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Contents

1 BACKGROUND

1.1 Intergenerational Equity: Discounting future people is not an option

1 This report has been prepared for future generations. For my children and their grandchildren, and your children and their grandchildren – in the face of Climate and Ecological Emergency (the "emergency").

> "*Vague, distant targets for 2030 or 2050 will not keep the world "well below 2°C" of warming as the Paris Agreement promised. I can tell you, a 2°C hotter world is a death sentence for countries like mine.*"
>
> Vanessa Nakate, Ugandan Youth Climate Activist, Independent 8th February 2021[1]

2 Previously, CEPP submitted a report to GNDP on the Intergovernmental Panel on Climate Change (IPCC) Special Report on 1.5degrees (SR1.5) at the request of the Greater Norwich Planning Policy Team Manager. The report covered impacts of Climate Change at 1.5°C, at 2°C and at beyond 2°C[2] that close and future generations face if the emergency is not tackled now.

[1] https://www.independent.co.uk/climate-change/opinion/climate-change-paris-agreement-uganda-b1769562.html

[2] Section 2.4, http://bit.ly/CEPP_R18B_CC_IPCC, submitted on behalf of Norwich Green Party.

1.2 Climate Emergency Planning and Policy (CEPP)

3 I am an independent environmental consultant, working in the interface of science, climate policy and law. My doctoral work was in structural biology, protein binding sites and dynamics[3].

4 Most of my career was in scientific computation for 40 years, including high performance climate models. COVID has highlighted the huge benefits that our society can gain from science. The severity of the climate emergency is clear through science and has been for several decades, and my work through CEPP is to promote the necessary rapid response to the Climate Emergency in mainstream institutions, such as local authorities, through the lenses of science, policy, and law – science is crucial for tackling the emergency too.

5 All the work here is completely transparent, and it is done to help facilitate the process of having a plan in Greater Norwich which fully addresses the scale of the emergency. Background spreadsheets and calculations are provided as links to cloud documents in the footnotes. Assumptions are made clear so that the work is truly transparent. If anything is missing in this respect, please contact me.

1.3 Scope of CEPP's submission

6 This submission largely focuses on whether the GNLP Reg 19 is sound and legally complaint on Climate Change, and especially mitigation.

To do, it explores several dimensions of the carbon budget of the GNLP area.

7 This work is indicative and illustrative. It is not attempting to be a definitive carbon footprint exercise.

> *"A finger pointing at the moon is not the moon. The finger is needed to know where to look for the moon.[4]"*

However, the work does point to several things, below, which we then explore in detail.

8 The GNLP Reg 19 draft plan is **not sound**, nor is it legally compliant. It provides no *effective* model of baseline carbon emissions in the area and how to reduce them by 2038, nor of the carbon footprint implicit in the house building that it proposes between 2018 and 2038. This document provides data on both without which is it impossible to *justify* policies. We recommend that the GNDP commission a more detailed carbon footprint before the GNLP draft plan is submitted to Examination in Public.

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[3] 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

[4]Buddhist quote as interpreted by contemporary Zen master, Thich Nhat Hahn at http://bit.ly/FingerMoon

9 The plan must address how to reduce carbon emissions against the baseline carbon emissions, and how not to introduce new emissions footprints - either embedded or locked-in operational emissions- via its growth and development programme. It is not *positively prepared*, nor *effective*, in using strategic planning for these challenges. It is not *consistent with national policy*, nor legal compliant with Section 19(1A) of the Planning and Compulsory Purchase Act 2004[5]. The last section of this document provides suggestions on how to make the plan sound, and legally compliant.

10 Further, the GNLP Reg19 draft plan attempts no rational separation of the role of national, and local in-plan and local ex-plan policies, nor how they can work together to maximise action on the emergency. It assumes instead that most climate change mitigation happens by magic from the national policy. However, a necessary first step is to understand the policy responsibility and the indicative quantum of the carbon footprint that may be addressed by strategic policies in the local plan. This document provides some insights into this.

11 This document also bases its analysis firmly in science-based carbon footprinting, and provides an analysis of how this compares to targets that are derived from the Climate Change Committee (CCC) sixth carbon budget (6CB) documents and the UK's legally binding net-zero 2050 targets.

12 This submission has concentrated on the implications of the housing numbers and distribution, and domestic and transport emissions. It does not examine industrial emissions and industrial growth within the plan, due to lack of time, although these need to be examined in a similar way.

13 Previous submissions have been made by CEPP to GNDP on the GNLP as in the footnotes[6]. This submission builds consistently on all our previous submissions.

2 ASSESSING SOUNDNESS AND LEGAL COMPLIANCE

2.1 Soundness, and key legal and guidance principles

14 Section 19(1A) of the Planning and Compulsory Purchase Act 2004[7] states

> "*Development plan documents must (taken as a whole) include policies **designed to secure** that the development and use of land in the local planning*

[5] https://www.legislation.gov.uk/ukpga/2004/5/section/19

[6]

i. 2016 SA Scoping Report http://bit.ly/CEPP_2016_SCOPING
ii. 2018 R18A Housing http://bit.ly/CEPP_R18A_HOUSING
iii. 2018 R18A Climate Change http://bit.ly/CEPP_R18A_CC
iv. 2018 R18B HELAA http://bit.ly/CEPP_R18B_HELAA
v. 2018 R18B IPCC Special report on 1.5 degrees http://bit.ly/CEPP_R18B_CC_IPCC
vi. 2020 R18C Climate Change http://bit.ly/CEPP_R18C_CC

[7] https://www.legislation.gov.uk/ukpga/2004/5/section/19

authority's area contribute to the mitigation of, and adaptation to, climate change." (my emphasis)

15 A key phrase concerning the type and quality of policies required is "designed to secure":

- "Designed" is a parallel to the NPPF 35 soundness principle of *positively prepared*: the policies must be designed to deliver an outcome, in the case of climate change mitigation, this means known and measurable CO2 emissions reductions.

- "Secure" is a parallel to the soundness principle of *effective*ness. In the case of climate mitigation, the policy must demonstrably secure well-defined outcomes. For climate change mitigation, the outcomes are CO2 reductions within a well understood carbon budget, and *effective*ness can only be demonstrated, if these outcomes are measurable.

16 This quote from a recent letter from leading US businesses to President Biden makes this same point about *effective*ness of climate policy:

> *"Be **Effective**: A key test of any climate policy is whether it will deliver timely emissions reductions across the economy and includes mechanisms that provide certainty that emission goals are met.[8]"*
>
> Letter to President Biden, Mar 9th, 2021

17 Under "*How can local planning authorities identify appropriate mitigation measures in plan-making?*"[9], the national planning guidance on Climate Change states:

> "*Every area will have different challenges and opportunities for reducing carbon emissions from new development such as homes, businesses, energy, transport and agricultural related development.*
>
> - ***Robust evaluation of future emissions*** *will require consideration of different emission sources, likely trends taking into account requirements set in national legislation, and a range of development scenarios*." (my emphasis)

"Robust evaluation" here expects that "likely trends" of CO2 reductions within a well understood carbon budgets (requirements set in national legislation) will be considered over "a range of development scenarios". This adds a further dimension to the soundness test of effectiveness - measurable emissions targets and carbon budgets should be assessed when comparing options.

[8] Letter to President Biden, Mar 9th 2021, from CEO Climate Dialogue's (CCD) - a broad-based, cross-sector coalition of 22 leading businesses and 4 of the country's top environmental NGOs committed to advancing climate policy in the United States. https://35b6ad34-567b-4d66-bb63-6bbcad5f180f.filesusr.com/ugd/17314c_d87513bc09844d93aaeaf243a3f2aa9c.pdf

[9] https://www.gov.uk/guidance/climate-change#how-can-local-planning-authorities-identify-appropriate-mitigation-measures-in-plan-making, Reference ID: 6-007-20140306

18 Robust climate change policies in local plans are *justified* because of the legal requirement within PCPA Section 19(1A). It explicitly requires them by law. They are also required and *justified* under the UK's national ambition for net-zero by 2050 under the Climate Change Act (2008).

19 And that such policies should be *consistent with national policy* is manifestly clear from NPPF 149 which states:

> "*Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures* <*footnote 48*>".
>
> Where footnote 48 is: "*In line with the objectives and provisions of the Climate Change Act 2008.*"

2.2 Climate change mitigation requires a strategic policy in itself

20 The task of meeting these climate change mitigation requirements is incredibly significant. **An overriding strategic policy on Climate Change within the GNLP is the only wise and rational approach to the challenge.** This is the approach previously followed by the GNDP within the current Joint Core Strategy (JCS). GNDP have departed from this approach in the GNLP Reg 19 in a wholly irrational way – that is also leaves the plan in*effective*, and **not sound** on all four soundness principles.

21 **CEPP's fundamental assessment is that none of the above soundness or legal compliance principles are met in the GNLP Reg 19.** Particularly, the GNLP cannot demonstrate *effective*ness: it makes no attempt to measure the carbon emissions impacts of the policies in the plan, nor provides evidence base to measure and test them. Given this, it is not in line with national legislation, the net-zero target, and the Climate Change Act. It unequivocally fails on the NPPF soundness tests of *effective* and *consistent with national policy*.

22 Note that the UK has international obligations, and has pledged to reduce economy-wide greenhouse gas emissions by **at least 68% by 2030, compared to 1990 levels** under the Paris Agreement NDC mechanism[10]. This is incredibly significant in this year of UK COP26 presidency, and only a strategic policy on climate change mitigation in the GNLP can make the plan consistent with this national ambition and demonstrate that it is *designed to secure* the Greater Norwich contribution to it.

23 Further, unlike other local authorities in recent local plans, GNDP have not placed climate change at the heart of the GNLP. Climate change mitigation has not been designed-in from the start. Instead, a fragmented approach has been taken which attempts to retrofit some unfocused policies via the "Climate Change statement". This fragmented approach contributes to these soundness and legal compliance failures, highlighted through this submission.

[10] https://www.gov.uk/government/publications/the-uks-nationally-determined-contribution-communication-to-the-unfccc & https://www.bbc.co.uk/news/science-environment-55179008

2.3 Fragmented and unfocussed policies on Climate Change

24 The GNDP have departed from the current policy approach of a dedicated climate change policy in the form of Joint Core Strategy Policy 1 "Addressing climate change and protecting environmental assets". Whilst there are many shortcomings with this policy, it was/is at least a single overarching and strategic policy for climate change.

25 The GNDP originally intended to maintain this precedent of a singular strategic policy for climate change. At 6.127 of the REG 18A Growth Options document, GNDP stated that the favoured option "is for the GNLP to include **a policy** to consider the impacts of climate change based on the current policy approach".

26 Most respondents at R18A wanted action on climate change at the heart of the plan and considered the proposed policy should be more robust than JCS1 policy[11]. The Growth options consultation summary "Draft Statement of Consultation, September 2018" is misleading as it lists the many organisations who wanted a more robust climate change policy as being against such a policy when these respondents were for an overarching strategic climate change policy, just much more robust one. They were disagreeing with "the current policy approach" as not being strong enough, **not** against having a strategic policy on climate change. The R18A consultation responses have been misconstrued in this respect.

27 **Despite this, no strategic policy on climate change has been produced.** Instead, climate change is now dealt with indirectly by retrofitting sub-sections of other policies and the "Climate Change Statement" at Reg 19, 157. In departing from the R18A Growth Options favoured option, GNDP have provided no evidence of how this set of policy fragments spread across many policies can be as *effective* as a dedicated, overarching climate change policy. This approach is not *justified* and is **unsound**.

28 Further the content of the disjointed sub-section policies on Climate Change has been highlighted previously as producing ***a disconnect*** with the policy substance needed to "contribute significantly to delivery of a low carbon future" (ie *effective*ness) by the Director of Place at Norwich City Council[12]. There has been no apparent response to this serious, senior officer level critique from one of the GNDP members, either implicitly in better policy to deliver a low carbon future, or explicitly in the evidence base.

29 Departure from the previously favoured option for a strategic climate change policy demonstrates at a high level that the GNLP **has not** provided a *positively prepared*, *justified*, nor *consistent with national policy* policy to mitigate climate change. It is

[11] The Growth options consultation summary "Draft Statement of Consultation, September 2018" is confusing as it lists many organisations who wanted a more robust climate change policy as being against the question – actually these respondents are for a climate change policy, just much more robust one.

[12] *Report to Sustainable Development Panel, Norwich City Council, 15th January 2020, "Greater Norwich Local Plan: regulation 18 draft plan consultation", bullet 27: "**The draft GNLP Strategy document addresses some of the issues raised by the council during its development as noted above. However, a number of outstanding issues remain, including the emphasis on rural dispersal /village clusters and transportation concerns. There is a disconnect between the vision, objectives and climate change statement and the actual policy substance needed to enable the plan to contribute significantly to delivery of a low carbon future."***

not just the plan itself, which is unsound on climate change, but the whole plan preparation process of the GNDP is **unsound**.

2.4 GNLP – opportunities lost

30 UK local authorities are not just capable of action: they are an essential part, potentially, of a rapid acceleration towards that non carbon-polluting society. Despite considerable civil society petitioning on climate change via detailed submissions at previous consultation stages (eg at R18A as above), that potential "to be part of the solution" has not been grasped in the draft plan by the GNDP.

31 Subsequent sections of this Reg 19 submission will assess the soundness of the plan and its policies, against the NPPF 35 principles for a sound local plan, and for legal compliance **against aspects of carbon budgets and targets for the GNDP area**.

32 The next section explains carbon budgets, why they are important for a local plan, and how the GNLP has failed to use them.

33 Then the subsequent section introduces two different, but complementary approaches for appraising soundness and legal compliance via carbon budgets and targets: science-based carbon budgets, ultimately grounded in physics, and national policy targets on climate change.

3 CARBON BUDGETS: TRUTH TELLERS

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

34 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*'[13]. 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*[14]." **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[15]. Carbon budgets reveal the truth of this situation.

35 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

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

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

[15] 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).*"

emergency with the urgency required. Simply put we are living outside of our budget.

> "*As the scientific community has told us again and again, we need to cut greenhouse emissions by 45% by 2030*[16]",
> Antonio Guterres, UN General Secretary, 23rd September 2019[17]

36 Collectively, we now know that this decade is the most crucial decade for reversing 200 years of carbon polluting activities, reversing the "spend" 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.

3.2 GNLP: Unsound in avoiding carbon budgets, carbon targets, and monitoring

37 These are three main domains where the governmental responsibilities for policies on climate change sit – a three-fold division:

- national policy by national government,
- non-plan strategies by local authorities, and
- local plan policies by local authorities.

38 There is no evidence that the GNDP, and constituent councils, have made any attempt to identify the carbon policies and budgets, or targets, associated with these three categories, and then to identify how the GNLP can address the local plan element.

This renders the GNLP **unsound**. The plan cannot be *effective* as it does not know what carbon budget it is dealing with, and it cannot be *positively prepared* as it has no targets or monitoring to meet the budget.

39 Further, GNDP propose no monitoring of the carbon budget except to continue the superficial monitoring practiced under the JCS, which has proved wholly inadequate. The last paragraph of GNLP Reg 19, Table 5 ("Climate Change Statement") on monitoring states:

> "*Carbon emissions in Greater Norwich will continue to be monitored using district wide figures produced by Government on transport, domestic and industrial emissions. Our ambition is to reduce per capita emissions and thereby contribute to meeting the national target to bring all greenhouse gas emissions to net zero by 2050, as well as helping to meet local targets, statements and plans. Measures contained within the GNLP will enable further emissions reductions, continuing recent year-on-year trends.*"

40 There are many limitations with this statement:

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[16] The 45% figure is globally from 2018 emissions levels. It can't be compared directly to the UK 78% target from 1990 levels by 2035.

[17] https://www.un.org/sg/en/content/sg/speeches/2019-09-23/remarks-2019-climate-action-summit

i. "Ambition" without targets and monitoring is vague ambition. Vague ambition is not enough, and it certainly is not the action required by an emergency.

ii. The top-level Government BEIS figures are useful for overall trends, but they provide no way to separate out the emissions savings from national policy, non-plan local authority policy, and local plan policy. The *effective*ness of the plan in delivering emission reductions from its own policies may only be measured if monitoring exists for carbon reduction trajectories in the local plan policies themselves. This use of superficial, overall trend data, as the **only** measure, is **unsound** on *effective*ness.

We later analyse the BEIS data in a more in-depth way – which is both temporally, and substantively, more fine grained, showing trends from 2005 to 2018 in each sub-sector emission category. This enables us to start the process of identifying where local plan policies might address different parts of the overall footprint.

iii. The "local targets, statements and plans" in the second sentence are not enumerated – particularly **no** local targets are given in the GNLP Reg 19 document. In any case the GNDP decided not to use local targets at their December 2020 board meeting, see below, so this is self-contradictory, and irrational. This is **unsound** on *effective*ness.

iv. "Our ambition is to reduce per capita emissions". The quantum of reduction of per capita emissions is not specified, and the local plan specific contribution required to monitor plan *effective*ness is not specified. This is **unsound** as it is not *effective*, nor is it *positively prepared*, nor based on an objectively assessed need for carbon reduction within the area. The objectively assessed need of carbon reduction must be based upon some form of science-based carbon budget.

v. Further, "per capita emissions" is not the best measure. When dealing with population wide effects within area wide carbon budget, the population wide footprint is the best measure to use. It is possible for overall emissions to increase whilst the per-capita footprint to decrease which is confusing and can give a misleading appearance of success. (This happened with transport sector emissions in Norwich in a recent year). Per capita levels are **unsound** as an *effective* measure of tackling the overall carbon footprint.

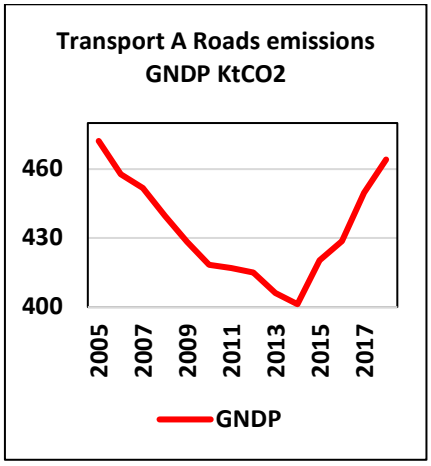
vi. "Measures contained within the GNLP will enable further emissions reductions, continuing recent year-on-year trends.". The measures concerned are not elaborated, nor is the individual contribution from each measure quantified. This is **unsound** on *effective*ness.

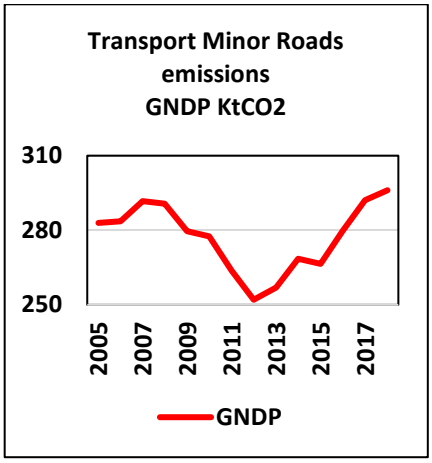
41 Later, we analyse the BEIS Government figures in more detail. It is remarkable that GNDP say that "measures contained within the GNLP will enable further emissions reductions, continuing recent year-on-year trends". 3 out of the 4 largest sub-sectors,

and for which local planning[18] (ie the current GNDP JCS) could have achieved emission reductions, as NPPF 148 requires, have instead shown increases in emissions in recent years. The graphs below do not represent an emergency response and continuing them into the future, as the paragraph suggests, is **unsound**, and not *consistent with national policy*.

