BAAN/W1/1

TOWN AND COUNTRY PLANNING ACT 1990

Appeal by Bristol Airport Limited concerning land at North Side Road, Felton, Bristol, BS48 3DY

DEVELOPMENT OF BRISTOL AIRPORT TO ACCOMMODATE 12 MILLION PASSENGERS PER ANNUM

Appeal Reference APP/D0121/W/20/3259234

PROOF OF EVIDENCE

of

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CONTENTS

1 INTRODUCTION 3
2 HEADLINE CONCLUSIONS 6
3 THE CLIMATE CRISIS AND ITS IMPACTS 8
4 THE UK'S CLIMATE COMMITMENTS 12
5 GENERAL ISSUES IN AVIATION EMISSIONS 21
6 ASSESSMENT OF THE PROJECT'S CARBON EMISSIONS 27
6.1 Non-CO_2 Emissions 27
6.2 The 'Predict and Provide' Fallacy 28
6.3 The 'Drop in the Ocean' Fallacy 30
6.4 Incompatibility with the CCC's Balanced Net Zero Pathway 31
6.5 Overly Conservative Estimates of Emissions 33
6.6 Overstated Influence over Scope 3 Emissions 34
6.7 Impact on Local Carbon Budget 35
6.8 The 'Fly local' Fallacy 38
6.9 Summary responses to other claims in appraisal documents 40
7 BAL'S PROPOSAL TO BE A "NET ZERO" AIRPORT 44

1 INTRODUCTION

1.1. My name is Professor Kevin Anderson. I currently hold a joint professorship in energy and climate change at the School of Engineering at the University of Manchester, the Centre for Sustainability and the Environment (CEMUS) at Uppsala University (Sweden) and the Centre for Climate and Energy Transformation at the University of Bergen (Norway). Prior to moving to academia in the mid-1990s, I worked for a decade as an engineer, principally in the petrochemical industry.

1.2. I have examined issues around energy and climate change for thirty years. I have been a member of the Tyndall Centre (the UK's leading interdisciplinary and academic climate change research centre) since 2001, an organisation where I have previously served both as the Deputy Director and Director.

1.3. I am the author and co-author of many academic papers and reports, including assessments of fossil fuel supplies, the mitigation potential of different sectors (including detailed work on aviation[1]), national emissions

1. Bows-Larkin, A., Mander, SL., Traut, MB., Anderson, KL. and FR Wood, (2016). Aviation and climate change – the continuing challenge, Encyclopaedia of Aerospace Engineering, DOI:10.1002/9780470686652.eae1031.
2. Bows-Larkin, A., Anderson, K., Climate Anderson, K., Bows-Larkin, A., Aviation and climate change: implications of a 2°C goal, Formal presentation at COP21, EU Pavilion, Paris 2015.
3. Bows-Larkin, A., Anderson, K., Climate change and aviation: CO2 and other impacts, Transport Policy and Climate Agenda, European Parliament, Brussels, 21 Oct 2015.
4. Anderson, K., 2014, Slow and low- the way to go: a systems view of travel emissions, in *Beyond Flying: Rethinking Air Travel in a Globally Connected World,* edited by Chris Watson, UIT Cambridge.
5. Wood, R., Bows, A., & Anderson, K., 2012, A one-way ticket to high carbon lock-in: the UK debate on aviation policy, *Carbon Management*, 3, 6, 537-540. doi:10.4155/cmt.12.61.
6. Bows, A., Anderson K., et al., Aviation and shipping privileged – again? UK delays decision to act on emissions, Tyndall Centre Briefing Note, 47, Tyndall Centre for Climate Change Research, Dec 2012.

accounting, and the development of carbon budgets aligned with the Paris Agreement.

1.4. Over many years I have given written and verbal scientific evidence to a range of parliamentary committees, to various government departments, including BEIS, DEFRA, DfT, and the Treasury, as well as to the UK Climate Change Committee (CCC), and the EU Commission and Parliament. I am regularly asked to present at the annual Political Party conferences, give seminars to 'all-party groups' and engage across a wide range of industry stakeholders, NGOs and civil society groups. I served as the scientific advisor to both the Welsh Government's Climate Change Commission and the Scottish Government's Climate Assembly. I recently held the Zennstrøm professorship in climate change leadership at Uppsala University (Sweden). In my ongoing role in Sweden I have been extensively involved in the development of carbon budgets and climate policies for Sweden's local and regional governments, as well as in the drafting of Sweden's 2018 Climate Change Law (national legislation).

1.5. I attended both weeks of the Paris Climate Conference, COP21, as a scientific observer, presenting at formal events (including on aviation) and engaging with scientists, policy makers and media. This has continued through to, and includes, COP25 in December 2019 in Bonn. At COP21, several scientific colleagues and I scrutinised the evolving drafts of the Paris text, making

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7. Wood, F.R., Bows, A., & Anderson, K., 2010, The impact of including the emissions from aviation in greenhouse gas emission reduction baselines, *Transport Policy*, 17, (4), 206-215.
8. Wood, R., Anderson, K. Bows, A, Aviation in the North-West, A research report for the Joule Centre of the North-West Development Agency (NWDA), November 2009.
9. Bows, A., & Anderson K., (2007), Policy clash: Can projected aviation growth be reconciled with the UK Government's 60% carbon reduction target? *Transport Policy*, 14 (2), 103-110.
10. Bows, A., Anderson, K. & Upham, P., (2006), *Contraction & Convergence: UK carbon emissions and the implications for UK air traffic*, Peer Reviewed Tyndall Centre.

clear and public assessments during major press conferences. I was commissioned by *Nature* to provide a personal evaluation of the final text of the Paris Agreement.

1.6. I am providing evidence at the behest of Bristol Airport Action Network Coordinating Committee. In so doing I am acting as an independent expert offering my (pro-bono) services based on my academic and industrial experience. The evidence which I have prepared and provide for this appeal in this proof of evidence is true to the best of my knowledge and belief. I confirm that the opinions expressed are my true and professional opinions based on the facts I regard as relevant in connection with the appeal.

1.7. All views contained within this statement are attributable solely to the author and do not necessarily reflect those of my wider researcher colleagues or associated organisations.

2 HEADLINE CONCLUSIONS

2.1. Bristol Airport's proposal to expand to 12 million passengers per year entails an incontrovertible increase in aviation emissions from the airport over the next two decades. At every level, and by every reasonable measure, the proposed expansion runs counter to the UK meeting both its domestic and international climate change obligations.

2.2. To increase emissions in the near to medium term runs completely counter to the Government's forthcoming net-zero legislation, which is expected to endorse the Climate Change Committee's recommendations to include aviation within the UK's sixth carbon budget.

2.3. The proposal goes against the CCC's own UK aviation pathway to align with its Balanced Net Zero (BNZ) pathway, whereby emissions from aviation are to be reduced in the near and medium term through demand management. The BAL proposal directly contravenes the CCC's clear statement that the BNZ pathway should be achieved with no net expansion of UK airport capacity.

2.4. The expansion flouts the UK's obligations as a signatory to the Paris Agreement, under which the country has committed to deliver emissions reductions that embody its 'highest possible ambition'.

2.5. Proceeding with the project would make a mockery of the high-profile acknowledgement by Somerset's five councils of the "climate emergency".

2.6. Given that North Somerset Council is now on an 'emergency response' footing towards emissions reduction, now is certainly not the time for a

development that, on its own, would wipe out a 'Paris-compliant' carbon budget for the local authority area.

2.7. Whether it is on the basis of policy or maths, this proposal is completely inappropriate for the huge climate and ecological challenges we are facing in the twenty-first century. It is akin to pouring yet more fuel on an already out-of-control fire.

3 THE CLIMATE CRISIS AND ITS IMPACTS

3.1. IPCC 1.5˚ Report. In the 2015 Paris Agreement the nations of the world committed to "[holding] the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels" [**CD 9.26**]. The Agreement requires all countries to bring global greenhouse gas emissions to a peak as soon as possible, with developed countries taking the lead, recognizing that peaking will take longer for developing country Parties (this is the principle of Common but Differentiated Responsibilities and Respective Capabilities or CBDR-RC).

