Responses to REP1-020 (Comments on RRs - Part 1 of 4)

Author: Michael Reddington: Unique Reference: 20037459

Note: Page numbers reflect the 'pdf' version of REP1-020

Page 42 Row 1: The areas impacted by noise increase with every Phase and therefore there is no net reduction in noise - all that is happening is a mitigation of increased noise.

Page 42: Row 2: Noise Insulation funding. The Applicant does not answer the question. He sets out costed compensation measures for several different scenarios, but does not give the sum total of monies required to complete the insulation nor hazard an estimate as to take-up, nor give a timescale within which the programme of insulation will be complete.

It is not clear how, and how much, the Applicant can budget for insulation.

The Applicant does not state whether these amounts are subject to price variation - with RPI, wage price increase or other index for example.

Page 45 Row 2: It is not clear from AS-128 whether the Applicant will consider claims for Statutory compensation from those who are also in receipt of insulation (Discretionary compensation), and not just those who fall outside the eligibility criteria.

Page 44 Row 2: The Noise Insulation Scheme is almost completely lacking in detail and needs a full description of how it will be implemented and managed. What is unacceptable is the timescale: "This will take place during the lifecycle of the project". There is no commitment to providing insulation to those properties which need it, BEFORE noise levels reach the eligibility threshold. This is surely a Health and Safety issue.

The ExA should instruct the Applicant to provide a detailed budget, programme and method statement.

Page 46 Row 3: Whatever about insulation which should reduce internal noise, there is no proposed mitigation to reduce external noise in gardens or balconies, except for a reduction in noise generated by the airport - and the Applicant is not proposing this mitigation.

Page 49 Row 2: This should be stated in the DCO and is typical of the lack of detail therein pertaining to insulation.

Page 49 Row 3: This should be stated in the DCO and is typical of the lack of detail therein pertaining to insulation.

Page 49 Row 4: As stated above, the Applicant is only mitigating additional noise - noise levels are still on the increase.

Page 49 Row 5: RR-0239. This is highly selective. The response actually said: "*I do appreciate that the Airport offered us a small contribution to get a couple of re-enforced windows but this is of absolutely no help in the summer months as the windows need to be open and to be honest, they need to be open most of*

the year to ventilate the house". This was just one sentence in a whole page of complaints against the airport.

Page 109 Row 2: The Applicant does not deny there are impacts on the health of residents but offers only 'mitigation' for the additional noise in the form of insulation rather than a reduction in noise form the current level.

Page 146 Row 1: Once again the Applicant considers only Significant effects of the additional noise and intends to Avoid them (rather than mitigate them as in previous responses). These impacts will not be reduced in spaces outside the residence such as balconies, gardens etc.

Page 147 Row 1: Note that the Applicant states that the GCG Framework relates only to '..Air noise and other environmental topics'. (Presumably the 'other environmental topics relates to pollution, waste disposal etc.) The Applicant seems to have disregarded Ground noise.

The ExA should instruct the Applicant to provide clarity on all noise elements and their mitigation.

Page 148 Row 1: '...there will be a reduction in the number of people who would experience adverse effects...'. This is not true: (a) noise contour areas increase as Development progresses and (b) even with no DCO, noise levels should fall relative to the 2019 baseline because of the expectation of quieter aircraft coming into the fleet by 2028 - as per Project Curium

Page 149 Row 1: second bullet point states that ground noise and vibration does not have significant impacts as in 'greater than SAOEL'. However ground noise modelling figures show that receptors will be subject to noise between LAOEL and SAOEL but above the 54dB LAeq 16h level which is the eligibility criterion for noise insulation. The ExA should instruct the Applicant to clarify what mitigation measures are proposed between LAOEL and SAOEL in order to meet NPSE..

Note that NPSE states:

"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse impacts on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."

Page 160 Row 1: Traffic noise to be evaluated and insulation provided if noise greater than SAOEL.
However NPSE states:"
"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse impacts on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."
The ExA should instruct the Applicant to clarify what mitigation measures are proposed between LAOEL and SAOEL in order to meet NPSE..

