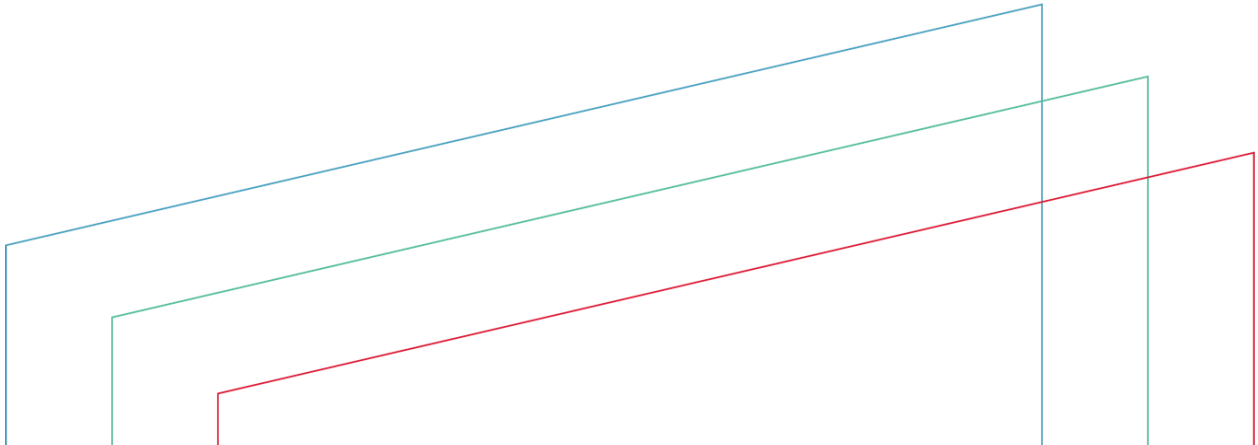
BRISTOL AIRPORT – RESPONSE TO CONSULTATION

Findings of independent analysis commissioned by the Parish Councils' Airport Association

New Economics Foundation



Bristol Airport – Response to Consultation

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Client: Parish Councils' Airport Association

The consultancy of the New Economics Foundation, NEF Consulting helps put new economics into practice with people and the planet at the heart of decision-making.

The New Economics Foundation is the UK's leading think tank promoting social, economic, and environmental justice to transform the economy so that it works for people and the planet.

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EXECUTIVE SUMMARY

NEF Consulting were commissioned by the Paris Councils' Airport Association (PCAA) to conduct a review and supplementary analysis on the economic and monetised impacts of the proposed expansion of Bristol Airport being considered at appeal stage.

Substantive Defects

- Bristol Airport represents core national travel infrastructure, and The Appellant provides evidence that its expansion will impact on consumer and business behaviour at airports around the UK, not just in the South West and South Wales region. The airport's expansion will also have impacts on the national aviation carbon budget, and its relative distribution across regions. A national appraisal study area should have been included.

- The Appellant has responded to NEF's previous critique by providing new disaggregated displacement estimates. However, The Appellant has failed to apply their disaggregated displacement estimates to their net GVA / GDP estimates. Applying these with known factors for the airports from which traffic could be displaced results in reductions in estimated employment benefits at the South West & South Wales level of about 25%, from 4,000 additional jobs to 3,056. At the UK level, using this information results in an additional GVA estimate of just £100 million, and just 162 additional jobs. With more conservative assumptions on airport job intensity these figures turn negative at the national level.

- Having established in their own analysis that 38% of the additional passengers who would use the expanded airport are newly created and not displaced from other airports, The Appellant fails to make any calculation of the likely transfer of consumer spending overseas which would result from the new international tourism facilitated. This means that the economic impact of the airport's primary function, i.e. facilitating UK residents on international tourism, remains unquantified despite likely being highly negative and material to the regional GDP contribution analysis of the scheme.

- The inclusion of Low Carbon costs and low weighting given to High Carbon Costs in the Demand Modelling is likely to bias benefits upwards and costs downwards - this has implications for every part of the assessment that relies on these traffic forecasts. While this is a substantive defect, the impact is of such a cross-cutting nature that no attempt can be made by NEF to quantify it.

- The Appellant recognises that business use of internet communication has increased "massively" during the Covid-19 pandemic, but then makes the unsubstantiated claim that business behaviour will return to the pre-pandemic normal before the time period of the assessment conducted, despite other evidence to the contrary. As a minimum, sensitivity analysis is required to consider the impacts of lower future business use of air travel, and/or lower marginal productivity gains to use of air travel.

- Implicit in The Appellant's submission is an assumption that the job intensity (i.e. the number of jobs per passenger) will remain the same in the 'with' and 'without' development scenarios. Given that a core impact of airport expansion is to facilitate greater returns to scale, and that such a premise is baked into The Appellant's later work

on the scheme's socioeconomic cost-benefit profile, this assumption seems overly optimistic and overstates the scheme's job creation potential.

- The scheme benefits, as set out in the GDP/GVA analysis are highly dependent on its proposed creation of business productivity benefits, jobs, and new inbound tourism. Its apparent merit to the public is also highly influenced by assumptions relating to carbon cost and outbound tourism costs. Given the high levels of uncertainty underpinning these parameters, particularly resulting from the Covid-19 pandemic and the expected government policy changes on aviation carbon emissions, best practice in the Green Book and TAG guidance would suggest a sensitivity analysis should be conducted. No such analysis is provided beyond The Appellant's consideration of different rates of demand growth - which are of little material significance when it comes to measuring the relative merits and risks of the scheme.
- The socioeconomic cost-benefit analysis conducted by The Appellant is fundamentally flawed and not fit for use in decision making without significant revision. The high social benefit-cost ratio (BCR) The Appellant reports relies on not including the costs to airlines, tax costs to passengers, and mis-specifying CO2 emission costs. Air fare and tax changes are likely to be near zero-sum, depending on market elasticities and constraints. Including the reciprocal effects in the social welfare calculation changes the net value from NPV £863 million and BCR 3.66 to the more modest £189 million and BCR of 1.21.
- By including carbon emissions in the manner that they have, Bristol Airport Limited (BAL) have provided a misleading result which they can accurately claim includes substantial double-counting. Re-calculating the values to focus only on what is not already included in air fares and to present sensitivities for non-CO_2 impacts and High Carbon Values, as required by the relevant guidance, results in a net benefits of £122 million and BCR of 1.13 (non-CO_2) or -£54 million and BCR of 0.95 (non-CO_2 and High Carbon costs).
- The economic analysis includes other defects of a less substantive nature that together may result in a material impact, including the lack of inclusion of other environmental costs (air quality and noise pollution), the dismissal of potentially negative outbound tourism effects, ambiguity over the study period applied, and incorrect discount rates.

What should be provided to the Inspector

- Revised demand modelling that treats carbon pricing in line with current guidance and legislation.
- Use of disaggregated displacement in GVA / Employment calculations
- Appropriate inclusion of reciprocal effects of air fare and tax changes in socioeconomic cost benefit analysis, at a conservative 1:1 unless BAL can demonstrate otherwise.
- Presentation of non-CO_2 effects, in line with guidance. A high carbon cost scenario that is fully specified, in line with guidance.
- Fully monetised Air Quality and Noise impacts
- Estimates of overseas transfers of spending resulting from increased rates of international tourism facilitated by the airport expansion
- Re-calculated job creation estimates considering returns to scale resulting from expansion and appropriate rates of industry job intensity decline
- Sensitivity scenarios assessing highly uncertain parameters, particularly future use and marginal utility of business air travel

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INTRODUCTION

Bristol Airport Ltd (BAL, also 'The Appellant' or 'The Airport') have submitted a planning application proposing to deliver enhanced facilities and access facilitating an increase in the airport's passenger throughput to 12 million passengers per annum (mppa), from its current capacity of 10 mppa.

NEF Consulting were previously commissioned by CPRE to review the Airport's socioeconomic case for expansion. Our report titled *Evaluating the Case for Expansion of Bristol Airport* was published in July 2019 and submitted via North Somerset Council's planning portal.

This report represents a follow up to our initial report, updated to consider addendums submitted by The Appellant for its appeal and new issues which have arisen in the intervening period since BAL's initial application was rejected. Our aim is to independently assess the costs and benefits of the proposed scheme. In particular, we identify, and where necessary fill in, the gaps in The Appellant's assessment with regard to the net costs and benefits of the scheme to the public including, but not limited to, its GDP impact.

In producing this report it has been necessary to review the documents submitted to the Planning Inspectorate, including the ES Addendum Main Report, the ES Addendums to the technical chapters, the original reports submitted to North Somerset Council, and the responses to comments from various parties. Key information on methods and assumptions is scattered across multiple documents; this consultation response raises questions regarding aspects of the evidence submitted in the hope that this gives The Appellant a chance to prevent any misunderstandings of their work or the methods that they have chosen to apply.

About us

NEF Consulting is the wholly-owned consultancy subsidiary of the not-for-profit UK 'think tank' the New Economics Foundation. NEF Consulting aims to support organisations across the private, public, and third sectors to put new economic thinking into practice. Over the past two decades NEF have pioneered the development of tools designed to measure social return on investment. NEF Consulting has a long track record in transport infrastructure appraisal. Recent projects include acting as independent reviewer of the climate change aspects of the proposal to expand Southampton Airport for Eastleigh Borough Council, reviewing the business case for the proposed extension to the M4 motorway (for the Future Generations Commissioner for Wales), reviewing the application to expand Leeds Bradford Airport (for the Group for Action on Leeds Bradford Airport), and reviewing the regional impacts of expanding Heathrow Airport (for the No Third Runway Coalition).

This assessment was conducted by Dr Alex Chapman and Marc Postle, Consultant and Associate Consultant at NEF Consulting. Alex Chapman is a specialist in policy impact analysis and evaluation. He has a PhD from the University of Southampton focused on the socioeconomic evaluation of climate change adaptation options. Marc Postle is a specialist in transport systems appraisal, he was previously economics consultant for the Future Cities Catapult, and prior to that held the same role at Jacobs. Marc conducted economic and carbon analysis for the Airports Commission's Phase 2 report, as well as carbon footprint and emissions trading assessments for Heathrow and London City Airports.

CONTEXT

Climate Change

The UK Government has declared a climate emergency and passed into law a commitment to reach net zero greenhouse gas emissions by 2050. While many climate researchers regard this target as inadequate if we are to prevent catastrophic climate breakdown, Net Zero by 2050 nonetheless means rapid and fundamental changes to ways of life in the UK. Every sector of the UK economy must dramatically reduce its greenhouse gas emissions, and most must achieve total carbon neutrality. The UK Government's Statutory advisor on climate change, the UK Committee on Climate Change (UKCCC) has set out a pathway to Net Zero which also allows the UK to meet its obligations to the Paris Climate Agreement of the United Nations. This pathway provides the scientific rationale behind the Net Zero 2050 commitment.

The UK aviation sector occupies a fortunate position in that the UKCCC's pathway does not require it to reach total carbon neutrality. Indeed, the pathway set out allows a degree of growth in passenger departures, despite the direct link between passenger departures and emissions. The UKCCC is clear however, that growth in passenger numbers must be managed. Principally this is because decarbonisation of the UK aviation sector cannot be achieved through technological solutions alone. Progress improving fuel efficiency has not been fast enough to offset the growth in the size of the industry. For instance, in 2018 the 58 largest global airlines achieved efficiency improvements of around 1%, in the same year the industry's growth led to an overall increase in emissions of 5.2%.[1]

In its Net Zero publication the UKCCC sets out three levels of ambition for the UK aviation sector, under its least ambitious pathway sector growth must be limited to a 60% increase over 2005 levels, its higher ambition options involve limiting growth to 20% or 40% above 2005 levels.[2] By 2019 departures were already 30% higher than 2005 levels. Critically however, if all planned airport expansions go ahead, capacity in the UK airports system would allow passenger departures to rise 90% above 2005 levels[3]. In other words, if all planned expansions go ahead the UK would face a choice of holding significant under-utilised airport capacity (potentially leading to stranded assets), or driving emissions incompatible with its commitment to the Paris Climate Agreement.