3.2. The Paris Agreement's commitment to 1.5°C has been recently reaffirmed (21st May 2021) in a published communique from the G7 Ministers responsible for Climate and Environment, in which they stated that G7 nations *"will make ambitious and accelerated efforts to reduce emissions to keep a limit of 1.5°C temperature rise within reach"* [**Appendix 1** para 14 p.5 BAAN/W1/2 p.7]. To provide a simplified picture of this more stringent commitment: if global CO_2 emissions were to remain within the IPCC's SR1.5 headline carbon budgets for a greater than 66% chance of staying below 1.5°C, would need to begin reducing from the start of 2022 and reach zero during 2029. If the 1.5°C commitment was weakened to just a 50:50 chance, the zero-emission date would extend to 2038. This stylised example makes no allowance for an increase in the carbon budgets through future and highly uncertain 'carbon dioxide removals' [see §§4.12–4.15 below]. It also does not reduce the budgets through similarly uncertain 'earth system feedbacks'. Moreover, these dates are for global emissions, with "developed

country parties' (to the Paris Agreement) being required to reach zero emissions well ahead of the "developing country parties".

3.3. The difference between 1.5°C and 2°C has been established by IPCC scientific review and documented in the Special Report on Global Warming of 1.5°C [**CD 9.58**], known as "SR1.5". There are compelling reasons to pursue 1.5°C in terms of reduced risk of harm to vulnerable populations, food security, water supply, and loss of unique and valuable ecosystems. Vulnerable communities, particularly in Least Developed Countries, will be severely impacted at 1.5 °C, with impacts getting considerably worse at 2°C and beyond. For example, up to 50% fewer people globally may experience water scarcity by restricting global warming to 1.5°C than at 2°C [**CD 9.58** p.179]. In terms of food security, the IPCC note that there is considerable variability between regions for these impacts, meaning that impacts will be significantly worse in more vulnerable, typically poorer communities [**CD 9.58** pp 179-180].

3.4. Furthermore, as temperature rises beyond 1.5°C the direct and indirect effects will be increasingly felt by all communities, such as through reductions in pollinating insects and crop failures, inundation of freshwater supplies, and changes in rainfall patterns [**CD 9.58** pp 216; 222-252, 253-261]. In already vulnerable communities, such stresses will compound with existing tensions such as population movements, civil unrest, and resource allocation.

3.5. Whereas historical and current responsibility for the overwhelming bulk of emissions that have led to the climate emergency lies with rich ('developed') countries, the worst impacts of climate change are and will continue to be suffered by poor ('developing') countries. In 2019 the mean per capita

emissions of USA were around 16 tonnes of CO_2 per year (tCO_2/yr). China and Europe both have mean per capita emissions around 7 tCO_2/yr, while Kenya is around 0.3 tCO_2/yr. Globally, almost half of all carbon dioxide arises from the activities of just 10% of the population, with the wealthiest 1% – the 'super-emitters' – being responsible for twice as much carbon dioxide as the entire bottom 50% [**CD 9.125** pp 6].

3.6. While climate change is largely the result of the historical and continued emissions from the activities of relatively wealthy individuals and countries, its most damaging impacts will be experienced by today's younger generations and generations to follow, with the most acute impacts occurring in already vulnerable communities and regions. However, few if any regions are likely to be exempt from impacts. Already in the UK coastal erosion is intensifying with rising sea level, leading to loss of land at Skipsea, East Yorkshire (faster than any other coastline in Northern Europe), Fairbourne, North Wales, and Happisburgh, Norfolk [**Appendix 2**].

3.7. Arguably more significant than coastal erosion, as acute climate impacts are increasingly felt in other more vulnerable regions of the world, the UK should expect to experience:

1) Increased pressure from inward migration as climate refugees seek safety.
2) Increasing and unstable food prices – much of the UK's food supply is imported, including quantities from areas that are already subject to climate stresses.
3) Tensions and stresses reverberating within the UK's huge immigrant community / diaspora, members of which continue to have close family ties to parts of the globe that are much more climate vulnerable than the UK.

3.8. In addition to sea-level rise and social and economic instability, the UK should be prepared for changed and extreme weather impacts on much of its infrastructure, which was not designed for such extremes. Examples include the impacts of more severe and frequent droughts on water supply infrastructure; the impact of more frequent and severe heavy rainfall events on sewerage/drains (flooding), and on road and rail networks (drainage and substrate damage, etc).

4 THE UK'S CLIMATE COMMITMENTS

4.1. The key to limiting temperature rise is limiting the total cumulative amount of CO_2 released into the atmosphere. SR 1.5 sets out a range of global carbon budgets, which represent the quantity of carbon dioxide that can be emitted for a given likelihood of breaching the relevant temperature threshold. SR 1.5 offers global budgets between 600 and 1200 $GtCO_2$ – the more generous budgets are associated with worse chances of staying 'well below 2°C 'and are less consistent with pursuing 1.5°C than the smaller budgets. The IPCC transposes statistical likelihoods of given temperature increases into adjectival descriptions [**CD 9.116** p.4 Table 1]. Hence a temperature outcome with a probability of 66–100% is defined as 'likely', while a probability of 33–66% is considered 'about as likely as not'. We can therefore express the Paris Agreement's commitment to staying below 2°C as seeking an outcome that is at the very least 'likely' and the commitment to pursuing 1.5°C as seeking an outcome that is 'about as likely as not'. That is, 66–100% chance of not exceeding 2°C, and 33–66% of 1.5°C.

4.2. Based on the distinction drawn in the Paris Agreement between "developed country parties" and "developing country parties" and their differing respective mitigation responsibilities and capabilities, my colleagues and I calculated emissions budgets for these two distinct groups. Our research, published in the journal *Climate Policy* last year (2020) [**CD 9.76**], takes the SR1.5 global budget associated with a likely chance of 2°C and disaggregates it for two groups: Developed Countries and Developing Countries. Once appropriate allowances are made for climate feedbacks, deforestation and cement production, this gave Paris-compliant emissions budget for energy production in Developed and Developing Countries respectively from the start of 2020. Analysis undertaken for this proof of evidence has updated the

budgets in the *Climate Policy* paper to reflect the Paris-compliant emissions space remaining from the start of 2022 (using provisional emissions data for 2020 and projected emissions for 2021). The post-January 2022 budget for the group of Developed Countries (including the UK) is 117 billion tons of CO_2 ($GtCO_2$), which may be emitted by all forms of energy consumption, from transport to electricity, while keeping within 2°C. For context, the corresponding budget remaining for all Developing Countries (home to over 80% of the global population) is 483 $GtCO_2$.

4.3. This separation between developed and developing countries reflects the commitment to the principle of equity enshrined in the Paris Agreement, which recognises the very significant extent and impact of historical CO_2 emissions emitted by developed countries, first to achieve their industrial development and then as a result of that development. The paper also acknowledges the *necessity* and *inevitability* of developing countries continuing to increase their emissions in the short term to provide for the basic food and energy needs of their populations and bring their citizens' quality of life closer to the global average.

4.4. It is important to note that the above division of the global carbon budget still envisages higher total cumulative emissions per capita for the citizens of developed nations than for those of developing nations. This pragmatic division (which exacerbates historical inequality of emissions) is a consequence of just how little of the carbon budget remains for 1.5–2°C and provides a strong reason for significant financial transfers from developed to developing nations, as established in the Paris Agreement.

4.5. There are various regimes available for apportionment of carbon budgets within the groups of developed and developing countries, some according to

population, others by historical emissions, yet others guided by economic indicators such as GDP. Each method has advantages and disadvantages. The regime my colleagues and I judged most appropriately reflects national circumstances within the developed countries is known as 'grandfathering' [**CD 9.76** pp 1296-1297]. In this system, each nation receives a share of the future carbon budget in line with its recent percentage of total emissions from the group of developed countries. Grandfathering essentially captures many elements of the other regimes – from structural lock-in of existing infrastructure through to the economic wherewithal to make rapid changes (i.e. having the requisite resources to make rapid changes, in terms of capital, skills and materials) [**Appendix 3** BAAN/W1/2 p 43].