Page 167 Row 3: RR-0908. Outdoor exposure will increase as the Development matures (contour areas increase) and noise insulation is only effective for interior noise level mitigation.

Terms and Abbreviations

ATMs	Air Traffic Movements
CAA	Civil Aviation Authority
CCC	Climate Change Committee
CO^2	Carbon Dioxide
dB	Decibel
dBA	Decibel A-weighted scale
DCO	Development Consent Order
ExA	Examining Authority
GHG	Greenhouse Gas
LAeq,16h	Equivalent continuous sound level, average summer day 7am -11pm
LAeq,8h	Equivalent continuous sound level, average summer night 11pm-7am
LAeq,T	Equivalent continuous sound level, for period of time, T
LLA	London Luton Airport
LOAEL	Lowest Observed Adverse Effect Level
mppa	million passengers per annum
NPSE	Noise Policy Statement for England
RPI	Retail Price Index
SAF	Sustainable Aviation Fuel
SOAEL	Significant Observed Adverse Effect Level

Responses to REP1-022 (Comments on RRs - Part 2B of 4, Members of the Public)

Author: Michael Reddington: Unique Reference: 20037459

Note: Page numbers reflect the 'pdf' version of the document.

Page 35 Row 1: penultimate paragraph. This does not answer the question. Changing the noise contours still does not make it clear which properties are within which boundaries. The Applicant should provide a list of eligible addresses and what they are eligible for. The Applicant should also identify which Phase of the proposed Development these properties become eligible.

The ExA should instruct the Applicant to clarify whether if an insulated property falls outside of eligibility criteria in later Phases whether the insulation will be removed.

Page 36 Row 1: The ExA should instruct the Applicant to clarify who would be parties to this S106 Agreement and who would police the subsequent installation programme

Executive Summary

Responses to REP1-023 (Comments on RRs - Part 2C of 4)

Author: Michael Reddington: Unique Reference: 20037459

Summary

The document: 'Responses to REP1-023 (Comments on RRs - Part 2C of 4' (Author: Michael Reddington: Unique Reference: 20037459) is composed of four sections:

1 Specific Comments on REP1-023

Responses to specific comments by the Applicant, by 'pdf' page number and row number. (It is not practicable to respond by individual RRs as they are replicated many times).

2 Comments on Jet Zero strategy One Year On ('JZS-OYO')

The JSY-OYO is reviewed in the light of the Applicant's many comments which typically state they are moving forward in general accordance with the JZS. This section places particular emphasis on the deviations between JSZ-OYO and the DCO due to recent developments,

This highlights how volatile the JZS is, and as a consequence how volatile the DCO Programme is, and how credible are the Applicant's ambitions and timescales. There are issues that need to be resolved, and the document requests the ExA to instruct the Applicant accordingly.

3 Comments on Sustainable Aviation Carbon Road Map v4 2023 ('the SA Document')

The SA document is called up by the JZS-OYO so is reviewed also. Anomalies between JZS-OYO and the SA Document need to be resolved, with a request for the ExA to instruct the Applicant accordingly.

4 Terms and Abbreviations

Responses to REP1-023 (Comments on RRs - Part 2C of 4)

Author: Michael Reddington: Unique Reference: 20037459

Note: Page numbers refer to those in the 'pdf' version of relevant documents.

1 Specific Comments on REP1-023

Page 42 Row 2: We suspect Clarion Housing Group have merely used the term 'runway' instead of 'terminal'

Page 50 Row 1: Response is not true. Lowest eligibility level is below SAOEL, at 54dB LAeq 16h.

Page 51 Row 2: First bullet point reply cannot be correct. Tables in Chapter 16 show an increase in air noise contours for each 'Do Something' scenario.

Page 61 Row 3: Reference error. Assume it is NPPF.