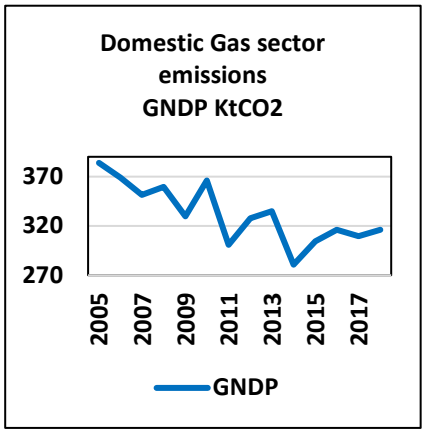
a. A **16% increase in emissions on A-roads** in the GNLP area between 2014 and 2018 against a national trend for same period of 2% increase.

b. A **17% increase in emissions on minor roads** in the GNLP area between 2012 and 2018, against a national trend for same period of 6% increase, as shown graphically below.





c. A **17% increase in domestic gas emissions** between 2014 and 2018 across the GNLP area, against a 10% increase nationally, indicating a policy failure in this crucial domestic sector for this 5-year period



42 Given this, it is even more remarkable to read in the 7th December 2020 GNDP Board meeting agenda that the GNDP had decided not to use local carbon targets and monitoring:

[18] Industrial emissions may be less influenced by local planning. Of transport and domestic sub-sectors, the only exception is the much smaller "Domestic Electricity" sub-sector which is largely attributable to national electricity decarbonisation trends and policy.

> "*No change to the monitoring for climate change as **it is neither possible nor desirable to set up plan specific monitoring**. Contributing to lowering emissions to help meet targets nationally reflects the role local plans can play among many other plans and initiatives in tackling climate change*".

Plan specific targets and monitoring may be set up in various ways including[19]:

- Whole Lifecycle Carbon assessment statements to reduce embodied emissions from new buildings which targets for the carbon intensity per m^2 which we elaborate later, and monitoring delivery of emissions savings
- Zero carbon building standards with measurable emissions savings to operational carbon "footprints" from thermal insulation, energy efficiency, and monitoring delivery of emissions savings
- Maximising renewable energy by producing, storing, and using renewable energy on-site, and monitoring delivery of emissions savings
- Minimising private car use and building in walking, cycling and public transport access, and monitoring delivery of emissions savings

The BEIS data itself is useful when it is analysed by sub-sector, and by trends, as we later show.

The statement from the GNDP, although outside the plan itself, that plan specific monitoring is "not desirable" relinquishes any claim that the plan *effective* or *positively prepared*. It implies **unsound** plan preparation on both counts.

Ultimately, it is an attempt by GNDP decision makers to avoid the truth implied by carbon budgets, and of the rising emissions in key BEIS sub-sectors.

3.3 GNLP's lack of engagement on climate change is counter to national advice

43 The lack of engagement by the GNDP with carbon budgets, targets, and monitoring, outlined above, is put into sharp contrast by the advice in the December 2020 sixth carbon budget report[20] by the government's own advisors, the UK Climate Change Committee who have stated:

> "*More than half of the emissions cuts needed rely on people and businesses taking up low-carbon solutions - decisions that are made at a local and individual level. Many of these decisions depend on having supporting infrastructure and systems in place. Local authorities have powers or influence **over roughly a third of emissions in their local areas***."

44 "Local policy and strategy" here mean **both** emissions reductions through normal council strategies (eg: **non-plan** Environment Strategies of the constituent councils) and from local plan policies. This separation of carbon budget attribution at the local level is kept clear as we proceed.

[19] Refer to the submission from the Centre for Sustainable Energy (CSE) for more detail

[20] "Local Authorities and the Sixth Carbon Budget", Dec 2020, https://www.theccc.org.uk/wp-content/uploads/2020/12/Local-Authorities-and-the-Sixth-Carbon-Budget.pdf

The GNLP has renounced responsibility and accountability for that approximately one third of the usage (ie "spending") of the population-wide carbon budget in the area, which may be influenced by local policy and strategy in its Climate Change Statement, as above.

The key point is that, in the emergency, the GNLP makes no attempt to engage with this third of emissions is any quantified way. This is **unsound** on all four soundness principles.

45 The next section looks at carbon budgets in the global context, via science-based carbon budgets for local authorities developed by scientists at the Manchester Tyndall centre, and in the national policy context, via the budgets from the UK Climate Change Committee.

4 CARBON BUDGETS – FROM THE GLOBAL TO THE LOCAL

46 The Intergovernmental Panel on Climate Change (IPCC[21]) has written regular reports since 1988 which summarise a consensus view of world scientists on Climate Change[22].

47 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[23]. 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.

48 Carbon dioxide (CO2) accounts for around three-quarters of the human contribution to global overheating. For the energy-based domestic, industrial and transport emissions consider for the GNLP footprint, we do not need to consider other greenhouse gases[24] which also contribute to global overheating.

49 Scientists have established models that calculate how much more carbon dioxide[25] 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 carbon budgets, and we have previous explained them above as a bank account analogy but with no overdraft, deficit, or quantitative easing facilities available.

50 The most recent global carbon budgets come from the recent IPCC Special Report on 1.5 degrees of global warming (IPCC SR1.5 report[26]), and further refinements of

[21] https://www.ipcc.ch/

[22] https://www.ipcc.ch/about/history/

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

[24] For simplicity we just use tonnes of CO2 units although emissions may be expressed as CO2eq "CO2 equivalents" elsewhere, and in sources. The distinction is not important here.

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

[26] https://www.ipcc.ch/sr15/

these carbon budgets will be produced for the sixth assessment report which is to be published over 2021 and 2022[27]. Carbon budgets are developed with a range of statistical uncertainties from a variety of models: these are reduced to single overall figures by the IPCC. For example, in the SR1.5 report, the remaining global budget for meeting a temperature target of 1.5degrees with 66% chance ("likely") of success was 420 GtCO2.

51 We now show two main benchmarks of carbon budget against which we test the GNLP policies on climate change.

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

52 To understand what emission reductions should be made in UK local authority areas to make a 'fair' contribution[28] 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 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[29].

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

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

a) a 2020 Climate Policy paper[30], widely referred to as the "Factor of Two" paper

b) the "full" report from the Tyndall Carbon Budget Tool for UK Local Authorities[31], widely referred to SCATTER budgets (the full report for the GNDP area is given in Appendix A, see the "steps" for the assumptions).

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 and is well cited.

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[27] https://www.ipcc.ch/report/sixth-assessment-report-cycle/

[28] '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

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

[30] 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

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

55 The aggregated SCATTER budget for the 3 GNDP authorities, Broadland, Norwich, and South Norfolk was previously provided in my response to the Reg 18C consultation. The full report is reproduced in Appendix A. A summary is given below with the corresponding 2018 annual footprint as reported by BEIS of 2.1MtCO2.

	Broadland	**South Norfolk**	**Norwich**	**GNDP**	**Reference 2018 BEIS aggregated annual footprint for GNDP**
Remaining CO2 budget 2020 – 2100 (MtCO2)	4.5	4.9	3.4	12.9	2.1
Budget expires at current (2017) burn-rate	2027	2026	2027	2027	
CO2 annual reduction rate from 2020	>13.0%	>14.2%	>12.7%	>13.4%	
5% budget left year	2042	2040	2043	2041	

Table 1: SCATTER budgets for GNLP area

56 These calculations show at the indicative level what is required to meet the UK's Paris Agreement commitments over the GNLP area. The numbers above align to the IPCC SR1.5 global carbon budgets calculated for a 1.7 degree temperature rise – not the oft quoted 1.5 degrees (see "Factor of Two" paper). Essentially, we are already too late to specify a 66% chance ("likely") 1.5degree carbon budget for the UK. If it were attempted within the Manchester Tyndall framework of assumptions, the UK budget (and each local authority) would already be negative. It should further be noted that the Tyndall centre calculations contain assumptions which themselves are optimistic, as explained in "Factor of Two"[32], **the GNDP SCATTER budget should not be considered pessimistic in any sense.**

57 The headline for the GNLP is that, based on science-based carbon budgets, to meet a Paris Agreement temperature target between 1.5 and 2.0 degrees, **carbon emissions need to reduce at 13.4% per year across the GNDP population total**. This must start now and requires a step change in policy and in delivery of emissions reductions. Continuing at current "burn-rate", as indicated by the 2018 BEIS data, will use the budget up around 2026-2027. Such a scenario will rapidly take humanity beyond the limits of the Paris Agreement ie overshoot 1.7 degrees, then 2 degrees, and into extremely dangerous territory.

[32] A similar breakdown of assumptions, at less detail, is given as "Steps" in Appendix A. Steps 2 and 3 are particularly optimistic at the global level before the UK budget itself is considered, assuming that emissions from cement and deforestation will reduce as modelled, and that developing country emission trajectories peak in 2025.

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

58 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.

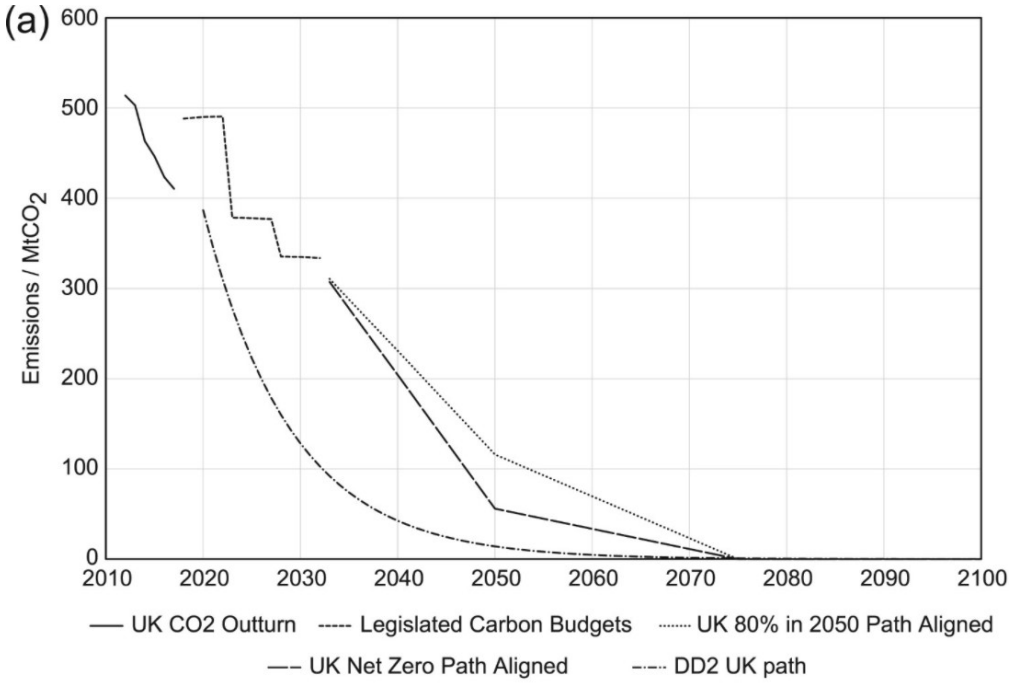
59 However, the CCC do not show anywhere how the 6th Carbon Budget (6CB) can be derived directly by a stepwise downscaling from a scientifically established global carbon budget (as the Manchester Tyndall references above do demonstrate). The derivation of the 6CB is focussed more on meeting the national net zero-target of 2050 via an array of policy interventions rather than fitting to a specific carbon budget.

60 In simple terms, the carbon budget is the area under the annual emissions trajectory curve (as in the figure below). 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.

61 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[33].

62 To show an indicative comparison, I reproduce Figure 2 (a) from the "Factor of Two" paper below.

[33] I am currently engaged with discussions with other climate and energy researchers on improving methods for a like-by-like comparison for future reference.



63 The (developed nations) "DD2 UK path" is the data from which the GNDP SCATTER budget is derived. The shape of the curve is similar, in the GNDP case, an annual year-on-year reduction of 13.4% per year. The graph was published before the CCC 6CB but the third, fourth and fifth carbon budgets are shown, and an indicative "UK Net Zero Path Aligned". The latter will be different following the CCC 6CB report, but for overall comparison the areas under the legislated budgets and net zero paths compared to the "DD2 UK path" shows the difference which is greater than a factor of two.

It should be noted that whilst the "UK outturn" may meet the third UK carbon budget, the UK is not currently on track to achieve the fourth or fifth carbon budgets and is far from the net-zero trajectory set by the CCC[34].

64 GNDP officers previously discussed SCATTER budgets with me and queried why they are more stringent that the budgets from the CCC. The simple answer is that the SCATTER budgets are fully developed and supported by a scientific analysis that is consistent with the IPCC reports, Paris agreement alignment, and informed by the latest science on climate change and defined in terms of science-based carbon budget setting. The CCC budgets are derived to meet a target for net-zero in 2050, as above.

65 Further, the CCC budgets assume a significant implementation of negative emissions technology (NETs) by 2050. However, the implementation of NETs at this scale is speculative at best, and there are major shortcomings and negative impacts – both issues are core to a highly charged debate about whether NETs can be deployed at the scale suggested[35].

[34] Carbon Brief, "CCC: UK must cut emissions '78% by 2035' to be on course for net-zero goal", Dec 2020, http://bit.ly/CBrief_6CB

[35] Just a few references on this issue: Scale - https://twitter.com/Peters_Glen/status/1335864599162351616 ; Land use of bioenergy - https://www.wri.org/blog/2019/08/how-effective-land-removing-carbon-pollution-ipcc-weighs &2021, FoE report

66 And the SCATTER budgets are determined by a fair and equitable analysis that allows for economic development by developing nations under the Paris equity principles as explained at Step 3 and 4 in the full GNDP SCATTER report in Appendix A.

67 In summary, going forward we will use **two** carbon budget/target benchmarks: the science-based carbon budgets from Manchester Tyndall, and policy targets from the CCC 6CB net-zero approach. The latter may be taken as a measure of current national policy targets whilst the former of the scale of the measures needed for the UK to comply with the Paris agreement, and the global heating temperature targets within it.

4.3 Comparing approaches

68 Anderson et al[36] find that the cumulative CO2 emissions implicit in UK policy pathway before CCC 6CB report was 9,000MtCO2 compared to 3,700MtCO2 of the Manchester Tyndall science-based carbon budget. The 6CB will have reduced the 9,000MtCO2 to some degree but largely after 2033 when the 6th carbon budget starts which is towards the end of the GNLP plan period. A reasonable comparison would be that the implied CCC budget is at least twice the Manchester Tyndall budget.

69 So, for example, where the Manchester Tyndall GNDP SCATTER budget to 2100 is 12.9MtCO2 for the GNLP area (Table 1 above), the CCC one may be 26MtCO2 or greater. Based on a 2.1MtCO2 2018 annual footprint from BEIS, the Tyndall budget is used up at 2027, and the CCC budget may be used up after 2034 on current burn rates: entire budgets are referred to here, and remember there is no overdraft. Both figures indicate the urgency of the emergency: neither give space for complacency.

70 The next sections returns to the question of "where we actually are now" in terms of climate change mitigation within the GNLP area, and the historic delivery record in recent years, and how future budgets and targets should look.

http://bit.ly/ChasingCarbonUnicorns ; 30 years of broken technological promises - https://www.nature.com/articles/s41558-020-0740-1 ; Carbon unicorns - Discounted futures & Defer mitigation and make our children pay

https://www.researchgate.net/publication/345992520_Carbon_unicorns_and_fossil_futures_Whose_emission_reduction_pathways_is_the_IPCC_performing

[36] 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

5 GNLP CARBON BUDGET DELIVERY

5.1 Analysis of the current carbon footprint (2018 BEIS data)

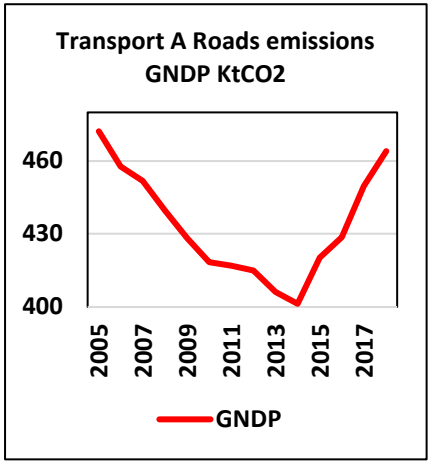
71 **These carbon budgets for the GNDP area must be delivered by local and national policy working together.** In the next section we provide indications of what policy interventions can be made across the three-fold split:

i. by national policies, for example as recommended by the Committee on Climate Change in the 6th Carbon budget report
ii. by local councils' policies, for example council Environmental strategies
iii. by the local plan ie the GNLP

72 In Table 2 over the following pages, we provide an analysis of the 2018 BEIS data, against historic trends from 2005, and by the *finer-grain sub-sectors* that the BEIS data provides, which, for example, allows domestic emissions to be separated between electricity, gas, and other heating sources (mainly oil and biomass). The **sub-sectors are ordered by their size** within the overall 2018 2.1MtCO2 footprint for the GNLP area.

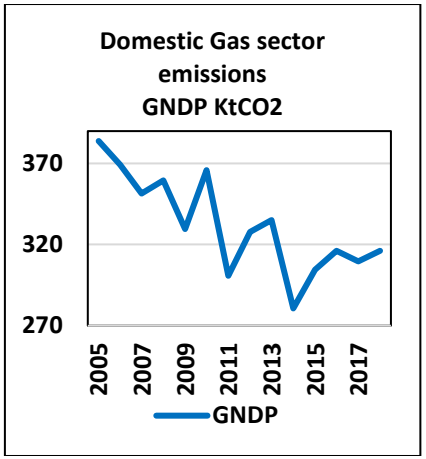
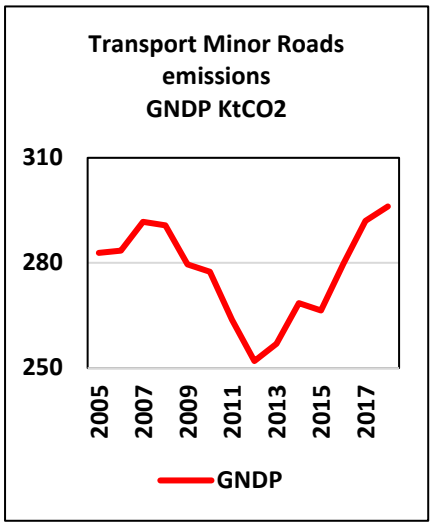
Table 2: Historic trends and policy responsibilities based on BEIS carbon emission sectors

The table shows the BEIS carbon emission sectors, and several key figures according to the key. The source spreadsheet is given at[37].

KEY / BEIS Sector Carbon footprint ktCO2 (2018 BEIS) 2005 – 2018 ⇵ % decrease / increase Per household 🚗 tCO2 Per capita 😐 tCO2 Percentage of total ◕ %	**2005 – 2018 profile** Sub-sectors are listed in decreasing size of their 2018 carbon footprint. The graph show carbon footprint trend between 2005-2018 in GNDP area.	**Indicative notes on threefold policy split: national policy, Local-Plan policy, ex-plan council policy** Indicative CCC 6CB equivalent budget for sub-sector: an indicative annual budget for this sub-sector based on CCC 6CB advice. This is an approximation as CCC are working from 2020 base year, but the latest BEIS figures shown here are for 2018, and the CCC 6CB "equivalents" are from a 2018 base. Points to highlight on GNLP Reg 19 draft plan
Transport A-roads **464 KtCO2** **⇵ -2%** **🚗 2.47** **😐1.1tCO2** **◕ 22.3%**		**The 2014 to 2018 increase is 16%** (against a national increase of 2% for same period). The impacts of the NDR which open in 2018 are unknown, but it is expected to bring further cumulative emissions increases above national trends. There is a -2% reduction in the GNLP area since 2005 against -12% reduction UK wide. National policies[38] in the CCC 6CB are for a 70% reduction by 2035 by low-emissions vehicles and demand reduction. The CCC 6CB equivalent budget for "Transport A roads" in GNLP area is then 139KtCO2 by 2035. The 16% upwards trend over 5 years indicates a failure of current local policy to be addressed by both non-plan strategy, such as Norfolk County Council's fourth local transport plan (LTP4) and the Transport for Norwich Strategy (TfN), and local plan policy. The emergency, along with the requirement to turn around poor performance locally, requires that policy should rule out rural dispersed housing in the GNLP. Modal shift to sustainable modes should be the highest priority. The NWL which increases traffic and emissions must be tested against *consistency with national policy* – this is done in an evidence-based way against available carbon budget, the inclusion of the NWL in the plan will be found **unsound**. NPPF 102 states that "transport issues should be considered from the earliest stages of plan-making" and the GNLP is not soundness *effective* is failing to identify the carbon budget requirements, nor provide *effective* policy, for this largest sub-sector.