The UKCCC has made repeated calls to government to set legally binding emission reduction targets for aviation and to publish a strategy for achieving them. The government has set out an intention to do so, by committing aviation to Net Zero emissions, tackling non-CO_2 impacts, and, importantly, initiating a survey of long-term travel expectations that will

[1] Becken, S. (2020) Major airlines say they're acting on climate change. Our research reveals how little they've achieved. The Conversation. Available at: https://theconversation.com/major-airlines-say-theyre-acting-on-climate-change-our-research-reveals-how-little-theyve-achieved-127800 [accessed 04/01/2021]

[2] Civil Aviation Authority (2020) Airport Data. Available at: https://www.caa.co.uk/Data-and-analysis/UK-aviation-market/Airports/Datasets/ [accessed 04/01/2021]

[3] Finney, D. and Mattioli, G. (2019) Planned growth of UK airports not consistent with net-zero climate goal. Available at: https://www.carbonbrief.org/guest-post-planned-growth-of-uk-airports-not-consistent-with-net-zero-climate-goal [accessed 04/01/2021]

feed a revision of the UK's airport capacity strategy.[4] A review of UK connectivity has begun,[5] but at the time of writing proposals were not forthcoming, leaving a vacuum in policy for local planning authorities to grapple with.

Covid-19

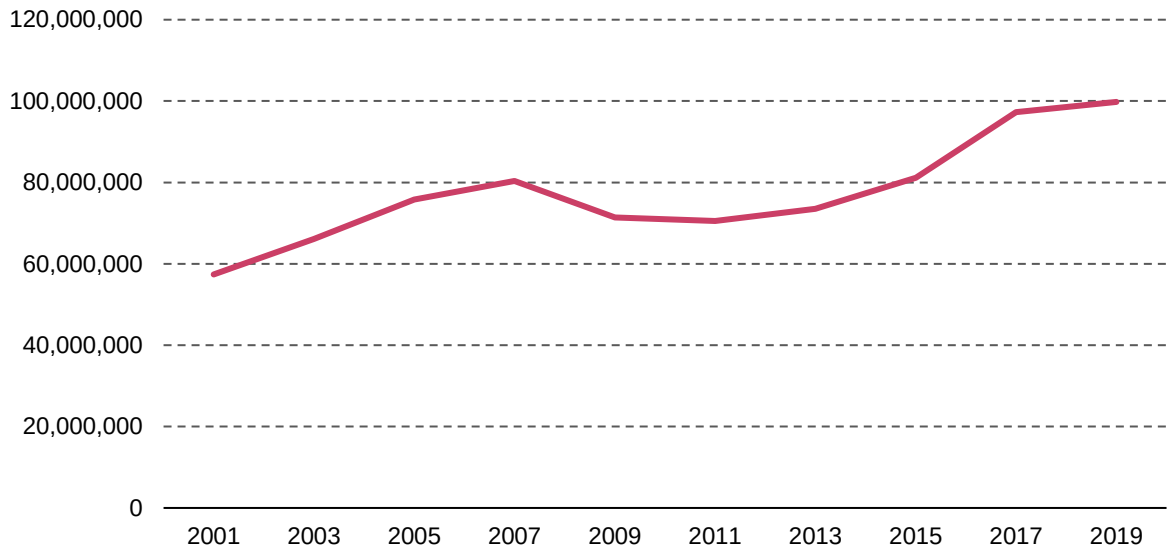
The Covid-19 pandemic has had, and continues to have, significant impacts on the operations of the aviation sector. These impacts are stated as being the primary driver of The Appellant's decision to submit a significant quantity of new information to the planning appeal. However, as far as we have been able to tell, the only material change to the business case which has been driven by Covid-19 is a four-year backward shift to all modelling. This accounts for a delay in demand growth attributed to the pandemic. The Appellant references the potential for longer-term changes to the business-aviation relationship, no such changes appear to filter through into the analysis. While BAL did produce more specific passenger displacement estimates for use in parts of the assessment, they did not use them in the economic assessment.

Decision making challenges

To date, the UK Government has largely left Britain's devolved and local authorities to deal with airport capacity expansion proposals outside of the London Airport System. This is despite the issue being a 'system problem' with implications on national and international connectivity, laws, agreements, and security. To illustrate this point, it is useful to note that airport expansion applications are currently under consideration by the relevant authorities at Leeds Bradford Airport and Southampton Airport. These applications, along with Bristol Airport, all make the claim that their resulting additional greenhouse gas emissions are insignificant in size compared to the overall sector budget. In aggregate however, they are significant. Indeed, the number of passenger departures from non-London airports has risen significantly over the past two decades (Figure 1).

[4] HM Government (2020) The Government Response to the Committee on Climate Change's 2020 Progress Report to Parliament
[5] Department for Transport (2020) Union connectivity review

Figure 1: Passenger departure numbers from the 10 largest airports outside the London system



Source: NEF calculations from Civil Aviation Authority data

The planning guidelines are poorly equipped to support local authorities in managing applications of this nature effectively, yet the stakes are extremely high. In the absence of a clear decarbonisation pathway for aviation at the national level, planning authorities would have to assume that all proposed growth associated with any airport capacity expansion will ultimately materialise (i.e. assuming a worst-case scenario in regard to environmental impacts). This alone implies significant social costs of carbon being experienced by communities in the UK and abroad. When all scheme costs are considered, rather than just those highlighted by BAL, including carbon, air quality, noise, public expenditure, and potential losses to outbound tourism, the negative impacts of the scheme are inordinate when seen in comparison with almost any local planning decision. Nor can most of these impacts be compensated for; even in the case of carbon emissions, where offsets are a cited solution, the currently available options are not in sync with the decarbonisation pathway.

A key further challenge for decision makers to grapple with is that the costs and benefits of the proposed scheme are unevenly and widely distributed. It is critical that decision makers have access to a comprehensive, transparent and quality assured bank of information with which to assess such proposals.

Decision makers are faced with a shifting picture of the costs and benefits of aviation. Notably over the past decade a large number of the oft-stated benefits of airport expansion have been eroded. These processes are discussed in greater detail below, but can be summarised under:

- **Jobs**: the 'job intensity' of aviation has been declining rapidly over time. Airports provide far fewer jobs per passenger than they previously did.
- **Carbon**: the cost of carbon rises every year, both in HM Treasury's impact accounting frameworks and in every year that global greenhouse gas mitigation efforts, including through technological advancements, fall short of the levels required to prevent catastrophic climate breakdown.

- **Business productivity benefits**: Not only has business travel been falling as a proportion of all trips, but the marginal economic return to each additional business traveller has been declining. Improvements in online communication technology reduce the relative advantage of business travel, and returns to additional connectivity diminish in an already highly connected United Kingdom.
- **Outbound cash flows increase**: airports have been facilitating UK households in spending a continually growing proportion of their incomes overseas, increasing the UK's travel spending deficit at a pace far outstripping inflation, and diverting spending away from other domestic sectors.

Some modern developments push in the opposition direction, for example technological improvements continue to reduce the noise and carbon emitted per air traffic movement. But these gains are far from sufficient to offset the above losses when compared in monetised terms. The risks presented to the public by airport expansion, particularly following the Covid-19 pandemic, are significant. Local Government Planning Authorities have been challenged with the task of deciding whether air capacity growth has now passed the threshold at which it presents more risks than rewards. The Planning Inspector now faces the same task.

ECONOMIC APPRAISAL

When should economic appraisal be used?

The Green Book provides a succinct description of economic appraisal, summarising the purpose as being to "provide an objective base for decision making". Green Book guided economic appraisal is mandatory for the use of significant "public resources". Typically, a planning application by a private sector business would not fall within this group. However, there are compelling reasons why this decision, to approve or reject Bristol Airport's application, does fall within the area where economic appraisal is not just desirable but is key to making a public decision.

In addition, while most public guidance (the Green Book, supplementary guidance, and data books) is focused on public spending decisions the actual techniques and methods that are recommended are typically best practice for assessment within their respective topic area, and the guidance on how to treat the results is often highly applicable, particularly for a large project such as this.

Why are economic appraisal techniques suitable for this decision?

The application is for a change in capacity of core national transport infrastructure and as such, the national level effects must be considered. Beyond the Green Book principles, specific guidance exists for the appraisals of aviation transport schemes, including the assessment of airport expansions. TAG Unit A5-2 Aviation Appraisal[6] contains detailed

[6] Department for Transport (2018) TAG Unit A5-2 Aviation Appraisal

guidance on the impacts that should be included in such an assessment and in turn refers readers to other sections of the TAG guidance. TAG Unit A5-2 explicitly recognises that aviation schemes are “most commonly paid for by the private sector”, the guidance is set out as “best practice for the appraisal of aviation interventions” and its use is not limited to the Department for Transport. TAG A5-2 provides a framework for the impact appraisal of airport planning applications, from which assessments should build.

The nature of the aviation system means that there are network effects that result in passengers switching between airport options – there are of course direct impacts on other businesses but, importantly, also on a number of public investments. It is acknowledged by BAL that their plan would directly affect passenger numbers at Cardiff Airport, among others. This decision has direct bearing on the payback and success of those public sector engagements.

Beyond those financial impacts, there are environmental impacts, particularly emissions of CO2 and related greenhouse gases, that are of national concern. The emissions pathway between today and 2050 will almost certainly be altered by any approval, requiring additional decarbonisation work elsewhere. This is regardless of whether these aviation emissions are considered at the local, industry, or national level.

It is recognised that, given the UK’s commitments as well as the global imperative to reduce global warming and minimise the negative impacts of changing climate and the limitations of technological advancement, there is a capped, and explicitly or implicitly ‘rationed’ number of flights to 2050 and beyond. The UKCCC provide no viable emissions pathway to net zero by 2050 which is compatible with passenger growth at the level implied by the current expansion plans of UK airports.

Due to the longevity of infrastructure, decisions being made today are likely to lock-in the distribution of flights in the UK over coming decades. This has significant impacts in terms of intra-regional distribution, potential business productivity, and the possibility of ‘stranded assets’ that require government intervention to support or ‘bail out’. This also goes some way to explaining why, at the time of writing, many airports around the country are pursuing expansion with urgency.

ECONOMIC IMPACTS

The primary, most up-to-date, economic and socio-economic case for the expansion of Bristol put forward to decision makers is described in Chapter 8: Socio-economics of the Environmental Statement Addendum[7], as well as the accompanying Appendix 11.1 Economic Impact Report[8]. These documents present three major components of analysis.

- Economic Footprint: an analysis of employment and 'value added', looking at Bristol Airport's direct employment, the supply chain effect, and 'induced' spending (spending that occurs as a result of higher wages).
- Wider Economic Benefits: this includes an analysis of employment and GVA as a result of potential productivity gains that occur as a consequence of business travel or freight movement, and an analysis of the relationship between passenger numbers and inbound tourists.
- Socioeconomic Cost Benefit Analysis: An assessment that presents the output of travel models, with the purpose of allowing for consideration of broader economic welfare changes, reflecting whether expansion of Bristol Airport will cause key actors to be better or worse off.

