGE RISK ASSESSMENT 2021

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12 APPENDIX E: WHAT IS A CARBON BUDGET AND HOW DOES IT POINT TO THE TRUTH?

114 A financial budget is defined as 'a plan to show how much money a person or organisation will earn and how much they will need or be able to spend'[36]. A carbon budget is similar, but instead of money, it sets out "the cumulative amount of carbon dioxide (CO2) emissions permitted over a period of time to keep within a certain temperature threshold[37]." **Unlike money, for carbon budgets, there are no overdraft facilities, nor national deficits, not quantitative easing mechanisms from central banks.** Once a CO2 budget is spent, it cannot be recovered, and the laws of physics determine the consequences for the planet and for humanity[38]. Carbon budgets reveal the truth of this situation.

115 The "laws of physics" can now provide increasingly accurate modelling of the global and local carbon budgets. In the last five years the reports of the Intergovernmental Panel on Climate Change (IPCC) have highlighted that our political institutions, businesses, and society have not started to respond to the climate emergency with the urgency required. Simply put we are living outside of our budget.

116 Collectively, we now know that this decade is the most crucial decade for reversing 200 years of carbon polluting activities, reversing the rash, profligate spending of our collective carbon budget, and building a new future based on a non-polluting global society. It is crucial that we address this emergency using every tool possible, and this includes carbon budgets and their capacity to point to the truth of where we are not doing enough, **and what we may be unable to do or build consequently.**

117 The Paris Agreement 2015 is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016[39]. The UK is a signatory to the agreement. Its goal is to limit global heating to well below 2°C degrees, preferably to 1.5 °C, compared to pre-industrial levels.

118 Scientists have established models that calculate how much more carbon dioxide[40] may be emitted globally into the atmosphere before breaching various temperatures of global overheating – eg: how many billions of tonnes (or Gigatonnes, GtCO2) before breaching

[redacted]

[redacted]

[38] Greenhouse gas removals (GGR) and negative emissions technologies may provide extremely costly, speculative, and unproven at scale methods which proxy for an "overdraft facility". Even if these work, they would be like paying back a loan at a huge interest rate. See, Kevin Anderson , John F. Broderick & Isak Stoddard (2020): A factor of two: how the mitigation plans of 'climate progressive' nations fall far short of Paris-compliant pathways, Climate Policy, DOI: 10.1080/14693062.2020.1728209, Appendix A "*However, there is wide recognition that the efficacy and global rollout of such technologies are highly speculative, with a non-trivial risk of failing to deliver at, or even approaching, the scales typically assumed in the models. … Whilst the authors of this paper are supportive of funding further research, development and, potentially, deployment of NETs, the assumption that they will significantly extend the carbon budgets is a serious moral hazard (Anderson & Peters, 2016).*"

[redacted]

[40] In fact, the models assess a variety of Greenhouse Gases, but for simplicity I restrict this document to CO2 (carbon dioxide) carbon budgets

1.5 degrees, how many billions of tonnes before breaching 2.0 degrees etc. These are referred to as carbon budgets, and I have previous explained them above as a bank account analogy but with no overdraft, deficit, or quantitative easing facilities available.

119 It is important to understand the difference between science-based carbon budgets and political targets like the net-zero target in the UK. Net-zero by 2050 can be achieved by many different paths or trajectories of annual carbon emissions, and the carbon emitted is basically the area under the curve. Annual emissions cuts may be applied late (not as "backloaded") or early (known as front loaded). Backloaded, or less steeply front-loaded, cuts will have a much greater quantum of carbon emissions emitted under the curve, and therefore also use much more of the carbon budget. Science-based carbon budgets by contrast aim to define a trajectory which meet a criterion – in the examples here, the path necessary to meet the temperature target in the Paris agreement. The UK Committee on Climate Change publish paths and budgets, but their ability to meet the criteria of the Paris temperature target has not been demonstrated scientifically – although CCC may claim, and genuinely, endeavour to meet that criterion. In fact, the CCC budgets, and assumptions, and hence UK carbon budgets, are increasingly challenged by scientists, see below.