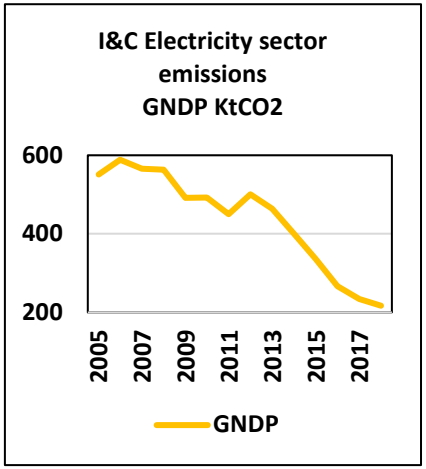
[37] Source data: My spreadsheet is available at http://bit.ly/GNLP_BEIS_CARBON_FOOTPRINT. CEPP have added further graphs and calculations onto the BEIS published spreadsheet from https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2018. National data trends are calculated at lines 5997-5999 of the "Full dataset" tab. Additional GNDP area calculations are at lines 2803-2815 of "Full dataset" tab. Other new tabs prefixed "GNDP" have been added for further worksheets and graphs.

[38] https://www.theccc.org.uk/publication/sixth-carbon-budget/ , page 96 onwards.

Domestic Gas **316 KtCO2** **⇵ -18%** **1.69** **0.8tCO2** **15.2%**		**The 2014 to 2018 increase is 13%.** Nationally there has been an increase of 10% for the same period. This indicates a national failure of policy which is worse in GNLP area. National policy[39] is for 34% abatement by 2030 from low carbon heat. The CCC 6CB equivalent budget for "Domestic Gas" in GNLP area is then 208KtCO2 by 2030. Due to its footprint, this is the key sub-sector for addressing in the domestic sector. The GNLP can maximise emergency action by phasing out gas boilers in new builds from 2022. However, the main footprint comes from existing homes, and the GNLP requires a policy for retrofitting existing buildings – see the CSE response for more detail, where Bath and North East Somerset Policy CP1 is highlighted. BANES CP1 includes priority to retrofitting "at whole street or neighbourhood scales to reduce costs, improve viability and support coordinated programmes of improvement". The GNLP is **not sound** (by *effective* principle) in failing to identify the carbon budget requirements, nor providing *effective* policy, for this large carbon footprint sub-sector.
Transport Minor roads **296 KtCO2** **⇵ +5%** **1.58** **0.72tCO2** **14.2%**		**The 2012 to 2018 increase is 17%.** Nationally, there has been an increase of 6% for the same period. This indicates that there is a specific policy failure within the GNLP area. National policies[40] in the CCC 6CB are for a 70% reduction by 2035 by low-emissions vehicles and demand reduction. The CCC 6CB equivalent budget for "Transport Minor roads" in GNLP area is then 88KtCO2 by 2035. The 17% upwards trend over 5 years indicates a failure of current local policy which requires emergency action to address by both non-plan strategy, such as Norfolk County Council's fourth local transport plan (LTP4) and the Transport for Norwich Strategy (TfN), and GNLP policy under Policy 4. The emergency, along with the requirement to turn around poor performance locally, requires that rural dispersed housing should be ruled out in the GNLP. Modal shift to sustainable modes should be the highest priority. NPPF 102 states that "transport issues should be considered from the earliest stages of plan-making" and "opportunities to promote walking, cycling and public transport use are identified and pursued" and "the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account", and NPPF 103 which states "The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health."

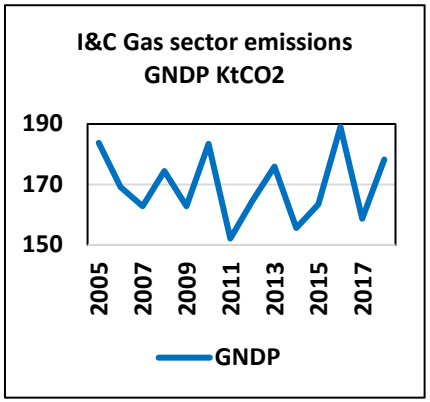
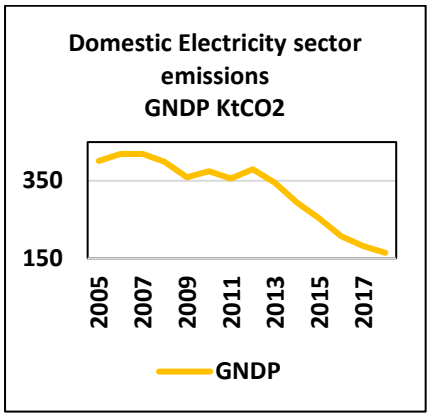
[39] https://www.theccc.org.uk/publication/sixth-carbon-budget/ , page 110 onwards.

[40] https://www.theccc.org.uk/publication/sixth-carbon-budget/ , page 96 onwards.

		The GNLP is **not sound** (by *effective* principle) in failing to identify the carbon budget requirements, nor providing *effective* policy, for "Transport minor roads" as a large carbon footprint sub-sector.
Industrial and Commercial Electricity **217 KtCO2** **⇵ -61%** **1.16** **0.53tCO2** **10.4%**		This sub-sector is out of the scope of this study. However, a recent study on Energy over the whole East of England for former MEP, Catherine Rowett[41] advised "*Roofs of commercial and industrial buildings offer significant potential for solar PV array installation on a larger scale than homes. These should be built with battery storage and connected to the distributed, smart grid where possible. The installation of roof mounted solar PV arrays at an average 40KW rating on 200,000 industrial and commercial buildings (from an estimated 232,000 in the region) will generate an estimated 3.78TWh/year. The remaining electricity can be decarbonised in line with the remaining domestic sector electricity, as explained above. Here, as there, the result will depend on the grid carbon factor in 2030. "* The CSE Reg 19 submission highlights the need within the GNLP for proactive and supportive renewable energy policies, and notes GNLP "policy appears entirely reactive and no overall strategy for maximising renewable energy is evident.". The GNLP Reg 19 is unsound being not *effective* in bringing about the increased deployment" needed to be *consistent with national policy*. National electricity decarbonisation is projected by the CCC 6CB[42] to rapidly reduce electricity footprint. With a further 30% decarbonisation from local policy, a 2030 target for "I&C Electricity" is 35 KtCO2 in 2030 and 7 KtCO2 in 2035. The GNLP requires a renewable energy policy with a target footprint for "Industrial and commercial electricity".

[41] ENERGISING THE EAST, "An energy transformation plan for the climate emergency", https://catherinerowett.org/wp-content/uploads/2020/01/EastofEnglandEnergyReport_LAYOUT_interactive-2-1.pdf, page 41, ©2020 Dr Karen Barrass, Dr Andrew Boswell, Jonathan Essex

[42] https://www.theccc.org.uk/publication/sixth-carbon-budget/ , page 134 "Carbon intensity of generation falls from 220 gCO2/kWh in 2019 to around 50 gCO2/kWh in 2030, 10 gCO2/kWh in 2035, and 2 gCO2/kWh in 2050 (Figure 3.4.b)"

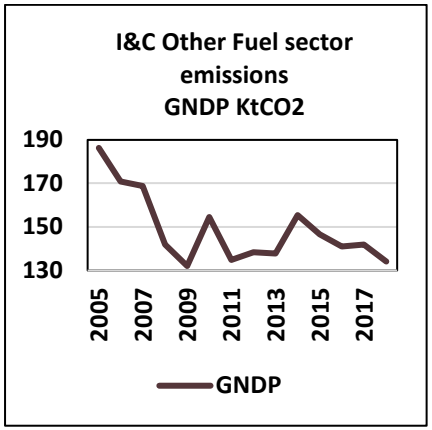
Industrial and Commercial Gas **178 KtCO2** **⇵ -3%** **0.95** **0.4tCO2** **8.6%**		This sub-sector is out of the scope of this study. However, a recent study on Energy over the whole East of England for former MEP, Catherine Rowett[43] advised "*In 2017, 6.68MtCO₂ was produced from gas and electricity used [across East of England] in the ICA sectors: this corresponds to 71% of the total. Most of this is used for heating and lighting buildings, and to run industrial processes.* ***While 75% of gas demand is for space heating in commercial buildings, only 13% of gas is used for heating in industry. 76% of gas use in industry is for processing and drying. To decarbonise this by 2030, all the space heating needs to be transferred from gas to electricity by deep building insulation and heat pumps****, as for the domestic sector above. Gas use for cooking and water heating may also be transferred to electricity. This leaves the use of gas for processing and drying in industry which would need to be addressed in detail in a separate more extensive study of the ways to decarbonise industrial production.[44] These measures taken together, and delivered by rapid programmes, on a similar scale to those described above for the domestic sector, can reduce much of the 2.76MtCO₂ footprint for gas, by 2030.*" The GNLP requires a policy with a target footprint for "Industrial and commercial gas" drawing on the above.
Domestic Electricity **165 KtCO2** **⇵ -59%** **0.88** **0.4tCO2** **7.9 %**		Of the key domestic and transport sub-sectors, only domestic electricity has shown a significant decrease since 2005, and this is due entirely to national electricity decarbonisation policy (the GNDP area reduction of 59% since 2005 is close to the national reduction in this subsector of 62% over the same period). In the 2020s, we require a combination of continuing national electricity decarbonisation, and local policies to increase decentralised renewables. Non-plan local authority initiatives such as Norfolk County Council's recent investment in an offshore industry campus[45] and Norwich City Council's "Solar Together" scheme[46] are welcome contributors to further decarbonisation of domestic electricity.

[43] ENERGISING THE EAST, "An energy transformation plan for the climate emergency", https://catherinerowett.org/wp-content/uploads/2020/01/EastofEnglandEnergyReport_LAYOUT_interactive-2-1.pdf, page 41, ©2020 Dr Karen Barrass, Dr Andrew Boswell, Jonathan Essex

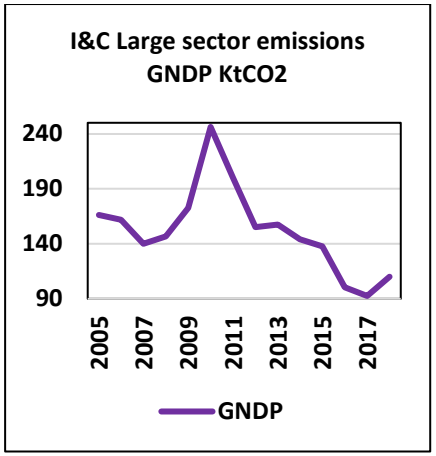
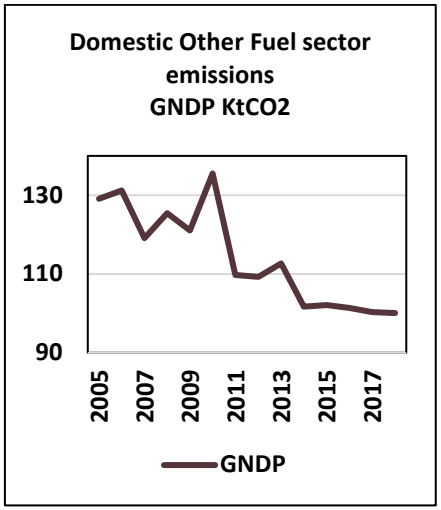
[44] However, there are some interesting developments that could offer significant reductions in this area. The European DryFiciency project, for example, is developing new heat pump technology that can use waste heat from industrial processes to power industrial scale heat pumps https://cordis.europa.eu/article/id/125300-new-heat-pump-technologies-for-industrial-drying Additionally, system efficiencies (such as reduced over-drying of products, or improving the thermal efficiency of processes) could also deliver energy savings in this area

[45] EDP, March 1st 2020, https://www.edp24.co.uk/news/great-yarmouth-operations-and-maintenance-campus-cost-7798078

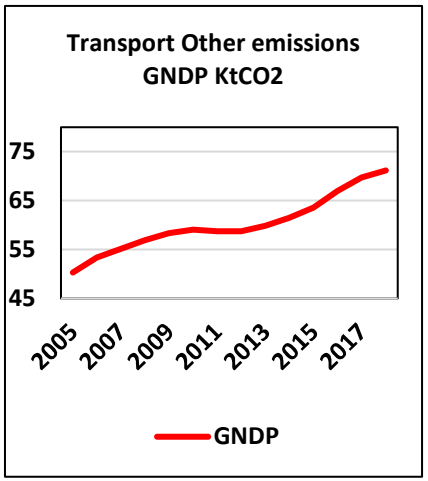
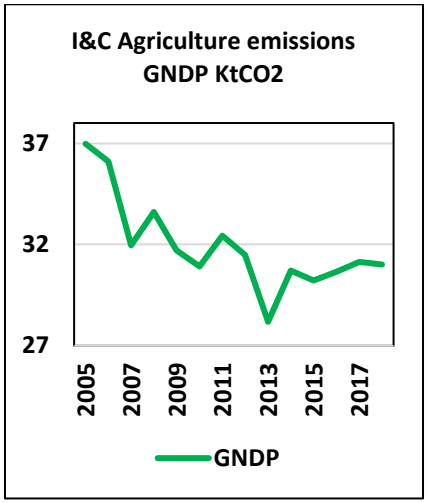
[46] https://solartogether.co.uk/norwich/home

		National electricity decarbonisation is projected by the CCC 6CB[47] to rapidly reduce electricity footprint. However, the transition to electric vehicles will place a significant new demand on the "Domestic electricity" sector: this means the role for decentralised renewables on top of national supply is important, and makes the inclusion of ambitious renewable energy policies within the GNLP critical. Further, transport policy needs to be considered here too – overall vehicle kilometres need to be reduced to avoid hitting ceilings on domestic decarbonised electricity supply. This needs to be resolve through pro-active transport policy. However, in-plan GNLP pro-active policies are missing, as the CSE Reg 19 submission highlights and notes GNLP "policy appears entirely reactive and no overall strategy for maximising renewable energy is evident.". The GNLP Reg 19 is unsound being not *effective* in bringing about the increased deployment of renewables needed to be *consistent with national policy,* and developing transport policy to reduce overall vehicle kilometres. The GNLP requires a renewable energy policy with a target footprint for "Domestic Electricity" emissions. We do not suggest a footprint due to the complexities of balancing electric vehicle uptake with other trends are beyond this analysis.
Industrial and Commercial Other fuel **134 KtCO2** **⇵ -28%** **0.72** **0.3tCO2** **6.4%**		This sub-sector is out of the scope of this study.

[47] https://www.theccc.org.uk/publication/sixth-carbon-budget/ , page 134 "Carbon intensity of generation falls from 220 gCO2/kWh in 2019 to around 50 gCO2/kWh in 2030, 10 gCO2/kWh in 2035, and 2 gCO2/kWh in 2050 (Figure 3.4.b)"

Industrial and Commercial Large installations **110 KtCO2** **⇵ -34%** **0.59** **0.3tCO2** **5.3%**		This sub-sector is out of the scope of this study. However, we note that this significant footprint is due almost entirely from the British Sugar factory at Cantley in Broadland (as also listed in BEIS spreadsheet Pollution Index tab). British Sugar, the GNDP authorities, and Broads Authority, need to take emergency action to find ways to reduce this footprint.
Domestic Other Fuel **100 KtCO2** **⇵ -22%** **0.53** **0.2tCO2** **4.8%**		Decreases in this sub-sector have levelled off since 2014. This is similar to national trends. National policy[48] is for 34% abatement by 2030 from low carbon heat. The CCC 6CB equivalent budget for "Domestic Other fuel" in GNLP area is then 66KtCO2 by 2030. The GNLP can maximise emergency action by ensuring no oil boilers in new builds from 2022. Biomass systems should also be discouraged – the "carbon neutrality" of these are contested, and there is increasing evidence of air pollution health hazards associated with them. However, the main footprint comes from existing homes, and the GNLP requires a policy for retrofitting existing buildings – see the CSE response for more detail, where Bath and North East Somerset Policy CP1 is highlighted. BANES CP1 includes priority to retrofitting "at whole street or neighbourhood scales to reduce costs, improve viability and support coordinated programmes of improvement". The GNLP is **not sound** (by *effective* principle) in failing to identify the carbon budget requirements, nor providing *effective* policy, for this significant carbon footprint sub-sector.

[48] https://www.theccc.org.uk/publication/sixth-carbon-budget/ , page 110 onwards.

Transport Other **71 KtCO2** **⇵ +42%** **0.38** **0.2tCO2** **3.4%**		This sub-sector is out of the scope of this study. An email exchange with BEIS indicates that this is largely due to the Broads inland waterways. This is a growing sector that needs addressing although it may be best addressed by the Broads Authority and GNDP councils by non-plan policy. Email from BEIS Greenhouse Gas Inventory Team to CEPP, 10th March 2021 – "National emissions and trends in sector 'M' are dominated by aircraft support vehicles and motorboats/workboats on inland waterways. Respectively around 1.5% and 12% of UK emissions from these sources are allocated to Norfolk LAs. **In particular, Broadland, Great Yarmouth, North Norfolk & South Norfolk have substantial CO2 emissions from inland waterways.** This allocation is constant across the timeseries and is based on data from the Association of Inland Navigation Authorities. This indicates that the Norfolk Broads accounts for 21% of vehicle kilometres on inland waterways in England & Wales, second only to the Thames (57%). Since the Thames intersects many more LAs, this results in Norfolk LAs having some of the highest proportional allocations of emissions from inland waterways. Emission factors for this source are largely constant across the timeseries, and as such the national trend for this source is due to a 53% increase in activity data from 2005-18. This is based primarily on a 2011 survey of trade bodies and operators, projected using data from OECD UK Household expenditure on Recreation and culture." The GNDP authorities, and Broads Authority, need to take emergency action to find ways to reduce this footprint.
Industrial and Commercial Agriculture **31 KtCO2** **⇵ -16%** **0.17** **0.1tCO2** **1.5%**		This sub-sector is out of the scope of this study.
Transport – Diesel rail // 9.5 KtCO2 // ⇵ -3%		This sub-sector is out of the scope of this study.
Transport –Motorways not shown // 0 KtCO2		This sub-sector is not relevant to GNLP area.