Appraisal geography

Throughout the analysis, the report uses three key study areas, corresponding to the immediate area of the airport in North Somerset, the West of England, and a wider area of the South West & South Wales. As Bristol Airport represents nationally significant transport infrastructure, this analysis should have incorporated a national-level study area. Department for Transport's Transport Analysis Guidance (TAG) states:

> *When estimating the complete extent of additionality, scheme promoters should consider a large enough geographical area to capture fully the behavioural responses of households and firms at the national level*[9]

While the decision not to conduct a national impact assessment is not justified by The Appellant in this Addendum, the original assessment stated that the majority (94%) of passengers departing from the airport live/originate from the South West Region and South Wales. While this may appropriately reflect the boundary within which the majority of airport users reside, it is not necessarily reflective of the extent of impacts. A significant number of residents of the South West and South Wales utilise airports outside of the region, particularly in the London Airport System. Indeed, The Appellant has a stated aim of "clawing back leakage of passengers from London airports" (ES Addendum p.19). As such the chosen maximum appraisal geography does not fully capture the behavioural responses of households and firms at the national level.

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7 Bristol Airport Limited (2020) Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum. Environmental Statement Addendum – Chapter 8: Socio-economics
8 York Aviation (2020). Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum: Economic Impact Assessment Addendum
9 Department for Transport. (2018). Transport Analysis Guidance (TAG) Unit A2.1 'Wider Economic Impacts Appraisal.

Furthermore, the carbon emissions of the national air travel system, their regional distribution and maximum levels, can only be co-ordinated through assessment at the national level.

The Economic Report approaches Bristol Airport's expansion as though it were a regional intervention – targeted at the West or England, and the wider South West. When assessed, these types of intervention should be appraised for:

- **Leakage** – effects outside of the target area. By choosing the study area based on capturing the majority of staff origins, the assessment is able to claim employment leakage levels at or below 1%.
- **Displacement and diversion** – where increases are offset by reductions elsewhere. The previous assessment had indicated that displacement will be a minor issue. However, the updated Addendum includes a new, more developed model of passenger allocation which implies greater displacement effects. These are useful, but again are inconsistently applied.
- **Substitution** – consumers or firms substituting one activity for another. Substitution isn't likely to be a relevant effect for this scheme.
- **Deadweight** – what would have happened regardless. By conducting a baseline assessment and projecting forward, there is a deadweight level to which the scheme can be compared.

Appraisal scenarios and uncertainty

All transport infrastructure schemes are subject to uncertainty about future trends and are limited by current knowledge in socio-economic and environmental systems. Models and forecasts will inevitably be biased by the assumptions made when selecting model inputs. An unusually uncertain environment faces the aviation sector at the present moment. Both the unprecedented global pandemic and the climate crisis amplify both the risk that past trends are not adequate proxies for future trends, and that future policy decisions will have material impacts on the functioning of the aviation industry.

Across research and practice one of the key tools established to support decision making in contexts of high uncertainty is sensitivity analysis. *The Green Book: Central Government Guidance on Appraisal and Evaluation* advises:

> At a minimum sensitivity analysis and the identification of switching values should be carried out on the preferred option from the shortlist appraisal. These results must form part of the presentation of results. If the costs and benefits of the preferred option are highly sensitive to certain values or input variables, sensitivity analysis will probably be required for other options in the shortlist [in this case we are only presented with two options, development or no development]. [10]

In addition, TAG Unit M4 states:

> The modeller must establish that the core scenario is robust to the key model uncertainties (model sensitivity analysis) that have been listed in the uncertainty log.

[10] HM Treasury (2020) The Green Book: Central Government Guidance on Appraisal and Evaluation states.

> This will demonstrate that the core scenario model results are significant given the model sensitivity tests, and the approach appropriate. (p.6)

Further:

> There are two sources of forecast error: uncertainty in the inputs (such as size of new housing development) and error in the model parameters and specification (how these inputs propagate through the model). The practitioner should summarise all known assumptions and uncertainties in the modelling and forecasting approach in an uncertainty log. The uncertainty log will also be the basis for developing a set of alternative scenarios. The alternative scenario is used to understand the possible impact of an error in assumptions on the model forecasts. (p.2)

The Appellant has conducted sensitivity testing based on one model output parameter, the rate of passenger demand growth, determined through a suite of varying inputs. Faster and slower rates of growth are tested. However, from the perspective of public risk and protecting the public interest, this parameter is of lesser interest. Weaker or stronger rates of passenger growth will, broadly speaking, amplify both the scheme costs and benefits equally. What is of concern to the public is the relative proportions of the costs compared to the benefits and to assess risk and uncertainty in this regard, different parameters must be more explicitly tested.

Above we identify four parameters upon which the relative merits of airport expansion depends, job creation potential, carbon costs, business productivity, and outbound tourism costs. All of these parameters are subject to either high policy uncertainty or forecast uncertainty. All of these parameters are also highly influential in the overall picture of the scheme's costs and benefits. All should therefore be subject to sensitivity or scenario analysis, as we set out below.

Displacement

A critical issue to understand when assessing economic impacts is that of displacement. Displacement is a particularly significant issue where transport infrastructure is concerned. An economic impact assessment that makes claims to scheme benefits must demonstrate how and why they believe that these benefits will be truly 'additional' as opposed to just involving the relocation of a good or service from one place to another. A scheme's 'true' impact is its net impact after displacement of both costs and benefits is considered - this extends to the non-economic factors as well.

A worst-case approach to displacement in each topic would mean assuming no displacement of negative impacts and total displacement of positive impacts. This approach is likely too pessimistic so determining an appropriate level of displacement is essential in order to claim benefits. In fact, DfT guidance on assessing non-transformative transportation schemes suggests that a scheme promoter should present credible evidence in order to claim anything other than 100% displacement at the appropriate geographical assessment area.

Transport Analysis Guidance (TAG), which states:[11]

> With respect to supply-side effects of non-transport factors of production, the default assumption is 100% displacement; this applies for all types of economic modelling. The onus is on the scheme promoter to present credible evidence that the particular transport investment will affect a non-transport factor of production. If the scheme promoter is unable to present credible evidence of additionality, the particular economic impacts will be considered displaced from elsewhere. (TAG: p.4)

Product Displacement

When referring to Product Displacement The Appellant is presumably referring to 'Product Market Displacement'. Product Market Displacement is where the proposed scheme results in taking market share away from other firms or organisations within the study area. The language used indicates a somewhat backwards approach, with the expansion of the airport seeming to be considered the base case, and an assessment made of the displacement that would occur were the airport to be constrained to 10 million. Despite this, the numbers presented seem to be appropriate, based on new modelling, and it remains in line with the substantial displacement levels suggested by NEF Consulting in their previous response to this application, though less drastic.[12]

The ES states:

> 8.3.3 ...72% of the growth in passenger demand that would have occurred if 12 mppa was consented at Bristol Airport is estimated to be displaced to airports outside the region (such as Heathrow), or chooses [sic] not to fly. 28% is estimated to be displaced to airports in the region.

(ES Addendum: p.117)

This can be more accurately stated as

> If 12 mppa is consented, then 28% of the growth will be displaced from regional airports, and up to 72% will be displaced from other airports.

The ambiguity is unfortunate as it once again leaves open that, at the national level, up to 100% of the growth is displaced. However, the displacement modelling, reported in the Economic Impact Assessment, does indicate the total level of displacement from other airports as 62%, giving us a split of passengers (Table 1).

> A significant majority of passengers that cannot use Bristol Airport if it were constrained to 10 mppa (around 62%) would travel via another airport,

(Economic Impact Assessment Addendum: p34)

[11] Department for Transport (2018) Transport Analysis Guidance (TAG) Unit A2.1 'Wider Economic Impacts Appraisal

[12] NEF Consulting (2019) Evaluation of the case for expansion of Bristol Airport

Table 1: Displaced and additional passengers [13]

	Proportion	Passengers (Annual)
Displaced from regional airports	28%	560,000
Displaced from other airports	34%	680,000
Additional 'new' passengers	38%	760,000

This allows for us to consider the possibility of using the 62% displacement rate in a national assessment. In addition, it allows us to estimate the disaggregated effects on different airports.

Table 2: Displaced passengers in 2030[14]

Pax, nearest 1,000	Passenger change (Annual)	Proportion of displacement
Bristol	2,000,000	n/a
Cardiff Airport	-291,000	23.5%
Newquay Airport	-42,000	3.4%
Exeter Airport	-178,000	14.3%
Bournemouth Airport	-27,000	2.2%
Heathrow Airport	-154,000	12.4%
Gatwick Airport	-108,000	8.7%
Birmingham Airport	-178,000	14.4%
Luton Airport	-74,000	5.9%
Stansted Airport	-37,000	3.0%
Undefined non-region airports[15]	-151,000	13.9%

These figures allow us to conduct a far more granular assessment of displacement, rather than applying a simple factor to the outputs - with this data we can understand the distributional impacts of the expansion as well. Distributional impact analysis is described as a "mandatory" component of transport appraisal in TAG Unit A4.2 (p.4).

There are limits to this approach, particularly in comparing implied 'per mppa' figures for total airports against modelled marginal changes. In order to reduce negative bias, the job efficiency improvements described in the later section on job creation have been applied to other airports for which factors were available; the Bristol Airport jobs per mppa employment figure was used where another factor was not available.

We considered it disproportionate to attempt to construct localised multipliers for each airport, so have used the simplified assumption that such multipliers will be equivalent to those presented for Bristol Airport.

[13] BAL statements and NEF calculations
[14] Data from BAL (2020) ES Addendum Technical Appendix 10B, Table 10B.1
[15] The reporting of the displacement data leaves approximately 8% of passengers unaccounted for, mostly from non-regional airports.

Table 3: Disaggregated displacement, BAL and NEF efficiency improvements

Airport	Economic Footprint GVA[16]	Total GVA	Direct Jobs[17]	Total Jobs	FTEs
Bristol	150	430	820	5560	4470
Cardiff Airport[18]	-16	-47	-249	-1686	-1356
Newquay Airport[19]	-4	-13	-37	-252	-202
Exeter Airport	-26	-75	-73	-492	-395
Bournemouth Airport	-2	-6	-11	-74	-59
Heathrow Airport[20]	-12	-33	-129	-874	-702
Gatwick Airport[21]	-13	-38	-54	-364	-293
Birmingham Airport[22]	-24	-69	-102	-692	-557
Luton Airport[23]	-3	-8	-64	-436	-351
Stansted Airport	-3	-8	-16	-110	-88
Undefined non-region airports	-11	-33	-62	-419	-337
Grand Total	**35**	**101**	**24**	**162**	**130**

[16] GVA per mppa from Acuity Analysis. For Heathrow, Stansted, Bournemouth and undefined airports, a figure £75 million per mppa was used, matching Bristol (and therefore equivalent to the original displacement assumption).

[17] Direct job estimates are from various sources. Where an estimate of direct jobs per mppa figure could not be sourced, the Bristol Airport factor in 2030 (408) was used.

[18] Public Policy Institute for Wales (2016). Maximising the Economic Benefits of the Welsh Government's Investment in Cardiff and St. Athan Airports.

[19] Acuity Analysis (2020). Economic and social importance of the UK's regional airports.

[20] Volterra (2020). Leeds Bradford Airport - Economic Peer Review

[21] Oxford Economics (2016). The Economic Impact of Gatwick Airport (implied GVA per mppa)

[22] Volterra (2020). Leeds Bradford Airport - Economic Peer Review

[23] ibid

Economic Footprint and Wider Impacts

Using the disaggregated displacement estimates it is possible to reassess Table 3.6 of the Economic Impact Assessment. The results for North Somerset and West of England are unchanged.