120 It is further worth noting that a recent report[41] from Climate Crisis Advisory Group (CCAG) has recently said that there is no remaining carbon budget and policy should be directed towards net-negative carbon emissions as soon as possible. The report says:

> *"**The CCAG is clear that the current shift in global emissions is not sufficient to avoid global disaster, and there is no 'remaining Carbon Budget'**. If proper account is taken of all greenhouse gases, and their CO2 equivalence, the 450ppm threshold has already passed, contradicting the widespread notion of a 'carbon budget' that could still be spent whilst remaining below 1.5°C temperature rise."*

The CCAG was founded, and is chaired, by the eminent scientist Professor Sir David King, Fellow the Royal Society (FRS), and former UK Government's Chief Scientific Advisor from 2000 to 2007. CCAG comprises prominent climate scientists. It was created in response to the Climate Emergency this year, as a new advisory group to help inform the public, governments and financial institutions providing them with the most comprehensive science, and more crucially, guiding them towards action for climate repair. CCAG's important scientific commentary on the climate crisis can be made by their small group on a faster cycle than the IPCC.

[41] CCAG report, August 2021, "The final warning bell",

12.1 Science-based carbon budget assessment of compliance against UK obligations under the Paris agreement

121 To understand what emission reductions should be made in UK local authority areas to make a 'fair' contribution[42] towards the Paris Climate Change Agreement, scientists at Manchester Tyndall centre have taken IPCC global carbon budgets and produced the so-called SCATTER budgets for UK local authorities. SCATTER stands for Setting City Area Targets and Trajectories for Emissions Reduction project and was funded by the Department for Business Energy and Industrial Strategy (BEIS). It developed a methodology for Local Authorities to set carbon emissions targets that are consistent with United Nations Paris Climate Agreement[43]. The Tyndall budget for the East Midlands area is given in Appendix F.

122 These budgets translate the "well below 2°C and pursuing 1.5°C" global temperature target, and the equity principles enshrined in the United Nations Paris Agreement, to a national UK carbon budget which is then split between sub-national areas using different allocation regimes.

123 The assumptions for this transformation from global to local budgets in given in two sources:

a) a 2020 Climate Policy paper[44], widely referred to as the "Factor of Two" paper

b) the "full" report from the Tyndall Carbon Budget Tool for UK Local Authorities[45], widely referred to SCATTER budgets

These two sources are authored by the same research group and are internally consistent. The "Factor of Two" paper is a landmark in 2020 in appraising national carbon budgets.

12.2 Relevant carbon budgets/targets derivable from the Climate Change Committee

124 The Climate Change Committee (CCC) has recently published its sixth Carbon Budget (6CB) report. Its headline recommendation is for the UK to deliver a reduction in net annual emissions of 78%, against a 1990 baseline, by 2035. Previous UK ambition was targeting an 80% reduction against 1990 figures by 2050 under the original Climate Change Act, so this represents a halving of the time to get to around 80% emission cuts (against 1990 baseline) from 2020.

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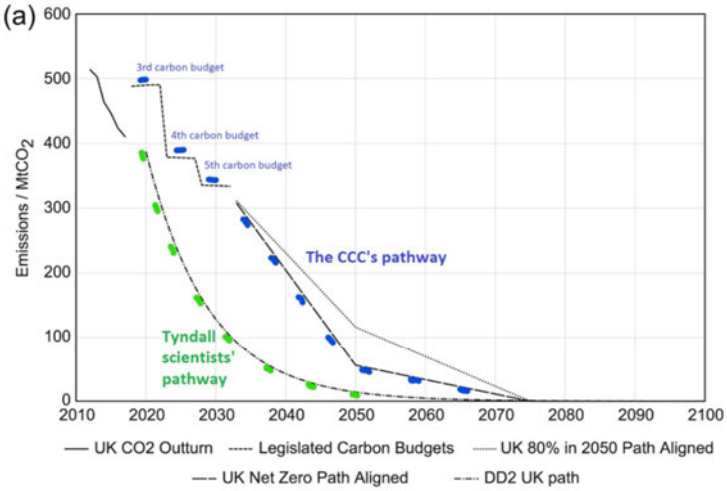
[42] 'fair' meaning equitable under the Paris Agreement equity principles between developing and developed nations, known as Common but Differentiated Responsibilities and Respective Capabilities (CBDR–RC) [redacted]

[redacted]