Land Use, Land Use Changes and Forestry // -10.5 KtCO2 // ⇵ -176% **NB: The LULUCF is broken down further by sub-sector with 2018 footprints as follows:** - **Sinking from forestry -70 KtCO2** - **Cropland emissions 70 KtCO2** - **Sinking from grasslands -35 KtCO2** - **Wetlands 0** - **Emissions from settlements 24 KtCO2** - **Emissions from harvested wood products 0**	This sub-sector is out of the scope of this study. The Norfolk County Council "1 Million Trees for Norfolk" is an excellent start on reforesting (and increasing the 70KtCO2 annual sink in GNLP area). Friends of the Earth have identified tree cover targets for the GNLP Councils for 2030: Broadland 24% from 12%, South Norfolk 20% from 6%, Norwich 20% from 8%[49]. Tree planting on this scale within the GNLP area would help meet the carbon budget and should be addressed under Policy 3. GNLP Reg 19, 112 acknowledges that "*Green infrastructure is vital to supporting biodiversity, combating climate change, reducing pollution, helping to create attractive homes …".* Rewilding projects and woodland planting could increase carbon sequestration across the area, and GNLP Policy should be included for this. The Climate Change Statement is vague on this "*Policies 1, 2, 3, 4 and 7 support further development of the green infrastructure network which will provide for mitigation of and adaptation to climate change*", and targets to increase sequestration are needed. Unsound on *effective*ness.
TOTAL of all sub-sectors 2081 KtCO2	For clarity, this is consistent (not surprisingly, as we use the same BEIS data source) with the data provided on page 37 [PDF 49] of the Lepus Sustainability Appraisal[50] which gives the total CO_2 emissions estimate for each district in 2018 as • Broadland – 748 KtCO2 • Norwich – 496 KtCO2 • South Norfolk – 836 KtCO2

[49] https://policy.friendsoftheearth.uk/download/league-table-local-authority-performance-climate-change

[50] "Sustainability Appraisal and Strategic Environmental Assessment of the Greater Norwich Local Plan", Volume 2, LEPUS, January 2021

5.2 Analysis of BEIS and CCC 6CB analysis against SCATTER budgets

73 To test the extent to which the assumptions of national, ex-plan local and ambitious in-plan policies discussed above in Table 2 would meet the SCATTER carbon budget for the GNLP area, the following Table has been calculated.

Budgets for 2030 and 2035 have been derived based upon the "CCC 6CB" aligned budgets in Table 2, with simple extrapolations between 2030 and 2035 (as only one of these years has a CCC 6CB equivalent), and further assumptions to fill in the remainder of the table. The sub-sectors marked green are ones for which an indicative local target may be derived in Table 2, and those marked brown are outside the scope of the local plan in this report.

All figures KtCO2		Key	CCC 6CB	Derived by assumption	
BEIS Sub-sector	**2018**		**2030**	**2035**	**Assumptions**
Transport A-roads	464		232.0	139.2	Table 2 + Assume 50% by 2030
Domestic Gas	316		208.6	137.6	Table 2 +Assume 2035 = 0.66 of 2030
Transport Minor Roads	296		148.0	88.8	Table 2 +Assume 50% by 2030
I&C Electricity	217		34.5	6.9	Table 2 + 30% local via renewable energy
I&C Gas	178		117.5	77.5	Table 2 + Assume 2035 = 0.66 of 2030
Domestic Electricity	165		37.5	8.5	Table 2 + EV's take up 30%
I&C Other	134		134.0	134.0	*No GNLP Policy*
I&C Large	110		110.0	110.0	*No GNLP Policy*
Domestic Other	100		66.0	43.6	Table 2 + Assume 2035 = 0.66 of 2030
Transport Other	71		71.0	71.0	*No GNLP Policy*
I&C Agric	31		31.0	31.0	*No GNLP Policy*
Transport Diesel rail	9		9.0	9.0	*No GNLP Policy*
Transport Motorways	0		0.0	0.0	n/a
LULUCF	-10		-10.0	-10.0	*No GNLP Policy*
Local Table 2 target	1736		844.1	502.2	
No Table 2 local target	345		345.0	345.0	
Total	2081		1189.1	847.2	
SCATTER			410.0	200.0	
Total/SCATTER ratio			2.9	4.2	

Table 3: Summary of possible local targets against SCATTER budgets

74 Using these assumptions, the total annual footprint in 2030 is 57% of 2018, and the footprint in 2035 is 41% of 2018, a 70% reduction[51]. Significant improvement could be made by introducing policies and targets to tackle sub-sectors where there currently exists no policy.

[51] Note, the recently announced national target is 78% reduction by 2035 from 1990 levels.

75 The total annual footprint in 2030 is 2.9 times the SCATTER annual budget in 2030, and the footprint in 2035 is 4.2 times the SCATTER annual budget in 2035.

76 This is a preliminary analysis but indicates that even with the more ambitious targets suggested in the Table 2 (compared to GNLP Reg 19), the GNDP area would still be far from meeting a Paris compliant carbon budget.

77 However, where national targets from CCC 6CB are combined with local indicative targets in Table 2, significant reductions can be found. The footprint sub-sectors where this has been applied reduce from 1736KtCO2 in 2018 to 502KtCO2 in 2035.

78 The sub-sectors with no identifiable policy through any of the three-fold ways (national, local ex-plan, local in-plan) are assumed constant, contributing 345 KtCO2 in 2018 and in 2035, and become an ever-larger part of the footprint. Therefore, it is crucial that the authorities start to plan actions on these emissions, largely from the industrial and commercial sectors, and the Broads tourism industry.

5.3 Implications for soundness of the GNLP Reg 19

79 No carbon footprinting has been undertaken for the GNLP, and GNDP have decided that it is not "desirable".

80 However, we have laid out in the section "ASSESSING SOUNDNESS AND LEGAL COMPLIANCE" that by law, plans must include climate change policies "*designed to secure*" mitigations of climate change, that to be effective climate policies must deliver "*timely emissions reductions across the economy",* and under national planning guidance that "*robust evaluation of future emissions will require consideration of different emission sources, likely trends taking into account requirements set in national legislation, and a range of development scenarios*."

81 The above analysis is an endeavour to do this at an indicative level. The GNDP have eschewed doing anything similar, and it is clear in the GNLP Reg 19 draft plan that GNDP have made no credible use of the planning system as set out at NPPF 148 to contribute to radical reductions of greenhouse gas emissions:

> "*The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to:* ***shape places in ways that contribute to radical reductions in greenhouse gas emissions****, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.*" [NPPF 148, emphasis added]

82 Further, GNDP make no credible attempt to indicate how local plan policies can interoperate with and enhance the effectiveness of national policies and other (ie non-GNLP) local council policies.

83 The GNLP Reg 19 is **unsound** on all four soundness criteria as no serious attempts to secure evidence-based climate mitigation policies has been made. This is also not

legally compliant with Section 19(1A) of the Planning and Compulsory Purchase Act 2004.

5.4 The new housing

84 So far, we have examined the existing carbon footprint of the GNDP, and possible future trends for it based on 2018 levels of housing and economic activity. The next two sections look at the number of houses proposed in the plan, their spatial distribution, and the carbon footprint associated with their construction and future operation (ie living in).

85 This is a vital additional, future footprint to consider. However, it is important to understand that it does not map onto the BEIS data just discussed. Whilst the new housing adds new carbon emissions to the overall footprint, which are directly attributable to policies in the GNLP, they cannot be simply reduced to the same sub-sectors as the BEIS data.

86 It is preferable to view these two different footprints as different tools which give different perspective of the overall carbon pollution impacts of the GNLP Reg 19 draft plan. The Table 2 data gives a baseline for the current footprint, and policies and suggested targets to reduce it. The new housing data reveals where policy should be provided for reducing emissions in the planned housing.

87 We first look at the housing numbers themselves in the next section and point out where they are unsound with respect to climate change mitigation. In the subsequent section, we produce a carbon footprint model for the new housing.

6 HOUSING NUMBERS AND SPATIAL DISTRIBUTION

88 The housing numbers, and their spatial distribution, in the plan are key aspects of soundness, and especially on climate change. This section examines how the housing numbers have been overinflated, and the subsequent section provides an indicative carbon footprinting exercise of the embedded and operational carbon emissions implicit in building the houses and living in them.

89 Overinflated housing numbers add a critical element to the GNLP area's carbon footprint, which is not affordable in the overall carbon budget, given the emergency, so we first examine the housing numbers in detail.

6.1 Carbon leakage and shapeless place shaping via overinflation of housing numbers between Reg 18A and Reg 19

90 Table 4 shows the GNDP's housing numbers at the various stages of developing the plan, and the CPRE response to the Reg 19 plan[52]. There has been considerable **drift** from the original intentions consulted upon at the Reg 18A, as described below, which we do not consider democratically accountable.

	2017 SHMA	Reg 18 A	Reg 18C	Govt 16/12/2020	CPRE	Reg 19	Reg 19 max
Plan Period	**2015-2036**	**2017-2036**	**2018-2038**	**2018-2038**	**2018-2038**	**2018-2038**	**2018-2038**
Local Housing Need	39486[53]	38988[54]	40541	40160	40541	40541	40541
Delivery			2938		5240	5240	5240
Existing Commitment		35665	33565		31452	31452	31452
Shortfall		*3323*	*4038*		*3849*	*3849*	*3849*
Costessey Contingency							*800*
South Norfolk Village Clusters & Diss						*[1450]*	*[1450]*
New Allocations		7222	7840		5876	10704	10704
Homes Policy 7.5						800	800
Windfalls						1296	4450
Reg 18A Strategic Growth options		42865					
Target Housing Delivery		**42887**	**44343**	**40160**	**42568**	**49492**	**53446**
Buffer above GNLP need (40541)					5.00%	22.08%	31.83%
Buffer above Govt need - allocations (40160)					6.00%	18.02%	20.01%
Buffer above Govt need - all (40160)						23.24%	33.08%

Table 4: Current and historic Housing Numbers

91 In the Reg 18A Growth options document, GNDP identified a locally assessed housing need of 38,988 homes which with 7,222 new allocations gave a 10% "delivery buffer". The document notes that windfalls, if counted on top of allocations could extend the 10% delivery buffer to 24% and consults upon how to treat windfalls in the numbers (see below).

92 Now GNDP have calculated a locally assessed need of 40,541 as described at GNLP Reg 19, 177. However, this figure is too high as, on 16th December 2020, the Government published an indicative annual housing need figure[55] of 2,008 homes for the GNLP area, following their own guidance, which is 40,160 over the 20-year plan period.

[52] I am grateful to CPRE Norfolk, and Bryan Robinson, for early sight of their responses which has helped inform the narrative in this section.

[53] Regulation 18A Growth Options document, 4.16

[54] Regulation 18A Growth Options document, 4.17

[55] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/944896/Indicative_Local_Housing_Need_Publication_Table_.ods from page https://www.gov.uk/government/consultations/changes-to-the-current-planning-system

93 MHCLG do not routinely publish indicative local housing need figures, and it is for local authorities to calculate their local housing need, using the method set out in planning practice guidance, and to update this when inputs to the formula change, for example, when new affordability ratios from the Office for National Statistics are published.

As the GNDP numbers do not agree with the Government numbers, CEPP request that the GNDP publish their calculation, and all the assumptions within it, and that subsequent updated calculations (for example, when the affordability ratios are published in March each year[56]) are also published showing the full calculation and assumptions.

94 GNDP have introduced a "windfall allowance" at Reg 19, outside of the "delivery buffer", which did not exist at R18C. Whilst the allowance is set as 1,296, Table 4 shows a "Max" scenario which includes the maximum GNDP Jan 2020 estimation of total windfalls in the area and the "Costessey contingency" which shows the potential for a 53,446 home build out, beyond the 49,492 of GNDP Reg19 Table 6.

95 The CPRE Norfolk Reg 19 response[57] scenario is provided for comparison. It includes an arbitrary buffer of 5% (5,876 homes) against the GNDP locally assessed need of 40,541 homes, and potentially 13,000 less homes.

96 At 178, the GNLP Reg 19 states that a buffer around 10% is used to ensure delivery, and 10% is typical "normal practice". No justification, nor evidence base, is given for extending beyond a 10% buffer. However, Table 4 shows that the intended buffer at Reg 19 is 22%-32%, and 23%-33% when the 16th December 2020 Govt assessed need is used.

97 The words "flexibility" and "choice" are used often in the GNLP Reg 19. However, such a high buffer **undermines the place shaping principle** of planning which NPPF 148 emphasises as a key aspect "*to shape places in ways that contribute to radical reductions in greenhouse gas emissions*".

The choice provided by a buffer, which could extend to around 30%, is to loosen the strategic shape of where home building happens, so undermining the strategic nature of Policy1 "The Sustainable Growth Strategy".

A further issue is the delegation of at least 1450 allocations to the South Norfolk Village Clusters Housing Sites Allocation plan, and the Diss and Neighbourhood Plan. This allows further carbon leakage from the GNLP carbon budgets.

The 23%-33% buffer undermines achieving sustainable development under the environmental objective at NPPF 8(c), and the plan is **unsound** as it is not *positively prepared* for this objective. Nor is it *justified*, *effective*, or *consistent with national*

[56] https://www.ons.gov.uk/peoplepopulationandcommunity/housing/datasets/ratioofhousepricetoworkplacebasedearningslowerquartileandmedian

[57] https://www.cprenorfolk.org.uk/wp-content/uploads/sites/32/2021/03/GNLP-Reg-19-consultation-response-FULL.pdf

policy in delivering against Section 19(1A) of the Planning and Compulsory Purchase Act 2004 and the soundness and legal requirements set out in the previous section.

98 The GNLP Reg 19 is not even sound against its own stated ambition which claims – falsely - at Reg 19, 83 that "*mitigating the effects of climate change within the Greater Norwich area is a cornerstone of the GNLP*".

6.2 COVID impacts not considered

99 GNDP consider, at 178, that the 2018-based projections could add a further 5000 homes; however, this is based on projections before the COVID crisis which may mean that delivery buffer generated is far is excess of what may be required post-COVID.

100 Demographics are changing because of COVID, and the UK has had a population drop during 2020[58] estimated to be 1.3m, and strongest in London. The long-term effects and trend of this are unknown, and the linkage between an overall UK population drop and future housing needs in the GNLP area will take some years to ripple through.

101 The housing figures need to be reviewed against COVID impacts. We note also that the affordability ratio data, used in the Government's indicative local housing need data[59] (of December 16th) was published 19th March 2020[60] and new data for 2020 is due out March 2021 which in time will be reflected in an updated local housing need figure.

6.3 Front loaded housing delivery trajectory

102 The Housing Delivery Trajectory at Reg 19, page 145 (appendix 6), front loads build out over the next 5 years peaking at 3,349 homes in 2022/2023 against a Government assessed need of 2,008 homes. The 66% overhead against need for that year is unjustified, and especially when the long-term housing demographics are unknown, as above.

103 Such high housing numbers drive carbon emissions in two ways:

- from **embedded** carbon emissions in construction, estimated to be around 100 tonnes of CO2 per house[61];

[58] "Estimating the UK population during the pandemic", "Economic Statistics Centre of Excellence". http://bit.ly/ESCoE_1-3m

[59] https://www.gov.uk/government/consultations/changes-to-the-current-planning-system & https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/944896/Indicative_Local_Housing_Need_Publication_Table_.ods

[60] https://www.ons.gov.uk/peoplepopulationandcommunity/housing/datasets/ratioofhousepricetoworkplacebasedearningslowerquartileandmedian, accessed March 12th 2021

[61] We will expand on *embedded carbon footprints* later, but an example of this rule of thumb of 100 tCO2 per home comes from this Climate Change section of the Environmental Statement for Chalgrove Airfield in Oxfordshire - this is 3000 home development (http://bit.ly/ChalgroveCarbon). At page 17, they calculate "Effects during Pre-construction and Construction" using a Lifecycle GHG impact assessment as 313,370 tCO2 which is around 100 tCO2 per house.

- and from energy and transport emissions from daily living (or "operation"). As we show later, there is still a massive amount of reduction necessary to these emissions. General current build standards lock-in high operations emissions into the future, and as the CSE consultation response shows there are no pro-active policies to reduce operational emissions in the future for home built under the plan.

104 The Reg 19 GNLP **has deferred**[62] making climate change policies that will deliver the lowest carbon homes until the next review of the adopted GNLP. This is despite Agreement 19 of the recently agreed Norfolk Strategic Planning Framework[63] stating:

> "*Norfolk Planning Authorities agree that climate change is **an urgent, strategic cross boundary issue** which will be addressed at the heart of Local Plans.*"

The recent Climate Change document from the Norfolk Strategic Planning Framework recommends a design guide is produced and reports on summaries of topic-based papers – this covers a range of urgent issues relating to climate change. Yet the results of this research are being deferred, by the GNDP, until a GNLP review, at least several years from now. This is not commensurate with emergency governance: it is **unsound**, and not *consistent with national policy* for deep emissions of 78% by 2035.

Deferral of vital policies which could reduce the carbon footprint of the plan is not even consistent with NSPF's own Agreement 19 on the urgency of tackling climate change. (The Norfolk Strategic Planning Framework is discussed further in a subsequent section.)

105 By deferring climate policy to implement improvements in low-carbon build standards, whilst front loading build-out, GNDP are maximising the number of homes that will be built to the current low standards. Poor standards of insulation and energy efficiency, and gas and oil heating, will be locked into these homes and maximising rather than reducing the long-term carbon footprint.

106 Further too much flexibility and choice, which is embedded in the GNLP Reg 19, will allow cherry picking of sites by developers, undermining the shaping principles in Policy 1 and leading to homes not served by sustainable transport, or close to employment centres, being built, locking in transport emissions for years to come. This is **unsound** and in*effective*, at not *consistent with national policy* on climate change. The Norfolk HELAA methodology needs to be reviewed and the HELAA re-run to sharpen up *effective*ness on climate change mitigation in site allocation assessment and we discuss this later.

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[62] Email 10 March 2021 from Judith Davison, Norwich City Council to Cllr Denise Carlo. Ms Davison confirms that the evidence contained in the "NSPF Climate Change research Paper" and the relevant policies will not be introduced until the adopted GNLP is reviewed.

[63] https://www.norfolk.gov.uk/-/media/norfolk/downloads/what-we-do-and-how-we-work/policy-performance-and-partnerships/partnerships/strategic-member-forum/25-january-2021/norfolk-strategic-planning-framework.pdf

107 In short, the over-inflated Reg 19 housing numbers result from a drift from GNDP's stated intention at Reg 18A. The numbers and shaping/distribution of the housing is also incompatible with seriously tackling carbon emissions in the GNLP area and is **unsound**. We will develop indicative carbon footprints later to illustrate this and provide a greater explanation.

6.4 Drift from Reg 18A: consultation legitimacy concerns

108 Furthermore, CEPP is concerned that these over-inflated housing numbers have not been legitimately consulted upon:

i. Six strategic growth options were given at Reg 18A (at Figure 3 within that document), and each of the six gave the total housing provision of 42,865 as shown on Table 4. Windfalls **were not considered** within the total housing provision of 42,865, but the public were asked at Reg 18A consultation question number 6 "*Do you agree that windfall development should be in addition to the 7,200 homes?*". Significantly more respondents (110) said 'No' than those who said 'Yes' (45)[64].

ii. GNDP appear to have taken the steer from the majority consultee responses on R18A, question 6, when at Reg 18C in Table 6 "Establishing the Plan's **total housing figure**" (my emphasis) gave 44,343[65] as total, a figure that included windfalls.

iii. It is only at Reg 19 that GNDP have departed from the majority consultee response at Reg 18A, and their own precedent at Reg 18C, and added in windfalls as an additional part of the housing buffer as a "windfall allowance". This important addition of new homes is only explained in footnote 59[66].

iv. However, although the "windfall allowance" has been included in Reg 19, the status of windfalls is still not clear as at Reg 19, 184 states "*Demand will determine whether windfall development is instead of, or in addition to, allocated growth.*"

This implies that it is not yet known if the "windfall allowance" is required or not. If it is not known if it is needed, it would be preferable not to include it now, and review the requirement for it at the adopted plan review.

Currently, by building the windfall allowance into the housing numbers and the housing delivery trajectory at Appendix 6, GNDP is **predetermining** the question as to whether to have a windfall allowance, despite the clear uncertainty at Reg 19, 184.