Table 4: Revised GVA tables at the South West and South Wales and UK geographies, applying disaggregated estimates of job displacement

		South West & South Wales			UK		
		GVA (£ million)	**Jobs**	**FTEs**	**GVA (£ million)**	**Jobs**	**FTEs**
York Aviation / Bristol Airport	Economic Footprint	110	1530	1260	110	1530	1260
	Total	310	4000	3210	310	4000	3210
Disaggregated Displacement (Base implied jobs, no efficiency gains)	Economic Footprint	101	1059	851	35	-65	-52
	Total	290	2777	2232	101	-439	-353
	Total adjustment from BAL estimate	-20	-1233	-978	-209	-4439	-3563
Disaggregated Displacement (BAL job efficiency change)	Economic Footprint	101	498	401	35	24	19
	Total	290	3,056	2,457	101	162	130
	Total adjustment from BAL estimate	-20	-944	-753	-209	-3838	-3080
Disaggregated Displacement (NEF job efficiency change)	Economic Footprint	101	451	362	35	132	106
	Total	290	3,380	2,717	101	898	722
	Total adjustment from BAL estimate	-20	-620	-493	-209	-3102	-2488

Looking at the airport-by-airport impacts results in a broadly similar estimate of GDP at the South West & South Wales level. However, we see that the claimed jobs and FTEs, both direct and indirect/induced, are substantially eroded by flight losses at other airports in that region - this is particularly driven by Cardiff Airport, which has a much higher number of jobs per mppa than other airports in the region. At the UK level we see substantial differences, resulting in a GVA improvement that is ⅓ of the original estimate, and negative outcomes for employment.

Business productivity

Table 8.8 of the ES Addendum suggests that 45% of all of the scheme benefits at the South West England and South Wales level depend on the business productivity uplift delivered by

the expansion. Page 6 of the Economic Impact Addendum recognises that business use of internet communication has increased "massively" during the pandemic, but then makes the unsubstantiated claim that business behaviour will return to the pre-pandemic normal before the time period of the assessment conducted. The Appellant has not, and likely cannot, substantiate this claim given the unprecedented nature of the crisis and the novel nature of the technologies which have gained popularity. Conversely, many sources suggest remote working is here to stay.[24] [25] [26] Given the exceptional reliance of the scheme benefits on the business productivity parameter this component should be subjected to sensitivity testing.

Direct jobs

Table 8.8 of the ES Addendum suggests that 35% of the economic benefits of the proposed scheme at the South West England and South Wales level rest on the economic footprint of the scheme, the footprint, direct, indirect and induced, is itself primarily a reflection of the job creation of the proposed scheme. BAL states that they expect their development to create 600 (gross) new direct jobs in 2030 in the West of England, 820 (gross) jobs in the South West & South Wales (Table 5).

BAL's assessment of the impact of displacement is also shown. BAL reduce the net jobs at the South West and South Wales level by 28%. This accounts for jobs lost at other airports in the region. It is these numbers upon which the full analysis of induced and indirect impacts rest. There is an argument however, that this overstates the scheme's job creation. The Appellant estimates that 38% of new Bristol Airport passengers would not fly in the absence of the scheme, this means their money would likely be spent in other areas of the regional economy, hence creating jobs elsewhere. The correct displacement rate could be between 28% and 66% when modelling the South West and South Wales geography.

Table 5: Job numbers projected in the original BAL application documents

	2018 (West of England)	2018 (South West & South Wales)	2030 (West of England)	2030 (South West & South Wales)
Without development	2,900	3,900	3,020	4,080
With development			3,620	4,900
Change			600	820
Change, 28% displacement BAL estimate			600	590

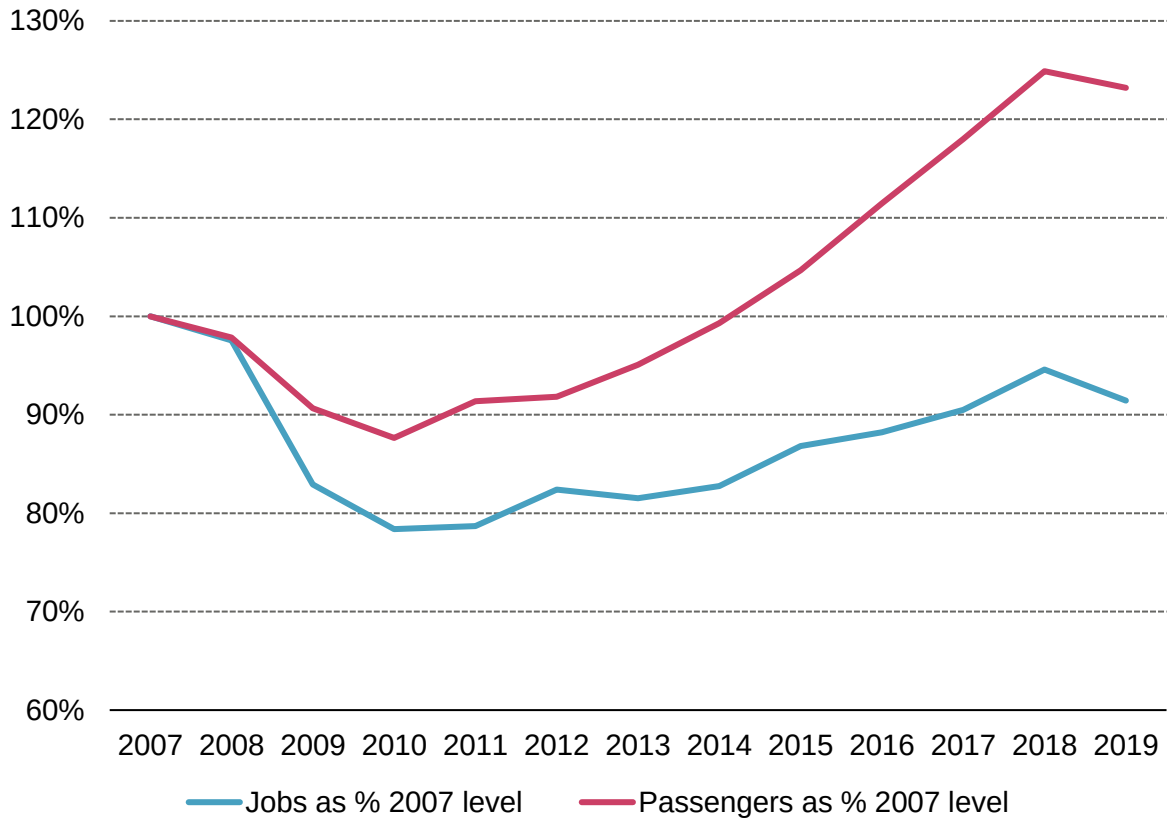
Employment in the aviation sector is in flux. Over the past decade the employment intensity of the sector (i.e. the number of jobs per passenger) has been falling consistently over time (Figure 2) as the sector utilises automation and other efficiency improving measures to reduce employment costs. Indeed, the job intensity of the sector fell by around 2.6% per

[24] The Wall Street Journal (2020), Remote Work is Here to Stay. Bosses Better Adjust. Available at: https://www.wsj.com/articles/remote-work-is-here-to-stay-bosses-better-adjust-11596395367 [Accessed on 04/01/2021]
[25] Institute of Directors (2020) Home-working is here to stay, new IoD figures suggest. Available at: https://www.iod.com/news-campaigns/news/articles/Home-working-here-to-stay-new-IoD-figures-suggest [Accessed on 04/01/2021]
[26] McKinsey & Company (2020) What's next for remote work. Available at: https://www.mckinsey.com/featured-insights/future-of-work/whats-next-for-remote-work-an-analysis-of-2000-tasks-800-jobs-and-nine-countries [Accessed on 04/01/2021]

year between 2001 and 2018.[27] In addition, as has been widely reported in the press, airlines and airports have been making significant redundancies and pay cuts through the Covid-19 crisis.

As an airport increases in size, its employment intensity will generally fall as it is able to make efficiency saving on a per-passenger basis. In 2018 Bristol Airport provided 453 jobs per million passengers. The aviation sector at-large provided around 454 jobs per million passengers in 2018 (although this figure is not directly comparable due to variations in how airports account for direct employment).

Figure 2: National aviation sector jobs and passengers as a percentage of 2007 levels.



Source: Civil Aviation Authority and the ONS Business Register and Employment Survey

BAL forecast no change in the job intensity of the airport between the 'with' and 'without' development scenarios. Expansion would very likely facilitate greater returns to scale – we would expect to see a difference between these scenarios.

Further, BAL forecast only a very limited decline in job intensity resulting from automation and efficiency enhancement over time. In the 'without development' case, job intensity falls just 10% between 2018 and 2030. This represents a very optimistic view of future developments in the aviation sector, which as cited above, has seen job intensity declining at 2.6% per year in recent years. This trend has likely increased significantly in the past 12

[27] NEF analysis based on BRES employment data and CAA airport data. For more details see: Chapman et al. (2020) Crisis support to aviation and the right to retrain. New Economics Foundation. Available at: https://neweconomics.org/2020/06/crisis-support-to-aviation-and-the-right-to-retrain [accessed 04/01/2021]

months as airlines and air support services have consolidated operations through the pandemic. NEF modelling utilising data on recent job trends estimates the likely job intensity at BAL would be 16% lower in 2030 than forecast by The Appellant (Table 6).

As job intensity declines resulting from automation and sector efficiency enhancements apply in both the 'with' and 'without' development cases this might be considered not to materially impact the change in the economic footprint. However, what this does imply is that The Appellant is significantly overstating the future economic footprint and job creation potential of the airport as a whole. The Airport's expansion would in fact create very few truly 'new' jobs as the majority of the jobs created would simply offset jobs likely to be lost to automation and efficiency gains.

Table 6: Different estimates of job intensity based on job creation at the South West England and South Wales geography with and without development

		2018	2030	Change
Implied by BAL application	**Without development**	453	408	-10%
	With development	453	408	-10%
	Change	N/A	0%	
NEF modelling based on recent sector trends	**With development**	453	341	-25%
Change against BAL application 'With Development' scenario		N/A	-16%	

Given the impact of the pandemic on aviation sector job production, and what appears to be a highly optimistic forecast for job creation from The Appellant, sensitivity scenarios should be developed and tested to support decision makers in understanding the risks and uncertainties inherent in the business case.

Tourism

Table 8.8 of the ES Addendum suggests that 19% of the economic benefits of the proposed scheme at the South West England and South Wales level rest on the tourism impact of the scheme. This is described as the totality of "the number of visitors to the relevant study areas that fly in via Bristol Airport", multiplied by average spend per trip. This is then uplifted through multiplier effects specified for the region's tourism economy and, at the final stage, a displacement factor is applied. Only inbound tourism is considered.

The decision only to consider inbound (i.e. international passenger) tourism is strange. As of 2015, only 12.4% of passenger journeys at Bristol Airport related to inbound international tourism.[28] The primary function of Bristol Airport is to transport outbound UK residents on foreign tourism, in 2015 this covered 60% of all journeys through Bristol Airport. To remove the primary function of the airport in this way leaves open a very significant risk that the economic cost-benefit profile of the proposed scheme is incomplete and not fit for purpose.

On a passenger basis, outbound tourism is a welfare improvement for the individual passengers - otherwise they would not be making the trip. However, when making an argument about regional GDP / GVA, it should be recognised that outbound tourism

[28] CAA (2016) CAA Passenger Survey Report 2015. Civil Aviation Authority

represents a flow of spending out of the study area, with negative knock-on effects on GDP. The Appellant makes clear that they believe such an impact is likely to be immaterial; this is despite that fact that it is the same process in reverse upon which they rely for their estimate of the benefits of inbound tourism. We disagree with The Appellant's assessment.

