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WRITTEN REPRESENTATION

INTRODUCTION: Climate Emergency Policy and Planning (CEPP)

I am an independent scientist and environmental consultant, working at the intersection of science, policy, and law, particularly relating to ecology and climate change. My doctoral work, at Oxford University after a BSc in chemistry at Imperial College London (1977), was in structural biology, protein binding sites and dynamics (DPhil, 1981)[1].

Most of my 40-year career was in scientific computation, including high performance climate models. Between 1985 and 1994, I was involved in the design and testing of software for the design and logic synthesis of Very Large Scale Integrated (VLSI) circuits: this included running software models of circuits, at that time[2], of up to 1 million transistors. Between 1995 and 2006, I ran the high-performance computer service at the University of East Anglia which supported the university's scientific research community in running models, across a range of sciences, on a small supercomputer. I have a wide understanding of the principles and practice of modelling complex systems which I bring to this submission.

Due to the climate crisis, from 2005 I have been involved in campaigning and politics, including being a Norfolk County Councillor for 12 years. The severity of the climate emergency is clear through science and has been for several decades, and my work through CEPP now is to promote the necessary rapid response to the Climate Emergency in mainstream institutions, such as local authorities and government, through the lenses of science, policy, and law. I am an Expert contributor to the proposed UK Climate and Ecological Emergency Bill[3], drafted by scientists, legal experts, ecological economists, and environmentalists, and designed specifically to reverse the climate and ecological breakdown that we are facing.

[1] An area that has become quite alive for me again, 40 years later, during the COVID pandemic re: the structural biology of vaccine design, viral protein mutations and vaccine escape etc

[2] 1 million was cutting edge at the time! Transistor counts now exceed 2 trillion on a single chip https://en.wikipedia.org/wiki/Transistor_count,

[3] https://www.ceebill.uk/bill

SUMMARY

1 In our full WR which follows, CEPP lay out a Carbon Assessment Architecture which would enable a coherent assessment of the A47BNB scheme's carbon emissions impact, both as the project itself and in-combination and cumulative impacts from other proposed schemes in the Greater Norwich area. We then make an indicative assessment using our architecture, against relevant local transport carbon budgets derived from BEIS historic data, the 4th Carbon Budget and science-based carbon budgets from the Tyndall Centre, University of Manchester.

2 In its opening year, the scheme accounts for between 13.4% - 32.5% of Broadlands's transport budget across a range of carbon budget methods. When a realistic indicative cumulative assessment is made in-combination with other schemes planned in the Greater Norwich area, then scheme in-combination accounts for 38% - 91.5% of the transport budget for the GN area. This falls in the 4th carbon budget period, a time critical to make strong progress on decarbonisation both locally and nationally.

3 Following these assessments, and conclusions, CEPP object to the scheme because it undermines all attempts to decarbonise transport in Norfolk and the wider UK, as laid out in our substantive text. <u>We strongly recommend that the Secretary of State refuses consent to the DCO.</u>

4 There is significant missing data which both leads to an under-estimation the carbon footprint of the scheme and creates a structural (modelling architectural) barrier to a coherent cumulative carbon assessment. The missing data identified needs to be collected and made available by the Applicant so that the cumulative carbon assessment may be carried out.

5 The Applicant has made no assessment against the now enacted UK 6th Carbon Budget.

6 The applicant has made no assessment against regional and local levels of carbon emissions, and budgets, in breach of the EIA regulations.

7 The application has not assessed land-use emissions, on the scheme, on in-combination with other local schemes, as required by PAS 2080.

8 The applicant has not assessed cumulative, and in-combination, carbon emissions in breach of the EIA regulations.

9 Further our detailed technical appraisal shows that, now, with the current assessment and modelling architecture of NCC and the Applicant, **<u>it is not possible to coherently or reliably assess the cumulative carbon emissions related to this scheme and other planned schemes in the Greater Norwich area</u>**. NCC and the Applicant are running models over a hotch-potch of "study areas", NATS model baseline years, model configuration, precluding any coherent in-combination assessment of carbon emissions between and across the schemes.

10 As the EIA regulations, and Highway England's own licence, require such a cumulative environmental assessment, the Applicant must– in consultation with NCC - indicate how they will adapt the assessment and modelling architecture so that a robust and safe cumulative carbon emissions assessment may be carried out.

11 No national level cumulative assessment has been made at least the 50 major road schemes under the RIS2 scheme, and also the array of road schemes under Large Local Major funding programme which includes the Norwich Western Link (NWL) in the Greater Norwich area. This is contrary to Highways England licence section 5.23(c). It is also under consideration by the High Court following a judicial review.

12 The legal status and scope of the NPSNN needs to be clarified to PINS and the parties at the Examination by the NPSNN.

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1 INTRODUCTION

13 On July 14th, 2021, the Secretary of State for Transport published the Transport Decarbonisation Plan (TDP)[4] and committed to a review of the NPSNN[5]. It would be valuable for the Government to advise PINS, and all parties at the Examination, on the on-going status of this policy following the review announcement. In particular as the "carbon emissions" section (NPSNN 5.16 to 5.19) is under a legal challenge by Transport Action Network (TAN)[6], clarification is required as to its legal status and scope for this Examination.

14 Further the TDP contained this commitment from the Government on page 151 "*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"*.

1.1 CEPP Carbon Assessment Architecture

15 NPSNN[7] requires the Applicant to provide evidence of the carbon impact of a project and assess it against the Government's carbon budgets.

16 This current framing for dealing with carbon emissions is inadequate, for reasons we will expand upon later. For this written representation, CEPP will extend the assessment of carbon emissions impacts to against:

A. **local carbon budgets**, local environmental policy, and also recent historic trends in emissions locally. Local assessment of carbon emissions is required by the EIA Regulations as described later. **It is an essential part of a lawful assessment process** which has been ignored by the Applicant.

B. **science-based carbon budgets** as the Government's carbon budgets do not accurately reflect the UK's obligations under the Paris agreement. CEPP strongly recommends assessment against science-based carbon budgets to gain a better perspective of compliance to meet the UK's obligations under the Paris treaty. We later introduce such science-based carbon budgets at the local level which are being increasingly used by local authorities.

[4] "Decarbonising Transport: A Better, Greener Britain", https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1002241/decarbonising-transport-a-better-greener-britain.pdf

[5] "National Policy Statement for National Networks", https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf

[6] See https://transportactionnetwork.org.uk/nps-legal-case-2/

[7] "National Policy Statement for National Networks", https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf, section 5.17

17 Our WR, therefore, its written at two levels. ***First***, we will consider whether the Applicant has met the minimum NPSNN conditions to:

A. provide evidence of the carbon impact of the project
B. assess the evidence against the Government's carbon budgets

Second, where following the EIA Regulations (which extend upon the NPSNN) and consider whether the Scheme is buildable in a Climate Emergency when assessed against:

C. local carbon budgets based on government data, enacted government carbon budgets and science-based carbon budgets
D. local environmental policy

18 The CEPP Carbon Assessment Architecture for this submission is based in the standard law and guidelines, for example, the relevant EIA Regulations[8] and PAS-2080[9], as we now expand.

2 REQUIREMENTS FOR CARBON IMPACTS ASSESSMENT OF THE PROJECT

19 This section expands on the data required to provide evidence of the carbon impact of the project under the NPSNN. As carbon assessment falls under environmental assessment, the EIA Regulations are also binding and extend the NPSNN as described below.

20 This section lays out the requirements of the EIA regulations, the spatial scales, and the types of carbon emissions for assessment.

21 Whilst acknowledging the assessment process made by the Applicant, this stage starts to highlight additional areas of assessment which should have been undertaken and have not been for the A47BNB scheme.