Page 97 Row 1: Ref 12 (CAP 1506:2021) and Ref 13 (CAP 2161:2021). The ExA should instruct the Applicant to review the DCO in the light of all the relevant literature - for example:

- CAP 1588 Aircraft Noise and Annoyance – Recent Findings: 2018
- CAP 1506c SoNA 2014 Aircraft Noise and Annoyance second edition - Peer Review: 2021
- CAP 2161a SoNA 2014 Aircraft Noise and Sleep Disturbance - Peer Review: 2021
- CAP 2398 Aircraft Noise and Health Effects – a six monthly update: 2022

Page 142 Row 1: The full package of insulation provision only applies to properties with noise levels at SAOEL or above. Properties that fall under Daytime SAOEL of 63dBLAeq 16h have a reducing scale of compensation down to 54dBLAeq 16h; properties that fall below the Night-time SAOEL of 55dBLAeq 8h get none.

Page 219 Row 1: The Applicant has not responded to the first bullet point. The ExA should instruct the Applicant to respond.

Page 219 Row 1: In respect of the third bullet point 'facilitating permissions' the purchase of large tracts of high quality agricultural land would also qualify as a facilitating permission.

Page 220 Row 2: 'reducing' noise impacts' due to increased noise as a result of expansion is not the same as 'maintaining or reducing EXISTING noise levels'.

Page 222 Row 1: Reference error. Assume it is NPPF.

Page 222 Row 2: RR-0817. Eligibility contours may extend over Caddington but the case in point is that peak noise disturbs sleep rather more than the 'averaged' dB LAeq.

Page 224 Row 1: However the noise contour areas have increased and therefore more residents are affected.

Page 224 Row 2: The Applicant's noise contours must surely have taken into account these 'top level' mitigation measures and yet the noise contours have increased in area.

Page 225 Row 1: The proposed 'insulation' scheme does not specifically include them either. In fact there are no details at all of how the Applicant intends to implement this scheme.

Page 225 Row 2: Reference error. Assume it is NPPF.

Page 225 Row 2: See comment about Ref 12 and Ref 13 under Page 97 Row 1.

Page 229 Row 1: Final sentence. The Applicant is aware that noise contours reflect noise external to a property. This noise is only going to increase as a result of the Proposed development and all the insulation in the world will not reduce it.

Page 246 Row 1: Reference should be to Jet Zero Strategy ('Ref.1')

Page 247 Row 2: Reference should be to Jet Zero Strategy ('Ref.1')

Page 249 Row 1: The Applicant liberally refers to the Jet Zero Strategy in responses to RRs such as RR0164, RR0165, RR0472, RR0530, RR0817 to name but a very few. The response is typically:
"Further, Paragraph 3.57 of the Jet Zero Strategy sets out that "we can achieve Jet Zero without the Government needing to intervene directly to limit aviation growth". The Applicant is aware that the rate of expansion of London Luton Airport is broadly aligned to the Jet Zero Strategy High Ambition Scenario, which reinforces the view that the Application aligns with Government ambitions on carbon reduction.

In response to RR-0817 the Applicant refers to the Net Zero Strategy One Year On ('JZS-OYO') and actually includes it in the References (Ref 22). Therefore the Applicant must be familiar with its contents.

Below is a commentary on JZS-OYO and how it applies to, and should modify, this DCO Application.

2 Comments on Jet Zero strategy One Year On ('JZS-OYO')

2.1 Introduction

2.1.1 JZS-OYO is a One Year update on the progress of the Jet Zero Strategy (July 2022) that sets out the Aviation sector's path to Net Zero by 2050.

2.1.2 All of the initiatives that will make the largest impact are still in their infancy: SAF, Hydrogen-fuelled aircraft; electric aircraft, long-distance capability, carbon capture and storage etc.

2.1.3 Given the sheer number of unknowns, related to these initiatives, progress and expectations will develop and change as the magnitude of tasks become clearer. The situation is, thus, dynamic and wide-ranging.

2.1.4 Of necessity due to the range of issues and risks, the report can seem vague or even optimistic. Underlying data is missing or estimated so it is not possible to fully assess the metrics in JZS-OYO.

2.2 Selected comments Pages 9 through 36:

Note: Page numbers refer to the 'pdf' version of each document

Page 9: The Table of territorial UK GHG emissions identifies the Transport sector (light blue line) does not specify whether the aviation element of the Transport sector includes international flight emissions, but in the light of later data this is assumed..