4.6. In our 2020 *Climate Policy* paper, my colleagues and I downscaled (using the grandfathering approach) the developed countries' carbon budget to the UK, giving a Paris-compliant carbon budget for UK energy use from 2020 until the end of the century and beyond of between 2.8 and 3.7 $GtCO_2$ [**CD 9.76** p.8][2]. Despite a reduction in UK territorial CO_2 emissions in 2020 of around 11%[3] compared with 2019 due to repeated COVID confinements [**CD 9.117** p1], from the start of 2022 a maximum of around 3 $GtCO_2$ remains for the UK to the end of the century and beyond. To put this into context, this represents less than eight years of emissions at the UK's current output.

4.7. The foregoing is important context in which to understand the current domestic policy situation in the UK. The Climate Change Act 2008 created a series of short-term, legally-binding carbon budgets in five-yearly blocks.

[2] The range reflects alternative groupings of developed and developing countries, whether according to current UN classification or by moving oil-rich countries (with high income per capita and high HDI) out of the list of developing countries into the developed group.

[3] Note that this excludes emissions from international aviation and shipping, for which robust 2020 data are not yet available.

These 'mini' budgets are *not derived* from the IPCC's AR5 or SR 1.5 global budgets (with associated temperature probabilities), but rather from the UK Climate Change Committee's (CCC) estimate of what constitutes the UK's "highest possible ambition" for mitigation[4]. This means that the carbon budgets do not have direct scientific correlation to internationally agreed temperature goals[5]. Instead they represent a much lower level of ambition than would be necessary if the UK were to meet its "well below 2°C" and "pursue 1.5°C" commitments as signatory to the Paris Agreement. Given this scientific reality, the UK's five-year carbon budgets need to be understood as the absolute minimum that needs to be adhered to, recognising that this level of ambition, if mirrored globally, would put the Paris temperature commitments beyond reach.

4.8. The UK's emissions came down sufficiently to meet the first three short-term budgets – culminating in a 37% reduction in emissions below 1990 levels. However, we are currently off track for meeting the fourth and fifth budgets – respectively, a 51% reduction below 1990 by 2025 and 57% reduction below 1990 by 2030. In other words, the UK is currently not on track for its own domestic targets, which are anyway below what is needed to meet its international temperature commitments.

4.9. Set against the need for significantly accelerated carbon reductions between now and 2030, Lord Deben's (Chair of the CCC) recent emphasis on "the critical importance of local councillors and planning authorities considering

[4] The Paris Agreement does not stipulate how the 2°C target should be transposed into mitigation actions at the national level. Rather it requires countries to submit Nationally Determined Contributions (NDCs), which must embody 'highest possible ambition' for decarbonisation. What constitutes 'highest possible ambition' is open to debate.

[5] The carbon budget implied by the CCC's BNZ pathway sums to around 6.5 $GtCO_2$ of actual emissions for the rest of the century and beyond, as given in the 'Different Methodologies' tab of the 6th Carbon Budget Dataset [**CD 9.128**].

fully the implications of their decisions on climate targets" could not be more apposite [**CD 9.120]**.

4.10. In 2019 the UK government amended the Climate Change Act 2008 to require a 100% reduction against 1990 levels of greenhouse gas emissions in the UK by 2050 (taking into account offsets or 'negative emissions'). In December 2020, the CCC published its Sixth Carbon Budget Report, setting out its advice to government for the period 2033 to 2037 [**CD 9.34**]. The previous five-yearly budgets did not include emissions from international aviation and shipping (IAS), but rather allowed 'headroom' within the budgets to account for IAS emissions [**CD 9.34** p.418]. That is to say, previous budgets were reduced by what the CCC considered an appropriate amount to allow for the expected emissions from international aviation and shipping in future years. However, the CCC's sixth budget requires a reduction of 78% below 1990 levels of all UK energy emissions, which includes emissions from international aviation and shipping [**CD 9.34** pp 418-421].

4.11. While the sixth carbon budget refers to the period 2033–37, it is important to notice that it has implications for the preceding decade, insofar as the 78% reduction below 1990 levels cannot possibly be delivered from a standing start in 2033. Steps must be taken in the immediate short-term to facilitate the almost 4/5th cut in emissions in the mid-2030s. This is especially true of sectors such as aviation that have long lead times for development and penetration of new technology. The CCC itself has made this clear, stating in the Sixth Carbon Budget Report: "Over the 2020s, the new pathway implies a reduction of 18 MtCO_2e per annum, compared to 12 Mt [CO_2e] per annum under the pathway set out in the advice on the Fifth Carbon Budget. This

means that an additional 66 Mt [CO_2e] of emissions reductions are needed by 2030" [**CD 9.34** p.432. See generally pp 430-433].

4.12. The Sixth Carbon Budget Report builds on the CCC's 2019 Net Zero Report, in which it laid out the plan for UK to cut its emissions to 'net' zero by 2050 by balancing residual CO_2 emissions with removals from the atmosphere [**CD 9.31**]. In order to achieve this balance – so-called net zero – the CCC relies on development and deployment at planetary scale of techniques and technologies that are as yet speculative (at such scale), known as Carbon Dioxide Removal (CDR); this includes Negative Emissions Technologies (NETs) and 'nature-based solutions' (NBS). The sixth budget period fits within the CCC's Balanced Net Zero Pathway (BNZ pathway), which explicitly relies on around 0.7 billion tonnes of engineered CO_2 'removals' (NETs) domestically within the UK before 2050 [**CD 9.128**]. By extension, the CCC's pathway tacitly assumes that total global removals (NETs and NBS) will reach around 11 $GtCO_2$ *per year* by 2050. These numbers represent enormously optimistic estimates, which sit at the higher end of the range of negative emissions being touted for this time period in the contemporary literature. Another way of envisaging this assumption for negative emissions is that it is broadly similar to the annual net absorption of CO_2 from the atmosphere by total global photosynthesis.

4.13. There are compelling reasons to be extremely cautious about emissions pathways that depend on huge amounts of negative emissions or carbon dioxide removal. The most prolific form of NETs invoked in contemporary scenarios is bioenergy with carbon capture and storage (BECCS) – essentially burning fast-growing fuel crops to produce electricity while capturing the CO_2 at source and storing it safely and permanently underground [**CD 9.34**

p.152]. Virtually all modelled pathways that assume widespread roll-out of BECCS fail to take into account:

(1) the as yet embryonic state of the CCS industry (thus far only one large demonstration power-station with CCS exists today with a numbers of years of operating experience, and this at only a few millions of tonnes of CO_2 per year, not the several orders-of-magnitude-greater billions of tonnes assumed in the models);

(2) the colossal quantities of land required to produce the requisite biomass (some BECCS-heavy scenarios requiring area equivalent to about half the global total agricultural land [**Appendix 4** p.7 BAAN/W1/2 p.53]), not to mention the threats to planetary boundaries for freshwater and biosphere/biodiversity conservation [**Appendix 5** p.151ff BAAN/W1/2 p.61ff].

4.14. Other negative emissions technologies, such as direct air capture and enhanced geological weathering, similarly suffer the drawbacks of unproven-at-scale demonstrations. There is a very real risk that they will not be able to deliver at the scale at which they are assumed in current decarbonisation pathways, such as the CCC's [**CD 9.68** pp 182-183]. For these reasons, NETs cannot be thought of as an 'insurance policy', since they come with no assurance that they will be able to 'pay out'.

4.15. Again, the reliance on negative emissions technologies provides an important context for decisions that increase heavily carbon-emitting activity. Given the enduring technical uncertainties and moral hazard posed by CDR, it is essential to achieve as much as possible through reducing or preventing emissions.

4.16. To meet the sixth budget and 'net' zero by 2050 target, the Sixth Carbon Budget Report gives detailed sector level policy recommendations. The aviation sector is often said to be 'hard to decarbonise', both because of the claimed economic advantages conferred by air links to other countries and because of the longevity of aviation industry assets, with modern commercial jets typically having a twenty to thirty-year operating life. This last point is acknowledged by the appellant in its Draft Carbon and Climate Action Plan [**CD 9.48** p 37].

4.17. The CCC has historically conferred special treatment on the international aviation sector, making it technically exempt from the budget constraints, in recognition of the foregoing considerations (although as set out above the budgets have been set allowing "headroom" for these emissions). From the start of the sixth budget period (2033) onwards, international aviation has been brought within the UK budget, to reduce its emissions as other sectors. Nevertheless, the CCC still envisages around 23MtCO_2 per year being emitted by UK aviation in 2050, down from a pre-COVID level of around 38 MtCO_2 in 2019 (for domestic, international and military aviation) [**CD 9.66** CCC 2020, Sector Summary, Aviation, p.21].