[8] "The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017", https://www.legislation.gov.uk/uksi/2017/572/contents/made

[9] Publicly Available Specification (PAS) 2080 Carbon management in Infrastructure provides a common framework for all infrastructure sectors on how to manage and reduce whole life carbon when delivering infrastructure assets and programmes of work

2.1 Requirements of the EIA regulations

22 The EIA regulations lay out that environmental **assessment** of an environmental **factor** should start from the current environmental **baseline**. Then the impacts of the scheme itself are assessed: for the case of carbon emissions as a climatic factor, this analysis will be across several different carbon emission types (eg: construction emissions, vehicle emissions etc) which we expand and define later. Then the impacts of the scheme in-combination with other schemes is assessed: this is at different **spatial scales** as we expand later, and is also over the different **carbon emission types**.

23 The sequentially of assessment can be summarised: ①baseline, ②scheme, ③scheme in-combination. The Applicant has only attempted the first two of these.

24 The guidance[10] on the preparation of the Environmental Impact Assessment reports ("the guidance") defines "Baseline Scenario" as "*Description of the **current status** of the environment in and around the area in which the Project will be located. It forms the foundation upon which the assessment will rest.*"

25 The EIA regulations require the assessment process as follows: first by specifying the factors[11] for EIA assessment including:

> "…
> *climate (for example greenhouse gas emissions, impacts relevant to adaptation)*
> …"

And then, the likely significant effects of a development which should be considered[12] which includes:

> *"(a) the **construction and existence of the development**, including, where relevant, demolition works;*
> …
> *(e) the **cumulation of effects with other existing and/or approved projects**, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;*
>
> *(f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change;"* (our emphasis)

[10] https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf, PDF page 7

[11] https://www.legislation.gov.uk/uksi/2017/572/schedule/4/paragraph/4/made

[12] https://www.legislation.gov.uk/uksi/2017/572/schedule/4/paragraph/5/made

And the significant effects to be assessed[13]:

> *"The description of the likely significant effects on the factors specified in regulation 5(2) should cover the direct effects and any indirect, secondary,* ***cumulative****, transboundary,* ***short-term, medium-term and long-term, permanent and temporary****, positive and negative effects of the development. … "* (our emphasis)

26 The sequential process for assessment of any environmental factor, including climatic factors, is then:

i. ①Define the baseline – the current status of the environmental factor – for the foundation of the assessment process.

ii. ②Determine the impact from the "*construction and existence of the development"*

iii. ③Determine the impact from *"cumulation of effects with other existing and/or approved projects"*

27 We further note that the requirement to assess cumulative impacts is included in the Highways England License (Department for Transport, 2015), at section 5.23, which states that, in complying with Section 4.2(g) and its general duty under Section 5(2) of the Infrastructure Act 2015 to have regard for the environment, the Licence holder should:

> *"c. Consider the cumulative environmental impact of its activities across its network and identify holistic approaches to mitigate such impacts and improve environmental performance;"*

CEPP note that the Applicant has quoted (e), (f), (g) and (h) of section 5.23 in Chapter 14 (Climate) of the Environmental Statement [AS-004], 14.3.17 but has omitted (c) above which relates to the duty for cumulative environmental assessment including on carbon emissions.

In not providing, an assessment of the cumulative impacts of carbon emissions "across its network" in the Application, Highways England has not considered these impacts, and has not complied with their license.

As per the EIA regulations, this is both "local" and "national" network, and the spatial scale meanings of "across its network" are described next.

[13] https://www.legislation.gov.uk/uksi/2017/572/schedule/4/paragraph/5/made

2.2 Spatial Scales for assessment

28 The guidance[14] addresses how a project's impact on greenhouse gas emissions should be addressed and states:

> *"The assessment should take relevant greenhouse gas reduction targets at the national,* ***regional, and local levels*** *into account, where available."* (our emphasis)

29 Whilst for cumulative effects[15]:

> *"[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)

30 On this basis, the EIA regulations require that carbon assessment is done for the scheme itself and for the scheme in-combination, at the local and regional scale, as well as at the national scale. This is a wider scope than the NPSNN which appears to only require national scale assessment (ie: comparison with national carbon budgets).

31 In only following the NPSNN, the Applicant has failed to meet the requirements of the EIA regulations in this respect.

2.3 National Spatial Scale assessment

32 For cumulative impacts at the national spatial scale, European Case law (CJEU, C-531-13, Marktgemeinde Straßwalchen and Others) states:

> *"A national authority must examine [a Project's] potential impact jointly with other Projects."* (as quoted in the guidance[16])

33 This judgement supports section 5.23(c) of the Highways England License in requiring assessment of cumulative environmental impact of HE activities across its network.

34 This also implies that the scheme should be assessed "local" and "national" networks, including at least the 50 major road schemes under the RIS2 scheme, and also the array of road schemes under Large Local Major funding programme which includes the Norwich Western Link (NWL) in the Greater Norwich area.

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[14] https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf, PDF page 41

[15] https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf, PDF page 52

[16] https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf, PDF page 52

2.4 What local spatial scale is appropriate?

35 Given the steer from the guidance for local effects both to be assessed against local targets, and as part of a cumulative impacts assessment, we note that an interpretation is needed on what local scale should be chosen.

36 For the A47BNB, a rational approach would be to assess at the County council area, the district council level (ie Broadland), and the Greater Norwich Local Plan (GNDP[17]/GNLP) area, as these areas have well established historical emissions data for comparison at the relevant local authority level[18]. These are also local authority areas which should be developing their own carbon budgets, targets, and monitoring, and so it is rational for transport schemes to be assessed within the same boundaries. The local assessment is not possible if it is not based on a spatial scale and area which corresponds to known and reliable carbon budgets. Assessment against any other than local authority areas, which already have the necessary budgets and historical data, is irrational at best, and, at worst, causes the tangled web of data that is currently being presented by the Applicant and NCC.

37 We will show all three levels of areas (ie: Broadland, GNLP, Norfolk) in our assessment later.

2.5 Irrational choice of Affected Road Network (ARN) for carbon assessment

38 Chapter 14 (Climate) of the Environmental Statement [AS-004] indicates that the study area is the ARN (eg: at 14.6.3, 14.7.3, 14.8.7, under Table 14-9). The ARN itself appears to be defined in Chapter 5 (Air Quality) of the Environmental Statement [APP-043] at 5.6.7, and it is shown at Figure 5-2 [APP-055].

39 An important point here is that the study area chosen for the traffic and carbon modelling of the A47BNB is irrational:

A. A study area that has been developed for air quality assessment, and may make sense for that, has been adapted for carbon assessment. Air pollutants and carbon emissions have completely different physical characteristics, environmental impacts, and accounting requirements: it is irrational[19] to use the same study area to assess each.

B. Examination of Figure 5-2 shows that the ARN covers 2 district council areas (Broadland, Great Yarmouth) but excludes the very significant, and proximate, urban area of Norwich City Council. For accounting purposes, carbon emissions pertain to the area where they are emitted, and this why the local spatial scale areas that CEPP suggest are

[17] Greater Norwich Development Partnership

[18] https://data.gov.uk/dataset/723c243d-2f1a-4d27-8b61-cdb93e5b10ff/emissions-of-carbon-dioxide-for-local-authority-areas, latest data release 24th June 2021

[19] This results from 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 specified methodology.

preferrable. The vehicle carbon emissions from the A47BNB would be emitted in Broadland, and accounted for in Broadland: they are also emitted, and accounted, in the Greater Norwich planning area (GNLP), and also within the Norfolk County Council area. They are **not** emitted, or accounted within, the Great Yarmouth district council area.

C. The irrational choice of carbon assessment study area also precludes any meaningful cumulative carbon assessment for the scheme, as the other relevant schemes, as listed in the next section, exist in the Greater Norwich area, but not the Great Yarmouth area.

2.6 Schemes to be assessed for local cumulative impacts

40 For cumulative impacts, the EIA guidance notes European Case law (CJEU, C-531-13, Marktgemeinde Straßwalchen and others):

> "*where nothing is specified, that obligation is not restricted only to Projects of the same kind"* (as quoted in the guidance[20])

41 In this WR, we only use road construction projects: this provides an incomplete assessment but, as we show, available data is limited even on the road projects. Ideally, carbon from other infrastructure developments such as rail should be included.