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[64] https://www.gnlp.org.uk/sites/gnlp/files/2021-01/Appendix%203b%20Growth%20Options%20and%20Site%20Proposals%20rep.%20summaries%20GNDP%20180926.pdf

[65] https://gnlp.oc2.uk/document/42/8917#d15500

[66] Reg 19, footnote 59 "*Recognising that the 2018-based projections indicate that growth may be higher, there is a significant delivery buffer, a contingency site and the plan makes use of only a proportion of its projected windfall delivery as a windfall allowance.*"

v. At R18A, the GNDP asked (question number 5) "*Do you agree that the plan should provide for a 10% delivery buffer and allocate additional sites for around 7,200 homes?*". Of a total of 153 separate responses were received: 49 replied Yes, 99 replied No[67].

109 The GNLP Reg 19 draft plan goes far beyond what the public were asked at question 5 and question 6 on the Reg 18A Growth Options consultation, and in introducing a "windfall allowance" at this stage has undermined in own precedents at Reg18C and doubt at Reg 19, 184.

7 CARBON FOOTPRINT OPTIONS OF DIFFERENT HOUSING NUMBERS AND POLICIES

110 CEPP have developed a carbon footprint model of the carbon emissions for both the embedded carbon emissions and operational emissions. The model is intended to provide **indicative** numbers which can be used to assess housing numbers, build trajectories, distribution, and policy. This model does **not** address the existing housing stock, **nor** the existing population carbon footprint associated with it. It does address the footprint that is directly in control of the plan and its policies for new builds.

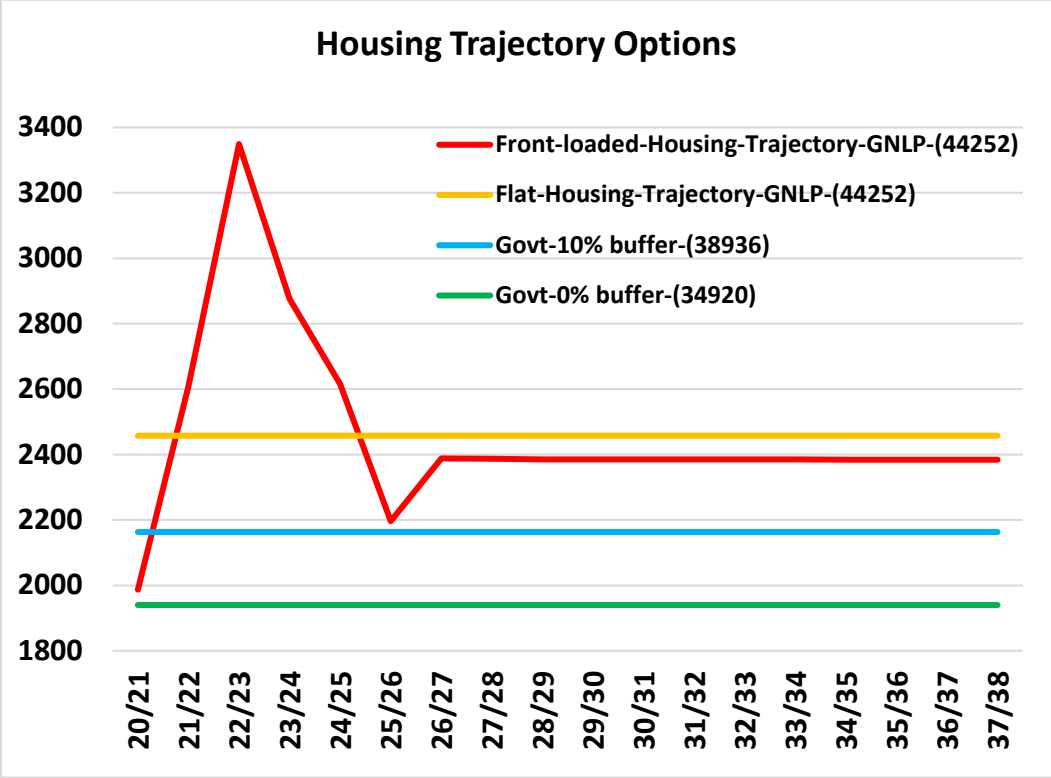
111 There are a number of assumptions in the model, which we explain below, and the full spreadsheet[68] is available as part of this submission.

7.1 Four housing trajectory options

112 We start with four possible housing trajectories for the 18 years 2020/21 to 2037/38 as shown below:

[67] https://www.gnlp.org.uk/sites/gnlp/files/2021-01/Appendix%203b%20Growth%20Options%20and%20Site%20Proposals%20rep.%20summaries%20GNDP%20180926.pdf

[68] Source data: My spreadsheet is available at http://bit.ly/CEPP_R19_HOUSING_FOOTP



113 In each case, the 5,240 houses already delivered in 2018/19 and 2019/20 are subtracted. Overall house totals for each graph are in brackets in the key.

- The red line is the GNLP Reg 19, housing trajectory figures from Appendix 6. This corresponds to 44,252 homes between 2021 and 2038, and a 23.24% buffer against Government assessed need, as in Table 4 above.

  We highlight the disproportionate amount of front-loaded housing in the early part of the plan: **these years correspond to a lock-in of low ambition and undeveloped climate change policy for both reducing embedded "build" emissions and operational "living" carbon emissions.**

- The orange line is the same housing (ie: 44,252 homes) on a flat trajectory. NB – this is not the same the "whole plan average target per annum 2,207" as in GNLP Reg 19 Appendix 6 which does not include the buffer allocations.

- The blue line is 38,936 homes based on the Government assessed need with a 10% buffer

- The green line is 34,920 homes based on the Government assessed need (and 0% buffer).

114 From these trajectories we select the GNLP Reg 19 trajectory (R19T, red) and the Government assessed need trajectory (GASNT, green) for indicative carbon footprinting for the next steps. These are chosen to be base housing trajectories of the

spread of possible carbon footprints below; these are developed as a "GNLP model" (low ambition) and a "better practice" (BP) (high ambition) model[69].

7.2 Embedded carbon emissions from building

115 Generally current building practices have a high associated carbon footprint. The London Whole Life Cycle Carbon (WLC) Assessment Guidance provides useful background, including[70]:

> "*The building and construction sector globally is responsible for 39% of carbon emissions: 28% from the energy needed to heat, cool and power them and* ***11% from materials and construction***."

116 In the GNLP Reg 19, there is some evidence that operational emissions "*the energy needed to heat, cool and power"* homes has been considered at Policy 2.

However, we see no evidence that emissions "*from materials and construction"* ie embedded emissions have been considered. Policy 7.1 does refer to the National Design guide[71], and although this does mention "whole life carbon assessment", the design issue of embedded emissions is not taken up at all by Policy 7.1. As there is no policy to reduce embedded emissions from house building, we reflect the GNLP Reg19 plan and model GNLP/R19T with no significant reduction in emissions per m^2 of build *from materials and construction* over the plan period.

This matter should be addressed by a policy requirement within the GNLP to perform Whole Life-Cycle Carbon (WLC) assessments as in Policy SI 2 DB of the London Plan[72].

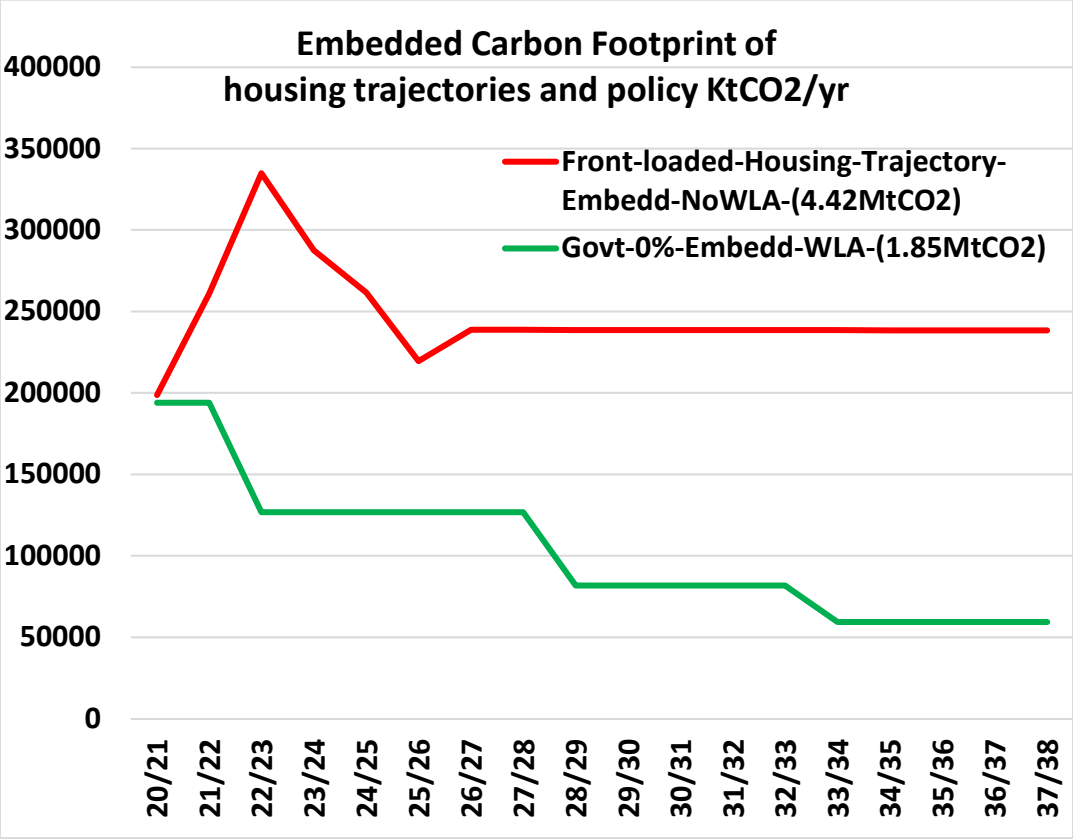
117 For the next graph, we plot the embedded emissions of the GNLP/R19T trajectory with no WLC policy, as above, against the BP/GASNT trajectory with a phased policy of introducing WLC with increasing levels of reducing embedded emissions. Overall carbon footprint totals for each graph are in brackets in the key. (The long strings in the keys are automatically generated in the spreadsheet and indicate the exact parameters for each graph for my assistance: they may be ignored for the purposes of this narrative.)

[69] We caution from saying "best practice" as when the science-based carbon budgets are considered, "best practice" on the Climate Emergency would be to reduce the housebuilding below the Government assessed need levels, and address the housing crisis and the housing need through robust social policies that are not based in house building alone.

[70] London Plan Guidance, "Whole Life Cycle Carbon (WLC) Assessment Guidance", http://bit.ly/LonWLA_Pres, page 5

[71] https://www.gov.uk/government/publications/national-design-guide

[72] https://www.london.gov.uk/sites/default/files/wlc_guidance_april_2020.pdf



118 The embedded emissions start with a *rule of thumb of 100tCO2 embedded emissions per home* for both trajectories. A reference site at these levels of embedded emissions is a recent assessment in Oxfordshire[73]. As the GNLP does not consider embedded construction emissions, we apply this figure across the red GNLP/R19T curve from 2020-2038.

119 For the green BP/GASNT trajectory, we start by calculating the 100tCO2 as 800 kgCO2/m^2 for an average house size of 78m^2. This gives 62.4 tCO2 for the building the house itself. We then add 37.6 tCO2 for the embedded infrastructure external to the house in building service roads and utility structures[74].

120 800 kgCO2/m^2 is a reasonable starting place as per the London Energy Transformation Initiative (LETI) "Embodied Carbon Primer"[75]. Best practice guidance is the current "business as usual" 800 kgCO2/m^2 being reduced to 500 kgCO2/m^2 in 2020, and 300 kgCO2/m^2 in 2030. Meanwhile industry body, the UK

[73] The rule of thumb of 100 tCO2 per home comes from this Climate Change section of the Environmental Statement for Chalgrove Airfield in Oxfordshire - this is 3000 home development (http://bit.ly/ChalgroveCarbon). At page 17, they calculate "Effects during Pre-construction and Construction" using a Lifecycle GHG impact assessment as 313,370 tCO2 which is around 100 tCO2 per house.

[74] https://www.ukgbc.org/wp-content/uploads/2021/01/New-Homes-Policy-Playbook-January-2021.pdf, page 27 [PDF 26] says "There are currently low levels of understanding about the embodied carbon impacts of new buildings.". We have not found good estimates for the embodied emissions for external infrastructure but understand they can approach that for the house itself.

[75] http://bit.ly/LETI_Embed, page 24

Green Building Council's (GBC[76]) "New Homes Policy Playbook - a resource for local authorities" has this requirement for all developments[77]:

> "*All developments shall calculate whole lifecycle carbon emissions (including embodied carbon emissions) through a nationally recognised Whole Lifecycle Carbon Assessment methodology and demonstrate actions taken to reduce lifecycle carbon emissions."*

and this "stretching" requirement for major developments:

> *"Major developments should target <500 kgCO2/m2 upfront embodied carbon emissions (equating to the emissions covered by Modules A1-A5 of the RICS methodology)."*

121 Based on this appraisal of recent references on embodied emissions by a local authority (London) and an industry body, the CEPP model makes these assumptions for the green BP/GASNT trajectory:

a. WLC applies from 2021/22, and housing is required to meet 800 kgCO2/m^2 embedded build emissions until 2022/23
b. Between 2023/24 until 2027/28, 500 kgCO2/m^2 applies
c. Between 2028/29 until 2032/33, 300 kgCO2/m^2 applies
d. Between 2033/34 until 2037/38, 200 kgCO2/m^2 applies
e. The external embedded emissions are reduced by similar amounts for the same periods

122 The application of these 4 stages of a WLC policy, which progressive ramps up, produces the step changes in the green BP/GASNT trajectory above.

123 In summary, the application of a "better practice" WLC policy and housing numbers constrained to government projections reduces the embedded carbon footprint (2021-2038) of the plan from 4.42MtCO2 to 1.85MtCO2, a 2.57MtCO2 saving. It should be noted that science based remaining carbon budget to 2100 for the GNDP area is 12.9MtCO2, so even the most constrained pathway of our graphs uses 14% of the available science-based carbon budget to 2100. Adopting our high ambition scenario saves more than the 2018 overall population carbon footprint in the GNLP area (2.1MtCO2/yr) ie: more than one year's worth of current carbon footprint.

7.3 Operational emissions

124 For operational emissions of the housing trajectories, we consider only fossil fuel (gas and oil) heating and electricity. We do not consider transport emissions although a significant demand on domestic electricity may be expected for transitioning to electric vehicles. To model this would involve assessing different transport options and is not included in this version of our model.

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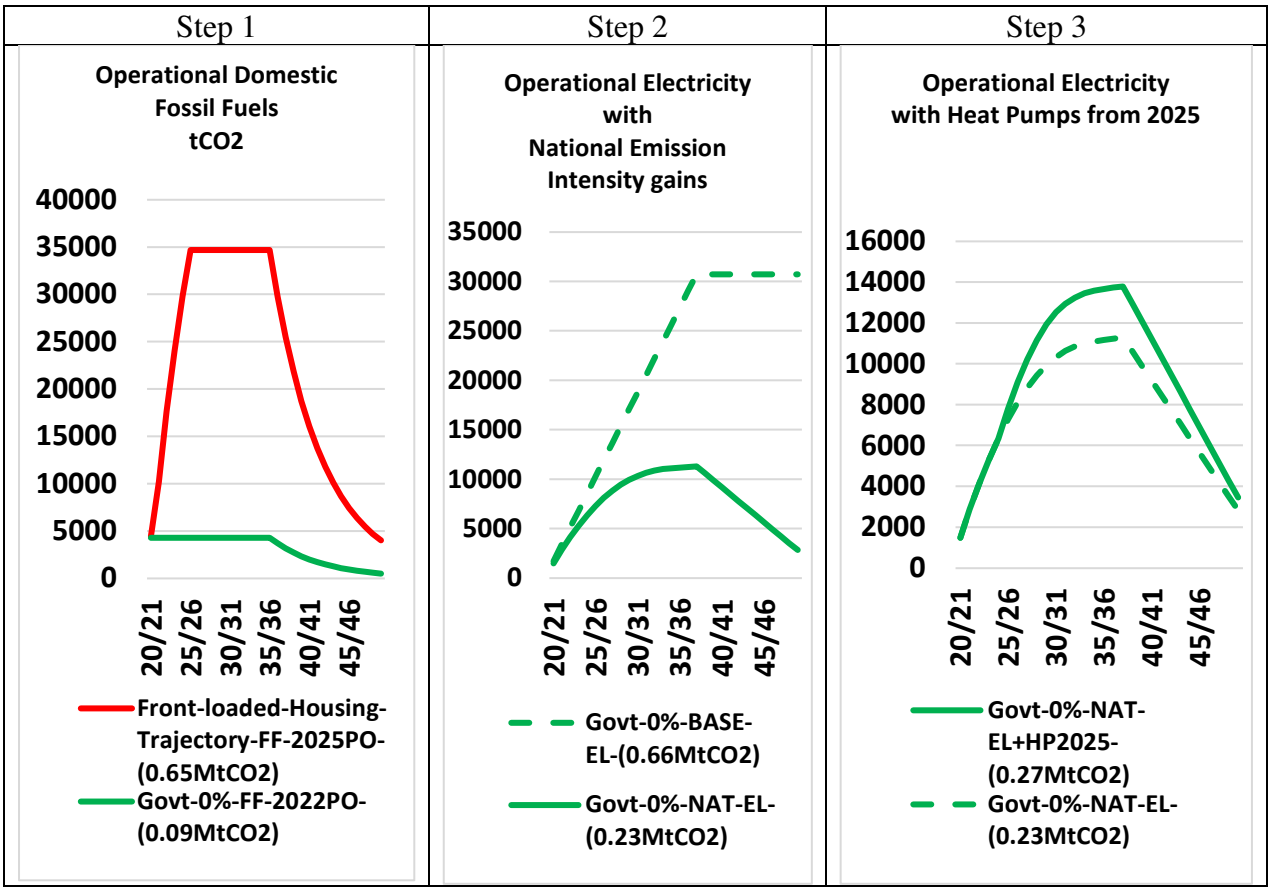
[76] "*Our Mission is to radically improve the sustainability of the built environment, by transforming the way it is planned, designed, constructed, maintained and operated.*"

[77] https://www.ukgbc.org/wp-content/uploads/2021/01/New-Homes-Policy-Playbook-January-2021.pdf, page 27 [PDF 26]

125 The three main logical steps in our model are shown below for illustration. Overall carbon footprint totals for each graph are in brackets in the key. Remember, these projections are for new housing in the plan period **only**, so the step changes at 2038 result from no new houses in the model after then.



- Step 1 shows fossil fuel heating from installing gas and oil in new builds. The Step 1 graph illustrates the emission reduction gain from early phase out of fossil fuel central heating. The red GNLP/R19T curve assumes phase out at the government target of 2025 with the amount of fossil fuel heating modelled until phase out on levels in the current GNDP housing stock. The green BP/GASNT curve shows phase out of fossil fuel heating in new build from 2022 under a local BP policy.

  There are assumptions in the spreadsheet of how the locked-in gas and oil systems are subsequently progressively replaced out to 2050.

  The difference between GNLP/R19T and BP/GASNT is over 0.5MtCO2 over the period to 2050 – approximately one quarter of the current annual GNDP footprint of 2.1MtCO2. This results largely from not locking gas and oil until 2025 in the BP/GASNT model against lock-in in the GNLP/R19T model.

- Step 2 shows the green BP/GASNT curves – dashed line assuming 2019 levels of electricity carbon intensity, whilst the solid line shows the carbon intensity realistically expected to 2050[78].