[44] Kevin Anderson, John F. Broderick & Isak Stoddard (2020): A factor of two: how the mitigation plans of 'climate progressive' nations fall far short of Paris-compliant pathways, Climate Policy, DOI: 10.1080/14693062.2020.1728209

[redacted]

125 However, the CCC do not show anywhere how the 6th Carbon Budget (6CB) can be derived directly by a stepwise downscaling from a scientifically established global carbon budget (in contrast to the Manchester Tyndall references above which do demonstrate this). The derivation of the 6CB is focussed more on meeting the national, politically set, net zero-target of 2050 via an array of policy interventions rather than fitting to a specific carbon budget (relating to the back-loading and front-loading point above). The point here is that are many possible pathways to reach net-zero, and each will have different accumulated carbon emissions under the curve – so one can reach net-zero having added more or less emissions to the global atmosphere, some pathways may blow our carbon budgets. The science-based carbon budget approach is designed to specify a pathway which keeps within the carbon budgets.



This graph is from the Factor of Two paper by climate scientists at the Tyndall centre. People & Nature added the highlights. The pathway for UK carbon emissions highlighted in green is one that, the scientists argue, is compatible with the Paris agreement. The pathway highlighted in blue is one they have plotted to reflect the CCC's emissions reductions proposals: it implies cutting emissions at about half the pace that the scientists' pathway implies

Figure 2

126 Generally, the difference between the Tyndall and CCC carbon budgets is that the Tyndall ones are 2 – 3 times smaller (and tighter). As shown above, the Tyndall budgets have rapid decarbonisation from 2020 in order to meet the overall budget (area under the curve). The Tyndall trajectory is derived from the IPCC budget for 1.7°C, supporting the point from CCAG that there is no remaining budget for 1.5°C.

127 The graph above is taken from[46] and illustrates the difference between CCC and Tyndall carbon budgets. In simple terms, the carbon budget is the area under the annual emissions trajectory curve. Issues such the shape of the curve, front-loading or back-

loading emissions reductions can produce vastly different curves and corresponding *areas under the curve*. So it is possible for the UK to meet net-zero at 2050 via vastly different overall carbon budgets. Therefore "net-zero", in itself, is not a good measure of compliance with the Paris agreement temperature target whereas a science-based carbon budget is.

128 Further, the details of the carbon accounting differ, so it is not easy to get a like-for-like comparison between the science-based carbon budget from Manchester Tyndall and the Climate Change Committee budgets. For further information, see footnotes[47].

[47] "How the UK Climate Change Committee steals from the carbon budget", blog post by Professor Peter Somerville, 8th July 2021, [redacted] and "Calculating a fair carbon budget for the UK". blog post by Professor Peter Somerville, 8th July 2021, [redacted]

13 APPENDIX F: SCIENCE BASED CARBON BUDGET FOR TEWKESBURY BOROUGH

129 As generated at [redacted]

130 Tyndall Carbon Budget Reports present recommended climate change commitments for UK local authority areas that are aligned with the commitments in the United Nations Paris Agreement, informed by the latest science on climate change and defined by science-based carbon budget setting.

13.1 Setting City Area Targets and Trajectories for Emissions Reduction (SCATTER)

131 This work was developed as part of the Setting City Area Targets and Trajectories for Emissions Reduction (SCATTER) project. The SCATTER project, funded by the Department for Business Energy and Industrial Strategy (BEIS), developed a methodology for Local Authorities to set carbon emissions targets that are consistent with United Nations Paris Climate Agreement. The SCATTER project was a collaboration between Tyndall Manchester, Anthesis Group and Greater Manchester Combined Authority. The further development of the carbon budget methodology into a widely applicable free online resource for local authorities UK-wide was supported through funding from the University of Manchester EPSRC Impact Support Fund. A SCATTER online tool by Anthesis Group is also available to local authority users online.

Setting Climate Commitments for Tewkesbury

Quantifying the implications of the United Nations Paris Agreement for Tewkesbury

Date:	January 2022
Prepared By:	Dr Jaise Kuriakose, Dr Chris Jones, Prof Kevin Anderson, Dr John Broderick & Prof Carly McLachlan

NB: All views contained in this report are solely attributable to the authors and do not necessarily reflect those of the researchers within the wider Tyndall Centre.

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