42 For local assessment, we **only** consider projects in the Greater Norwich area (as defined by Broadland, Norwich, and South Norfolk local authority areas, with proposal for construction before the end of the 4th Carbon budget (2023-2027) as below.

i. A47 Blofield to North Burlingham (A47BNB)
ii. A47 North Tuddenham to Easton (A47NTE)
iii. A47/A11 Thickthorn Junction (A47THI)
iv. Norwich Western Link (NWL)
v. Long Stratton Bypass (LSB)

43 It should be noted that this excludes:

A. Schemes that may be proposed later than 2027: these include additional A47 schemes like the A47 Acle Straight.

B. Two schemes in Great Yarmouth, are due in the 3rd and 4th carbon budget periods. The "Great Yarmouth Third River Crossing" is already under construction, it will emit additional operational emissions in the 4th carbon budget which we are not accounting at this stage. The "A47 Great Yarmouth junctions improvements" would emit additional construction

[20] https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf, PDF page 52

and operational emissions in the 4th carbon budget which we are not accounting at this stage.

44 This appraisal itself is, therefore, "optimistic" in excluding some possible future schemes; however, it is pragmatic at this stage, to limit the Carbon Assessment Architecture to within the Greater Norwich area, and to a "manageable size". Once cumulative carbon emissions in the Greater Norwich area are understood better, cumulative carbon assessment may be extended to the Norfolk County Council area which would include the Great Yarmouth, and also other schemes in the West of Norfolk. CEPP reserve the right to introduce these later to our requirements and submissions.

2.7 Schemes to be assessed for national cumulative impacts

45 For national assessment, this should include at least the 50 major road schemes under the RIS2 scheme, and also the array of road schemes under Large Local Major funding programme which includes the Norwich Western Link (NWL) in the Greater Norwich area.

46 We note a legal case which was recently heard at the High Court[21], awaiting judgement, concerning the cumulative assessment of carbon emissions under the RIS2 programme, and note that the outcome of the case will have an impact on this aspect of the current Examination.

47 We note the absence of any assessment of national cumulative impacts by the Applicant for the scheme despite the requirement for it under section 5.3(c) of the Highways England licence.

2.8 Requirements of the types of carbon emissions to be assessed

48 Emeritus Professor of Transport Policy, Phil Goodwin[22], has outlined 5 main ways in which increasing road capacity increases CO2 emissions[23], in summary:

A. Construction, embodied carbon in concrete, tailpipe emissions for vehicles, and land clearance and preparation;

B. Operation, maintenance, servicing, lighting;

C. Vehicle emissions from use, including induced traffic and effects of changes of traffic speed;

[21] https://transportactionnetwork.org.uk/ris2-legal-case/ - Transport Action Network Limited v The Secretary of State for Transport (And Highways England Company Limited), CO/2003/2020

[22] Emeritus Professor of Transport Policy at University College London and at the University of the West of England, also Senior Fellow (Transport and Climate Change) of the Foundation for Integrated Transport Policy

[23] Witness statement, Prof Phil Goodwin, for case CO/2003/2020, https://transportactionnetwork.org.uk/wp-content/uploads/2021/03/Witness-statement-of-Phil-Goodwin-23-10-2020-16-03-2021_Redacted.pdf, section 6

D. Wider impacts from induced development and car-dependent lifestyles and car ownership

E. Synergetic effects

49 Whilst PAS 2080 defines these categories:

A. Capital carbon, "GHG emissions associated with the creation, refurbishment and end of life treatment of an asset"

B. Operational carbon "associated with the operation of infrastructure required to enable it to operate and deliver its service"

C. User carbon - "GHG emissions associated with Users' utilisation of infrastructure and the service it provides during operation"

50 In PAS 2080, these are coded into detailed "modules" which each have their own carbon emissions quantification. For example, module A-1 is embedded emissions from "raw material supply".

51 In the CEPP Carbon Assessment Architecture, we introduce a simplified model for the carbon emissions that should be assessed, which is closer to the Applicant's presentation, but also can be mapped to, **and is consistent** with the PAS-2080 modules. It uses seven carbon emission types for quantification, as follows:

	Accounting phase / type	**Description**	
Construction	*Construction* ***<CONST>***	Material supply including primary extraction, manufacturing, transportation and construction process and site works associated with the scheme	PAS-2080 module A
Land-use emissions from land-clearance	*Construction* ***< CONST-LUC>***	Carbon released in land-clearance (eg: for carbon rich soils or woodland destroyed)	PAS-2080 module A-5
Loss of carbon sequestration	*Construction* ***<CONST-SEQ>***	Future loss of ability to sequester carbon from habitats lost during construction	PAS-2080 module D
Operation	*Operation* ***<OP>***	Associated with the maintenance and refurbishment of the scheme, and lighting	PAS-2080 module B
Road user carbon emissions (operation)	*Operation* ***<OP-USE>***	Vehicle emissions	PAS-2080 module B-9
Carbon sequestration gained	*Operation* ***<OP-SEQ>***	Future ability to sequester carbon from habitats gained	PAS-2080 module D
End of life	*End of life* ***<EOL>***		PAS-2080 module C

Table 1

52 Each of the seven types of carbon emissions identified is given a code for future reference. So far, this just identifies the type of emissions but not its temporal characteristics with respect to carbon budgets which is expanded later.

53 The land-use change emission types ***< CONST-LUC>, <CONST-SEQ>,*** and ***<OP-SEQ>*** are separated out as they operate in different ways and timescales**.**

54 The Applicant has reported emissions under the ***<CONST>, <OP>, <OP-USE>*** types. Land use change emissions have not been determined for the A47BNB and the significance of their quantum is unknown: this requires clarification from the Applicant. End of life emissions, PAS-2080 module C, have not been determined for the A47BNB: this requires clarification from the Applicant.

55 With respect to land use change emissions, when the cumulative carbon impacts are considered across several local schemes, the nature of some of the local habitats are high-carbon and therefore have a very significant level of emissions associated with them. These should be assessed for all schemes, as part of cumulative carbon impact accounting, and are included in our assessment architecture.

2.9 Combined requirements for spatial scale, cumulative impacts, and types of carbon

56 Table 2 brings together the requirements from the previous sections into one table, and also shows the available published data for each emission type.

- A ✓ means data exists, not that its calculation is necessarily correct, or agreed with, or endorsed by CEPP.
- A ✗ means that as far as we know published data is not available.
- The ?✓for the national cumulative data means that data may be available for some of the schemes in each of the RIS2 and LLM categories, but the ☒ for RIS2 indicates its calculation is currently contested in the Courts[24] and by experts[25].
- The ?✗ for national cumulative data means that largely this data is not known, and cumulative total across the sum of relevant schemes has not been published by any authorities.
- The ✗↑↑indicates that construction and land use change carbon emissions are expected to be high on the NWL scheme: <CONST> emissions due to a 700m viaduct within the scheme requiring a large quantum of cement; < CONST-LUC> due to significant areas of woodlands, veteran and ancient trees, and carbon-rich soil that would be disrupted; and <CONST-SEQ> due to loss of significant areas of woodlands, veteran and ancient trees, and carbon-rich soil sinks. Data on this is required for the in-combination assessment to be completed for this scheme, but NCC have made no information available on these impacts yet.

[24] https://transportactionnetwork.org.uk/ris2-legal-case/ - Transport Action Network Limited v The Secretary of State for Transport (And Highways England Company Limited), CO/2003/2020

[25] Witness statement, Prof Jillian Anable, for case CO/2003/2020, https://transportactionnetwork.org.uk/wp-content/uploads/2021/03/Witness-statement-of-Jill-Anable-23-10-2020-16-03-2021_Redacted.pdf

- The "Temporal" column indicates whether the emissions, the terms of carbon budgets, are short-term, or longer-term. The short-term emissions from these schemes are expected to fall predominantly within the 4th carbon budget (2023-2027) period, whilst the long-term emissions spread out over 60 years (typically 2025-2084). *Note, we refer here only to the period in which the emitting happens as short-term. In physical science[26], and radiative forcing[27], terms, all emissions are long-term as CO2 remains in the atmosphere for centuries, unless sunk by natural or artificial carbon removal.*

- In Table 2, we have broken down some emissions types for assessment, both short-term over the next three published UK carbon budgets (4CB, 5CB and 6CB), and their 60-year assessment period. This corresponds to the Applicants submission for <CONST>, <OP> and <OP-USE> types.

