Full Options Appraisal

Greenhouse Gas Assessment
London City Airport RNP-AR Airspace Change

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1. Introduction

This report presents the Greenhouse Gas (GHG) Full Options Appraisal of the London City Airport Airspace Change. The appraisal has been prepared to meet the requirements of Chapter 6 of the CAA's Environmental Assessment Requirements and Guidance for Airspace Change Proposals, CAP 1616i[1].

The report is structured across 3 sections as follows;

1. Full Options Appraisal: Methodology,
2. Full Options Appraisal: Results, and
3. Full Options Appraisal: Findings

2. Full Options Appraisal: Methodology

2.1. Greenhouse Gas Assessment: Quantitative

Greenhouse Gas (GHG) emissions from air traffic movements at London City Airport have been assessed quantitatively for

- the existing baseline,
- Do nothing: without the airspace change in the opening year (2027) and for each subsequent year until 2038 (12 years after opening)
- Do something option: with the airspace change (single preferred option) in the opening year (2027) and for each subsequent year until 2038 (12 years after opening)

2.1.1. Methodology

2.1.1.1 Scope

GHG emissions have been modelled for aircraft operating from London City Airport (LCY) covering full flight emissions to the destination airport. This includes GHG emissions over the Landing and Take Off (LTO) cycle, use of Auxiliary Power Units (APU) on the ground, and the Climb out Cruise and Descent (CCD) cycle. Each is described further below.

Landing and Take-off (LTO) cycle.

The LTO cycle is a standardised definition used by ICAO and environmental regulators to measure aircraft emissions near to an airport. It includes all aircraft operations below 3,000 ft (915 m) and is divided into four stages:

1. Approach (from 3,000 ft down to touchdown),

2. Taxi-in and taxi-out,

3. Take-off, and

4. Climb-out (from lift-off to 3,000 ft).

Auxiliary Power Units (APU)

Aircraft use their auxiliary engine to provide power prior to take off and after landing to condition the cabin and provide electrical power to the aircraft.

[1] https://www.caa.co.uk/publication/download/20867

Climb out Cruise and Descent (CCD) cycle

The CCD cycle is the standard ICAO methodology for estimating in-flight (above 3,000 ft) aircraft fuel burn and emissions. The CCD cycle represents all phases of flight above 3,000 ft, broken into the following segments:

1. Climb (above 3,000 ft),
2. Cruise, and
3. Descent (down to 3,000 ft).

Full flight emissions have been modelled since the effect of the Airspace Change at LCY is to enable a faster transition to new more fuel-efficient aircraft. In terms of GHG emissions any change to the aircraft fleet schedules is significant. Similarly, any change in the flight profile on arrivals (by the removal of existing steeper approaches) is minimal and not significant in terms of GHG emissions. Furthermore, the environmental effects of GHG emissions are global and therefore the full flight effects of the change in emissions are relevant. Consistent with United Nations Framework Convention on Climate Change (UNFCCC) reporting of aviation emissions only one-way trips are modelled.

2.1.1.2 Modelling Methodology

GHG emissions have been modelled separately for the LTO, APU and CCD cycle using best available data inputs and modelling techniques. Each is detailed further below.

Fleet Forecast

Forecast aircraft fleets are the key data input for the modelling of GHG emissions and were provided by LCY for each year from 2027 to 2038, for both the Do Nothing and Do Something option scenarios. A summary of the fleet forecasts are set out in the LCY Full Options Appraisal document Section 2.

Apart from the replacement of Embraer E190 aircraft with Airbus A320neo aircraft in the Do Something scenario, no significant changes to the fleet mix were forecast, and in particular, no future aircraft types are assumed, which is a worst-case assumption.

The forecast movements are categorised into UK ETS traded and not traded destinations (see further below), and all aircraft emissions were calculated separately for these categories. In terms of the Embraer E190 aircraft that are replaced by Airbus A320neo aircraft in the Do Something option scenario, it is assumed that the mix of routes used by the two aircraft are the same.

Modelling LTO and APU GHG emissions

Emissions in the LTO cycle (below 3000 feet) and from APU emissions were calculated using fuel consumption rates calculated as part of the air quality assessment. Full details of the fuel calculations are given in the air quality report see LCY Full Options Appraisal Annex Local Air Quality. Fuel consumption was converted to CO_2e emissions by first multiplying by 3.18kgCO2e/kg fuel, on the assumption that all fuel is Jet-A1; this factor is for Jet-A1 fuel, but is also applied to the small amount of aviation spirit used at the Airport.

CCD

GHG emissions from departures above 3000 feet, known as the Climb, Cruise and Descent phase or CCD, were calculated based on an average route length for each aircraft type, provided by LCY. These emissions were uplifted by 5% in accordance with DfT guidance[2] to account for additional travel distances associated with factors such as divergence of flight tracks from the great circle distance, standard instrument departure routes and stacking on arrival.