4.18. While the CCC and government have traditionally been chary of demand management in the aviation sector (and the transport sector generally), the recent Sixth Carbon Budget Report and its ancillary policy and sector reports are clear that constraining aviation demand is now essential to delivering the required emissions reductions. Thus the 23MtCO_2 residual emissions in 2050 from aviation reflects a limitation on UK aviation demand to 25% passenger growth by 2050 (against 2018), compared with unchecked growth which is forecast to reach 65% in the same period [**CD 9.66** CCC 2020, Sector Summary, Aviation, p.21]. The CCC assumes that this 25% passenger growth

will be offset by efficiency improvements to allow the overall budget to remain viable. **Significantly, the CCC specifies in its advice to government, that this growth should only be achieved with no net expansion in UK airport capacity** [**CD 9.66** pp 29 and 35]. That is, if capacity is anywhere increased there must be a corresponding reduction elsewhere.

4.19. As set out at §4.11 above, this approach to airport capacity necessarily carries over into the periods of the Fourth and Fifth Carbon Budgets.

4.20. For this reason, and in accordance with the CCC's advice, in the absence of the closure of significant existing airport capacity, there should be no new airport expansion. Consequently, the proposal to expand Bristol airport goes directly against the unequivocal advice from the CCC.

5 GENERAL ISSUES IN AVIATION EMISSIONS

5.1. Emissions from UK aviation were around 38MtCO₂ in the last full pre-COVID year (2019), or 9.3% of the UK's total CO₂ emissions from energy use [**CD 9.84** BEIS Final UK greenhouse gas emissions national statistics 1990-2019, Tables 1.1, 1.2 & 6.1]. As stated above (§4.18), these need to be reduced to 23 MtCO₂ by 2050 to comply with the CCC's Balanced Net Zero pathway. Aviation is the only sector in which emissions are still growing in absolute terms in developed 'post-industrial' countries (the COVID confinement notwithstanding).

5.2. In stark contrast with the proposed expansion and consequent increase in emissions through to the mid-2040s, the CCC's BNZ pathway has aviation emissions peaking in the mid-2020s before a gradual decline to around 61% of pre-COVID levels by 2050.

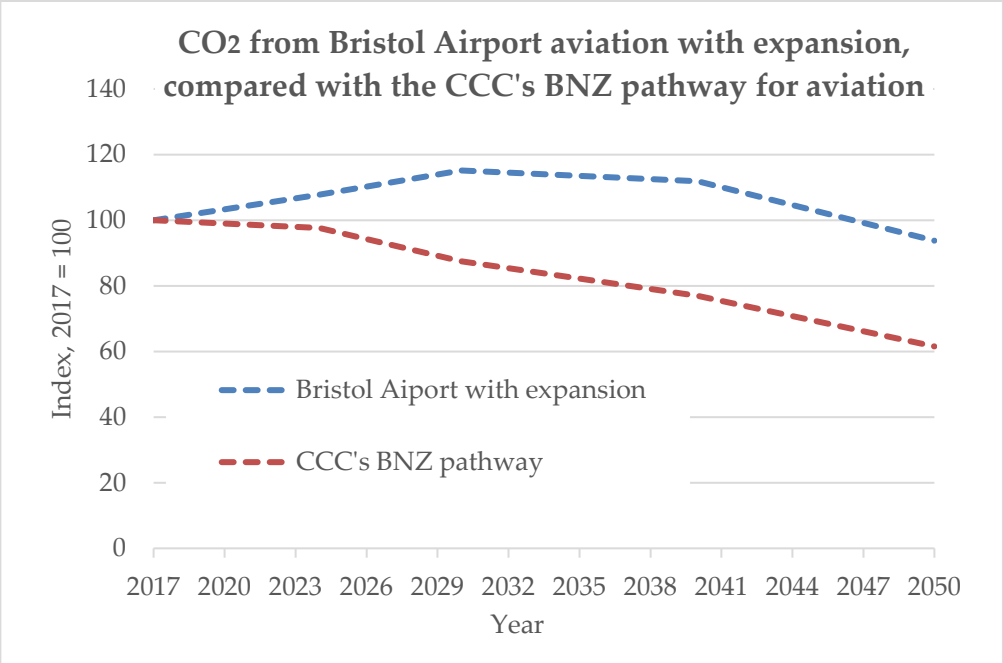

Figure 1. Comparing the CO_2 emissions trajectory in Bristol Airport's 'with expansion' central estimate with the emissions trajectory (indexed to 2017) for aviation in the CCC's Balanced Net Zero Pathway. [Data source ES Add **CD.2.20.6** Table 10A.7 on p.10A-13, CCC 6CBR dataset **CD 9.128**].

5.3. Despite this, aviation is on course to become the single biggest emitting sector in the UK by late 2030s – overtaking the residential sector in 2038 in the CCC's BNZ pathway. This is because all other sectors of the UK economy are required to reduce their emissions to zero (or almost zero) by 2050, whereas aviation is allowed to continue to emit at relatively high levels.

5.4. The principal reasons typically offered for the leeway afforded to continued high aviation emissions are:

1) aviation's claimed importance to the economy in allowing movement in and out of the country makes the cost of curtailing flying politically unattractive;

2) limited sustainable options for drop-in fuels of sufficient energy density for long-distance flights mean there are no ready alternatives to current fossil-based aviation fuel;

3) the longevity of aviation assets and slow turnover means new technology takes decades to penetrate commercial air fleets;

4) strenuous and protracted safety protocols on the testing of any new technology for civil aviation use put the widespread deployment of electric and hydrogen-powered aircraft decades away.

5.5. Since 2012 aviation within the European Union has been covered by the EU Emissions Trading Scheme (EU ETS), a cap-and-trade system whereby polluters (companies) are allocated permits which they must submit to account for each year's carbon emissions, although permits may be bought from other polluters that hold a surplus. The total amount of available permits is ratcheted down each year, the idea being that scarcity should drive up the resale price and exert pressure to curb their emissions on companies (in this case airlines) that lack sufficient permits of their own.

After leaving the European Union at the end of 2020, the UK launched its own national emissions trading system, known as the UK ETS, which came into operation in May 2021.

5.6. There are fundamental problems with counting on either the EU ETS or UK ETS to deliver the kind of emissions reductions required in the aviation sector to meet the climate and statutory targets outlined in section 4 above. First, flights into or out of the EU area from or to non-EU airports are not included within either scheme, EU or UK ETS. This means a significant portion of international aviation emissions is beyond the control of these systems. Second, the carbon price in both schemes is still far too low to apply any meaningful pressure on airlines to cut their emissions, which receive enormous fuel duty subsidies that more than compensate the expense of additional permits (see further on this the proof of evidence of Finlay Asher [BAAN/W2/1] at §8.1 and **CD 9.122**) . In fact, throughout its period of inclusion in the EU ETS, aviation emissions in the EU continued to rise, showing an annual increase in emissions of 1.5% in 2019 on routes covered by the scheme. This stands in comparison to an average reduction in emissions of 8.9% for other sectors traded within the EU ETS [**CD 9.122**].

5.7. The UK ETS closely mirrors the EU's, with carbon traded at fractionally higher prices in the first UK ETS auction in May 2021 than in the EU (almost £44 per tonne of carbon in UK compared with the EU's approximately £43). In this regard, the UK ETS cannot be expected to have any significantly greater effect in reducing the (still rising) emissions from aviation than the EU ETS.

5.8. From 2021 international aviation emissions are to be 'offset' via emissions removals projects administered through the Carbon Offsetting and

Reduction Scheme for International Aviation (CORSIA). Participation in CORSIA is voluntary until 2027, from which point it is tabled to become mandatory for airlines operating in countries that adopt the scheme. There are widespread concerns about the ability of CORSIA to deliver actual emissions reductions through offsetting. The UK Climate Change Committee is explicit in its Sixth Carbon Budget Report that "the CORSIA scheme is not currently compatible with the Paris Agreement or the UK's path", and "under current rules, credits under CORSIA should not contribute to meeting the carbon budgets" [**CD 9.34** p.425].