		This scheme	**Greater Norwich cumulative**				**National cumulative**	
Accounting type	Temporal	A47BNB	A47NTE	A47THI	NWL	LSB	RIS2	LLM
<CONST>^{CB4}	*CB4 Short-term*	✓	✓	✓	✗↑↑	✗	? ✗	? ✗
< CONST-LUC>^{CB4}	*CB4 Short-term*	✗	✗	✗	✗↑↑	✗	? ✗	? ✗
<CONST-SEQ>^{CB4}	*CB4 Short-term*	✗	✗	✗	✗↑↑	✗	? ✗	? ✗
NB: Schemes beyond CB4 construction excluded								
<OP>^{CB4}	*CB4 Short-term*	✓	✓	✓	✗	✗	? ✗	? ✗
<OP>^{CB5}	*CB5 Short-term*	✓	✓	✓	✗	✗	? ✗	? ✗
<OP>^{CB6}	*CB6 Short-term*	✗	✗	✗	✗	✗	? ✗	? ✗
<OP>^{60YR}	*Long-term*	✓	✓	✓	✗	✗	? ✗	? ✗
<OP-USE>^{CB4}	*CB4 Short-term*	✓	✓	✓	✓	✓	? ✓☒	? ✓
<OP-USE>^{CB5}	*CB5 Short-term*	✓	✓	✓	✓	✓	? ✓☒	? ✓
<OP-USE>^{CB6}	*CB6 Short-term*	✓	✗	✗	✗	✓	? ✓☒	? ✓
<OP-USE>^{60YR}	*Long-term*	✓	✓	✓	✓	✓	? ✓☒	? ✓
<OP-SEQ>^{60YR}	*Long-term*	✗	✗	✗	✗	✗	? ✗	? ✗
<EOL>	-	✗	✗	✗	✗	✗	? ✗	? ✗

Table 2

57 The Sixth Carbon budget has only recently been legislated[28], after the Applicant's submission. The Applicant's carbon assessment [AS-004] now requires updating at Table 14-9 to reflect this.

[26] https://twitter.com/KenCaldeira/status/1141849042189578240?s=20 Eminent climate scientist, Prof Ken Caldeira, Carnegie Institution for Science, Stanford lead author for the U.N.'s Intergovernmental Panel on Climate Change (IPCC) AR5 report: "*If you burn a lump of coal, the greenhouse effect from the carbon dioxide released from burning that coal will, over its lifetime in the atmosphere, heat the Earth about 100,000 times more than the thermal energy released from burning that coal.*"

[27] https://en.wikipedia.org/wiki/Radiative_forcing

[28] https://www.legislation.gov.uk/ukdsi/2021/9780348222616,

58 Table 2 shows that the required data is very incomplete. For local cumulative assessment especially, reliable construction and land-use change emissions for the Norwich Western link scheme are missing.

59 For national cumulative assessment, much of the data is missing or contested, suggesting that a national cumulative assessment may not be possible within the timeframe of the Examination. If the data is not available to the Examination, then a conclusion may not be possible, on whether the A47BNB, or the RIS1/2 programmes of which it is part, are consistent with the legal and policy requirements and obligations (eg: the 4CB, 5CB and 6CB Carbon budgets, the 2030 national target of 68% reduction in the UK National Determined Contribution under the Paris Agreement[29], and the 6CB 2035 78% reduction by 2035[30] target). The Secretary of State may be required to make an assessment for the DCO decision.

3 PRACTICAL ISSUES: CARBON IMPACTS ASSESSMENT OF THE PROJECT

60 The carbon assessment architecture described in the previous section has several practical requirements, especially for the calculation of vehicle emissions, which derive from transport models, in order for a coherent carbon assessment to be made which are now described.

3.1 Study areas for vehicle use emissions in cumulative assessment

61 In order to sum the vehicle emissions (<OP-USE>) to determine an overall cumulative figure for this emission type, the modelling areas must be the same. As CEPP previous submitted at deadline D1, in response to the ExA request under Rule 17 for further information [REP1-074], it is not clear how the study areas overlap in different schemes. This does not just risk double counting, as identified by the Applicant, but there is no way to unravel it. The only solution is start with the same study for all schemes. This extends our comments above that Affected Road Network (ARN) chosen for carbon assessment is irrational.

62 As CEPP wrote in REP1-074, a rational approach would be to choose the County council area, or the Greater Norwich local plan area, as these areas have well established historical emission data for comparison at the relevant local authority level.

3.2 Model baseline years for vehicle use emissions

63 The Norwich Area Transport Strategy (NATS) models are used by both the Applicants for the A47 schemes and by the County Council. Despite, apparent standardisation on overall choice of NATS, the models are run from different baseline years. NCC has chosen to adopt a different NATS model (base year 2019 – "NATS-

[29] 12th December 2020, https://www.gov.uk/government/publications/the-uks-nationally-determined-contribution-communication-to-the-unfccc

[30] https://www.legislation.gov.uk/ukdsi/2021/9780348222616

2019") for its NWL scheme whilst Highways England use an earlier model (base year 2015 – "NATS-2015").

64 This raises concerns that Highways England are using a NATS-2015 baseline when the local transport authority, NCC, have made a preference for NATS-2019.

65 However, it has not been adequately demonstrated that the NATS-2019 model is a closer reflection of real and predicted traffic patterns. This is shown by a CEPP analysis of data from NCC for the NWL modelled with an earlier study with NATS-2015 (for a Strategic Outline Business Case, SOBC in 2019), and their current Outline Business Case (OBC in 2021) study at NATS-2019, as below.

66 Table 3 shows a comparison of high-level vehicle km data from the studies. The ticks ✓ indicate that the A47NTE scheme is included in all models of the NWL shown.

	NWL/SOBC (2019)		NWL/OBC (2021)	
	NATS-2015		NATS-2019	
NWL	Do Minimum	Do Something	Do Minimum	Do Something
A47NTE	✓	✓	✓	✓
Vehicle km	SOBC-DM	SOBC-DS	OBC-DM	OBC-DS
2025 km	*5950805*[31]	*5707558*[32]	*4136000*[33]	*4087000*[34]
2040 km	*6788116*[35]	*6853722*[36]	*4904000*[37]	*4767000*[38]
2025 OBC/SOBC Vkm			-30.50%	-28.39%
2040 OBC/SOBC Vkm			-27.76%	-30.45%
2025 DS-DM Vkm		-243247		-49000
2040 DS-DM Vkm		65606		-137000

Table 3

We observe two key effects:

[31] Table 5.29, SOBC, OSR, PDF page 112, https://bit.ly/2019Jul15_NWL_OSR

[32] Table 5.29, SOBC, OSR, PDF page 112, https://bit.ly/2019Jul15_NWL_OSR

[33] OBC, Environmental Impact Report, 4.7.3, p33, https://www.norfolk.gov.uk/-/media/norfolk/downloads/roads-and-transport/nwl/environmental-impact-report.pdf

[34] OBC, Environmental Impact Report, 4.7.3, p33, https://www.norfolk.gov.uk/-/media/norfolk/downloads/roads-and-transport/nwl/environmental-impact-report.pdf

[35] Table 5.29, SOBC, OSR, PDF page 112, https://bit.ly/2019Jul15_NWL_OSR

[36] Table 5.29, SOBC, OSR, PDF page 112, https://bit.ly/2019Jul15_NWL_OSR

[37] OBC, Environmental Impact Report, 4.7.3, p33, https://www.norfolk.gov.uk/-/media/norfolk/downloads/roads-and-transport/nwl/environmental-impact-report.pdf

[38] OBC, Environmental Impact Report, 4.7.3, p33, https://www.norfolk.gov.uk/-/media/norfolk/downloads/roads-and-transport/nwl/environmental-impact-report.pdf

A. Blue shaded area: There is a reduction of around 30% of vehicle km in the modelling between the SOBC and OBC modelling, on all scenarios (ie: DM/DS, 2025/2040).