- Step 3 models the electricity loading to the green BP/GASNT if heat pumps are installed for home heating from 2025. *2025 is only an example* here to illustrate the logical step taken, in the high ambition model below we use *2022* for substituting heat pumps for gas and oil in all new build. The dashed line corresponds to the solid line in step 2, and the solid line illustrates the total with the additional electricity demand from heat pumps[79]. The additional carbon cost of the heat pumps in new build is relatively small 0.04MtCO2 in the period out to 2050.

126 We now combine the modelling to give low and high ambition scenarios.

- **Low ambition** is the plan housing trajectory (red GNLP/R19T) with no policy on top of national policy – a 2025 phase out of fossil fuel heating and national electricity decarbonisation trends.

- **High ambition** is the better practice green BP/GASNT curve based on lower housing build out, Whole Life Cycle assessments gradually reducing embedded emissions, and now the elimination of fossil fuel heating in 2022.

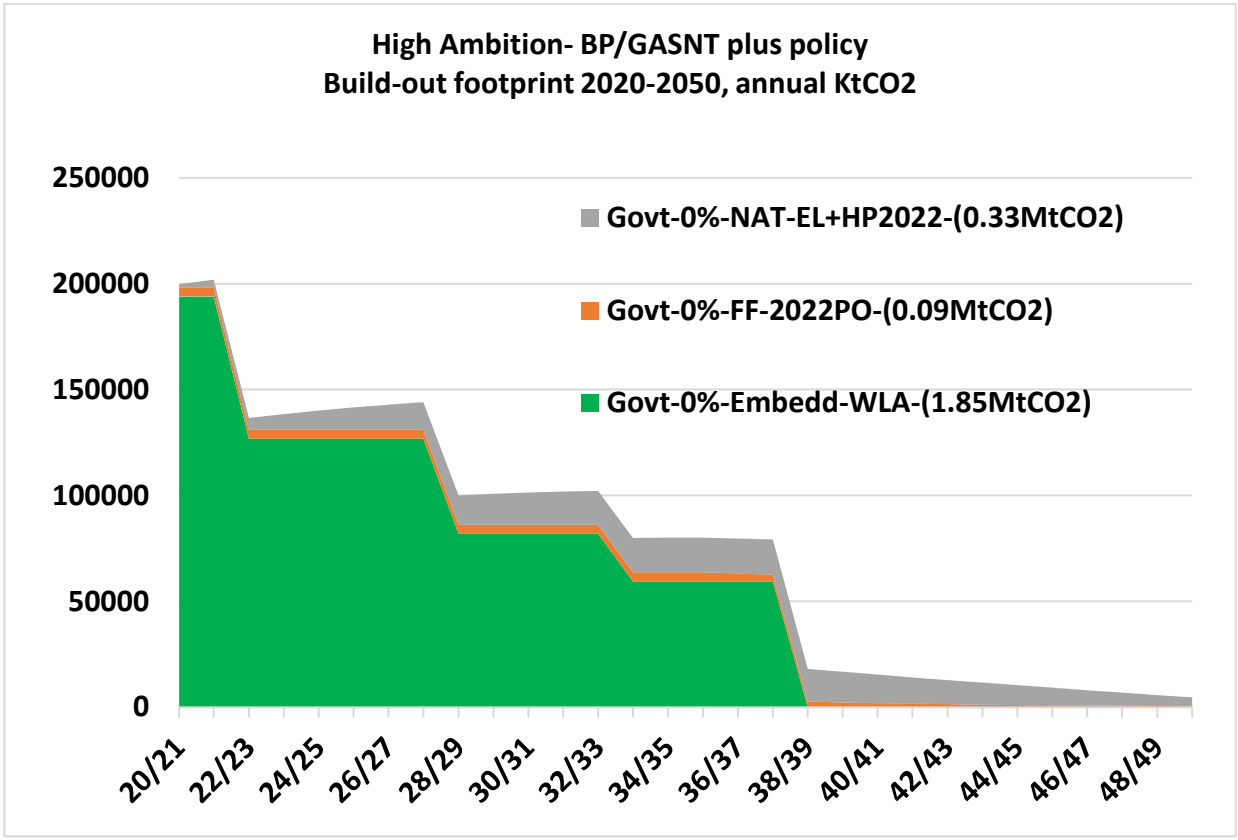
127 The embedded, operational fossil fuel and operational electricity footprints are shown separately for each scenario on the graphs below. Overall carbon footprint totals for each graph are in brackets in the key.

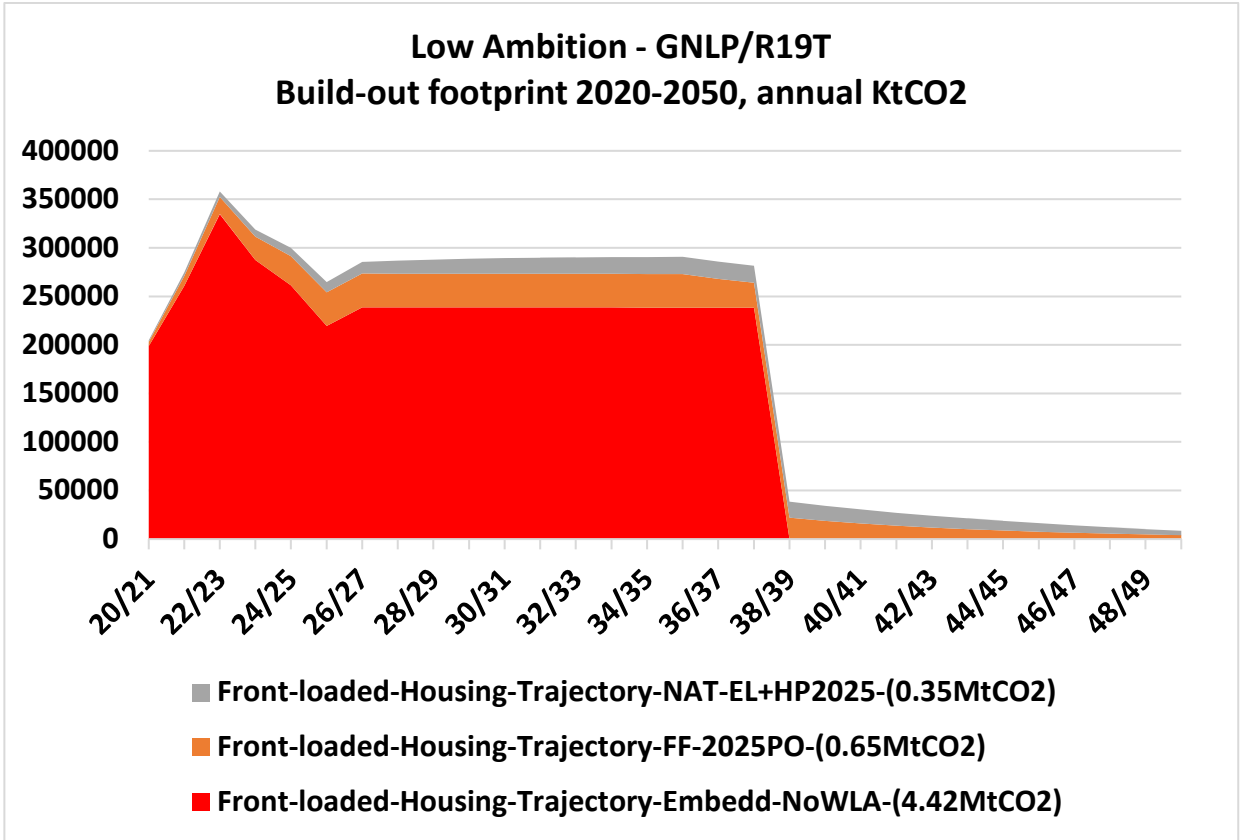
128 The total footprint to 2050 for the high ambition scenario is 2.27MtCO2 whilst for the low ambition scenario it is 5.42MtCO2 (3.15MtCO2 saving). This shows that c. 3MtCO2 could be saved on the GNLP housing to 2038 by dispensing with over-inflated housing numbers and following government assessed need instead, early introduction of Whole Life Cycle assessments and early elimination of fossil fuel heating. The 3MtCO2 of additional carbon generated in the GNLP/R19T low ambition scenario is significant, corresponding to 1.5years of the total 2018 GNDP footprint: **an opportunity cost of resulting lack of serious climate policy (and associated unsoundness) in the GNLP draft plan.**

129 **The biggest opportunity is clearly from dealing with embedded emissions in construction**. The highest priority for the GNDP to rectify this is for Whole Life Cycle assessments and with progressive targets for embedded emissions (eg: 800 kgCO2/m2 reducing to 500, 300 and then 200 as in our assumptions on the high ambition scenario) to be added as policy in the GNLP Reg 19.

[78] Climate Change Committee, 6th Carbon Budget, https://www.theccc.org.uk/publication/sixth-carbon-budget/, page 134 "**Decreasing carbon intensity of electricity generation**. Carbon intensity of generation falls from 220 gCO2/kWh in 2019 to around 50 gCO2/kWh in 2030, 10 gCO2/kWh in 2035, and 2 gCO2/kWh in 2050 (Figure 3.4.b)."

[79] The carbon intensity of heat pumps are modelled from current data at https://www.gshp.org.uk/HVR_Awards_CO2_Calculator_Heat_Pumps.html and the 6th Carbon budget decarbonisation rate applied.


High Ambition- BP/GASNT plus policy
Build-out footprint 2020-2050, annual KtCO2
250000
200000
150000
100000
50000
0
20/21
22/23
24/25
26/27
28/29
30/31
32/33
34/35
36/37
38/39
40/41
42/43
44/45
46/47
48/49
Govt-0%-NAT-EL+HP2022-(0.33MtCO2)
Govt-0%-FF-2022PO-(0.09MtCO2)
Govt-0%-Embedd-WLA-(1.85MtCO2)


Low Ambition - GNLP/R19T
Build-out footprint 2020-2050, annual KtCO2
400000
350000
300000
250000
200000
150000
100000
50000
0
20/21
22/23
24/25
26/27
28/29
30/31
32/33
34/35
36/37
38/39
40/41
42/43
44/45
46/47
48/49
Front-loaded-Housing-Trajectory-NAT-EL+HP2025-(0.35MtCO2)
Front-loaded-Housing-Trajectory-FF-2025PO-(0.65MtCO2)
Front-loaded-Housing-Trajectory-Embedd-NoWLA-(4.42MtCO2)

130 The current low ambition nature of the GNLP is **unsound** on all four soundness principles. It is not *positively prepared* as there is no attempt to proactively reduce emissions in the house building plan: the excessive housing numbers, front loaded housing trajectories, lack of policy to reduce construction embedded emissions, and to eliminate fossil fuel heating beyond national measures all contribute. It is not *effective* in the emergency for the same reasons. It is not *justified* – no justification has been given for the increased carbon footprint associated by not taking the steps made in the high ambition scenario. And it is not *consistent with national policy* on climate change.

131 These findings are consistent with the response from the Centre for Sustainable Energy which highlighted low ambition on sustainable building standards.

8 NORWICH WESTERN LINK (NWL)

132 I refer to the submission from the Stop the Wensum Link (SWL) campaign on which I am a co-author for further details.

133 The plan is confused on the status of the NWL as outlined by SWL, and there is conflicting legal advice regarding the inclusion or not of the NWL in the GNLP. NWL is presented an assumed infrastructure delivery that will be included in the transport delivered by Policy 4 at 2038. It is unsound that the GNLP Reg 19 does not test such a major piece of infrastructure within the draft plan and its strategic polices.

134 In terms of NPPF 35 soundness of the Reg 19 draft Plan, the NWL must be tested for soundness on several issues:

- Alignment with national policy on climate change and international obligations under the Paris Agreement, especially under strategic Policy 4, and plan "ambitions" to reduce carbon emissions.
- Whether there is adverse effect on the integrity of sites protected under the Habitats Regulations Directive, especially under strategic Policy 4.
- Land allocation for the NWL construction.

135 It does none of these, but here we examine the carbon emissions element only.

136 The data from the most recent estimates from Norfolk County Council (NCC)[80] show that close to the end of the plan date (2040), that even without the scheme NCC expect an additional 39KtCO2 of annual transport CO2 emissions. With the scheme the figure is an additional 55KtCO2. See Table 5 below.

[80] Norwich Western Link, Option Selection Report, July 2019, Data taken from "**Table 5.29 - Greenhouse Gases: CO2e emissions for the six options"**

	Without scheme	Option C
2025 km/yr	5950805	5707558
2040 km/yr	6788116	6853722
2025 tCO2/yr	293996	282008
2040 tCO2/yr	333008	336907
New carbon emissions tCO2/yr	39012	54899
tCO2 2040/2025	13.27%	19.47%
km 2040/2025	14.07%	20.08%

Table 5: Vehicle kilometres and carbon emissions with/without NWL Option C

137 It is important to understand what this means. The CCC 6CB has advised government to make a 70% **reduction** in transport emissions by 2035. The NWL figures over a study area which is part of Broadland show that the NCC Transport model[81] is modelling **no reductions in emissions at all** (over a similar time frame as the GNLP, 2025-2040), and then adding annual emissions between 39KtCO2 and 55KtCO2 to the GNLP transport sector emissions (this would be spread across A-roads and minor roads BEIS sub-sectors).

138 The science-based carbon budget for the entire GNLP is 100KtCO2 in 2040 (see Appendix A). There clearly is an insurmountable problem in "fitting" the NWL into the available carbon budget for the area. This is also true if you take a CCC 6CB budget at 2-3 times larger (ie 200KtCO2 – 300KtCO2 in 2040) than the Manchester Tyndall budget.

139 The inclusion of the NWL in the GNLP is **unsound** and not *consistent with national policy* to reduce transport emissions by 70% by 2035. It is not legally complaint with PCPA Section 19(1A) as it is not compatible with policies *designed to secure* the mitigation of climate change by *the development and use of land in the local planning authority's area.* (my emphasis)

[81] CEPP do not know what emission factor NCC have used emission factors in the modelling in the July 2019 Option Selection Report, and whether electric vehicles are included. It is urgent that NCC make their assumptions clear, and publish all their transport models transparently. CEPP have an outstanding FoI request for the 2019 NATS Model as run over the Norwich Western link study area at https://www.whatdotheyknow.com/request/2019_nats_model_comprehensive_am#incoming-1735969

9 SUSTAINABILITY APPRAISAL ISSUES

9.1 SA does not assess carbon in meaningful way

140 We previous pointed out at R18C[82] that the methodology for assessing carbon emissions in the then SA draft was flawed. The methodology generates a percentage increase in carbon emissions calculated by simply calculating the increase in emissions based on new population and the current levels of emissions. And then specifies that a 1% increase would have a major negative impact.

141 The same methodology has been carried forward into the Reg 19 SA document[83].

142 The entire carbon footprint and carbon budgeting process that has been explained so far in this document shows that carbon emissions cannot be calculated as a direct relationship with population. This is simply nonsense.

9.2 LEPUS themselves consider their carbon assessment requires "greater carbon detail"

143 On page 14 [PDF 26], LEPUS address our concerns and state that:

> "*… more detailed appraisal of the Plan area's carbon footprint would help.*"

144 It would appear then that although LEPUS just carry forward the previous flawed methodology, they agree that the sustainability appraisal methodology is not detailed enough, and therefore not fit for purpose. Later at section 4.9, page 34 [PDF 46], they discuss "limitations in predicting effects". Apart from distancing themselves, generally, from any responsibility for accuracy of their SA in predicting effects, they highlight poor carbon emission data at 4.9.4:

> "*The appraisal of the GNLP is limited in its assessment of carbon emissions, and greater detail of carbon data would help to better quantify effects.*"

9.3 LEPUS reference is not to carbon assessment guidance

145 The LEPUS carbon assessment statement now reads:

> "*Development proposals which could potentially increase the Plan area's carbon emissions by 1% or more in comparison to the 2018 estimate would be expected to have a major negative impact for this objective. Development proposals which may be likely to increase the Plan area's carbon emissions by between 0.1% and 1% in comparison to the 2018 estimate would be expected to have a minor negative impact for this objective.* ***For the purpose of this report, this threshold has been deduced from available guidance*** *<footnote 40>.*"

[82] 2020 CEEP R18C response, Climate Change http://bit.ly/CEPP_R18C_CC

[83] LEPUS "Sustainability Appraisal and Strategic Environmental Assessment of the Greater Norwich Local Plan", Volume 2, https://www.gnlp.org.uk/sites/gnlp/files/2021-01/LC-663_Vol_2of3_GNLP_SA_Reg19_20_250121LB_compressed%20Jan%202021.pdf, section 4.13, page 37 [PDF 49]

146Footnote 40 refers to "*DTA Publications (2017) The Habitats Regulations Assessment Journal: Air Pollution*". A user review of this publication[84] indicates that it relates to the HRA regulations. There are two things to note:

- This publication is not guidance in the usual use of the word eg: Government guidance. Whilst it may be excellent in its field, it is produced by a small environmental planning consultancy[85].

- The publication is not a known source for assessment of carbon emissions in developments.

9.4 SA is not fit for purpose on carbon assessment

147We previously gave reasons why the SA does not assess carbon in any meaningful way. This situation has not changed in the GNDP Reg 19 document set. This renders the plan **unsound** – it is not *positively prepared,* nor *effective,* on climate mitigation, and the Sustainability Appraisal by its own admission is limited in assessing how the effectiveness of climate change policies.

10 OTHER ISSUES: UNICORN THINKING, DELAYING, AND HELAA

10.1 Unsubstantiated claims

148Reg 19, 83 claims that "mitigating the effects of climate change within the Greater Norwich area is a cornerstone of the GNLP". We have shown above that this is patently not true. The rest of the plan should be completely rewritten to make this statement true so that the draft plan can meet the legal requirements of PCPA Section 19(1A).

However, this is just one example of unicorn-thinking in the draft plan. In this emergency, now is the time to get real about what we are dealing with. The plan should be edited thoroughly to remove statements which act to hide *climate delaying* action, or are based on unicorn-thinking.

10.2 Climate delaying on the NSPF climate change information base

149Norfolk Strategic Planning Member Forum (NSPMF) oversees the production of the Norfolk Strategic Planning Framework (NSPF) document on behalf of all the local planning authorities in Norfolk. It has recently produced a position paper "Climate Change and the Planning System" which has a recommendation:

> "*Local Planning Authorities in Norfolk agree that climate change is an urgent, strategic cross boundary issue which will be addressed at the heart of Local Plans. To do this, Local Authorities agree to consider the evidence contained in the NSPF Climate Change research Paper when the relevant policies are next being reviewed and updated as part of the Local Plan*

[84] https://www.dtapublications.co.uk/review

[85] https://www.dt-a.co.uk/team

process and their appropriateness considered against local factors including viability of developments. Local Authorities agree to collectively review the latest evidence and advice on a regular basis and to update this research to ensure that the most appropriate actions are being undertaken to support climate change initiatives."

150 Despite the position paper, the Climate Change research paper, and the agreement at the NSPMF by representatives of Norfolk councils that climate change is urgent, no policies reflecting action on Climate Change along the NSPF lines appear in the GNLP Reg 19 draft plan. Realistically, this is a delay in implementaing climate change policies by around 5 years.

151 It is not legally complaint with PCPA Section 19(1A) as it is not compatible with policies *designed to secure* the mitigation of climate change by the development and use of land in the local planning authority's area. Delaying action is the worst possible position to take in an emergency. Not review policy against the latest information and leaving things to get worse is not *securing* mitigation.

152 The position paper suggests that Climate Change research paper, a supporting countywide Design Guide and several topic-based papers which are summarised in some detail in the position paper have been worked on for some time already. Even if this material is not fully complete, the best action to demonstrate that the GNLP Reg 19 is *designed to secure* policies on climate change, as PCPA S19(1A) requires, would be reviewing the GNLP Reg 19 against this information base, and enhancing the Climate Change policy within it, before submitting it to Examination later this year.