The main points made by The Appellant are that:

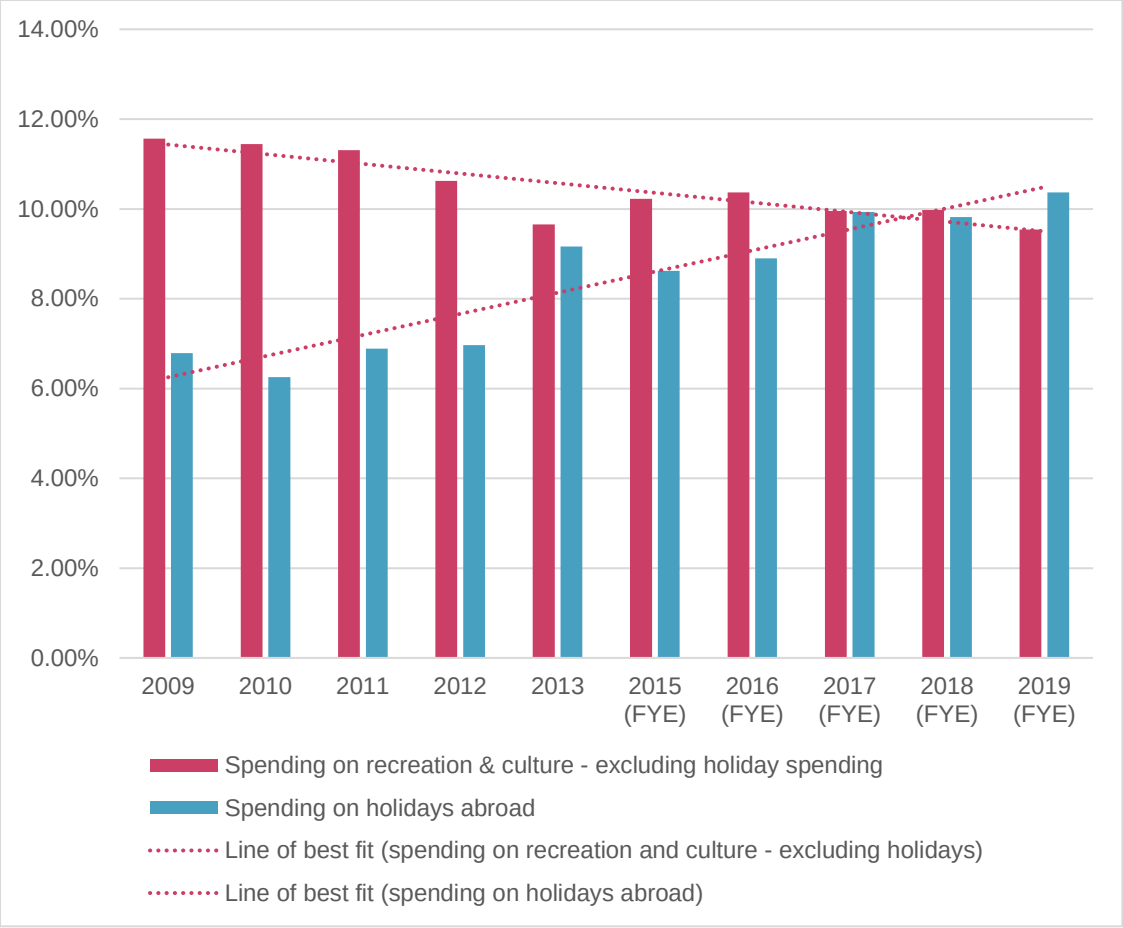
1. Tourism demand is asymmetrical; in the event of a decrease in price to access a region (such as through airport expansion), the equilibrium number of inbound tourists will increase, as the region becomes comparatively more attractive. Outbound tourists, however, are insensitive to price, and will travel from anywhere available resulting in a similar number of outbound journeys.
2. Where outbound tourists are sensitive to travel cost, they compensate through changing their travel habits. In the event of an airport expansion, we might expect more frequent, shorter trips from outbound tourists, but roughly the same level of spending.
3. Outbound tourists engage in spending within the UK economy prior to making their trip; when potential outbound tourists don't spend abroad that means they will not be spending within the region on holiday preparation.
4. Outbound tourists would, if unable to be tourists, still spend the money on imports from outside the region.
5. There are wider non-economic and economic benefits to access to air travel.

These points are responded to below.

1. The Appellant's tourism modelling shows that some outbound tourists are sensitive to price, with the 38% who would not otherwise travel if Bristol Airport were not to expand. This implies that we can look at a tourism deficit for those 38%.
2. While outbound tourists have changed in the length and types of trip they are taking within their 'travel budget', it should also be recognised that people's overall spending on travel has changed as well, and will continue to evolve. This has to be considered in the context of the potential substitutes - not just alternate airport choices, but different choices when it comes to spending on recreation, or even across the entire household budget.

   Household spending on holidays abroad, as a proportion of total household expenditure, has risen rapidly over the past decade. In 2009 households spent just over 6% of their income on holidays abroad. By 2019 it was just over 10%. This proportionate growth is even larger if fixed costs such as rent and bills are controlled for, and only the 'disposable' component of household expenditure is considered. Some of the most significant declines in proportionate household expenditures have been seen in non-holiday related recreation and culture, which fell from around 11.5% of expenditure to 9.5% over the 2009-2019 period. Other areas which have seen declines are sections of retail, such as clothing and footwear (down from 5.5% to 4.8% over the period). Many factors have undoubtedly influenced these shifts and further research is needed to better understand cause and effect.

Figure 3: Household expenditure on recreation and culture (excluding holidays) and holidays abroad, as a proportion of all household expenditure.



Source: ONS Family Spending Workbook 1.

3. If passengers were not travelling overseas they would spend this money elsewhere in the regional economy, likely on some other form of recreational or leisure-related purchase. It may be most appropriate to assume that 100% of the UK-side spending linked to outbound tourism would take place irrespective of the scheme. This is because the proposed scheme does not 'create' new or 'additional' money in the economy, it simply takes existing money, in the form of household expenditure, and changes the location at which it gets spent.
4. While it is true that other purchases involve flows of money overseas, scale and proportion are important. We do not know precisely what a household would spend their money on if they were not spending it overseas. But other recreational spending will typically involve a far smaller proportion going overseas. For example, a significant proportion of the money spent on a trip to the cinema or theatre, or a local restaurant, will stay within the local economy. Some imported manufactured goods will involve a much higher proportion moving overseas, for example some electrical, computing, and communications equipment, others will involve a much lower proportion, for example a UK-manufactured car or item of furniture. It is also important to note that any total quantification of the flow of money overseas does not paint a full picture of the potential negative impacts of outbound travel. Specifically, it

does not include the lost economic 'multiplier' effects which also move overseas. This represents the loss of 'knock-on' spending which would follow the initial spending, for example by the employees working in the industry from which the initial product or service was bought.

5. We'd agree with The Appellant that there are positive benefits that people and regions get from access to air travel. However, The Appellant hasn't described a situation where without expansion some required threshold isn't met and the South West loses the airport forever. Indeed, 72% of the additional trips will still happen. As for the remaining 28%, only 50% of the UK population take any flights at all each year,[29] and further, an estimated 70% of flights are taken by only 15% of the population.[30] It is likely that the 28% of flights not taken are additional trips by the same people, in line with the evidence presented around shorter trip length.

In order to emphasise the importance of consideration of overseas money flows resulting from newly incentivised international tourism we have calculated indicative estimates. These estimates are based on the top 20 destinations of passengers departing Bristol Airport in 2018, modelling the component of their trip spending which takes place overseas. In Table 7 we first present the total spending of all new outbound international passengers, we then reduce this number by 62% to remove those passengers who BAL suggest would otherwise have flown from another airport. Our figures suggest this flow is a material consideration, and could be of a magnitude sufficient to fully cancel out any benefits from inbound tourism (estimated at £60m for the South West and South Wales region).

These figures might be diminished somewhat by considering flows of money overseas which could also materialise in the counterfactual 'without development' scenario, via spending on other products. However, these figures are also conservative in that they have not had any multipliers applied to account for knock-on, or 'second-order', spending which also shifts overseas.

Table 7: NEF estimates of overseas spending resulting from new international tourist trips facilitated by Bristol Airport expansion

All new passengers	**2030**	**2050**	**Cumulative 2020-2080**
South West and South Wales	£193,781,173	£144,713,157	£6,833,786,735
UK Residents	£206,150,184	£153,950,168	£7,269,985,888
38% of new passengers	**2030**	**2050**	**Cumulative 2020-2080**
South West and South Wales	£73,636,846	£54,991,000	£2,596,838,959
UK Residents	£78,337,070	£58,501,064	£2,762,594,637

[29] See: https://www.theguardian.com/environment/2019/sep/25/1-of-english-residents-take-one-fifth-of-overseas-flights-survey-shows [accessed 04/01/2021]

[30] See: https://fullfact.org/economy/do-15-people-take-70-flights/ [accessed 04/01/2021]

Socio-economic Cost Benefit Analysis

The Appellant has presented an assessment of the socio-economic cost-benefit or 'welfare' impact of the scheme, distinct from the GVA assessment. While this is good to do (and arguably required, as per the obligations required of those seeking to alter the usage of UK airspace) this particular assessment is unfortunately misleading in its conclusions, as it fails to be sufficiently holistic or to clearly articulate the relationships between the beneficiaries of the benefits. Further, several aspects of the methodology are either misapplied or insufficiently defined.

The assessment period for the analysis is "over a 60 year period". However, the actual period covered is unstated, leaving a reader to guess as to whether this begins in 2020 (the year the report was written), 2022 (when the airport reaches its constraints under the fast growth case), 2024 (when the airport reaches its constraints under the core growth case), 2030 (when the airport reaches 12 mppa under expansion and core growth). In order to not overly bias the adaptation of the results we have assumed a start of 2020, as that minimises negatives added to the assessment.

The description of method states the use of a constant 3.5% discount rate; the correct approach would be to use a stepped down discount rate declining to 3.0% after 30 years.[31] This has the effect of understating both costs and benefits, however the effect is greater where the real value increases in the second 30 years of the assessment period. No correction has been done to the data The Appellant has presented - however, an understatement of 1 to 1.5% might be expected if the flow of costs or benefits is approximately equal across the period.

The Appellant draws on some of the principles of assessment as well as some of the key available guidance. However, they also state:

> [this assessment is] not a WebTAG appraisal and is not intended to be one.

While the principles of proportionate assessment are recognised, The Appellant has missed an opportunity to be transparent and comparable, as well as to 'speak in the language' of project assessors. The dismissal of WebTAG appraisal techniques results in overstated benefits as well as a significant number of missing, and or incorrectly applied, costs.

The Appellant describes four groups: passengers, airlines, the airport company, and the UK government. In addition, there is also the cost source of carbon emissions. This selection of stakeholders is confusing, it is not clear what is meant by airlines and the airport company. These shorthands can hide that the true beneficiaries are owners and/or shareholders. Arguably the most important stakeholder, the general public (non-passengers) is missing from the assessment.

Each of The Appellant's benefit/cost categories is considered below:

[31] HM Treasury (2008) Intergenerational wealth transfers and social discounting: Supplementary Green Book Guidance.