B. Orange shaded area: In the SOBC model, introduction of the NWL reduces overall Vkm at the opening year. Traffic then expands over time faster with the NWL, so that by the forecast year, Vkm are greater with the NWL. **By contrast,** in the OBC model, after an initial reduction of traffic with the NWL, traffic expands less slowly with the NWL so that by the forecast year, there is a greater reduction in Vkm with the NWL.

67 An explanation is required from NCC as to why these significant difference are observed between the models. *Simply, how have 30% of vehicle km been lost in the modelling? And how has the relative traffic growth been switched from year-on-year increasing with an NWL in the SOBC model run to year-on-year decreasing with an NWL in the OBC model run?*

68 As far as the A47BNB, the Applicant needs to provide a rationale for continuing with an older model when NCC has upgraded.

69 With respect to cumulative assessment, the modelling should use the same baseline year for all schemes in the cumulative assessment. Given the outstanding concerns about the NWL OBC modelling, in which the traffic characteristics of the road have been radically changed by switching model base years, it may be preferable to use the NATS-2015 model for the cumulative assessment, as outlined below.

70 NCC should also provide information of the carbon assessments from the Long Stratton Bypass (LSB) schemes which is also required for the local scale cumulative assessment.

3.3 What needs to be done to facilitate vehicle emissions, <OP-USE>, cumulative assessment

71 As CEPP wrote in REP1-074, the precursor for assessing cumulative operational carbon emissions across these schemes is a coherent and consistent modelling environment. To achieve this, it is necessary:

A. To choose an appropriate "study area" which covers all the schemes. A rational approach would be to choose the County council area, or the Greater Norwich local plan area, or district council level.

B. To set a common base year for the model, agreed between Highways England and NCC.

C. To develop a consistent set of model assumptions to apply.

D. To set the DM, at the correct current environmental baseline in which none of these schemes exist. Currently, in 2021, as far as vehicle carbon emissions, none are emitted from any of the A47 schemes, nor from the

NWL scheme or the LSB schemes. This is the correct baseline for DM modelling.

4 LOCAL CUMULATIVE ASSESSMENT

	1	2	3	4	5			
	tCO2e		No schemes	This scheme	Greater Norwich cumulative			
	Accounting type	Temporal	DM	A47BNB	A47NTE	A47THI	NWL	LSB
A	<CONST> CB4	*CB4 Short-term*	0	25,765[39]	87,727[40]	25,946[41]	×↑↑	×
B	< CONST-LUC> CB4	*CB4 Short-term*	0	×	×	×	×↑↑	×
C	<CONST-SEQ> CB4	*CB4 Short-term*	0	×	×	×	×↑↑	×
	NB: Schemes beyond CB4 construction excluded							
D	<OP>CB4	*CB4 Short-term*	0	66	39	54	×	×
E	<OP>CB5	*CB5 Short-term*	0	110	63	90	×	×
F	<OP>CB6	*CB6 Short-term*	0	110	65	90	×	×
G	<OP>60YR	*Long-term*	0	1,320	780[42]	1,080[43]	×	×
H	<OP-USE> CB4	*CB4 Short-term*	3,179,030[44]	3,188,451	Requires modelling			
I	<OP-USE> CB4Δ	*CB4 Short-term* Δ	0	9,421	Derivable H5-H3			
J	<OP-USE> CB5	*CB5 Short-term*	5,182,172[45]	5,196,307	Requires modelling			
K	<OP-USE> CB5Δ	*CB5 Short-term* Δ	0	14,135	Derivable J5-J3			
L	<OP-USE> CB6	*CB6 Short-term*	×	×	Requires modelling			
M	<OP-USE> CB6Δ	*CB6 Short-term* Δ	0	×	Derivable L5-L3			
N	<OP-USE>60YR	*Long-term*	59,396,960[46]	59,528,977	Requires modelling			
O	<OP-USE>60YRΔ	*Long-term* Δ	0	132,017	Derivable N5-N3			
P	<OP-SEQ>	*Long-term*	0	×	×	×	×	×
Q	<OP-SEQ>60YR							
R	<EOL>	-	0	×	×	×	×	×

Table 4

[39] Section 14.8.3, A47 BLOFIELD TO NORTH BURLINGHAM DUALLING, Environmental Statement Chapter 14 [TR010040/APP/6.1, AS-004]

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

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

[42] Section 14.8.4, A47 NORTH TUDDENHAM TO EASTON DUALLING, Environmental Statement Chapter 14 Climate [TR010038/APP/6.1, APP-053]

[43] Section 14.8.1, A47/A11 THICKTHORN JUNCTION, Environmental Statement Chapter 14 Climate [TR010037/APP/6.1, APP-051],

[44] Table 14-9, A47 BLOFIELD TO NORTH BURLINGHAM DUALLING, Environmental Statement Chapter 14 [TR010040/APP/6.1, AS-004]

[45] Table 14-9, A47 BLOFIELD TO NORTH BURLINGHAM DUALLING, Environmental Statement Chapter 14 [TR010040/APP/6.1, AS-004]

[46] Table 14-9, A47 BLOFIELD TO NORTH BURLINGHAM DUALLING, Environmental Statement Chapter 14 [TR010040/APP/6.1, AS-004]

72 Table 4 shows the sequential cumulative assessment as laid out in "Requirements of the EIA regulations" above, and fills in figures where they are published. This indicates 3 model runs ①Baseline=" No schemes", ②Impact of "This scheme", ③Impact of cumulative schemes in the Greater Norwich Area.

73 For the cumulative model run across Greater Norwich, the same 'rational' study area would be run, as for the scheme itself and the baseline, but with the inclusion of the further schemes.

74 All three model runs also require the same NATS model (same base year) and the same configuration of it for a reliable cumulative impact assessment to be made.

75 The architecture above avoids the double counting issue raised by the Applicant, and prompting the Inspector's Rule 17 request for more information.

4.1 Notes on Table 4

76 We introduce the Δ symbol to indicate where differential, or delta, data is used as opposed to absolute carbon emissions.

77 It is important to note that the Δ data is very often small differences between exceptionally large base absolute emissions, and it is the very large quantum of absolute carbon emissions which are being generated year-on-year. The small differential, delta, figures reported, as in the 60-year vehicle carbon appraisals, masks the underlying massive erosion of available carbon budgets by the continuing with transport systems which profile high absolute carbon footprint. For example, the 60-year absolute carbon emissions across the ARN for the scheme are over 59 MtCO2e, but the delta figure reported is 132,000 tCO2e which 0.22% of the absolute carbon proposed to be emitted.

78 When comparing emissions to carbon budgets, it is preferrable to use absolute data, as the carbon budgets themselves are absolute, and also finite.

79 The data above separates out the <OP> and <OP-USE> data more clearly than the Application in [AS-004]. However, the figures precisely relate to the Application. For example, on CB4:

A. AS-004, Table 14-8 shows the traded and non-traded vehicle emission as 227 tCO2e and 9,194 tCO2 respectively, which sum to 9,421 tCO2 in cell I4 for <OP-USE>$^{CB4\Delta}$ for A47BNB.

B. Cell H4 is derived the "Operation (DS)" in AS-004, Table 14-9 of 3,188,517 tCO2e with 66 tCO2 for non-vehicle use operation emissions subtracted = <OP-USE>^{CB4} for A47BNB of 3,188,451 tCO2.