Page 10: The table claims that the UK aviation sector produced – in total - 38.2 $MtCO_2e$ in 201. However, it does not advise that offsetting has reduced this by 8 $MtCO_2e$ (as claimed in the Sustainable Aviation Carbon Road Map ('the SA Document') discussed separately below.

Page **11**: This page states the JZS modelling is based on the High Ambition scenario but there is no sensitivity analysis of the alternatives. Note that on page 19, the report states that MOD emissions are not included in aviation figures.

Also, Page 11 states in relation to projections: "….*This has had the impact of reducing forecast passenger demand growth under our High Ambition scenario to 52% in 2050, relative to 2018 levels, compared to 70% in the published Jet Zero Strategy*",

So, forecast passenger demand is now just **52%** higher for 2050 than in 2018, reduced from 70% in just one year. This is a significant reduction and if the Applicant is following the Jet Zero strategy as alleged under responses to RR0164 etc. above, its forecasts would also be expected to be reduced accordingly.

By comparison the Applicant is expecting a 78% increase, from 18mppa to 32mppa between 2019 and 2050.

The Applicant should demonstrate where the expected increase in demand over and above the national forecasts is going to come from.

The ExA should instruct the Applicant to revise the DCO Application to reflect these new JZS-OYO forecasts.

Page 14: States that the ambition is that domestic aviation will reach Net Zero by 2040 and that SAF will represent 10% of aviation fuel by 2030.

2040

From 2021 GHG figures on Page 10, 13.3 MtCO2e was produced from international flights and 0.7 MtCO2e from domestic flights. This means (assuming a constant ratio), that domestic represents 5% of the total of 14 MtCO2e. For 2040 the total is expected to be 28.4 MtCO2e, therefore domestic emissions would be some 1.42 MtCO2e.which is a large amount. (There is significant room for error here since 2021 was a Covid year therefore ratios may vary).

10% SAF

It is not clear how the 10% figure for SAF usage is to be framed: SAF (excluding hydrogen from this definition) cannot compete with Jet-A1 in terms of energy per unit volume so either has to be mixed with Jet-A1 in an as-yet unspecified ratio or aircraft using SAF-only fuel will be limited in range, speed or capacity thereby skewing the figures.

Page 18: refers to the SA Document which is discussed separately below.

It is not readily clear from JZS-OYO that SAF: (a) is not as efficient as Jet -A1; (b) still produces GHGs and; (c) is not some sort of homogeneous material – it has several sources and therefore several chemical compositions..

The main advantage is that SAF itself should not involve non-renewable sources Different fleets or even different aircraft may use SAF of different compositions, unless there is some global agreement to standardise. This is yet another risk, not overtly stated.

The difficulties (and costs) involved in providing feed material for SAF is not discussed in detail, nor are the difficulties of converting aircraft engines to run on SAF mixtures. Associated costs and delays to re-approve the aircraft are not discussed, nor are the difficulties in distributing and storage of potentially different SAF mixtures.

Page 21: With reference to the SA Document the numbers of 'green' jobs in SAF are quoted: 10,350 by 2030 and 60,000 by 2050 with commensurate Gross Value Added of £1.8bn and £10.1bn respectively.

The figures do not specify if inflation is included.

There is a stated assumption also that the cost per unit of UK-produced SAF is roughly the same as global production costs. This is a further risk.

Page 23: System Efficiencies.

There are other advances in system efficiencies to be gleaned, such as in-craft software to optimise climb and wake, engine and airframe improvements, and airspace changes, which would of themselves reduce emissions –some 15% of the Jet Zero target.

However these are couched in language such as "….seeks views on the scope and design of achieving zero emissions in airports in England". (This target relates to airports in England as elements of relevant policy are devolved to the Scottish and Welsh Governments plus the Northern Ireland Executive.)

The JZS-OYO is underlining that there are many unknowns yet to be factored in.