5.9. The principal problems with CORSIA relate to the lack of enforceable governance structures for offset credits and sustainable fuels, and lack of verifiability of emissions reductions or removals. This latter point is critical: it is inherently difficult to ensure that emissions reductions activities undertaken elsewhere in the world in the name of the offset scheme are additional to what would have occurred anyway. For these reasons – and given the CCC's categorical rejection of CORSIA as a fit tool for meeting carbon budgets – it would be grievously misleading to suggest that CORSIA offers any prospect of genuine or verifiable emissions reductions. See also on this Finlay Asher Proof of Evidence §§8.3-8.5.

5.10. As mentioned in §3.5, there are significant equity issues at play in both the responsibility for the emissions that cause climate change and the distribution of impacts of climate change. This is nowhere starker than in the unequal distribution of emissions from flying by income group. Only 11% of the world's population travels by plane, with a mere 4% of people taking international flights [**CD 9.80** p.4]. In the UK – one of the world's wealthiest countries – 48% of people do not take a single flight abroad in any given year, while the top 10% of frequent fliers took over half of all flights from UK

airports, with a fifth of all flights taken by the 1% most frequent fliers (see Finlay Asher Proof of Evidence §§3.6-3.8 and Asher Appendix 5) [**CD 9.118**, Table NTS0316 'Number of flights abroad in the last 12 months: England, 2006 onwards'].

5.11. This huge skew in the use of aviation towards a small set of frequent flyers makes it all the more obvious that aviation is being privileged at the expense of other sectors. The data and maths make clear that the leeway afforded to the aviation sector in contemporary decarbonisation pathways (such as the CCC's Balanced Net Zero Pathway) privileges the high energy consumption habits of a wealthy set of frequent fliers above the needs of the vast majority of humanity, who simply never fly. Even in the UK, where more than half of all flights are taken by 10% of the population, to allow aviation to decarbonise at a much slower rate than other sectors is to privilege a minority interest over the needs of the majority of the UK population. Put simply, the disproportionate use of aviation by a small group of heavy-users consumes the carbon budget for essential services such as hospitals and schools, as well businesses, homes and other forms of more accessible transport.

5.12. Since aviation is to be included in the UK's sixth and future carbon budgets, the activities of the frequent flying minority will effectively squeeze the remaining emissions budget for other sectors. This is a strong reason for strict adherence to be given to the CCC's advice in the BNZ pathway that there should be no net expansion of UK airports. Even strict adherence to the CCC's advice would still see the aviation sector privileged over and above other sectors.

5.13. Furthermore, the CCC's BNZ pathway relies on compensating the emissions from aviation with as yet speculative (at scale) Negative Emissions Technologies and poorly characterised and highly uncertain 'nature-based solutions', so as to allow total UK emissions to reach 'net' zero in 2050. However, large quantities of such 'carbon dioxide removal' will be required to cancel out the inevitable (unmitigable) warming from non-CO_2 emissions from agriculture and food production. Thus, to facilitate the frequent use of aviation by the wealthier within UK society, 'carbon dioxide removal' is assumed to compensate for ongoing and high emissions from flying rather than the residual and genuinely unavoidable emissions from agriculture. The implications of this are likely to be a further exceedance of the Paris temperature thresholds with an accompanying rise in climate impacts.

6 ASSESSMENT OF THE PROJECT'S CARBON EMISSIONS

6.1 Non-CO_2 Emissions

6.1.1. Greenhouse gas emissions from aviation are a product of burning hydrocarbon fuel to power an aircraft at sufficient speed to generate lift. 99% of these emissions are in the form of CO_2, the remaining 1% being nitrous oxide plus trace amounts of methane. International aviation is unlike other fossil fuel uses in that most of its emissions occur at high altitude, where reactive non-GHG oxides of nitrogen (NO_x) chemically interact with ozone and methane in the upper atmosphere, causing additional net warming (i.e. beyond that of the bulk GHGs). High altitude aviation also creates contrails, when atmospheric water vapour condenses around soot from fuel combustion, which can disperse to form alto-cirrus clouds. While there is still considerable uncertainty around contrails and cirrus formation, the overall effect is thought to be warming.

6.1.2. There is strong scientific consensus that non-CO_2 emissions at altitude (excluding contrails) have a warming effect that approximately doubles the warming potential of the emitted CO_2 alone [see, eg **CD 9.60** Lee et al 'The contribution of global aviation to anthropogenic climate forcing for 2000-2018 (2021) *Atmospheric Environment* 244]. The UK government department of Business Energy and Industrial Strategy (BEIS) recommends that a multiplying factor of 1.9 be applied to CO_2 emissions from aviation to estimate the total warming effect of non-CO_2 emissions at altitude [**Appendix 6**: pp 86-87 BAAN/W1/2 pp 86-87]; note these refer to an earlier analysis by Lee]. However, there is as yet no consistent methodology for applying emissions 'multipliers' for the non-CO_2 emissions from other sectors, for instance from agriculture and all surface-based combustion of fossil fuels. While the effects of non-CO_2 emissions at altitude from aviation

are considerably greater than they are from other sectors, if we are to compare 'like with like' a multiplier for aviation alone is theoretically imbalanced. Nevertheless, it is important to recognise that the warming effect of emissions from aviation is significantly greater (by a factor of around two, and perhaps higher) than from the CO_2 emitted alone. For this reason it is a serious flaw of the ES Addendum to disregard any quantitative assessment of non-CO_2 emissions [**CD 2.21.1** p.160 main report and **CD 2.20.6** p.10A-5 of technical appendix].

6.1.3. The CCC has advised that non-CO_2 effects should not be accounted for in the UK's carbon budgets, because it is challenging to aggregate their effects accurately. Nevertheless, the CCC stated in the Sixth Carbon Budget Report that "action to limit these effects is necessary – just dealing with aviation CO_2 is not enough." [**CD 9.34** p.423] The CCC has therefore advised that the UK should report annual best estimates of the impacts of these non-CO_2 effects as "they are a significant part of aviation's impact on the climate" [**CD 9.34** p. 374]. The ES Review wrongly takes this as a reason to exclude non-CO_2 effects completely from its assessment, on the basis that they cannot be adequately quantified or contextualised [**CD 2.21.1** p.160]. This does not reflect that CCC's advice that action should be taken to address non-CO_2 effects; nor does it reflect BEIS guidance on the use of a 1.9% multiplier; nor does it properly take account of the precautionary principle (i.e. that there does not have to be scientific consensus on the methodology for an effect which is acknowledged to be harmful to be assessed).

6.2 The 'Predict and Provide' Fallacy

6.2.1. Throughout the appraisal documents there is an assumption that there is an 'optimum' passenger capacity at Bristol Airport. For example on page 19 of

the ES Addendum [**CD 2.21.1**], "BAL maintains that 12 mppa is the optimum capacity for the Proposed Development taking into account national aviation policy, on-site capacity, highways capacity, airspace and the forecast economic benefits associated with increasing the capacity of the airport." On page 17 of the ES Addendum it is claimed that "The Core Case indicates that Bristol Airport will reach 10 mppa in around 2024 and 12 mppa in around 2030." I also note that the longer-term plans of Bristol Airport (as outlined in their Master Plan consultation) is to grow to 20 mppa [**CD 14.3** §.24].

6.2.2. Such 'predict and provide' thinking has been the mainstay of national transport policy for decades. But in aviation, as in the road transport sector, there is an accumulating body of evidence that this represents a fallacy, that in fact providing additional capacity to meet predicted demand merely becomes a self-fulfilling prophecy; increased provision simply stimulates further demand [**Appendix 7** p.13 BAAN/W1/2 p.96] known as 'induced travel demand' [**Appendix 8** p.17 BAAN/W1/2 p.105]]. As Cairns et al wrote presciently in 2006, "The greatest threat to the UK's successful mitigation of climate change is contained in a growth in demand that *has not yet happened*. This means that, whilst aviation may be a poor candidate for emissions reduction through technological efficiency, it is a very good candidate for demand restraint" [**CD 9.126** p.36].