C. We note v small inconsistencies in the Applicant's data which are probably due to rounding. In Table 14-8, CB4 "Operation (DS)" and "Construction (DS)" are summed to "Total DS": the "Total DS" figure

should be 3,214,282 not 3,214,283 to be consistent with the table figures. In a similar calculation, a loss of 2 tCO2e is observed in the "Sixth to 16th (2033 to 2087)" data when 1,114 tCO2e (52 years at 22 tonnes) is used for the <OP> datum. It would be helpful if the Applicant's data in the AS-004 Tables were to be presented so that it adds up correctly.

80 The orange shaded area reproduces the data from the Application. However, it should be noted that this is effectively 'placeholding' and not the final data required for the cumulative assessment architecture described. As stated above, this would require a rational study area – the current ARN used is not. When this is corrected, the scheme is run on a new study area, the figures will be different.

4.2 Three carbon totals to assess against local budgets

81 CEPP identify three carbon totals to take forward to an indicative assessment against local budgets for the 4th carbon budget. These are:

A. The Applicant's "Difference (DS-DM)" figure for the 4th Carbon budget from AS-004, Table 14-9 of 35,253 tCO2e ("A47BNB").

B. This figure with the <CONST>^{CB4} and <OP>^{CB4} figures for A47NTE and A47THI schemes added to A. This *35,253*+87,727+25,946+39+54 = 149,019 tCO2e ("A47BNB_CUMU1"). This figure is *far below even a minimum estimate* of the Greater Norwich cumulative total for CB4 but represents the sum of known data.

C. A more realistic guess-estimate of the Greater Norwich cumulative total for CB4 of 300,000 tCO2e ("A47BNB_CUMU2"). This is a guess-estimate for a final figure of additional emissions which must include the <CONST>^{CB4}, < CONST-LUC>^{CB4}, and <CONST-SEQ>^{CB4} for the NWL and other emissions on the NWL and LSB. We have already indicated that the construction, land-use, and sequestration-loss figures for the NWL are expected to be large.

82 As our comment above, the A, B and C figures above have been produced from modelling which has several issues including incoherent study areas, different NTS base years, different model configuration. By taking these figures forward to an indicative assessment, we do not endorse them, or accept them as correct.

83 Note that most of these carbon emissions figures, from construction emissions, can be expected to be accounted in 1 year, 2025, although vehicle use and operation emissions are also included for 2026 and 2027. The data, therefore, represents various estimates of an emissions spike which would predominantly occur in 2025.

84 The next section makes the assessment.

5 ASSESSMENT AGAINST LOCAL CARBON BUDGETS

5.1 What is a carbon budget and how does it point to the truth?

85 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*'[47]. 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*[48]." **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[49]. Carbon budgets reveal the truth of this situation.

86 The "laws of physics" can now provide increasingly accurate modelling of the global and local carbon budgets. In the last five years, in particular, 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.

87 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 as a consequence.**

88 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[50]. The UK is a signatory to the agreement. Its goal is to limit global warming to well below 2 degrees, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

[47] https://dictionary.cambridge.org/dictionary/english/budget

[48] https://carbontracker.org/carbon-budgets-explained/

[49] 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).*"

[50] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

89 Scientists have established models that calculate how much more carbon dioxide[51] 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 1.5 degrees, how many billions of tonnes before breaching 2.0 degrees etc. These are referred to as carbon budgets, and we have previous explained them above as a bank account analogy but with no overdraft, deficit, or quantitative easing facilities available.

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

90 To understand what emission reductions should be made in UK local authority areas to make a 'fair' contribution[52] towards the Paris Climate Change Agreement, scientists at Manchester Tyndall centre have taken IPCC global 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[53].

91 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.

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

a) a 2020 Climate Policy paper[54], widely referred to as the "Factor of Two" paper

b) the "full" report from the Tyndall Carbon Budget Tool for UK Local Authorities[55], 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.

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

[52] '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) https://www.oxfordclimatesociety.com/blog/what-you-need-to-know-aboutcommon-but-differentiated-responsibility

[53] https://carbonbudget.manchester.ac.uk/about/

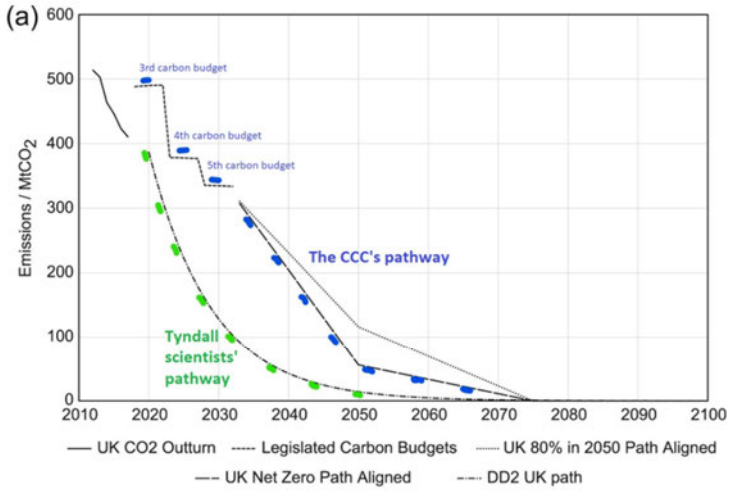
[54] Kevin Anderson, John F. Broderick & Isak Stoddard (2020): A factor of two: how the mitigation plans of 'climate progressive' nations fall far short of Paris-compliant pathways, Climate Policy, DOI: 10.1080/14693062.2020.1728209

[55] https://carbonbudget.manchester.ac.uk/reports/

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

93 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.

94 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 (as the Manchester Tyndall references above do demonstrate). The derivation of the 6CB is focussed more on meeting the national net zero-target of 2050 via an array of policy interventions rather than fitting to a specific carbon budget.



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

95 Generally, the difference between the Tyndall and CCC carbon budgets is that the Tyndall ones are 2 – 3 times larger. As shown above, the Tyndall budgets have rapid decarbonisation from 2020 in order to meet the overall budget (area under the curve).

96 The graph above is taken from[56] 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

[56] https://peopleandnature.wordpress.com/2021/07/08/how-the-uk-climate-change-committee-steals-from-the-carbon-budget/

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.

97 Further, the details of the carbon accounting differ, so it is non-trivial 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[57].

5.4 Results of assessment against local carbon budgets

98 We now assess three carbon emissions totals, derived above, against three carbon budgets from historic BEIS data, the published 4th carbon budget, and science-based budgets from the Tyndall Centre.

99 Table 5 gives the assessment. The left-hand side of the table displays the budgets.

100 The latest BEIS data for local authorities is given[58], corresponding the reported emissions in 2019, for Broadland, the GNDP/GNLP area, and Norfolk. The transport total is separated out, and its percentage of the total is also given. Assessment against the "Transport total 2019 ANNUAL" figure for each area is then as assessment against the actual reported data for 2019 of the emissions spike that is expected to occur in 2025 (with some in 2026 and 2027).

101 The data for the "4th Carbon budget" takes the annual legislated carbon budget for the 4th Carbon budget and distributes it on the basis of % of UK population[59]. Annual and 5-year transport budgets are calculated on this basis for the Broadland, GNDP and Norfolk areas.

102 The data for the "Tyndall SCATTER budget" takes the annual budgets from the Tyndall local carbon budgets website[60] for Broadland, GNDP and Norfolk areas, and calculates the 5-year 4CB budget. This is then apportioned into a 5-year and average annual transport budget for the 4CB period, using the 2019 transport shares of the overall BEIS budget.