Page 25: SAF

The High Ambition Strategy is expected to reduce emissions by 17% through the use of SAF. How this is to be achieved is not clear.
JZS-OYO claims that there is a £165m fund available to support UK SAF production and have provided £82.5m to launch the first five UK SAF production plants, with the remainder to be distributed in the next tranche of projects. It is estimated that the five projects will produce some 300,000 tonnes of SAF annually when operational– see table under **Page 26** below.

Page **26:** UK SAF Investment Projects to date

Operator	**Operational year**	**Annual Yield (ktonnes SAF)**	**Technology**
LanzaTech	2026	79.0	Alcohol-to-jet
Fulcrum BioEnergy	2027	83.7	Bin-bag waste
alfanar Energy (Teeside)	2028	86.6	Bin-bag waste
Velocys plc	2028	37.4	Bin-bag waste
	Total by 2028:	**286.7**	ktonnes

Also: Veolcys given go-ahead to build large demonstrator plant to convert industrial CO2 and green Hydrogen into jet fuel but no figures as to yield or potential operational date.

Unfortunately there are figures in the SA Document which suggest this is not going to be enough, and this raises the question whether 300kt reflects the " 10% of SAF by 2030" claim. Figures are shown in the table below:

Year	**Mt of SAF required**	**% SAF Produced in UK**	**Mt SAF produced in UK**
2030	1.1	39%	0.429
2050	8.4	65%	5.46

From these figures, in 2030 the UK will require 1.1 Mtonnes of SAF, with 39%, or 429 ktonnes, being produced in the UK.

However the 5 no. UK sites in the previous table will produce only 286.7kt by 2030. This represents a shortfall of 142.3kt relative to 429 kt. No explanation is provided for how this shortfall is to be met, or whether it is the smaller or larger figure of SAF production that constitutes the '10% of aviation fuel' mentioned earlier.

Page 27: The Jet Zero Strategy states "*Zero emission aircraft enter the modelling via the fleet mix component of the National Air Passenger Allocation Model (NAPAM) described in Chapter 4 of Jet Zero: modelling framework document. For the 'High Ambition' scenario, two new hypothetical aircraft types (one for Class 1 and 2, one for Class 3) with zero tailpipe emissions are modelled to enter the fleet from 2035 and replace existing aircraft in these classes at existing replacement rates (22-25 years). For the 'High Ambition with a breakthrough on Zero Emission Aircraft' scenario, an additional 'mid-size' concept aircraft with zero tailpipe emissions is*

assumed to also enter the fleet from 2035."

However JZS-ONO expects Zero Emission flights to deliver only a reduction of 4% of emissions by 2050, even with the High Ambition scenario. This clearly is an acceptance that widespread use of hydrogen-powered or electric aircraft are a distant reality and that most aircraft by 2050 will use 'conventional' designs, i.e. turbine engines using SAF, or SAF with Jet-A1 mixture, albeit with improvements in weight, emissions, noise, capacity and range.

It could be assumed that the impediment to the widespread use of this Zero Emission technology is technical. i.e. associated with the aircraft development, but it could also be due to lack of electrical infrastructure to produce green hydrogen or even the ergonomics of safely transporting storing and distributing such a volatile material (either under hundreds of Bar of pressure or at extremely low temperatures near -200^{o}C).

Given progress to date it seems likely that small aircraft - particularly those which currently use propellers - are more likely to be replaced by hydrogen cell or battery-powered craft in this timeframe.

Page 29: This page discusses Markets and Removals under a High Ambition scenario to reduce emissions by 27%. The the market for carbon offsetting is developing, with CORSIA and EU ETS, and UK ETS to name but three. However the technology for large scale carbon removal and storage is in its infancy, and the removal of 27% of (presumably) 2019 aviation emissions of 38.2 Mt, = 10.14 Mt, is a huge ambition.

Page 33: Non-carbon emissions are another unknown and much research is required to determine causes and effect, then methods to remove them, or mitigate them in line with the various offset systems that will be in place at the time.

Page 36: JZS-OYO recognises that challenges exist in all areas:

(i) Technology: fuels, airframes, airspace allocation, materials, engines etc.