6.2.3. As already mentioned above, the need to manage and reduce demand in the aviation sector is recognised in the CCC's Sixth Carbon Budget Report, where it notes [**CD 9.66** p.21 Aviation Sector report] that its BNZ pathway to net zero allows for limited growth in passenger numbers out to 2050, compared with unconstrained business as usual of around 65% growth. This 25% growth in passengers, the CCC maintains can and must only be met with existing capacity. As stated in §4.18 above, the CCC is clear in its

recommendation to government that there be no net expansion of UK airport capacity.

6.3 The 'Drop in the Ocean' Fallacy

6.3.1. The claim is made in the appraisal documentation that the additional emissions from the airport expansion are but a tiny part of whole UK carbon budget for certain periods [**CD 2.20.1** ES Add. §10.8.22], therefore irrelevant. Elsewhere the appellant compares emissions from the expansion with the 'planning assumption' allowed for aviation until it is brought within the sixth carbon budget, for example: "In the 2050 forecast, Bristol Airport's share of total UK aviation emissions is estimated to be 1.01–1.20% of the 37.5 MtCO2/yr planning assumption." [**CD 2.20.6** ES Add TA p. 10A-21].

6.3.2. In this case, the appellant has unfortunately compared the additional emissions from the expansion with an outdated and much greater value for the planning assumption (the 37.5 $MtCO_2$) than the 23 $MtCO_2$ allocated to aviation in the CCC's Sixth Carbon Budget Report's BNZ pathway.

6.3.3. Notwithstanding this error, of course the impact of any individual project appears small when compared with a much larger whole. The climate emergency is the result of steady inputs of CO_2 into the atmosphere in individually small but cumulatively planet-altering quantities over decades and centuries. To meet our Paris commitments and the UK's own legislated carbon budgets, we are now faced with the urgent cessation of emissions from all sectors, most pressingly from aviation, which is set to overtake domestic housing as the biggest emitter in the mid-2030s; and this is without factoring in the non-CO_2 warming that BEIS recommend should be considered. In this context, it is the recourse of the mathematically illiterate

or those trying to mislead to suggest that a small percentage of some much larger total level of emissions is irrelevant.

6.4 Incompatibility with the CCC's Balanced Net Zero Pathway

6.4.1. A far more appropriate comparison of emissions from the proposed expansion is with a decarbonisation pathway aligned with the temperature and equity objectives of the Paris Agreement (and the May 2021 G7 Communiqué, **Appendix 1**). Notwithstanding that the CCC's BNZ pathway is less onerous than the UK's 1.5–2°C commitments, its targets are set to become UK law in a matter of months [**CD 9.38**]. Therefore – and recalling the CCC's advice to government that there should be *no net expansion* of UK airports for this pathway to remain viable – it is reasonable to consider the emissions of the expansion in the context of the CCC BNZ pathway.

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Year	Change in emissions cf. 2017 **with** expansion	Change cf. 2017 required by CCC's BNZ pathway for aviation
2024	**+8%** *up 37 $ktCO_2$*	**-2%**
2030	**+15%** *up 72 $ktCO_2$*	**-13%**
2040	**+12%** *up 56 $ktCO_2$*	**-23%**
2050	**-6%** *down 29 $ktCO_2$*	**-38%**

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Aviation CO_2 emissions in Bristol Airport's Central Emissions Scenario, compared with the emissions reductions required under the CCC's Balanced Net Zero Pathway. Figures are rounded to the nearest whole number. [Data sources: ES Addendum Technical Appendix Table 10A.7 **CD 2.20.6** p.13; CCC Sixth Carbon Budget data tables **CD 9.128**].

6.4.2. As highlighted in Table 1 and Figure 1 (in §5.2 above), the Airport's projected emissions in the 'with expansion' case are in completely the opposite direction to the CCC's BNZ pathway for aviation – with Bristol increasing its emissions substantially during the next two decades, whereas the CCC pathway requires a substantial reduction.

6.4.3. Whereas the CCC pathway requires reductions in emissions from the mid-2020s, the Airport's emissions in the 'with expansion' case increase until well into the 2040s, with only a trivial 6% decrease below 2017 baseline reached in 2050. In order to follow the CCC's Balanced Net Zero pathway, Bristol Airport's aviation emissions would need to be reduced by 38% by 2050 (a cut of more than 180ktCO_2 per year), whereas the 'with expansion' forecast is for a reduction of only 6% (29ktCO_2). **This expected 2050 emissions level at Bristol Airport is a sixfold underachievement against the reductions required by the CCC's pathway for aviation.**

6.4.4. Because the Central 'with expansion' forecasts show an increase in emissions throughout the period from now until the 2050 time period, the *cumulative emissions* that accrue from this scenario cannot be ignored. Since Bristol's emissions in the 'with expansion' case continue to rise for another twenty years or more, this increases the rate at which CO_2 accumulates in the atmosphere and expands the 'area under the curve'. This puts pressure on other sectors to decarbonise even faster than their already very demanding targets – or we simply exceed the budget and fail to address the climate emergency.

6.4.5. If the same policy were followed by other UK airports, the national carbon budget would not be viable. **Without significant contraction in capacity at some other UK airport, it is irresponsible and, from a climate impact basis,**

reckless to increase Bristol's emissions when all other sectors and indeed airports are required to reduce their emissions.

6.4.6. In fact the position is diametrically opposite to this as outlined in NEF's report 'Turbulence Expected' [**CD 9.32** p.4]. This report gives details of six other UK airport expansion schemes which are currently at different stages of the planning procedure. Together, if they were approved, these plans would amount to an extra 86.8 mppa. Clearly this cannot happen if the UK is to achieve its carbon budgets.

6.4.7. It is salient that even in the Airport's 'without expansion' case, forecast emissions reduce slowly from the present day, reaching a maximum reduction of 20% against the 2017 baseline by 2050 [**CD 2.20.6** p.13]. This still falls far short of the CCC's BNZ pathway targets for aviation emissions – in fact, it underachieves the CCC target almost by a factor of two. Furthermore, Bristol's 'without expansion' reduction is premised on optimistic estimates of aircraft load factors and technology-based efficiency improvements (see below). It therefore highlights the inescapability of significant demand reduction – not merely demand management – if the CCC's climate-based reduction targets are to be met. The fact that the 'without expansion' case falls far short of what is required for compliance with the CCC's BNZ pathway further underlines the need to reject the proposed expansion, which will make a bad position much worse (a twofold underachievement would become a sixfold underachievement).

6.5 Overly Conservative Estimates of Emissions

6.5.1. Given the evidence on the effects of non-CO_2 GHGs emitted at altitude, the appellant's estimates of aggregate emissions in each future year are very conservative. As noted in §6.1.2 above, BEIS recommends applying a

multiplier of 1.9 to aviation CO_2 emissions to reflect this. Other experts put the multiplying effect of high altitude GHGs closer to a factor of 3 [**CD 9.60** Lee et al (2021)]. Recent analysis of BAL's expansion appraisal documentation by NEF highlighted the difference in total emissions from the expansion with higher and lower non-CO_2 multipliers applied [**CD 9.32** p.20], and with arriving flights including (the appraisal documentation considers only departing flights). Whilst there are problems with applying a multiplier to one sector (aviation) but not to others, it is safe to say that the emissions estimates in the appraisal documents are very likely a significant underestimate of the true extent of the GHGs, and hence the subsequent level of warming, from this expansion.

6.6 Overstated Influence over Scope 3 Emissions

6.6.1. It is a major flaw in the appraisal documentation to claim that the emissions from aviation are within the control of the airport. All the predictions in the appraisal documents regarding uptake of more efficient aircraft relate to the behaviour of airline operators using the airport. It is revealing that the YAL Passenger Traffic Forecast Report [**CD 2.21**] notes that the key reason for the increase in average plane size at Bristol Airport in recent years is the demise of airline BMI Regional, which operated smaller aircraft – a circumstance entirely outside the influence of the Airport. The YAL Forecast report also notes, "Environmental upsides may be gained through factors such as a faster switchover to newer generation aircraft, but the most likely case reflects that the airport may not be able to control the rate of introduction sufficiently to assume this as a reasonable basis for assessment as the Core Case". I agree and endorse this point.