[57] "How the UK Climate Change Committee steals from the carbon budget", blog post by Professor Peter Somerville, 8th July 2021, https://peopleandnature.wordpress.com/2021/07/08/how-the-uk-climate-change-committee-steals-from-the-carbon-budget/ and "Calculating a fair carbon budget for the UK". blog post by Professor Peter Somerville, 8th July 2021, https://peopleandnature.wordpress.com/2021/07/08/calculating-a-fair-carbon-budget-for-the-uk/

[58] https://data.gov.uk/dataset/723c243d-2f1a-4d27-8b61-cdb93e5b10ff/emissions-of-carbon-dioxide-for-local-authority-areas, 2005-2019 data, downloaded June 25th, 2021

[59] Using mid-2020 ONS population data from under the "Mid-2001 to mid-2020 detailed time series edition of this dataset" at https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland

[60] https://carbonbudget.manchester.ac.uk/reports/

tCO2e				*A47BNB - 35,253 tCO2e*			*A47BNB_CUMU1 - 149,019 tCO2e*			*A47BNB_CUMU2 - 300,000 tCO2e*		
2019 BEIS ANNUAL	Broadland	GNDP	Norfolk	Broadland	GNDP	Norfolk	Broadland	GNDP	Norfolk	Broadland	GNDP	Norfolk
Transport total 2019 ANNUAL	263,667	789,887	1,884,453	13.37%	4.46%	1.87%	56.52%	18.87%	7.91%	113.78%	37.98%	15.92%
LA area 2019	723,374	2,064,620	5,761,936									
% Transport of Total	36.45%	38.26%	32.71%									
4th Carbon Budget												
Transport (2023-2027) 5-YEAR	1,258,908	3,915,035	7,592,585	2.80%	0.90%	0.46%	11.84%	3.81%	1.96%	23.83%	7.66%	3.95%
Transport (2023-2027) ANNUAL	251,782	783,007	1,518,517	14.00%	4.50%	2.32%	59.19%	19.03%	9.81%	119.15%	38.31%	19.76%
LA Area (2023-2027) by population ANNUAL	690,766	2,046,637	4,643,042									
% UK Population	0.18%	0.52%	1.19%									
Carbon Budget ANNUAL	390,000,000	390,000,000	390,000,000									
Tyndall SCATTER budget												
Transport (2023-2027) 5-YEAR	543,099	1,641,278	3,456,941	6.49%	2.15%	1.02%	27.44%	9.08%	4.31%	55.24%	18.28%	8.68%
Transport (2023-2027) ANNUAL	108,620	328,256	691,388	32.46%	10.74%	5.10%	137.19%	45.40%	21.55%	276.19%	91.39%	43.39%
LA Area (2023-2027) ANNUAL	298,000	858,000	2,114,000									

Table 5

5.5 Results of local carbon budget assessment

103 The assessment results are on the right-hand side of Table 5. The percentages on the right-hand side of the table are the proportion of the relevant budget that the particular carbon footprint for the scheme would use. So, for example, the Applicant's 35,253 tCO2e figure for the 4th carbon budget (A47BNB) corresponds to 13.37% of the Broadland total transport footprint in 2019.

104 In the year of construction and initial use (2025), the scheme alone, based on the Applicant's figures accounts for 13.4% - 32.5% of Broadlands's transport budget across the range of carbon budget methods. When a realistic indicative cumulative assessment is made in-combination with other schemes planned, then scheme in-combination accounts for 38% - 91.5% of the transport budget for the Greater Norwich area.

105 In more detail, for the Applicant's reported figure of 35,253 tCO2e ("A47BNB"). This corresponds to:

A. >13% of Broadland's BEIS reported transport emissions in 2019

B. c.1% of GNDP's 5-year 4th carbon budget for transport

C. >10% of the GNDP's SCATTER 2025 budget for transport

106 The significant underestimate of Greater Norwich cumulative emissions of 149,019 tCO2e ("A47BNB_CUMU1") corresponds to:

A. >56% of Broadland's BEIS reported transport emissions in 2019

B. 3.8% of GNDP's 5-year 4th carbon budget for transport

C. >45% of the GNDP's SCATTER 2025 budget for transport

107 The more realistic guess-estimate of the Greater Norwich cumulative total for CB4 of 300,000 tCO2e ("A47BNB_CUMU2") corresponds to:

A. >113% of Broadland's BEIS reported transport emissions in 2019

B. 7.6% of GNDP's 5-year 4th carbon budget for transport

C. >91% of the GNDP's SCATTER 2025 budget for transport

108 Metric B shows that significant new emissions are added to the transport emissions in the GNDP area over a 5-year 4th carbon budget period assessment. Up to 7.6% for the realistic cumulative impact figures of the scheme.

5.6 Discussion of local carbon budget assessment

109 This local assessment for the 4th carbon budget needs to be considered against the following:

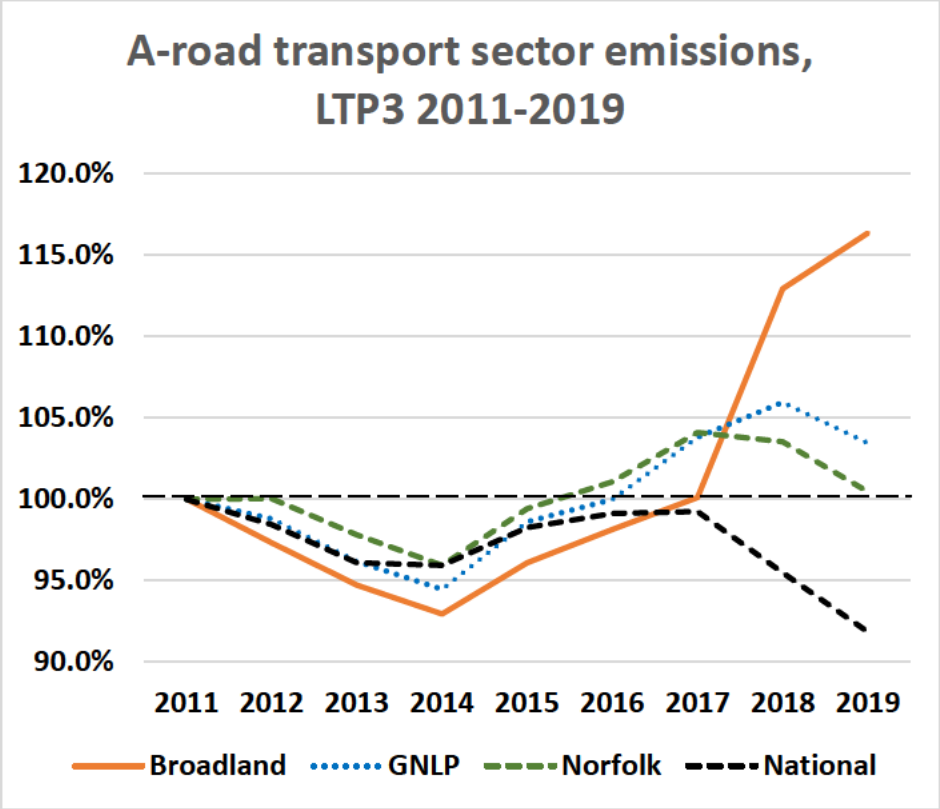
A. There is already a significant policy gap identified by the Climate Change Committee in meeting the 4th carbon budget, so any new emissions **add to the shortfall** in meeting the UK legally binding net-zero commitment for 2050.