- Passengers: the greatest difficulty in interpretation and assessment is understanding who The Appellant means by passengers, as there are three sub-groups of passengers that are of interest: Existing passengers at Bristol, passengers switching from other airports, and new passengers who would not otherwise have travelled.
    - Surface access time and costs - the cost inputs for these appear to be calculated in accordance with good practice; however, there is a level of uncertainty in knowing exactly who The Appellant is considering for these. This should only be the 62% of the 2 million that are switching - the 10 million existing passengers don't change their travel, the 38% begin to incur travel costs as a result of their decision to start using the airport.
    - Flight time savings - again, this relates differently to switching and non-switching passengers.
    - Air fare savings - The savings as described - the difference in average fares at different airports for different destinations - accrue to the switching passengers; however, The Appellant also mentions the impact of relieving constraints on flights. This effect could impact the existing passengers. Further, and more importantly, this is a reciprocal benefit - it is a cost to airlines generally as well as the airports that have been switched away from. While stating potential air fare savings to passengers is useful in terms of specifying what transfers the development may enable it should not be presented as a pure benefit within the welfare analysis unless supported by demand elasticities that can demonstrate that the saving is not purely a transfer; instead the associated cost should be presented as well.
- Airport company - The Appellant suggests that as the airport grows it is able to realise economies of scale and therefore improve its profitability. Provided that this is the case, this component might represent a welfare improvement as The Appellant is able to deliver more 'supply' at a lower per unit cost. That they are able to profit from this implies that the airport expects to operate without much regulation of aero-charges for the duration of this assessment. This is at odds with the assessment of employment enabled by the scheme, which has the same job efficiency at both sizes.
- Airlines - The Appellant specifically calls out airlines as a beneficiary, noting that providing flights at Bristol Airport must be their best option, or the airlines would not do it. That view has some issues. Firstly, it assumes that the expansion has occurred. Within that scenario, providing flights is indeed the best option. However, Fare changes are partially symmetric – the saving made by a passenger is offset by a surplus lost to an airline when conducting analysis on a system scale. When comparing the expansion to the Do Nothing we see that for every £1 of 'air fare savings' that benefit passengers, there is a reciprocal £1 reduction in airline revenue. By only presenting one half of this the benefits 'to society' are overstated.
- Government - The APD gained from the new passengers is a cost to those passengers. Again, this is a reciprocal benefit / cost.
- Carbon - given the comments made by The Appellant in their preamble to this section it would have been beneficial to apply WebTAG principles. As they say, a proportion of

carbon costs are implicitly 'priced in' in air fares, and should feed into the demand response functions. More detail on this subject is provided later in this assessment; however, in summary there are a fraction of flights that are, due to freely given allocations, not 'carbon adjusted' and there is also a requirement that analysts illustrate the potential impact of higher carbon prices while WebTAG 5-2 suggests to include non-CO2 emissions as quantitative sensitivity test.

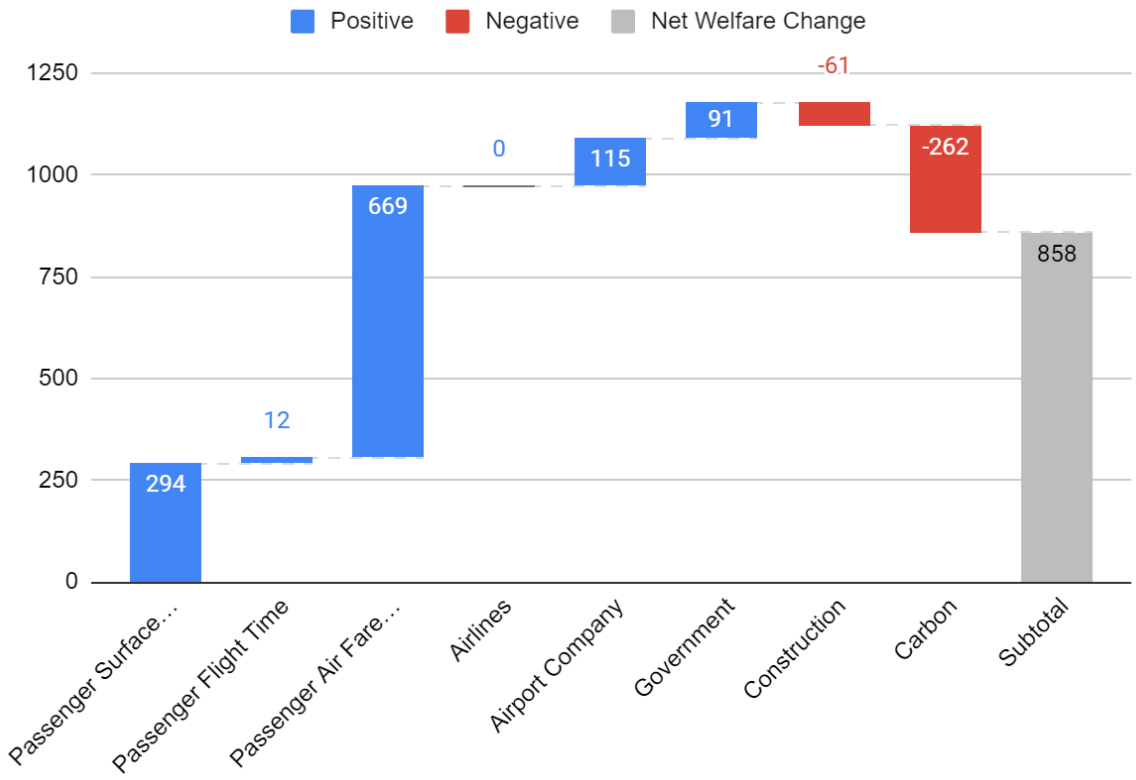
In addition to these areas, it is notable that there are areas where no attempt was made to include monetisation. These impacts including noise and air quality; while the Environmental Statement concluded primarily Negligible or Minor Adverse impacts, the monetisation of those impacts, across 60 years, could influence the BCR of a sensitive assessment. Further, while this application is for the expansion of the airport, it is almost certain that airspace changes will occur as a result. Any proposal that may result in airspace changes requires noise to be monetised using the TAG Noise workbook.

Beginning with The Appellant's estimates (Table 8and Figure 4), we can apply some transformations in order to determine a more realistic social welfare and create a scenario from which further refinement can be done.

Table 8: The Appellant's welfare benefit-cost estimates

Passenger Surface Access	Passenger Flight Time	Passenger Air Fare (net of tax)	Airlines	Airport Company	Government	Construction	Carbon
294	12	669	0	115	91	-61	-262

Figure 4: The Appellant's welfare benefit-cost estimates

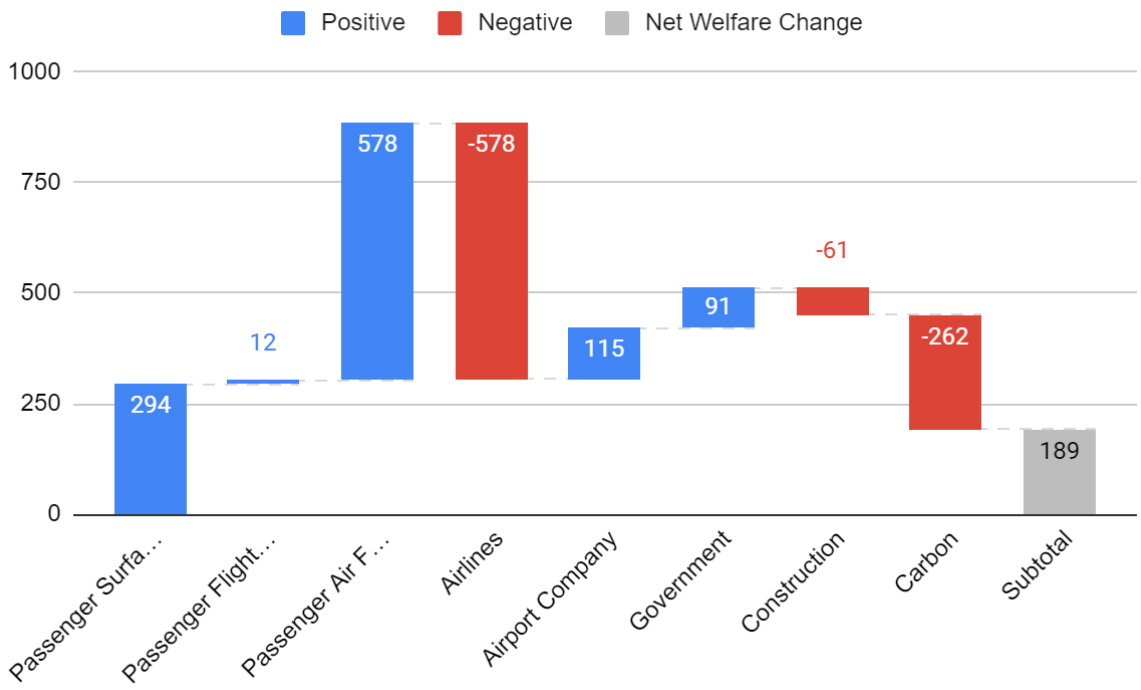


The first transformation is to include the reciprocals for air fares and for taxation. At this stage it should be noted that information on the market elasticity as well as local and national capacity constraints would allow for the relationship to differ from 1:1. This (Figure 5 and Table 9) is therefore a simplified adjustment.

Table 9: The Appellant's welfare benefit-cost estimates with reciprocal airline losses added

Passenger Surface Access	Passenger Flight Time	Passenger Air Fare (net of tax)	Airlines	Airport Company	Government	Construction	Carbon
294	12	578	-578	115	91	-61	-262

Figure 5: The Appellant's welfare benefit-cost estimates with reciprocal airline losses added

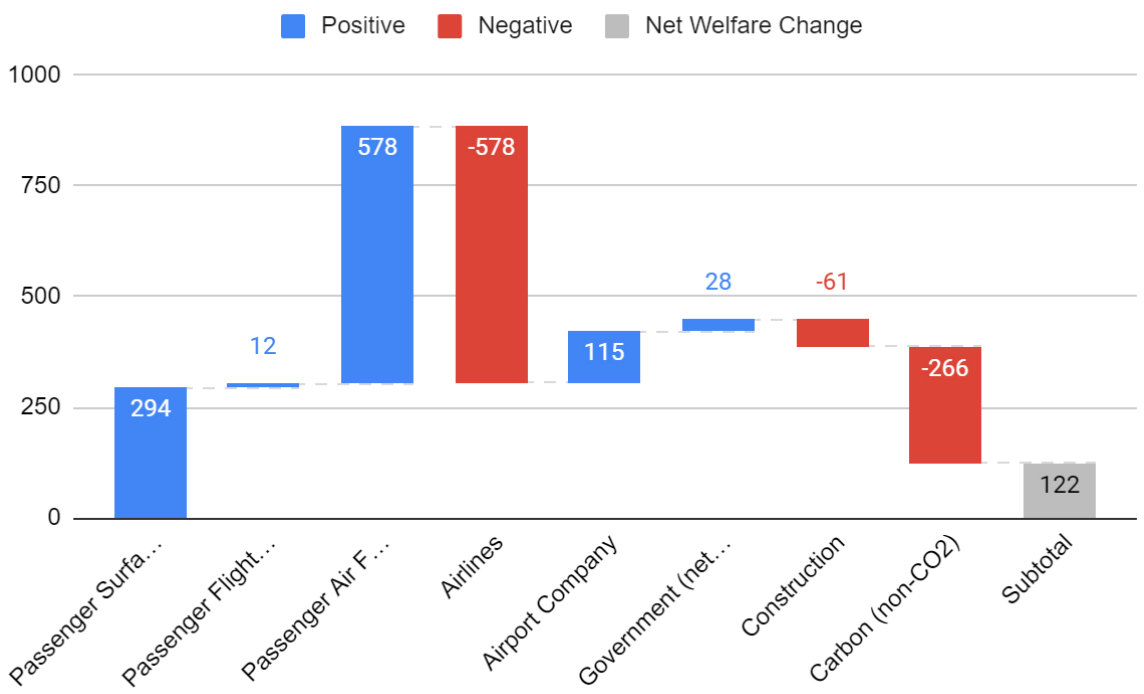


The next transformation is to incorporate the implicit carbon subsidy to the project in the analysis, against the government costs and benefits. For more information, see the later section on the carbon subsidy. It should be noted that this is a conservative overestimate. In addition, as indicated by guidance, non-CO2 effects are quantitatively considered here, taking the place of the carbon values that are already internalised in the air fares (Table 10 and Figure 6).