6.6.2. When considering more speculative methods to reduce emissions such as those from using hydrogen-based fuel, there would need to be a major overhaul of the infrastructure at both Bristol and the destination airports, as well as a completely new generation of aircraft (see further the proof of evidence of Finlay Asher at §6.7). This is largely outside the ambit of the airport's decision making.

6.6.3. From a climate change mitigation perspective, it is questionable whether an airport's passenger capacity is a good proxy for emissions since there are so many intervening factors that influence emissions more than simple passenger numbers. These intervening factors – such as aircraft occupancy, efficiency, distance flown – are, primarily, not within the gift of the airport. **Consequently the airport cannot vouch for 'safe' emissions levels in future years with any reasonable level of confidence.**

6.6.4. To effectively respond to the climate emergency, absolute emissions must be cut dramatically, not merely emissions intensity. To deliver on the UK's Paris temperature and equity commitments, the emissions need to be zero between 2035 and 2040 at the latest. But even to meet the UK's less onerous domestic legislation in and under the Climate Change Act 2008, they need to *decrease* by at least 40% by 2050, compared with the airport's proposal of only 6%. **In the absence of a site-specific cap on actual emissions – or at the very least a cap on ATMs – passenger capacity must not be allowed to increase.**

6.7 Impact on Local Carbon Budget

6.7.1. Although international aviation emissions are not presently included within regional or local authority emissions inventories, there are good arguments

why some of the emissions from international airports' aviation should be allocated to the locality where they are sited. For example, while a regional airport such as Bristol obviously serves a broad geographical hinterland, much of the economic benefit from the airport, such as employment and ancillary services, accrues principally to its home local authority, North Somerset. As argued in Wood et al 2010 [**CD 9.121** p.206], these economic benefits form a good case for allocating all emissions from landing and take-off (LTO) to the airport's home local authority or region, in addition to a percentage of cruise-climb-descent (CCD) emissions equivalent to the share of airport passengers from the home local authority.

6.7.2. In the case of Bristol Airport, LTO emissions are reported to be one quarter of the total aviation emissions for domestic and international flights combined [**CD 2.20.6** ES Add. Tech Appx p.10-C.1, Table 10C.1]. Passenger origin data presented in the original ES for the expansion shows that 19% of passengers using Bristol Airport are from the North Somerset local area [**CD 2.5.46** Table 17A.11].

6.7.3. Applying these fractions to the forecast emissions from aviation at Bristol in 2030, 2040 and 2050 gives the following allocations to the North Somerset Council (NSC) area.

Year	$ktCO_2$ from aviation at BAL with expansion	LTO (25%)	CCD (75%)	19% of CCD	$ktCO_2$ p.a. for NSC (total with expansion)	$ktCO_2$ p.a. for NSC (+2 mppa only)
2024	509	125	384	73	198	15
2030	544	134	410	78	212	34
2040	529	130	399	76	206	33
2050	443	109	334	63	172	27

Table 3. Suggested allocation of annual aviation emissions from Bristol Airport to North Somerset Council, based on emissions data from ES Addendum Table 10A.7 **CD 2.20.6** p.13.

6.7.4. At the behest of Great Manchester Combined Authorities and following a workshop with a range of local authority stakeholders, Tyndall Manchester has estimated carbon budgets for every local authority area in Britain [**Appendix 9** BAAN/W1/2 p.106ff]. For North Somerset Council, the headline findings were as follows: "Stay within a maximum cumulative carbon dioxide emissions budget of 6.9 million tonnes ($MtCO_2$) for the period of 2020 to 2100. At 2017 CO_2 emission levels, North Somerset would use this entire budget within six years from 2020." [**CD 9.42, p.2** Kuriakose et al]. It is salient that emissions from international aviation are not included within the comparison made by Kuriakose et al of 2017 emission levels (in keeping with emissions reporting at local authority level in government datasets).

6.7.5. The Tyndall budget report for North Somerset breaks the total maximum cumulative CO_2 budget down into the following interim carbon budgets.

Carbon Budget Period	Recommended Carbon Budget ($MtCO_2$)
2018 - 2022	4.7
2023 - 2027	2.3
2028 - 2032	1.1
2033 - 2037	0.5
2038 - 2042	0.2
2043 - 2047	0.1
2048 - 2100	0.1

Table 4. Interim carbon budgets for North Somerset Council, source Kuriakose et al 2021 [**CD 9.42**, p.7].

6.7.6. Note that by 2030 annual emissions from aviation at Bristol Airport accruing to North Somerset Council under the allocation system proposed by Wood et

al (§6.7.1 above) amount to around 20% of the five-year interim budget for 2028-2032. That is to say, **NSC's share of Bristol Airport's aviation emissions would consume the local authority's entire carbon budget in the five years from the start of 2028 to the end of 2032**. **By 2040, a single year of NSC's share of aviation emissions from the airport would use up the entire carbon budget intended for the five years 2038–2042.**

6.7.7. If we take the additional emissions from the expansion from 10 to 12 mppa estimated in the ES Addendum and apply the same split to NSC (the final column in table 3 above), **by 2040 these extra emissions (if extrapolated for the five-year budget period 2038–2042) consume 82% of the five-year budget**[6]. In my view, this is a far more appropriate comparison of the significance of aviation emissions than comparing with the national total.

6.8 The 'Fly local' Fallacy

6.8.1. The appellant has claimed in press releases and other public statements that expansion of Bristol Airport would bring a relative 'emissions benefit' compared with no expansion, whereby, it is suggested, additional local capacity may reduce the emissions penalty of travelling to another airport (such as in the London area). BAL's Statement of Case, para 7.9 summarises this contention: "…an increase in the capacity of Bristol Airport will reduce the displacement of passengers to airports outside of the South-west region, principally to London Airports, generating an emissions benefit" [**CD 2.18**].

6.8.2. This contention is false for the following reasons. First, as discussed in §6.2 above, expansion of airport capacity stimulates demand, whereas capping

[6] 33 $ktCO_2$ per year multiplied by five gives 164 $ktCO_2$, or 0.164 $MtCO_2$, which is 82% of the 0.2$MtCO_2$ budget estimated by Tyndall Manchester for NSC from 2038 to 2042.

and withdrawing capacity constrains demand. Thus expansion of Bristol's capacity to 12m passengers will in all likelihood create entirely new trips that would not otherwise have occurred, and as a result negate any putative net displacement.

6.8.3. Second, the ES Addendum makes it clear that there will be an absolute increase in emissions in the 'with expansion' case until at least 2040. Thus there will be a significant increase in the cumulative CO_2 put into the atmosphere in the interim compared with the 'no expansion' case. This cumulative amount of CO2 and other GHGs is what the climate responds to, not any relative efficiency improvement in the amount of carbon emitted per trip or per passenger. Note that throughout the history of technology and engineering, efficiency improvements have almost always been accompanied by a net increase in the absolute total consumption of energy and hence emissions (often referred to as Jevon's Paradox or the 'rebound effect').

6.8.4. Third, travel from the Southwest to, for example, Heathrow, by car with multiple occupancy is less carbon intensive than a connecting flight to Heathrow.

6.8.5. Fourth, around 60% of passengers using the main London airports (Heathrow and Gatwick) access them by public transport rather than private car, making a connecting flight from Bristol even more of a carbon penalty [**CD 9.119** p.7, which shows public transport use to airports at 56% for Gatwick and 60% for Heathrow in 2018]. I also note that Bristol Airport is the largest airport in the UK with no rail link meaning that individual car journeys to this airport are much more prevalent than in many other airports.

6.9 Summary responses to other claims in appraisal documents

6.9.1. In the Statement of Case [**CD 2.18**, paragraph 7.1], the appellant claims that "increasing the capacity of Bristol Airport will not materially affect the ability of the Government to meet its 'net zero' carbon target for 2050. This target does not require 'absolute' emissions to be reduced for any particular airport". As explained in §6.3 above, the impact of any individual project appears small when compared with a much larger whole. As detailed in §6.4, the CCC's Balanced Net Zero pathway for aviation requires the sector as a whole to reduce its emissions by 38% by 2050. The CCC has also recommended that the government enact legislation to ensure that there is no net expansion of UK airport capacity. To expand Bristol Airport is a direct contradiction of the CCC's pathway and explicit statement on net expansion, and thus (in the absence of any equivalent and specified withdrawal of capacity) materially affects the Government's ability to meet its net zero carbon target.