B. The key decade for reducing emissions is 2020-2030, including the vital 4CB period, in the UK. As the UN has continually warned:

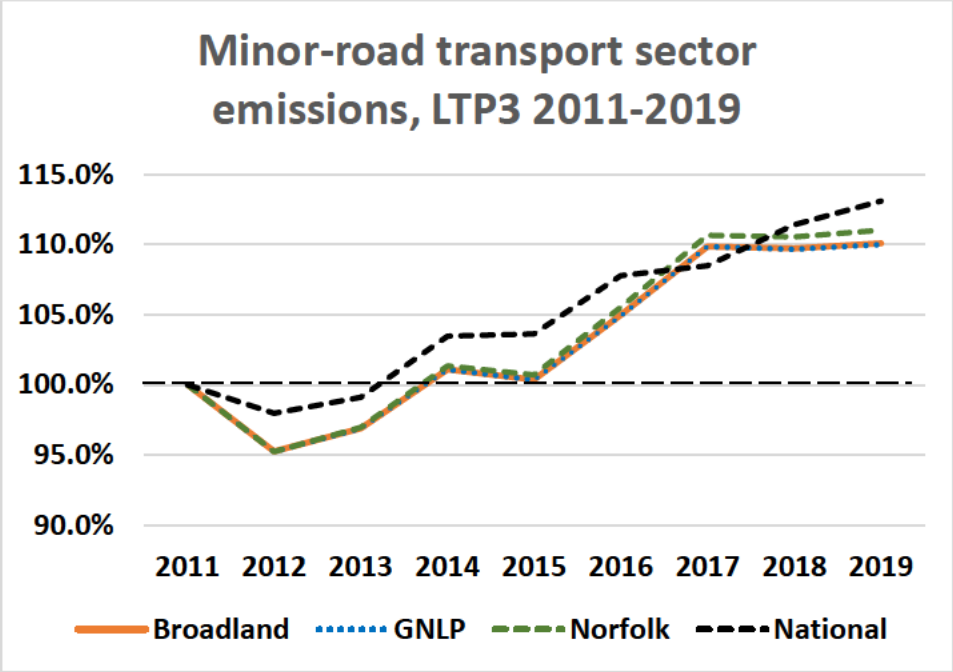
> "*As the scientific community has told us again and again, we need to cut greenhouse emissions [globally] by 45% by 2030*"
>
> Antonio Guterres, UN General Secretary, 23rd September 2019

C. The emissions reported for the scheme alone and for the two indicative cumulative assessments do not occur in isolation. **They are additional emissions on top of the existing extremely high transport carbon footprints** (>38% of GNDP/GNLP BEIS reported emissions in 2019 are for transport).

D. **Transport carbon emission profiles have been rising in Norfolk, and faster than nationally**, until very recently. In Broadland itself, they continue to rise, as shown below which shows the A-roads transport emissions as reported in the latest BEIS data. These are plotted for the period since the current local transport plan (LTP3) was adopted in 2011 (normalised in 2011 as 100% for each data series).



A similar plot is shown for the Minor-road data below. These have drastically increase over the LTP3 period:



110CEPP conclude that transport emissions have been out-of-control in Norfolk for nearly a decade since the adoption of the LTP3. To introduce additional emissions from transport infrastructure, and use, is unacceptable in a climate emergency. The

additional emissions from the A47BNB scheme alone, and especially in-combination with other planned schemes, in the crucial 4th carbon budget have been shown to add up to significant percentage increases to local transport carbon budgets as outlined above.

111 The local assessments are required under the EIA regulations as we have shown above. In every case in Table 5, emissions increase with the A47BNB scheme, alone or in-combination, over the existing background of extremely high transport emissions in Norfolk. The emissions calculated in the local assessment undermine vital national endeavours to meet all the following national obligations. Each these require significant emissions reductions, locally and nationally, in the 4th carbon budget - not increases and additions:

- science-based carbon budgets from the UK Tyndall Centre, as discussed above
- UK obligations under the Paris agreement as calculated scientifically the Tyndall centre, as above
- UK obligations under the Paris agreement including the UK's Nationally Determined Contribution (NDC) – legal binding emissions reductions for the national targets by 2030 (68% reduction from 1990 levels in the UK National Determined Contribution under the Paris Agreement[61])
- the legally binding target under the Climate Change Act 2008 to meet net-zero carbon emissions by 2050
- the UK Sixth Carbon Budget (6CB) - (legal binding emissions reductions of 78% reduction from 1990 levels by 2035[62])
- the commitment from the Government in the July 14th, 2021, Transport Decarbonisation Plan[63] to drive *"decarbonisation and transport improvements at a local level by making quantifiable carbon reductions a fundamental part of local transport planning and funding"*
- the NPPF 148 planning requirement for "radical reductions of greenhouse gas emissions"
- the statutory duty on Highways England under the Infrastructure Act 2015 section 5(2) to have regard for the environment, including cumulative assessments of the network, and carbon emissions assessments

[61] 12th December 2020, https://www.gov.uk/government/publications/the-uks-nationally-determined-contribution-communication-to-the-unfccc

[62] https://www.legislation.gov.uk/ukdsi/2021/9780348222616

[63] "Decarbonising Transport: A Better, Greener Britain", https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1002241/decarbonising-transport-a-better-greener-britain.pdf

112 Finally at the level of local environmental policy, 2019 NCC Environmental Policy[64] states:

> *"Striving to meet this collective global challenge, we will work with our neighbours within the region, specifically Suffolk County Council and the Broads Authority, to collectively achieve 'net zero' carbon emissions on our estates by 2030, but within our wider areas,* ***work towards 'carbon neutrality' also by 2030****"*

113 The scheme, and especially in-combination with other planned schemes, introduces large additional carbon emissions to transport budgets in the vital 4th carbon budget, and will render futile attempts to decarbonise, and work towards carbon neutrality, within Norfolk by 2030.

6 CONCLUSIONS

114 CEPP have laid out a Carbon Assessment Architecture which would enable a coherent assessment of the A47BNB scheme's carbon emissions impact, both as the project itself and in-combination and cumulative impacts from other proposed schemes in the Greater Norwich area. We then made an indicative assessment using our architecture, against relevant local transport carbon budgets derived from BEIS historic data, the 4th Carbon Budget and science-based carbon budgets from the Tyndall Centre, University of Manchester.

115 In its opening year, the scheme accounts for between 13.4% - 32.5% of Broadlands's transport budget across a range of carbon budget methods. When a realistic indicative cumulative assessment is made in-combination with other schemes planned in the Greater Norwich area, then scheme in-combination accounts for 38% - 91.5% of the transport budget for the GN area. This falls in the 4th carbon budget period, a time critical to make strong progress on decarbonisation both locally and nationally.

116 Following these assessments, and conclusions, CEPP object to the scheme because it undermines all attempts to decarbonise transport in Norfolk and the wider UK, as laid out in our substantive text. We strongly recommend that the Secretary of State refuses consent to the DCO.

117 There is significant missing data which both leads to an under-estimation the carbon footprint of the scheme, and creates a structural (modelling architectural) barrier to a coherent cumulative carbon assessment. The missing data identified needs to be collected and made available by the Applicant so that the cumulative carbon assessment may be carried out.

118 The Applicant has made no assessment against the now enacted UK 6th Carbon Budget.

[64] https://www.norfolk.gov.uk/what-we-do-and-how-we-work/policy-performance-and-partnerships/policies-and-strategies/natural-environment-policies/environmental-policy

119 The applicant has made no assessment against regional and local levels of carbon emissions, and budgets, in breach of the EIA regulations.

120 The application has not assessed land-use emissions, on the scheme, on in-combination with other local schemes, as required by PAS 2080.

121 The applicant has not assessed cumulative, and in-combination, carbon emissions in breach of the EIA regulations.

122 Further our detailed technical appraisal shows that, now, with the current assessment and modelling architecture of NCC and the Applicant, **it is not possible to coherently or reliably assess the cumulative carbon emissions related to this scheme and other planned schemes in the Greater Norwich area**. NCC and the Applicant are running models over a hotch-potch of "study areas", NATS model baseline years, model configuration, precluding any coherent in-combination assessment of carbon emissions between and across the schemes.

123 As the EIA regulations, and Highway England's own licence, require such a cumulative environmental assessment, the Applicant must– in consultation with NCC - indicate how they will adapt the assessment and modelling architecture so that a robust and safe cumulative carbon emissions assessment may be carried out.

124 No national level cumulative assessment has been made at least the 50 major road schemes under the RIS2 scheme, and also the array of road schemes under Large Local Major funding programme which includes the Norwich Western Link (NWL) in the Greater Norwich area. This is contrary to Highways England licence section 5.23(c). It is also under consideration by the High Court following a judicial review.

125 The legal status and scope of the NPSNN needs to be clarified to PINS and the parties at the Examination by the NPSNN.

7 SIGN OFF

[redacted]

Dr Andrew Boswell,
Climate Emergency Policy and Planning, July 19th, 2021

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