Table 10: The Appellant's welfare benefit-cost estimates with reciprocal airline losses added and corrected carbon costs

Passenger Surface Access	Passenger Flight Time	Passenger Air Fare (net of tax)	Airlines	Airport Company	Government (net of CO2 Subsidy)	Construction	Carbon (non-CO2)
294	12	578	-578	115	28	-61	-266

Figure 6: The Appellant's welfare benefit-cost estimates with reciprocal airline losses added and corrected carbon costs

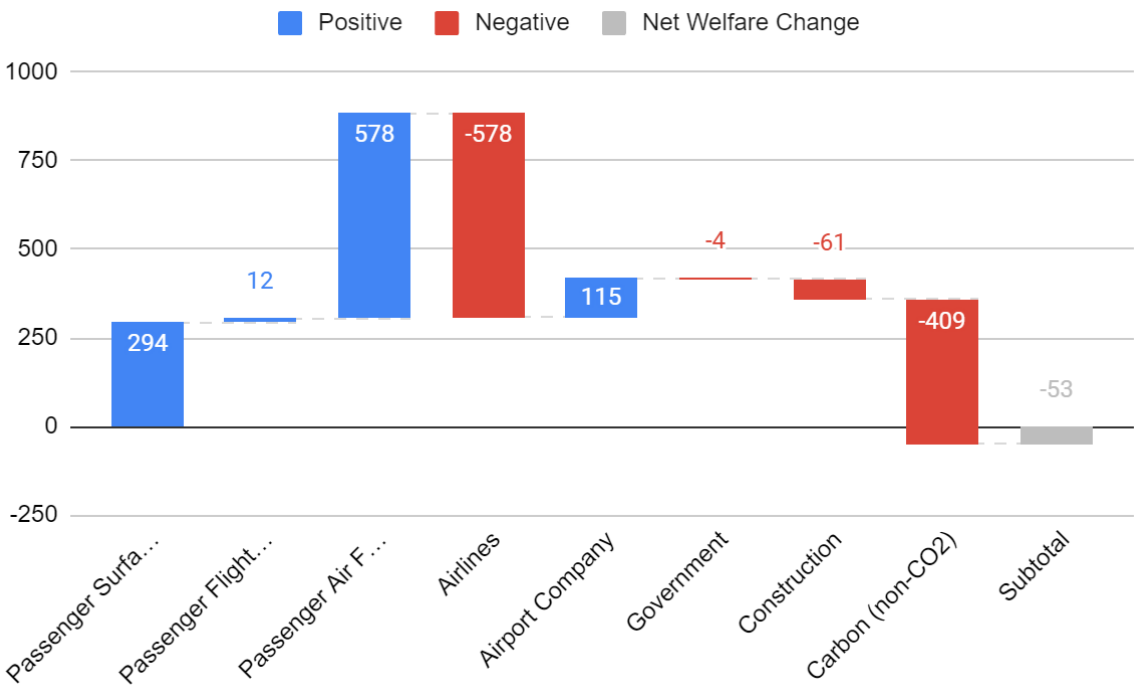


A final adjustment is to consider the impact of High Carbon costs. This sensitivity is complicated, as the high costs would be incorporated into air fares, likely resulting in reduced demand growth and lower demand at any point. This demand reducing feedback is not within the scope of this review to assess; instead, the non-CO2 High values, not incorporated into airfares, have been presented as an additional sensitivity (Figure 7 and Table 11).

Table 11: The Appellant's welfare benefit-cost estimates with reciprocal airline losses added and 'high' carbon costs

Passenger Surface Access	Passenger Flight Time	Passenger Air Fare (net of tax)	Airlines	Airport Company	Government	Construction	Carbon (non-CO2)
294	12	578	-578	115	-4	-61	-409

Figure 7: The Appellant's welfare benefit-cost estimates with reciprocal airline losses added and 'high' carbon costs



Over these different scenarios, the Private Costs and Benefits remain the same, though as noted the High Carbon cost could impact the private benefits via reduced demand. The public costs and benefits are highly sensitive to the assumptions and inputs. We find that once the fare loss to airlines and the tax cost is included the social value BCR is reduced to just 1.21. Including Non-CO_2 costs in place of the 'double-counted' carbon costs shifts this BCR to 1.13. Considering a scenario of High Carbon Costs makes the social BCR 0.95, a net loss to society even as the private return on investment for the airport remains at £176 million. Monetised estimates of air quality and noise pollution are missing and should be added by The Appellant, these will reduce the BCR further.

Table 12: Net social welfare impact, adjusted (NEF calculations)

	Original	Adjusted for reciprocals	Non-CO2 included	High Carbon costs
Benefits	1181	1090	1027	999
Costs	-323	-901	-905	-1052
Net Private Benefits	176	176	176	176
Net Public Benefits	682	13	-54	-229
BCR	3.66	1.21	1.13	0.95

ENVIRONMENTAL IMPACTS

When making the decision of whether to grant planning permission to The Appellant, it is clear that the provision of aviation services should balance the public's demand for travel, and the benefits that can result, against both local and national environmental goals. Only by presenting the available evidence can the understanding of the societal and environmental benefits and costs allow for the Inspectors to make decisions that maximise benefits and minimise costs.

At present, monetising environmental impacts is not currently required in the production of an Environmental Statement. However, it is typically considered best practice to do so for several topic areas and, for government decision making, the usage of such values is recommended or mandatory. Alongside qualitative assessment of impact, monetisation can provide valuable evidence in determining if an application serves the public good. In some topic areas, monetised costs can be used to determine appropriate levels of spending on mitigation or balancing payments towards social welfare when mitigation is not possible.

The Appellant's Environmental Statement Addendum has only provided values for carbon costs. By not including air quality and noise costs, The Appellant essentially 'ignores' material impacts, even where the EIA methodology may indicate that the impacts are negligible. As stated in the *Green Book: Central government Guidance on appraisal and evaluation.*[32]

> When there is no market price for costs and benefits to society they need to be estimated and are known as shadow prices. This is particularly important for environmental, social and health effects (p.40)

Further, the carbon costs presented by The Appellant were effectively un-auditable, and confused in presentation and interpretation. As such, the carbon costings have been remodelled using best practice methodology - this is a particularly important area as there are a number of policies and schemes to mitigate aviation emissions that should be included.

In doing so we have taken the underlying emissions and noise modelling by The Appellant at face value. However, we are aware that these predictions may be open to challenge on various grounds.

Carbon

The construction and operational atmospheric 'carbon dioxide equivalent' emissions (CO_2e or 'carbon emissions') are presented in the ES Addendum Technical Appendix 10A. The Central and High results from Table 10A.7 form the basis this review of the carbon emissions from aviation.

Non-CO_2 Effects

The results reported in the ES do not include the additional impacts that aircraft have during operation, including radiative forcing, referred to as Non-CO2 Effects. These are omitted

[32] HM Treasury (2018) Green Book: Central government Guidance on appraisal and evaluation.

based on “the CCC 2020 Progress Report recommendation to the Department for Transport (DfT) that they ‘consider how best to tackle them [non-CO_2 emissions] alongside UK climate targets’”.

Reviewing the referenced UKCCC report,[33] we find that the actual comments are that:

> Action is also needed on non-CO_2 warming effects from aviation

Interestingly, from the standpoint of this Inquiry, is UKCCC’s other advice:

> Review the UK's airport capacity strategy in light of COVID-19 and the Net Zero transition.

In any case, while it can be argued that not taking any steps to include non-CO_2 emissions is far from UKCCC and the UK Government’s ideal where these are monitored and considered, the fact is that not including them is a move away from best practice. The calculations, as described in the methodology, utilise ICAO Aircraft Engine emissions factors. ICAO do not use any radiative forcing multipliers or Global Warming Potential uplifts in the values they present. In contrast, the emission factors for aviation presented by BEIS are intended to be used with an uplift. A review of the associated methodology paper shows that while the complexities of incorporating Radiative Forcing should be acknowledged, there is more benefit considering this impact as “it is clear that aviation imposes other effects on the climate which are greater than that implied from simply considering its CO_2 emissions alone”.[34] They recommend the application of a 1.9 ‘multiplier’ to the CO_2 proportion of emissions in order to account for these; when accounting for trade-offs between aviation and other forms of travel (or not traveling) this can be appropriate, even though the ‘multiplier’ approach cannot help in determining trade-offs in the development of future aircraft.

This is summarised in the Conversion Factors worksheet as follows:

> Organisations should include the influence of radiative forcing RF in air travel emissions to capture the maximum climate impact of their travel habits.

(Worksheet: Business travel- air)[35]

Further, in WebTAG A5-2 Aviation it is clarified that a quantitative assessment of non-CO_2 emissions can be made as a sensitivity test, drawing on the latest guidance on GWP factors and BEIS guidance on valuing greenhouse gas emissions.

We have therefore quantified the impact of radiative forcing in our calculations of monetised carbon emissions.

For information, we also provide the total monetised carbon emissions inclusive of inbound flights as well as outbound. While responsibility for inbound CO_2 emissions is usually delegated elsewhere (e.g. at the point of departure), an airport expansion may still incentivise creation or relocation of new inbound flights.

[33] Committee on Climate Change (2020) Reducing UK emissions Progress Report to Parliament

[34] BEIS (2020) 2020 Government greenhouse gas conversion factors for company reporting: Methodology Paper for Conversion factors Final Report

[35] BEIS (2020) Conversion Factors 2020 - Full Set for advanced users

If the UK is committed to ensuring that the world keeps to less than 1.5 C of warming then taking action to reduce emissions elsewhere may also be necessary. However, the issue of carbon leakage in aviation is complex.

Carbon costs – the monetisation of emissions

When it comes to monetisation of carbon emissions, there isn't the same direct impact pathway to the harm an individual suffers as there is with, for example, noise and air quality. The costs of carbon emissions are experienced at the societal level, and often at a great remove physically and temporally from the emission source. However, given the UK's commitments to reduce our overall emissions, it should be considered that each additional tonne of CO_2 emitted by a project where a carbon tax or similar mechanism isn't in place represents a subsidy supplied by the public to the emitter. Due to the coverage of existing emissions schemes, the aviation sector has attributes that mean that the 'subsidy' is more than just theoretical - it is in actuality a cost borne by the UK government. The UK is legally committed to achieve net-zero greenhouse gas emissions by 2050 and has signed up to the Paris Climate Agreement. Further to this national commitment, North Somerset Council have declared a climate emergency as of February 2019, and in the study area Bristol declared the same in November 2018.[36]

Emissions that are additional to the target decarbonisation pathway, local or national, will necessarily require actions to reduce, or more likely offset (as most feasible reductions are already 'planned in'), emissions elsewhere at a more rapid pace and to a larger degree.

UK Aviation currently participates in both the United Kingdom Emissions Trading System (UK ETS) and the International Civil Aviation Organisation's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). The UK has enacted a cap-and-trade Emission Trading Scheme that is intended to be at least as ambitious as the EU ETS. The UK ETS maintains a free allocation for UK ETS aircraft operators that is equally as generous as the EU Aviation ETS[37]; therefore, additional emissions associated with Bristol Airport aviation operations will be directly subsidised through an airline's receipt of an allowance of free credits.