(ii) International issues: standardisation, offsetting, SAF feedstock

(iii) Revenue: SAF produced in the UK must be competitive with international sources so there is uncertainty about what level of energy independence and self-sufficiency is anticipated versus how much government subsidy may be required or forthcoming

(iv) Energy and feedstock: green hydrogen will require huge investment in electricity and water supply; SAF feedstock may have to be imported, etc.

2.3 Conclusion

2.3.1 There are huge challenges ahead to reach Net Zero for aviation ('Jet Zero'), requiring solutions at intergovernmental as well as at national level.

2.3.2 There are huge budgetary implications for the UK particularly in the areas of energy provision, fuels, subsidy and technological innovation.

2.3.3 Since the Jet Zero target was set by Government and not by industry it is likely that businesses will be looking to the Exchequer, in many areas, for subsidies or underwritten loans to bridge the gap between their 'business as usual' costs and the costs of decarbonisation etc. to Jet Zero. Some of these costs are: SAF fuel costs and engine/airframe conversions, purchase of Carbon credits, or Carbon capture and storage.

2.3.4 There are so many scenarios in so many areas, it is impossible for the Applicant to provide a programme with any certainty, to achieve 'Jet Zero' and is hugely dependent upon developments elsewhere.

2.3.5 It is incumbent upon the Applicant to track these developments closely and resolve actual or apparent anomalies in the plethora of literature available, with the utmost haste.

2.3.6 It is hoped that the ExA will instruct the Applicant to amended the DCO as appropriate.

3 Comments on Sustainable Aviation Carbon Road Map v4 2023 ('the SA Document')

3.1 Introduction

3.1.1 This SA document is called up by the JZS-OYO so it is only reasonable that its contents be addressed.

3.1.2 There are anomalies in the figures provided within the JZS-OYO above and the SA Document.

3.1.3 These anomalies are potentially due to the timing of the documents (it is assumed that the former preceded the latter).

3.1.4 For instance, the JZS-OYO has downgraded the increased UK passenger demand forecast between 2018 and 2050 to 52% whereas the SA document assumes this is still 83%. relative to the 2019 baseline. It is noted that the baselines differ but this only serves to exacerbate the differences since there were more ATMs for all UK Reporting Airports in 2019 (3,087,805) than 2018 (3,065,047).

3.1.5 Accordingly, the numbers of ATMs, hence fuel demand and hence emissions, are significantly different in the two documents.

3.1.6 Like the JZS-OYO, the SA document is also necessarily vague on detail. It continually cries out for central Government funding, It does not specify whether the Government will actually benefit directly in the long run from its largesse – for example in royalties or licences – or whether it will assume indirect payment through taxation on profits etc.

3.2 Specific Comments: Pages 12 through 39

Page 12: Table of additional energy requirements.

Topic	**2050 Forecast UK aviation renewable energy demand to deliver net zero carbon emissions**
Hydrogen and electric aircraft	63 TWh
Power to liquid SAF	50 TWh
Carbon removals	34 TWh
Maximum additional renewable energy need	147 TWh

What is noticeable is the 2050 energy demand for hydrogen and electric aircraft (i.e. Zero Emission craft) of some 65TWh. (This is a big jump from the Jet Zero Strategy: "*We will double our UK ambition for hydrogen production to up to 10GW by 2030, with at least half of this from electrolytic hydrogen*".

JZS-OYO Page 27 shows only a 4% reduction in emissions for Zero Emissions craft by 2050, therefore 65TwH for a 4% reduction seems extreme. These two documents appear to differ wildly in their assumptions on Zero Emission aircraft rollout. (see also numerical calculations under '**Page 31**' below).

Page 16: UK passenger demand is set to increase by 83% over 2019 baseline. This does not agree with the JZS-OYO – see above.

Page 18: Hypothetical 'No Improvements' scenario shows Aviation sector CO_2 emissions increasing by 78% from 37.8 MtCO2e in 2019 to 67.5 MtCO2e. This forecast is meaningless as it does not even take into account efficiencies in fuel consumption, airspace changes, or other 'natural' technological improvements such as

materials, engine design or in-craft software. The forecast increase in passenger demand over JZS-OYO only serves to exaggerate the forecast.