153 The apparent failure to use the NSPF material is **unsound** and indicates that the Reg 19 draft plan is not *positively prepared* on climate change.

10.3 The Norfolk HELAA methodology renders the plan unsound and not legally compliant

154 CEPP previously submitted paper to GNDP at the Reg 18B consultation[86] of the Norfolk HELAA methodology. We advised then that the HELAA process for the GNLP should be completely re-run following a review of the HELAA methodology.

155 Our position was, and still is, that the Norfolk HELAA methodology contains in-built biases so that the process cannot legally comply with climate mitigation policy objectives, specifically the policy frameworks for promoting renewable energy generation and access to public transport.

156 With the massively increased housing numbers, and high buffer, **the place shaping principle** of planning which NPPF 148 emphasises as a key aspect "*to shape places in ways that contribute to radical reductions in greenhouse gas emissions*" is undermined. It is now even more important that the HELAA methodology is reviewed. The reasons are given in our previous report, and are in summary:

[86] http://bit.ly/CEPP_R18B_HELAA

i. The call for sites is limited in that it does not call for sites that activate a HELAA evaluation for renewable energy production. None appear to have been identified through several site allocation calls. This is counter to NPPF 148 on climate change, and NPPF 151 which encourages plans to take a more proactive role in renewable energy to:

> a. provide a positive strategy for energy from renewable and low carbon energy, that maximises the potential for suitable development;
>
> b. consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development.

It is **unsound** as the plan is not positively prepared in this respect.

ii. The HELAA methodology provides an assessment framework which is based upon a RAG grading of each site against 15 different Suitability Assessment Criteria (SAC). No criteria in the SAC generates a Red RAG assessment for sites that are unable to deliver public transport and modal shift to public transport.

iii. The HELAA methodology provides a mechanism to automatically exclude sites from the HELAA based on flooding, environmental and related criteria (this is supported). However, the list of criteria omits the exclusion of sites where no access to public transport is possible. This omission creates a bias against policy objectives to deliver public transport and modal shift, such as Policy 4.

iv. Both ii and iii above, also, introduces an equalities issue for future residents who wish to access a wide range of services who do not drive, or do not own a car, or are prevented from driving by disability or age.

v. Both ii and iii above do not comply with:

vi. NPPF 102 "Transport issues should be considered **from the earliest stages of plan-making** …" and "… opportunities to promote walking, cycling and public transport use are identified and pursued".

NPPF 103 "*The planning system should actively manage patterns of growth in support of these objectives … Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes.*"

NPPF 108 "*In **assessing sites** that may be allocated for development in plans, or specific applications for development, it should be ensured that:*

a) *appropriate opportunities to promote sustainable transport modes can be – or have been – taken up, given the type of development and its location;"*

It is **unsound** as the plan is not *positively prepared*, nor *effective*, in the respect.

157 The approach via the Norfolk HELAA methodology is not legally complaint with PCPA Section 19(1A) as it is not compatible with policies *design to secure* the mitigation of climate change by *the development and use of land in the local planning authority's area.* (my emphasis)

11 EFFECTIVE ACTIONS TO SECURE CLIMATE MITIGATION

158 This is a list of actions that would amend the GNLP Reg 19 draft plan so that it starts[87] to provide *designed to secure* policies in climate change mitigation (ie compliance with PCPA Section 19(1A).

11.1 Commission a full carbon footprinting evidence base

159 Develop a carbon footprinting and monitoring methodology that can measure genuine progress in making radical reductions in carbon emissions across the GNLP area, by strategic planning policy and place shaping (NPPF 148), against science-based carbon budgets.

> *"Be Effective: A key test of any climate policy is whether it will deliver timely emissions reductions across the economy and includes mechanisms that provide certainty that emission goals are met.[88]"*

The data that has been provided in this report is a starting place, or a finger pointing to, the areas which need to be looked at in more detail in *a fully commissioned GNDP report* to be part of the evidence base for the GNLP **before** its Examination in Public. Such a report should also establish a carbon footprinting and monitoring methodology for the GNLP which draws on leading-edge expertise, performance of best peer councils in the topic, and assesses progress against science-based carbon budgets.

11.2 Address whole lifecycle emissions in new housings

160 Implement a policy on all GNLP developments as per the UK Green Building Council's (GBC) "New Homes Policy Playbook - a resource for local authorities"[89] "*All developments shall calculate whole lifecycle carbon emissions (including embodied carbon emissions) through a nationally recognised Whole Lifecycle Carbon Assessment methodology and demonstrate actions taken to reduce lifecycle carbon emissions.*"

Set "stretching" requirements for major developments:

---

[87] It is not a comprehensive list

[88] Letter to President Biden, Mar 9th 2021, from CEO Climate Dialogue's (CCD) - a broad-based, cross-sector coalition of 22 leading businesses and 4 of the country's top environmental NGOs committed to advancing climate policy in the United States. https://35b6ad34-567b-4d66-bb63-6bbcad5f180f.filesusr.com/ugd/17314c_d87513bc09844d93aaeaf243a3f2aa9c.pdf

[89] https://www.ukgbc.org/wp-content/uploads/2021/01/New-Homes-Policy-Playbook-January-2021.pdf, page 27 [PDF 26]

"Major developments should target <500 kgCO2/m2 upfront embodied carbon emissions (equating to the emissions covered by Modules A1-A5 of the RICS methodology)."

Set "stretching" requirements to achieve the progressive decarbonisation levels as in the green BP/GASNT trajectory in the carbon footprint (or values refined by further work by the commissioned report):

a. WLC applies from 2021/22, and housing is required to meet 800 kgCO2/m^2 embedded build emissions until 2022/23
b. Between 2023/24 until 2027/28, 500 kgCO2/m^2 applies
c. Between 2028/29 until 2032/33, 300 kgCO2/m^2 applies
d. Between 2033/34 until 2037/38, 200 kgCO2/m^2 applies
e. The external embedded emissions are reduced by similar amounts for the same periods

161 Develop robust policies for the operational emissions from new housing – use the recommendations in the CSE consultation response as a starting place.

11.3 Reset housing targets

162 The housing numbers need to be recalculated from an up-to-date base figure. **The calculation of locally assessed need should be published fully.** As we point out, the current figures differ from the Governments: the full calculation and assumptions of numbers taken forward into the GNLP should be fully clear and transparent to the public.

163 The quantum of housing should then be calculated **with embedded and operational carbon footprints** based on WLC assessment methodologies for all parts and sub-sections of the housing numbers.

164 Given the significant embedded footprint from the new housing which we have demonstrated here, and is well established anyway[90], methods to reduce the overall housing levels should be fully investigated. This means investigating other ways to meet housing needs, and particularly addressing the housing crisis, which do not resort to "just building more houses".

165 CEPP do not speculate here on what the housing target should be. However, we do advise that **no new housing**[91] can fit within the science-based carbon budget for the GNLP area. **Therefore to be sound, the GNLP must *justify* every new house built against science-based carbon budgets, and the urgency of the climate emergency.**

11.4 Review allocations in the settlement hierarchy

166 We have already discussed how the hugely over-inflated housing buffer in the GNLP Reg 19 draft plan makes for shapeless place shaping, leading to carbon leakage from the carbon budget.

[90] London Plan Guidance, "Whole Life Cycle Carbon (WLC) Assessment Guidance", http://bit.ly/LonWLA_Pres, page 5

[91] given the current "rule of thumb"100tCO2 embedded emissions footprint per house

167 As part of the previous point that every new house must be justified against the GNLP area science-based carbon budget, the allocations in settlement hierarchy should be reviewed. The housing at the lower levels of the hierarchy such as village clusters in rural areas has a higher operational carbon footprint due to transport associated with it. It may also have a higher embedded carbon footprint, both from construction of the house itself, and from greater quanta of service infrastructure required. This requires investigation, and data provided as part of the carbon footprint evidence base to the GNLP Examination in Public.

168 The village clusters particularly need to be reviewed in this context. The South Norfolk Village Clusters Housing Sites which are "delegated" out to other plans should be removed from GNLP plan until a similar carbon footprint exercise has been carried out. The emerging evidence-base on the housing carbon footprint should be used to determine whether they should be within the GNLP allocations or not.

11.5 Focus fastest on the top 3 BEIS sub-sector carbon footprints in GNLP area

169 Rapid reduction of emissions in the three largest BEIS sub-sector carbon footprints of "A-road transport", "Domestic gas", "Minor roads transport" will make the largest overall impact on the GNLP carbon footprint, and help Broadland DC, Norwich CC, and South Norfolk DC make the biggest contributions to the headline recommendation from the CCC 6CB for the UK to deliver a reduction in net annual emissions of 78%.

GNLP must closely monitor "Domestic Gas" emissions, the second highest BEIS sub-sector in the area, and **the one where local plan policy has a strong capacity to impact**. A local policy of no new **implementation of gas (or oil) central heating in GNLP area from 2022** is required. CEPP's carbon footprinting exercise has shown above that this could save over 0.5MtCO2 over the period to 2050 from avoiding lock-in to fossil fuels in homes built before 2025.

In parallel, a retrofitting policy to rapidly remove gas central heating is required across the GNLP. The CCC 6CB recommendation is "*By 2030, heat pump sales reach just over 1 million per year in new and existing homes of a total market of 1.8 million boiler installations currently. There are a total of 5.5 million heat pumps installed in homes by 2030, of which 2.2 million are in new homes*"[92].

To help deliver the CCC 6CB recommendations, GNDP must include policies to make an at-least 30% local authority contribution in delivering and developing supply chains and the market for heat pumps in the Greater Norwich area, and demonstrate that GNDP are doing this. Similar action should be taken on new technologies like microwave boilers[93] which may have the potential for gas and oil decarbonising homes which are not suitable for heat pumps.

[92] https://www.theccc.org.uk/publication/sixth-carbon-budget/, page 115

[93] https://www.energylivenews.com/2021/03/17/british-firm-unveils-worlds-first-microwave-powered-boiler/

170 The first and third highest BEIS sub-sector footprints come from A-road transport and minor-road transport. **The Norwich Western Link should be removed from the plan.** It must not be an assumed deliverable that requires no testing at the GNLP plan stage.

171 A comprehensive sustainable transport plan should be developed. I refer to submissions of others, for more detail, for example the Stop the Wensum Link (SWL) campaign submission and Cllr Denise Carlo's submission.

11.6 Make East Norwich and Northern City Centre exemplars in climate practice

172 **All the above policies should be included, and maximised for carbon reduction, in masterplans for the East Norwich and Northern City Centre areas.** Norwich has already shown how it can be ahead of the game with passivhaus development. East Norwich and the Northern City Centre area policies should be for 100% passivhaus development, a stretching WLC assessment policy requirement, and fully decarbonised space and cooking energy.

173 However, such exemplar practice must not remain in Norwich; it should be across the whole GNLP area. Norwich can lead the whole area, given its existing experience in passivhaus delivery.

11.7 Tackle other BEIS sub-sectors

174 Introduce policies, and work within other council strategy, to tackle the industrial emissions sub-sectors. If not tackled now, during the plan period industrial emissions generally, and sites like Cantley, will become to a significant quantum of the carbon footprint of the GNLP area. The councils must act now to bring radical emissions reduction to these sub-sectors too in years to come.

12 SIGN OFF

Dr Andrew Boswell, Independent Scientist, Activist & Consultant
Climate Emergency Policy and Planning, March 2021

13 APPENDIX A: THE "FULL" GNDP AREA REPORT FROM THE TYNDALL CARBON BUDGET TOOL FOR UK LOCAL AUTHORITIES[94], WIDELY REFERRED TO SCATTER BUDGETS

[94] https://carbonbudget.manchester.ac.uk/reports/ - This version was re-run through the website in February 2021, although I believe there are no differences to the version submitted by me at Regulation 18C consultation.

MANCHESTER 1824 The University of Manchester

Tyndall Centre for Climate Change Research

Setting Climate Committments for GNDP-Feb2021

Quantifying the implications of the United Nations Paris Agreement for GNDP-Feb2021

GNDP-Feb2021 consists of the following local authorities: Broadland, Norwich, South Norfolk

Date:	February 2021
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.

Key Messages

This report presents climate change targets for GNDP-Feb2021[i] that are derived from the commitments enshrined in the Paris Agreement [1], informed by the latest science on climate change [2] and defined in terms of science based carbon setting [3]. The report provides GNDP-Feb2021 with budgets for carbon dioxide (CO_2) emissions and from the energy system for 2020 to 2100.

The carbon budgets in this report are based on translating the "well below 2°C and pursuing 1.5°C" global temperature target and equity principles in the United Nations Paris Agreement to a national UK carbon budget [1][ii]. The UK budget is then split between sub-national areas using different allocation regimes [4]. Aviation and shipping emissions remain within the national UK carbon budget and are not scaled down to sub-national budgets. Land Use, Land Use Change and Forestry (LULUCF) and non-CO_2 emissions are considered separately to the energy CO_2 budget in this report.

Based on our analysis, for GNDP-Feb2021 to make its 'fair' contribution towards the Paris Climate Change Agreement, the following recommendations should be adopted:

1. Stay within a maximum cumulative carbon dioxide emissions budget of 12.9 million tonnes ($MtCO_2$) for the period of 2020 to 2100. At 2017 CO_2 emission levels[iii], GNDP-Feb2021 would use this entire budget within 7 years from 2020.
2. Initiate an immediate programme of CO_2 mitigation to deliver cuts in emissions averaging a minimum of -13.4% per year to deliver a Paris aligned carbon budget. These annual reductions in emissions require national and local action, and could be part of a wider collaboration with other local authorities.
3. Reach zero or near zero carbon no later than 2041. This report provides an indicative CO_2 reduction pathway that stays within the recommended maximum carbon budget of 12.9 $MtCO_2$. At 2041 5% of the budget remains. This represents very low levels of residual CO_2 emissions by this time, or the Authority may opt to forgo these residual emissions and cut emissions to zero at this point. Earlier years for reaching zero CO_2 emissions are also within the recommended budget, provided that interim budgets with lower cumulative CO_2 emissions are also adopted.

1. Introduction

This report presents advisory climate change targets for GNDP-Feb2021 to make its fair contribution to meeting the objectives of the United Nations Paris Agreement on Climate Change. The latest scientific consensus on climate change in the Intergovernmental Panel on Climate Change (IPCC) Special Report on 1.5°C [2] is used as the starting point for setting sub-national carbon budgets [3, 4] that quantify the maximum carbon dioxide (CO_2) associated with energy use in GNDP-Feb2021 that can be emitted to meet this commitment. This report translates this commitment into;

1. a long-term carbon budget for GNDP-Feb2021;
2. a sequence of recommended five-year carbon budgets;
3. a date of 'near zero'/zero carbon for the area.

The United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement commits the global community to take action to "hold the increase in global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C" [1]. Cumulative emissions of CO_2 from human activity are the principle driver of long-term global warming[iv]. It is the relationship between CO_2 and global temperatures which means that staying within a given temperature threshold requires that only a certain total quantity of CO_2 is released to the atmosphere. This is the global carbon budget.

In addition to setting global average temperature targets, the UNFCCC process also includes foundational principles of common but differentiated responsibility [1]. This informs the fair (equitable) distribution of global emissions between nations at different stages of economic development. Industrialised nations are expected to show leadership towards a low carbon future, while it is acknowledged that a greater total share of future emissions will be associated with other countries as they develop (though their emissions per capita will remain low). Any sub-division of the global carbon budget must therefore account for the development needs of what the Paris Agreement refers to as "developing country Parties" in setting a fair/equitable national or sub-national carbon budget.

The carbon budgets presented here apply to CO_2 emissions from the energy system only. Although all greenhouse gas (GHG) emissions, such as methane and other forcing agents, such as aircraft contrails, affect the rate of climate change, long term warming is mainly driven by CO_2 emissions [5]. Furthermore the physical or chemical properties of each GHG vary, with different life-times causing warming in different ways, and with subsequent, and often large, uncertainties in their accounting [6]. As such the global carbon budgets in the Intergovernmental Panel on Climate Change (IPCC) Special Report on 1.5°C (SR1.5) [2], relate to CO_2-only emissions. In this report we have discussed non-CO_2 emissions and CO_2 emissions associated with land use, land use change and forestry separately.

Ultimately staying within a global temperature threshold (e.g. "well below 2°C") requires limiting cumulative CO_2 emissions over the coming decades. Carbon budgets can be an effective way to understand the amount of CO_2 emissions that can be released into the atmosphere in order to do this. End point targets such as 'net zero' by 2050, with very clear assumptions, can be useful indicators of ambition, but it is ultimately the cumulative CO_2 released on the way to that target that is of primary significance to achieving climate change goals. Whereas end point focused targets can be met with varying levels of CO_2 emissions (and therefore varying global temperature with consequent climate impacts) depending on their reduction pathways, carbon budgets specify the limits to CO_2 emissions within the period of the commitment. This is a reason why the UK Climate Change Act has legislated 5-year carbon budget periods, as well as a long term target, to keep CO_2 emissions consistent with the framing goal of the climate change commitment. It is also the reason why we recommend a carbon budget based approach.

1.2 Wider UK Policy Context

The UK Climate Change Act now legislates for a commitment to net zero greenhouse gas emissions by 2050[v], with five yearly carbon budgets to set actions and review progress [7]. The carbon budgets for this target were not available at the time of our analysis for direct comparison, however the recommended budget in this report will most likely be more stringent. This is primarily due to two key differences between our approach and the current recommendations of the UK Government's advisory body the Committee on Climate Change (CCC) that inform the revised UK net zero target:

1. The equity principles of the Paris Agreement and wider UNFCCC process are explicitly and quantitatively applied. Our approach allocates a smaller share of the global carbon budget to the 'developed country Parties', such as the UK, relative to 'developing country Parties'. Moreover the approach is also distinct in including global 'overheads' for land use, land use change and forests (LULUCF) and cement process emissions related to development.
2. Carbon dioxide removals via negative emissions technologies (NETs) and carbon offsets[vi] are not included. The UK Climate Change Act's 'net zero' framing means that the commitment is met when greenhouse gas emissions (debits) and removals (credits) from the UK's carbon 'account' balance at zero. Hence the 2050 target can be met using carbon dioxide removal technologies, including land use sequestrations, and potentially carbon offsetting. The CCC include a significant role for NETs such as bioenergy carbon capture and storage and direct air capture in their analysis supporting the net zero target. Doing so theoretically increases the size of a carbon budget, but increases the risk of failing to deliver on the Paris global temperature target. The UK Government has also rejected the CCC's advice to explicitly exclude international carbon offsetting as an approach to meeting the net zero target. Allowing for future carbon dioxide removal technologies and international carbon offsetting ostensibly increase the size of the UK's carbon budget. However carbon removal technologies are at a very early stage of development and whether they can be successfully deployed at sufficient scale is highly uncertain. While they are an important technology to develop, it is a major risk to prematurely adopt a carbon budget that allows for additional CO_2 on the basis that future generations will be in a position to deploy planetary-scale NETs. Similarly, as the CCC note in their advice, the efficacy of carbon offsetting as a contribution to meeting global climate change commitments is not robust enough to incorporate into recommended carbon budgets.

We regard our UK carbon budget to be at the upper end of the range that is aligned with the Paris Agreement's objectives. Early results from the latest Earth system models suggest that the climate may be more sensitive to greenhouse gases than previously thought implying a smaller global carbon budget is required [8]. In addition, assuming that developing countries will, on aggregate, implement rapid emissions reduction measures in line with a 2025 peak year is far from certain. Therefore, we recommend that these budgets are taken as reflective of the minimum commitment required to deliver on the Paris Agreement.