6.9.2. In the Statement of Case [**CD 2.18**, paragraph 7.2], the appellant claims that "The Net Zero target is a UK 'net target' and is not absolute zero so allows for offsetting". The 'offsetting' referred to by the appellant here is in fact the use of as yet highly speculative (at scale) techniques and technologies of carbon dioxide removal (CDR). As explained in §§4.13–4.14 above, CDR is by no means a 'get out of jail free card', since it comes with no assurance of delivery or effectiveness. Rather, relying on CDR over mitigation today brings the 'moral hazard' of handing to younger people and future generations the burden of developing CDR technologies or suffering the consequences of higher levels of climate change. I prefer to endorse the UN World Commission on Environment and Development approach in the Brundtland Report (1987) *Our Common Future:* "sustainable development is

development that meets the needs of the present without compromising the ability of future generations to meet their own needs." [**CD 9.127** p.11] I consider that the planned expansion directly contradicts this approach.

6.9.3. In the Statement of Case, the appellant notes that the Government's 2018 green paper, Aviation 2050 states that:

> "planning applications should demonstrate that 'that their project will not have a material impact on the Government's ability to meet its carbon reduction targets'. The assessment presented in Chapter 17 of the ES established, based on a methodology agreed with NSC officers, that aviation emissions associated with the addition of 2 mppa would represent only 0.28% of the 37.5 $MtCO_2$ /annum 'planning assumption' adopted by Government, which was not considered to materially affect the UK's carbon budgets. … Based on the current passenger and traffic forecasts, the scale of emissions would be 0.18% of the 37.5 $MtCO_2$ headroom recommendation" [**CD 2.18**, paragraphs 7.4 and 7.5].

As explained in §6.3 above, the impact of any individual project appears small when compared with a much larger whole. As outlined in §6.7 above, a more appropriate comparison would be with the Paris-derived carbon budget estimated for North Somerset Council and published by Tyndall Manchester. Against such a budget and pathway, the impact of the expansion is stark. By the early 2040s, annual emissions from the proposed expansion that fairly accrue to the North Somerset Council area would use up 82% of the Council's carbon budget.

6.9.4. The ES Addendum Main Report [**CD 2.20.1** at §10.2.8] states that "At a local level there are no binding GHG targets". Many local and regional authorities in the UK (and worldwide) are recognising the need to adopt local carbon budgets that can be used to motivate and track mitigation in their areas.

Following a stakeholder consultation and after working extensively with the Greater Manchester Combined Authorities (GMCA), Tyndall Manchester has published carbon budgets for every local authority in Britain. While not legally binding, there is now a growing precedent for the implementation of sub-national and local authority emissions budgets. The GMCA have adopted the Tyndall budgets as binding policy.

6.9.5. The ES Addendum Main Report [**CD 2.20.1**, page 149] quotes the Sustainable Aviation group as saying that the UK "can accommodate a 70% growth in passengers whilst reducing net carbon emissions…to zero through smarter flight operations, new aircraft and engine technology, modernising our airspace, the use of sustainable aviation fuels and significant investment in carbon reductions through smart market-based policy measures". Setting aside the partisan role of Sustainable Aviation in lobbying on behalf of the aviation industry, the crucial things to note about this statement are, first it refers to an end state in 2050, giving no information about the pathway taken to that point. This completely ignores the science, i.e. increased cumulative emissions (from growing demand and more flights between now and 2050, as stated in §6.8.3 above) is all that the climate responds to.

6.9.6. Second, it is explicitly counter to the CCC's conclusion that if the UK is to meet its future statutory carbon budgets (less onerous than if they were Paris-derived), passenger numbers cannot be allowed to grow beyond 25%, and that this should occur without any net increase in UK airport capacity. Put bluntly, the statement by Sustainable Aviation ignores both the science and the CCC's recommendations.

6.9.7. The ES Addendum Main Report **CD 2.20.1**, p.149 says that the target figure of 30 $MtCO_2$ from aviation by 2050 has not been adopted by Government, and that as a consequence the previous 37.5$MtCO_2$ target applies and remains the most 'appropriate value' against which to consider aviation emissions. The point is moot since the CCC's Balanced Net Zero pathway (published after the ES Addendum) is for a gradual annual reduction in aviation emissions to 23$MtCO_2$ by 2050. Note that the CCC is only able to reconcile even this lower emissions level with its net zero pathway by assuming heavy roll-out of as yet speculative negative emissions technology (see §§4.12 to 4.14 above).

7 BAL'S PROPOSAL TO BE A "NET ZERO" AIRPORT

7.1. The Appellant's Draft Carbon and Climate Change Action Plan (CCCAP) [**CD 9.48**] contains a number of suggestions and assertions that warrant criticism. The most conspicuous problem with the CCCAP is that it premises achieving 'net zero' emissions (by 2030) almost entirely on use of emissions credits through the UK ETS and offset credits through CORSIA. Both of these systems are unable to deliver verifiable reductions in absolute cumulative emissions (see §§5.5–5.9 above). While it is claimed that the plan is to reduce dependency on offsetting over time by later reducing GHG emissions [**CD 9.48** p.14], this ignores the irrevocable emissions that will continue to accumulate in the atmosphere all the while, locking in climate change and consuming the emissions 'space' of other sectors. It bears repeating that the CCC has categorically rejected use of CORSIA for meeting the UK's emissions budgets, pointing to the scheme's serious shortcomings in governance, verifiability and sustainability, as detailed in §5.9 above.

7.2. On page 12 of the CCCAP it is stated, "Through the adoption of more fuel-efficient aircraft and operations, along with use of sustainable biofuels, the CCC has suggested that growth in the aviation sector can be compatible with the UK achieving its long-term climate change goals." This substantially misrepresents the CCC's suggestion that 25% passenger growth could be compatible with the UK achieving its climate goals, since it fails to point out that the CCC makes this suggestion with the crucial caveat that this should only be achieved with **no net expansion of UK airport capacity**.

7.3. Page 23 of the CCCAP includes the frankly Machiavellian statement that, "Growth to 12mppa affords us with an even greater opportunity to reduce emissions." BAL's own emissions forecast for the proposed expansion show

a marked increase in emissions out to the 2040s (Addendum Technical Appendix Table 10A.7 **CD 2.20.6** p.13). Increasing capacity will increase emissions – that much is uncontested by the appellant. It is clearly perverse to argue, as does the CCCAP, that by increasing emissions one creates an even greater 'opportunity' to reduce those emissions.

7.4. The CCCAP makes a number of references to the 'exploring' the best method to provide sustainable aviation fuels infrastructure, in the form of a feasibility study. Clearly this is not a commitment to deployment of such infrastructure within any defined timeframe. The flaws in reliance on sustainable aviation fuels are canvased in detail in the proof of evidence of Finlay Asher [BAAN/W2/1].

7.5. Very little, if any, weight can sensibly be given to the CCCAP as a way of addressing or mitigating Bristol Airport's emissions.

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Appendices in BAAN/KA/2

Appendix 1: G7 (2021), G7 Climate and Environment Ministers' Meeting Communiqué.

Appendix 2: Various news reports of climate impact in UK

Appendix 3: Anderson K and Stoddard I, (2020): Beyond a climate of comfortable ignorance, The Ecologist

Appendix 4: Fajardy M, Köberle A, Macdowell N, & Fantuzzi A (2019), BECCS deployment: a reality check. Grantham Institute Briefing Paper no.28.

Appendix 5: Heck V, Gerten D, Lucht W et al, (2018). Biomass-based negative emissions difficult to reconcile with planetary boundaries. *Nature Clim Change* 8, 151–155.

Appendix 6: Extract from DBEIS 2019 *Government greenhouse gas conversion factors for company reporting Methodology paper for emission factors Final report*

Appendix 7: Gunn (2018) History of Transport Systems in the UK

Appendix 8: Extract from Transportation Research Board (2002) *Aviation Demand Forecasting A Survey of Methodologies* "Forecasts for a Multi-Airport Region"

Appendix 9: Tyndall Manchester web front end with links to estimated carbon budgets for every local authority and the North Somerset budget