Page 20: Demand reduction is shown as a table that harks back to the table in Page 18 which has made wildly different assumptions to JZS-OYO in respect of demand and efficiencies.

Page 21: Demand reduction due to decarbonisation.

This uses the questionable demand projections on Page 18 so should be ignored.

In addition this page recommends that the UK government subsidise SAF production to the tune of 15% return on investment (ROI) for SAF producers, as well a support to initiate an emerging SAF industry. Given the current cost-of-living crisis and budgetary constraints this is a big assumption and is not monetised.

Page 22: Figures 9 and 10 shows the cost of different decarbonisation measures including SAF. Extrapolating from Figure 10 puts the cost by 2050 at approximately £5bn. This is yet another enormous number that does not appear to have a financial source.

(In mitigation, this figure is based on the questionable assumptions of Page 18)

Page 23: Assumes that the price of SAF 'reduces slightly over time'. Given that the SAF sector by 2050 will have been in production for at least 20 years, it would be expected to reflect the economies of scale, know-how and efficiency improvements of a mature industry. It is therefore questionable why there is not a greater unit cost reduction.

Page 31: Aircraft and Engine technology

Para. 6.4 assumes electric aircraft will only replace small aircraft (19 seats) with limited rage of 800NM.

It also assumes that by 2050 there will be hydrogen-based aircraft to replace Large narrow-bodied aircraft such as the 757, but not wide-bodied craft. This oes not align with the Jet Zero Strategy or the revised JZS-OYO numbers referenced in JZS-OYO Page 27 (above).

Furthermore it is assumed the infrastructure to support hydrogen aircraft will not exist in many parts of the underdeveloped world.

New regulations and methodologies will also be required to support this new technology. These have yet to be developed and constitute a risk.

It is estimated that 970kt of hydrogen will be required in 2050. (No figures are given for interim dates such as 2035 when the first Zero Emission aircraft are expected to be deployed).

Assuming this is 100% 'green' hydrogen, 63TWh of electricity will be required to produce it, with an additional 0.4 TWh required to charge electric aircraft.

Calculating the number of watts per tonne of Hydrogen:

$$63 \times 101^2 / 970 \times 10^3 = 65 \times 10^6, \text{ i.e. 65 Megawatt hours per tonne.}$$

This is a huge number given that it is not yet known how much lift energy will be generated by one tonne of hydrogen and how much will be required for even a medium-range journey with a narrow-bodied aircraft.

Note also by comparison:

a) the (carbon neutral) Drax power station produces approximately 24 TWh

per annum,

b) Dungeness B Nuclear power station = 4.4TWh,

c) Sizewell B Nuclear power station = 0.6TWh

d) Heysham Nuclear power station = 0.6TWh.

Given that it takes some 15 years to obtain permission, fund, design, build and commission a (carbon-neutral) nuclear power facility, and it is already 2023, the challenges of meeting these energy demands are enormous.

(Alternatives such as wind or solar energy are not consistent so it is assumed a base load provider will be necessary. However the base load percentage is not defined so it is assumed to be 100% for now.)

Approximately 8.92 litres of extremely purified water are required per kg of hydrogen produced. Waste water from these plants will be warmer than the surrounding environment, so there are significant environmental challenges in its disposal.

970kt of Hydrogen could thus require 970,000 x 8,920 = 8.652 billion litres of water.

Finally, though hydrogen may burn cleanly, as a fuel it is inconvenient because of its corrosive properties, its low energy per unit of volume, and its tendency to explode. Storing and moving hydrogen around will require huge investment in shipping facilities, pipelines, filling stations, or facilities to convert hydrogen into the more stable form of ammonia.(The SA Document does not even consider ammonia)

Page 35: SAF

Paragraph 7.1 States refers to a mandate consultation ('Sustainable aviation fuels mandate':2021) that by 2050, it is hoped that 75% of aviation fuel should be SAF. Using that figure should thereby mitigate 39% of total CO2. (Note also there is a proposed 2030 mandate for 10% of aviation fuel to be SAF).