Between 2013 and 2020, 82% of the sector's capped emissions allowance were granted 'for free' to aircraft operators under the EU ETS system. The free allocation of allowances reduces the economy-wide pressure on moving towards lower-carbon technologies, and represents, in effect, a subsidy to that industry. Research on the impact of carbon prices on carbon leakage and competitiveness from CCC and DfT shows that an allowance giveaway is a double-subsidy, since it incentivises not just the departing flight but an arriving one as well.[38] While it is intended that the giveaway under UK ETS will reduce by 2.2% a year from

[36] As have the West of England Combined Authority (July 2019), Bath and North East Somerset Council (March 2019), Mendip District Council (February 2019), South Somerset District Council (May 2019), Somerset West and Taunton Council (February 2019), South Gloucestershire Council (July 2019), the Welsh Government (April 2019), and many others across the South West and Wales.

[37] BEIS (2020), UK ETS: apply for free allocation from 1 January 2021, Available at: https://www.gov.uk/guidance/uk-ets-apply-for-free-allocation [accessed 28/12/2020]

[38] Air Transport Analytics Ltd and Clarity Ltd (2018) The Carbon Leakage and Competitiveness Impacts of Carbon Abatement Policy in Aviation

2021, this means there will still be a giveaway of 60% of emissions allowances in 2030, 38% of the required allowances in 2040, and 16% in 2050.

In order to determine this potential carbon cost and subsidy the following methodology was used. The carbon emissions presented in the ES were extracted for each modelled year. Other years were linearly interpolated between these dates - it is recognised that this results in a variance with the full scheme totals, particularly in the period 2040-2050, where the ES uses a 0.8 to 1.2% decline, followed by a 5% to 10% reduction in 2050. However, in the absence of the full annual emissions tables, this simplifying assumption shouldn't create excessive variance.

When presenting uncertain outcomes, it can be valuable to look at forecast ranges. For this reason, the table below presents the UK government's Low and High Forecast Carbon assessment values. These BEIS prices were calculated based on the UK Government's previous carbon reduction target of an 80% decline by 2050. In addition, a policy paper by the Grantham Research Institute on Climate Change and the Environment, *How to price carbon to reach net-zero emissions in the UK*, was published in the wake of the CCC's case for net-zero emissions by 2050. These prices are different from those of the UK Government, 'front-loading' much of the cost to the period of 2020 to 2030, as well as having potentially greater prices after 2075. The price path ends at 2050, however the 3.8% growth rate indicated in the policy paper has been used to extend it as necessary.

Table 13: Carbon costs used in the carbon model[39, 40]

2018 £/tCO₂e	Carbon Price, Traded, Central	Carbon Price, Traded, High	Carbon Price, Grantham for Aviation
2017	5	5	45
2024	41	65	58
2030	81	121	73
2040	156	234	105
2050	231	346	153

In addition to these pricing sensitivities, it is important to split out the potential carbon costs with reference to how they might fit in an assessment of the BAL scheme, as well as what is already included within other benefits or costs.

Total carbon cost for appraisal

The carbon cost for appraisal recognises that when a project results in the emission of carbon dioxide it will require additional abatement action somewhere else in the economy; in the period covered by the cost estimates, the price of a UK Allowance (or EU Allowance) is considered to reflect the average cost of abatement, though it is recognised that there can

[39] BEIS (2019) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal, Data Tables 1-19, Table 3 Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal [accessed 02/09/2020]

[40] Burke J, Byrnes R and Fankhauser S (2019) How to price carbon to reach net-zero emissions in the UK. London: Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science. https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2019/05/GRI_POLICY-REPORT_How-to-price-carbon-to-reach-net-zero-emissions-in-the-UK.pdf [accessed 02/09/2020]

be significant deviation in the short and even medium term. The cost of the greenhouse gas emission is borne somewhere, whether an allowance is purchased or not. As emissions taxes or caps become more prevalent across the economy, and apply to a greater proportion of the aviation sector, is that these costs will be partially borne by passengers as increased fare prices - this assumption is included in national level modelling. When considering this, and especially in the context of the potentially desired global convergence towards carbon trading by 2050, it is appropriate to consider all of the emissions associated with the project. Looking at aviation, this does include the impact of non-CO_2 emissions, and radiative forcing, as such impacts will necessitate more abatement elsewhere in order to meet climate targets - at present aviation non-CO_2 impacts are not calculated in UK/EU ETS aviation emission submissions, despite being mandatory for other company reporting.

The below concentrates on the aviation emissions, as it is the largest component and the most material to the decision making. In addition, it also appears to be an area where the results presented by The Appellant differ from attempts to replicate it - primarily as a result of the use of a flat 3.5% discount rate rather than a stepped rate.

Here we present the net additional costs, considering the central and high demand scenarios presented by Bristol Airport as well as the value if non-CO_2 emissions are included, and if arrivals are included (Table 14).

Table 14: Carbon Costs of Bristol Airport expansion.

2020 £, Net Present Value 2020-2080, to nearest £100k	Central	High	Grantham
Bristol Expansion	£298,500,000	£459,700,000	£241,800,000
Bristol Expansion (High Demand)	£319,500,000	£492,400,000	£258,900,000
Bristol Expansion + Radiative Forcing Factor	£564,300,000	£869,100,000	£457,100,000
Bristol Expansion + Radiative Forcing Factor (High Demand)	£604,100,000	£931,000,000	£489,500,000
Bristol Expansion + Radiative Forcing Factor + Arrivals	£1,111,700,000	£1,712,200,000	£900,000,000
Bristol Expansion + Radiative Forcing Factor + Arrivals (High Demand)	£1,190,300,000	£1,834,400,000	£963,800,000
Bristol Airport Analysis - Carbon Costs with Offsetting	£262,000,000	This value purports to include all residual carbon costs, after the airports offsetting programme. Therefore, it represents primarily aviation emissions. The discrepancy between this value and the one presented above under Bristol Expansion is likely a result of the usage of a flat 3.5% discount rate, rather than a stepped discount rate.	

Direct financial subsidy under the UK ETS

The free allowances given away to airlines under the UK ETS are planned to continue. The UK ETS for aviation does not include radiative forcing, nor would the accounting be likely to use both departing and arriving flights (though both EU ETS and CORSIA do include requirements associated with travel to countries that are not covered by their respective schemes), so it can be presumed that the UK ETS will follow the same practice. The most appropriate number to use is likely the one without arrivals and radiative forcing; however, it is possible that these schemes will adjust to the reality that aviation has higher impacts than just the CO_2 would indicate and so the full range are presented (Table 15). These values are dependent on the path of future policy as well as where aviation operators are based.

Table 15: UK (and EU) government subsidies to airlines implicit in Bristol expansion.

2020 £, Net Present Value, to nearest £100k	Central	High	Grantham
Bristol Expansion	£62,700,000	£94,900,000	£51,400,000
Bristol Expansion (High Demand)	£64,700,000	£97,900,000	£52,900,000
Bristol Expansion + Radiative Forcing Factor	£118,600,000	£179,400,000	£97,200,000
Bristol Expansion + Radiative Forcing Factor (High Demand)	£122,400,000	£185,200,000	£99,900,000
Bristol Expansion + Radiative Forcing Factor + Arrivals	£232,700,000	£352,000,000	£190,300,000
Bristol Expansion + Radiative Forcing Factor + Arrivals (High Demand)	£240,200,000	£363,300,000	£195,700,000
Bristol Airport - Government Revenue (Benefit)	£91,000,000	Air Passenger Duty benefit from passengers who would not travel from any other airport. Note that this is a symmetrical benefit, as consumers pay it.	

These calculations can be combined to understand the different components of the scheme, which ones have already been priced into fares, which ones have no existing mitigation, and which ones are borne by other governments or are part of other nation's carbon budgets.

Table 16: Accounting for aviation emissions.

2020 £, Net Present Value, to nearest £100k	**CO_2 Included in fares**	**Subsidised emissions estimate**	**Non-CO_2 effects (Not priced in)**	**Arrivals (inc. non-CO_2 effects; partially priced in, partially subsidised)**	**Total CO_2**
Central Carbon Costs	£235,700,000	£62,700,000	£265,800,000	£547,400,000	£1,111,600,000
High Carbon Costs	£364,800,000	£94,900,000	£409,400,000	£843,100,000	£1,712,200,000
Grantham Carbon Costs	£190,400,000	£51,400,000	£215,300,000	£442,900,000	£900,000,000

Implications on the Demand Modelling

The updated demand modelling was generated using a process that incorporated carbon pricing into fare costs for passengers. Unfortunately, the process used was flawed - in 25% of the demand models that were run, the now-defunct Low-Cost estimate of carbon was used. The low cost should not be used or presented. Instead, the Central and High costs should be used, until a pricing set consistent with the UK's legal obligations is produced. This would imply that the demand modelling simulations should have been run with a 50% chance of either scenario (rather than the Low 12.5%, Core 75%, High 12.5% used currently). Establishing the full impact of this misspecification is outside the scope of this review - it can be inferred that demand and demand growth will be lower, with implications for every part of the ES.

Noise

We believe that BAL should provide noise monetization tables. While sufficient information is presented that these could be constructed, the issues related to demand modelling may also change the values. A 'back of the envelope' calculation can be based off of Tables 6A.62 and 6A.63 of the ES Addendum Technical Appendices 6A-E, using the TAG Aviation Noise Worksheet. If the noise modelling results presented are indicative then it results in an estimate of approximately £4 million over the appraisal period – despite not being as large as some of the over impacts it should be clear that the proposed expansion is sensitive to these impacts.

Air Quality

We believe that BAL should provide air quality monetization tables. Insufficient information was provided for NEF to independently determine this monetised impact.

Comments on equity

When considering impacts on people it is usually of value to consider distributional impacts. While we were not able to do detailed supplementary analysis here, we think it is a

worthwhile issue to raise. When a key proportion of the schemes GVA benefits are the result of job displacement it is important to consider who will lose out. The evidence provided by BAL indicates that many of these displaced jobs will be in Cardiff. No accounting of the negative wellbeing impacts of job losses resulting from the expansion is made in The Appellant's welfare analysis, rather a presumption is implicit that relocation of jobs from around the UK to the vicinity of Bristol Airport is in the public interest.

There are also intergenerational equity issues that are relevant to carbon emissions, due to the long-lasting negative impacts of climate change. As the UK has yet to develop effective sectoral and regional carbon budgeting systems the 'carbon subsidy' discussed above must inevitably be provided by future generations. While we have followed the standard approaches to carbon accounting, the figures presented here are only one way to consider the harms that result from carbon emissions.

A final and topical issue to consider is the impact of airport expansion in the midst of a crisis in the hospitality and leisure industry. A significant cost of the proposed scheme is likely to be its impact on the industries consumers might otherwise spend their money with, if they were not travelling abroad. The proposed scheme will likely result in significant job losses in hospitality and leisure industries, industries which typically employ a disproportionate number of low-wage earners.

FURTHER READING

For further reading on many of the issues discussed in this report see NEF's other recent reports:

Chapman, A. and Postle, M. (2020) *Supplementary analysis of the economic case for the expansion of Leeds Bradford Airport, Parts 1 and 2.*

Chapman, A. and Wheatley, H. (2020) *Crisis support to aviation and the right to retrain*

Chapman, A., Kiberd, E., Pendleton, A., Wilson-Morris, B. and Postle, M. (2020) *Baggage claim: the regional impact of Heathrow's third runway*

Chapman, A. and Postle, M. (2019) *Evaluating the case for expansion of Bristol Airport*

Pendleton, A. and Smythe, E. (2018) *Flying low: The true cost of Heathrow's third runway*