2. Method

The Setting City Area Targets and Trajectories for Emissions Reduction (SCATTER) project [4] 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. This report uses the SCATTER methodology with revised global carbon budgets, based on the latest IPCC Special Report on 1.5°C and updated CO_2 emissions datasets, to downscale global carbon budgets to GNDP-Feb2021. This methodology has been successfully piloted with Greater Manchester Combined Authority and is being made available nationally to support all local authorities and groupings of local authorities.

Step 1: A global carbon budget of 900 $GtCO_2$ is taken from the Intergovernmental Panel on Climate Change (IPCC) Special Report on 1.5°C [2]. This global carbon budget represents the latest IPCC estimate of the quantity of CO_2 that can be emitted and still be consistent with keeping global temperatures well below 2°C with an outside chance of stabilising at 1.5 °C. This budget assumes no reliance on carbon removal technologies.

Step 2: A 'global overhead' deduction is made for process emissions arising from cement production (60 $GtCO_2$) [9][vii]. Cement is assumed to be a necessity for development [5]. We also assume that there is no net deforestation at a global level (2020 to 2100) so none of the global carbon budget is allocated to this sector. This will require a significant global effort to rapidly reduce deforestation and significantly improve forestry management as well as increase rates of reforestation and potentially afforestation.

Step 3: A share of the global carbon budget is allocated to "developing country parties" assuming a trajectory for those countries from current emissions to a peak in 2025 then increasing mitigation towards zero emissions by around 2050. The remaining budget is allocated to "developed country parties" which includes the UK [10]. This approach of considering developing countries first, is guided by the stipulation of equity within the Paris Agreement (and its earlier forebears, from Kyoto onwards) [10].

Step 4: The UK is apportioned a share of the 'developed country Parties' budget after Step 3 to provide a UK national carbon budget. The apportionment is made according to "grandfathering"[viii] of emissions for the most recent period up to the Paris Agreement (2011 to 2016).

Step 5: Aviation and shipping emissions are deducted. Assumptions and estimates are made about the level of future emissions from aviation, shipping and military transport for the UK. These emissions are then deducted from the national budgets as a 'national overhead" to derive final UK energy only carbon budgets. Emissions from aviation including military aircraft are assumed to be static out to 2030, followed by a linear reduction to complete decarbonisation by 2075. The total CO_2 emissions of this path are >25% lower than Department for Transport central forecast followed by reduction to zero by 2075. Shipping emissions are based on Walsh et al [11] 'big world' scenario out to 2050 followed by full decarbonisation from this sector by 2075. These aviation and shipping emissions (1,518 $MtCO_2$) are then deducted as a 'national overhead' from the UK budget to derive the final carbon budgets for the UK, from which local authority budgets are subsequently derived [4]. The budgets provided are therefore aligned with "well below 2°C and pursuing 1.5°C" provided that aviation and shipping emissions do not exceed the pathway assumed in our analysis [4]. Failure to hold aviation and shipping emissions within the outlined allocation will reduce the carbon budget for UK regions, including for GNDP-Feb2021.

Step 6: GNDP-Feb2021 is apportioned a part of the remaining UK carbon budget. Our recommended budget is based on sub-national allocation through 'grandfathering'. A grandfathering approach allocates carbon budgets on the basis of recent emissions data. The most recent annual CO_2 emissions for GNDP-Feb2021 up to the Paris Agreement [12] (2011-2016) is averaged and compared to averaged data for the whole UK [13] over the same period. The carbon budget (2020-2100) for GNDP-Feb2021 is then apportioned based on GNDP-Feb2021's average proportion of UK CO_2 emissions for the 2011-2016 period. CO_2 emissions in the carbon budget include emissions from fossil combustion within the region and a share of the emissions from national electricity generation (relative to the GNDP-Feb2021 area's end-use electricity demand).

Step 7: Carbon emission pathways. The carbon budgets for GNDP-Feb2021 are related to a set of illustrative emission pathways. These pathways show projected annual CO_2 emissions from energy use in GNDP-Feb2021 and how these emissions reduce over time to stay within the budget. The energy-

only CO_2 emissions for 5-yearly interim carbon budget periods are calculated in line with the framework set out in the UK Climate Change Act. It is the cumulative carbon budget and the 5 year interim budgets that are of primary importance as opposed to a long term target date. The combination of a Paris-compliant carbon budget and the projected emissions pathways can however be used to derive an indicative near zero carbon target year for GNDP-Feb2021. The near zero carbon year of 2041 is defined here as the point at which, on the consistent reduction rate curve, less than 5% of GNDP-Feb2021's recommended budget remains. Annual CO_2 emissions at this point fall below 0.08 $MtCO_2$ (CO_2 levels >96% lower than in 2015 – a Paris Agreement reference year).

3. Results

3.1 Energy Only Budgets for GNDP-Feb2021

Following the Method the recommended energy only CO_2 carbon budget for the GNDP-Feb2021 area for the period of 2020 to 2100 is 12.9 $MtCO_2$. To translate this into near to long term commitments a CO_2 reduction pathway within the 12.9 $MtCO_2$ is proposed here. A consistent emissions reduction rate of -13.4% out to the end of the century is applied. In 2041 95% of the recommended carbon budget is emitted and low level CO2 emissions continue at a diminishing level to 2100.

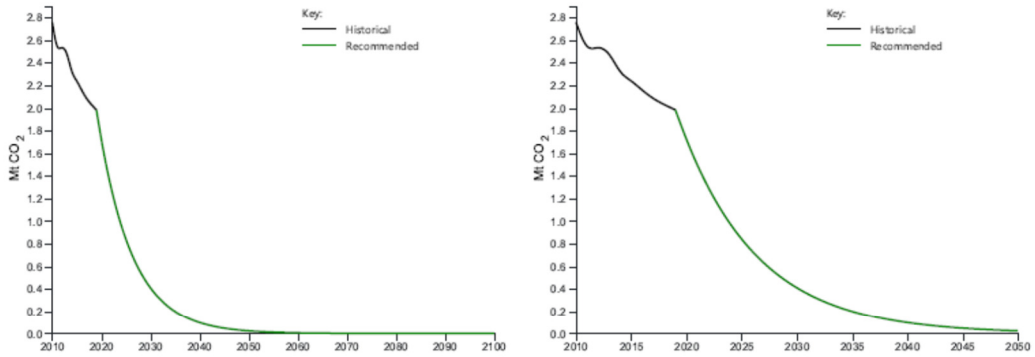


Figure 1a (left): *Energy related CO_2 only emissions pathways (2010-2100) for GNDP-Feb2021 premised on the recommended carbon budget.* ***Figure 1b (right):*** *Energy CO_2 only emissions pathways (2010-2050) for GNDP-Feb2021 premised on the recommended carbon budget.* ***y-axis shows emissions in $MtCO_2$***

Table 1 presents the GNDP-Feb2021 energy CO_2 only budget in the format of the 5-year carbon budget periods in the UK Climate Change Act. To align the 2020 to 2100 carbon budget with the budget periods in the Climate Change Act we have included estimated CO_2 emissions for GNDP-Feb2021 for 2018 and 2019, based on BEIS provisional national emissions data for 2018 [14] and assuming the same year on year reduction rate applied to 2019. The combined carbon budget for 2018 to 2100 is therefore 16.9 $MtCO_2$.

Table 1: *Periodic Carbon Budgets for 2018 for GNDP-Feb2021.*

Carbon Budget Period	**Recommended Carbon Budget** (Mt CO_2)
2018 - 2022	8.5
2023 - 2027	4.3
2028 - 2032	2.1
2033 - 2037	1.0
2038 - 2042	0.5
2043 - 2047	0.2
2048 - 2100	0.2

The recommended budget is the maximum cumulative CO_2 amount we consider consistent with GNDP-Feb2021's fair contribution to the Paris Agreement. A smaller carbon budget, with accelerated reduction rates and an earlier zero carbon year, is compatible with this approach. It is however important that for an alternative zero carbon year the proposed 5 year budget periods are the same or lower that those specified in Figure 2. Furthermore meeting the budget must not rely on carbon offsets.

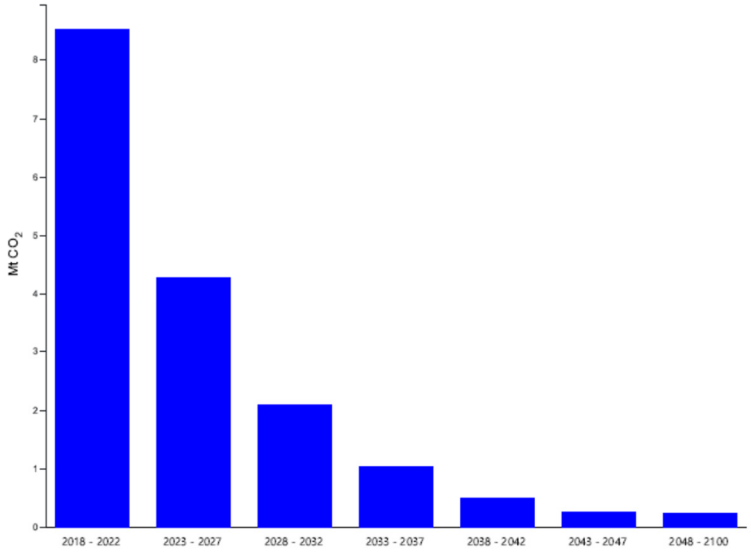


Figure 2: *Cumulative CO_2 emissions for budget period (based on Table 1) from 2018 to 2100 for GNDP-Feb2021*

3.2 Recommended Allocation Regime for Carbon Budget

The recommended carbon budget is based on a grandfathering allocation regime for sub-dividing the UK sub-national energy only carbon budget. There are three distinct allocation regimes that can be applied to determine sub-national budgets. We have opted to recommend one common approach for allocating carbon budgets that can be applied to all Local Authority areas. This enables straightforward compatibility between carbon budgets set at different administrative scales. For example this makes it easier for individual Local Authorities to calculate their own carbon budgets that are compatible with a budget set at Combined Authority scale. It also means that under the recommended carbon budgets, all Authorities are contributing to a common total UK carbon budget. If for example all Authorities selected the allocation regime that offered them largest carbon budget the combined UK budget would not comply with the objectives of the Paris Agreement. The common approach to allocation we recommend therefore further assures that the carbon budget adopted is Paris Agreement compatible.

We have chosen a grandfathering as our common allocation approach because, based on our analysis, it is the most appropriate and widely applicable regime within the UK.

Population and Gross Value Added[ix] (GVA) are alternative allocation regimes. Population shares the carbon budget equally across the UK on a per capita basis. In this allocation regime the UK population [15] is compared to that of GNDP-Feb2021 [16] from 2011 to 2016. The carbon budget (2020-2100) for GNDP-Feb2021 is then apportioned based on its average proportion of the UK population for the period 2011-2016. For regions where per capita energy demand deviates significantly from the average (e.g. a large energy intensive industry is currently located there) the budget allocated may not be equitable for all regions, therefore it is not recommended as the preferred allocation. GVA is used as an economic metric to apportion carbon budgets. For example, the UK total GVA [17] is compared to that of GNDP-Feb2021 [17] from 2011 to 2016. The carbon budget (2020-2100) for GNDP-Feb2021 is then apportioned based on GNDP-Feb2021's average proportion of UK GVA for the period 2011-2016. GVA can be useful as a proxy for allocation on economic value, however without an adjustment for the type of economic activity undertaken, areas with high economic 'value' relative to energy use can get a relatively large budget, while the inverse is true for areas with energy intensive industries, and/or lower relative economic productivity. We would therefore not recommend GVA as an appropriate allocation regime for all regions.

Table 2 presents the result outcomes for alterative allocation regimes – population and gross value added (GVA).

Table 2: *Energy only CO_2 budgets and annual mitigation rates for GNDP-Feb2021 (2020-2100) by allocation regime*

Allocation regime (% of UK Budget allocated to GNDP-Feb2021	UK Budget[x] ($MtCO_2$)	GNDP-Feb2021 Budget ($MtCO_2$)	Average Annual Mitigation Rate (%)
Grandfathering to GNDP-Feb2021 from UK (0.6%)	2,239	12.9	-13.4%
Population split to GNDP-Feb2021 from UK (0.6%)	2,239	13.6	-12.7%
GVA split to GNDP-Feb2021 from UK (0.5%)	2,239	11.8	-14.4%

Pathway projections for the change in annual energy-only CO_2 emissions pathways for GNDP-Feb2021 based on the carbon budgets in Table 2 are illustrated in Figure 3a & 3b.

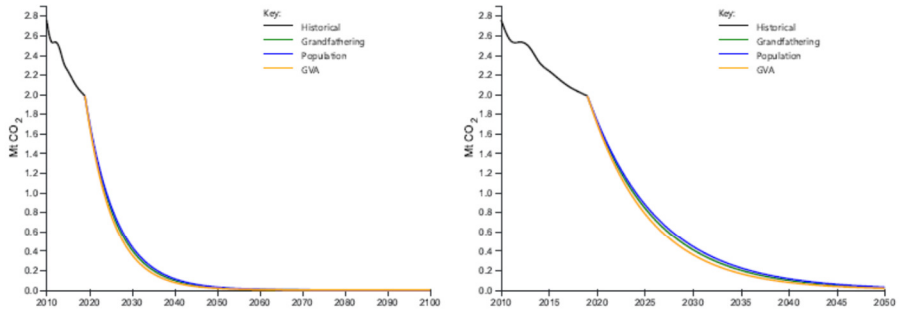


Figure 3a (left): *Energy related CO_2 only emissions pathways (**2010-2100**) for GNDP-Feb2021 premised on carbon budgets shown in Table 2.* ***Figure 3b (right):*** *Energy related CO_2 only emissions pathways (**2010-2050**) for GNDP-Feb2021 premised on carbon budgets shown in Table 2.* ***y-axis shows emissions in $MtCO_2$***

3.3 Land Use, Land Use Change and Forestry emissions for GNDP-Feb2021

Land Use, Land Use Change and Forestry (LULUCF) consist of both emissions and removals of CO_2 from land and forests. We recommend that CO_2 emissions and sequestration from LULUCF are monitored separately from the energy-only carbon budgets provided in this report. GNDP-Feb2021 should increase sequestration of CO_2 through LULUCF in the future, aligned with Committee on Climate Change's high level ambition of tree planting, forestry yield improvements and forestry management [18]. Where LULUCF is considered, we recommend it compensate for the effects of non-CO_2 greenhouse gas emissions (within the geographical area) that cannot be reduced to zero, such as non-CO_2 emissions from agriculture.

3.4 Non-CO_2 Emissions

The IPCC SR1.5 report identifies the importance of non-CO_2 climate forcers (for instance methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), sulphur dioxide (SO_2) and black carbon) in influencing the rate of climate change. However, a cumulative emission budget approach is not appropriate for all non-CO_2 greenhouse gases, as the physical and chemical properties of each leads to differing atmospheric lifetimes and warming effects [19]. There are also substantial relative uncertainties in the scale, timing and location of their effects.

We do not provide further analysis or a non-CO_2 emissions reduction pathway in this report. However the global carbon budget in the IPCC Special Report on 1.5ºC, that our analysis is based on, assumes a significant reduction in rate of methane and other non-CO_2 emissions over time. Therefore to be consistent with carbon budgets GNDP-Feb2021 should continue to take action to reduce these emissions.

The Department of Business Energy and Industrial Strategy's Local Authority emissions statistics do not at this time provide non-CO_2 emissions data at the regional level. Given the absence of robust non-CO_2 emissions data, any non-CO_2 emissions inventory by other organisations at scope 1 and 2 for GNDP-Feb2021 may form the basis of monitoring and planning for these emissions. We recommend considering the adoption of a LULUCF pathway that includes CO_2 sequestration sufficient to help compensate for non-CO_2 emissions within GNDP-Feb2021's administrative area.

4. Conclusions

The results in this report show that for GNDP-Feb2021 to make its fair contribution to delivering the Paris Agreement's commitment to staying "well below 2°C and pursuing 1.5°C" global temperature rise, then an immediate and rapid programme of decarbonisation is needed. At 2017 CO_2 emission levels[xi], GNDP-Feb2021 will exceed the recommended budget available within 7 years from 2020. **To stay within the recommended carbon budget GNDP-Feb2021 will, from 2020 onwards, need to achieve average mitigation rates of CO_2 from energy of around -13.4% per year**. This will require that GNDP-Feb2021 rapidly transitions away from unabated fossil fuel use. For context the relative change in CO_2 emissions from energy compared to a 2015 Paris Agreement reference year are shown in Table 3.

Table 3: *Percentage reduction of annual emissions for the recommended CO_2-only pathway out to 2050 in relation to 2015*

Year	Reduction in Annual Emissions (based on recommended pathway)
2020	23.4%
2025	62.6%
2030	81.7%
2035	91.1%
2040	95.7%
2045	97.9%
2050	99.0%

The carbon budgets recommended should be reviewed on a five yearly basis to reflect the most up-to-date science, any changes in global agreements on climate mitigation and progress on the successful deployment at scale of negative emissions technologies.

These budgets do not downscale aviation and shipping emissions from the UK national level. However if these emissions continue to increase as currently envisaged by Government, aviation and shipping will take an increasing share of the UK carbon budget, reducing the available budgets for combined and local authorities. **We recommend therefore that GNDP-Feb2021 seriously consider strategies for significantly limiting emissions growth from aviation and shipping.** This could include interactions with the UK Government or other local authority and local enterprise partnership discussions on aviation that reflect the need of the carbon budget to limit aviation and shipping emissions growth.

CO_2 emissions in the carbon budget related to electricity use from the National Grid in GNDP-Feb2021 are largely dependent upon national government policy and changes to power generation across the country. **It is recommended however that GNDP-Feb2021 promote the deployment of low carbon electricity generation within the region and where possible influence national policy on this issue**.

We also recommend that the LULUCF sector should be managed to ensure CO_2 sequestration where possible. The management of LULUCF could also include action to increase wider social and environmental benefits..

Endnotes

[i] Defined in terms of the administrative boundary of the GNDP-Feb2021 area.

[ii] We base our global carbon budget on the latest IPCC Special Report on 1.5°C (IPCC SR1.5) findings on how carbon emissions relate to global temperatures. The budget value we have selected provides a 'likely' chance of staying below 2°C and offers an outside chance at holding temperatures to 1.5°C. As IPCC SR1.5, notes there are no emissions pathways for limiting warming to 1.5°C that do not rely upon significant carbon dioxide removal technology deployment [2]

[iii] Based on BEIS LA statistics 2017 CO_2 emissions GNDP-Feb2021 (excluding aviation, shipping, process CO2 emissions from cement production and those from LULUCF).

[iv] This is due to the near-linear relationship between cumulative CO2 emissions and temperature is the result of various feedback processes and logarithmic relationship between atmospheric CO2 concentrations and radiative forcing, as well as the changes in the airborne fraction of CO2 emissions [19].

[v] The 2019 amended UK Climate Change Act commits the UK to at least a 100% reduction in greenhouse gas emissions by 2050 from 1990 levels on the basis that the UK's 'carbon account' is 'net zero' by this point. This is not the same as zero greenhouse gas emissions by 2050. In this framing residual greenhouse gas emissions are net zero on the provision that they are balanced by greenhouse gas removals in the UK's carbon account.

[vi] Carbon offsetting refers to the purchase of a tradeable unit, representing emissions rights or emissions reductions, to balance the climate impact of an organisation, activity or individual.

[vii] Based on IEA's ambitious 2 degree scenario on process CO_2 for the period 2020-2050, subsequently extrapolating to zero by 2075

[viii] Grandfathering is based on the average proportion of CO_2 emissions from each Party in recent years.

[ix] Balanced approach at current basic prices

[x] After deducting an emissions budget for aviation, shipping and military transport of 1,518 $MtCO_2$

[xi] Based on GNDP-Feb2021's 2016 CO2 emissions (excluding aviation, shipping, process CO_2 emissions from cement production and those from LULUCF).

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