As mentioned above there are questionable assumptions on Page 18 in respect of demand increase. JZS-OYO page 25 puts saving in CO^2 from SAF at 17%, as opposed to 39% in the SA Document. This is a significant anomaly.

In tabular form Figure 15 appears as follows:

Year	Mt of SAF required	% SAF Produced in UK	Mt SAF produced in UK	UK Employees in SAF production
2030	1.1	39%	0.429	10350
2050	8.4	65%	5.46	60000
Increase (%)			1273%	580%

On further analysis however and as noted previously, the economies of scale in 2050 do not reflect the expected performance for a mature industry, just a 220% increase in output per employee:.

Year	Tonnes of SAF per UK employee
2030	41.4
2050	91.0

Increase	220%

The Gross Value Added (GVA) does not specify if this relates to UK-generated SAF or Total SAF, so both options have been calculated below: GVA per UK Mt decreases markedly from £4.2m to £1.8m between 2030 and 2050 whereas the GVA for Total SAF decreases slightly from £1.6m to £1.2m - reflecting perhaps that global SAF prices are similar to the UK..

Year	Gross Value Added (£m)	Gross Added Value per Mt (if UK SAF only)	Gross Added Value per Mt (if Total SAF)
2030	£1,800.00	£4,195,804	£1,636,364
2050	£10,100.00	£1,849,817	£1,202,381

Page **39:** States that *"….so no UK farmland will be used for UK SAF production'*.

Therefore the UK SAF yield figures rely heavily on the use of waste materials as feedstock with some vague assumptions about sourcing feedstock elsewhere.

In all this there is an assumption that the UK will be dependent upon the rest of the world for 35% (100%-65%) of its SAF requirements by 2050. Of course these figures must be treated with suspicion as they are based on the questionable assumptions on Page 18. However, it does raise the question of SAF-supply security.

There is also a warning that some of the start-up SAF facilities may not be able to have their products registered as a qualifying SAF !

3.3 Conclusion

3.3.1 As stated in the comments against JZS-OYO this document also is replete with assumptions, aspirations and expectations. However, it does not align with JZS-OYO.

3.3.2 It is hoped that the ExA will instruct the Applicant to clarify these anomalies and amend the DCO Application as appropriate.

4 Terms and Abbreviations

ATMs	Air Traffic Movements
CAA	Civil Aviation Authority
CCC	Climate Change Committee
CO^2	Carbon Dioxide
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
dB	Decibel
dBA	Decibel A-weighted scale
DCO	Development Consent Order
EU ETS	European Union Emissions Trading Scheme
ExA	Examining Authority
GHG	Greenhouse Gas
GVA	Gross Value Added
GWh	GigaWatt hours (10^9 Watt Hour)
Jet-A1	Kerosene-based jet aircraft fuel
kg	kilogramme
kt	kilotonne
LAeq,16h	Equivalent continuous sound level, average summer day 7am -11pm
LAeq,8h	Equivalent continuous sound level, average summer night 11pm-7am
LAeq,T	Equivalent continuous sound level, for period of time, T
LLA	London Luton Airport
LOAEL	Lowest Observed Adverse Effect Level
mppa	million passengers per annum
Mt	Megatonne (10^6 tonnes)
$MtCO_2e$	Megatons of Carbon Dioxide emitted
MWh	MegaWatt hours (10^6 Watt Hour)
NM	Nautical Miles
NPPF	National Planning Policy Framework
NPSE	Noise Policy Statement for England
NZS	Net Zero Strategy
NZY-OYO	Net Zero Strategy One Year On: July 2023
Project Curium	Agreement to expand LLA capacity from 9mppa to 18mppa
ROI	Return On Investment
SA	Sustainable Aviation
SA Document	Sustainable Aviation Carbon Road Map Road Map v4 2023
SAF	Sustainable Aviation Fuel
SOAEL	Significant Observed Adverse Effect Level
SoNA	Survey of Noise Attitudes
TWh	TeraWatt hours (10^{12} Watt Hour)
UK ETS	United Kingdom Emissions Trading Scheme
ZEF	Zero Emission Flight