GHG emissions for each aircraft departure in the CCD phase have been calculated using the aviation emissions calculator tool published as part of the European Environment Agency/EMEP air pollutant emission inventory guidebook[3]. The “EMEP/EEA Air Pollutant Emission Inventory Guidebook is a technical guidance framework maintained by the EEA (in cooperation with the relevant Task Force under the UN Convention on Long-Range Transboundary Air Pollution, CLRTAP).

It provides standardised methods, default emission factors, and calculation procedures for compiling national emission inventories (air pollutants and greenhouse gases) across many sectors including aviation. The Guidebook (latest edition 2023) is the reference document for European (and many national) reporting of GHG emissions.

The European Environment Agency/EMEP tool uses the aircraft type (for which it obtains an engine fuel consumption formula from an in-built database) and the CCD stage length to calculate total CO_2 emissions for each aircraft departure. Emissions of CO_2e were calculated by first multiplying the CO_2 emissions extracted from the EMEP/EEA calculator tool by 3.18/3.15 = 1.0095, on the assumption that all fuel is Jet-A1.

Specifically, the EMEP/EEA tool provides a methodology suitable for calculating full flight GHG emissions where the detailed full flight routing data is not available, as is the case for this study.

Sustainable Aviation Fuel

Sustainable Aviation Fuels (SAF) are fuels that reduce GHG emissions from aviation over their lifecycle when compared to standard jet fuel (Jet-A1). SAF can be made from a variety of feedstocks and can be easily blended with conventional jet fuel for use in existing engines, with no modification for engines needed.

The UK SAF Mandate[4] requires an increasing amount of SAF, starting in 2025 at 2% of total UK jet fuel demand, increasing linearly to 10% in 2030 and then to 22% in 2040. From 2040, the obligation will remain at 22% of total UK jet fuel demand until there is greater certainty regarding SAF supply.

The GHG modelling presented in Section 3 has been modelled assuming 100% fossil-based jet fuel. This is a worst-case assessment as it does not account for the increasing blend of SAF that is required under the UK’s SAF Mandate.

The GHG emissions resulting from SAF are lower than from fossil-based jet fuel and depend on the method of production and feedstocks used. Under the UK SAF Mandate all SAF must achieve a minimum GHG emissions reductions of 40% and is estimated to achieve an average of over 70% GHG emissions savings on a lifecycle basis relative to conventional fossil-based jet fuel.

[2] DfT (2017), UK Aviation Forecasts
[3] [EEA (2023) EEA/EMEP air pollutant emission inventory guidebook 2023 Chapter 1.A.3.a Aviation, http://www.eea.europa.eu/publications/emep-eea-guidebook-2023
[4] The Renewable Transport Fuel Obligations (Sustainable Aviation Fuel) Order 2024.

2.1.1.3 Modelled Outputs

CO_2e emissions

The mass of carbon dioxide equivalent (CO_2e) emitted for the do-nothing and do-something option has been calculated by multiplying the mass of aviation fuel burned during flight by a factor of 3.18 kg of CO_2e per kg of fuel.

This is the latest 2025 GHG conversion factor for aviation turbine fuel published for Department for Energy Security and Net Zero (DESNZ) for company reporting of greenhouse gas emissions[5].

Traded and Non-Traded Emissions

Since 2021, CO_2e from domestic flights, flights to and from Gibraltar, and certain flights departing from the UK such as those arriving in the European Economic Area (EEA, excluding the outermost regions) have been included in the UK Emissions Trading System (UK ETS). Therefore, CO_2e emissions subject to inclusion within the UK ETS have been categorised into 'traded', and the remainder categorised as 'non-traded'.

Non-traded emissions include those associated with international flights that are not traded under the UK ETS.

The traded and non-traded status for CO_2e considers only the UK ETS and does not take into account other emissions trading systems such as the EU ETS and CORSIA.

TAG Assessment

In alignment with the DESNZ guidance on greenhouse gas emissions valuation, the change in emissions (from do nothing to do-something option) has been valued using the TAG Greenhouse Gasses Workbook covering the period from opening (2027) up to and including after 12 years (2038). This takes into account the traded and non-traded status of the emissions in the UK ETS as described above. The TAG assessment results are summarised in an appendix of the LCY Full Options Appraisal document.

2.2. Fuel Burn Assessment – Quantitative

Fuel burn is calculated using the methodology described under the GHG emissions section above.

Once fuel burn has been calculated as described in the GHG section, it is then monetised by assuming a cost per tonne of Jet Fuel of £588.41. This value had been calculated from the jet fuel price of $778.74[6] per tonne and a currency conversion rate of 1USD = GBP 0.7556 from Reuters[7] (both as of 25/11/2025).

3. Full Options Appraisal: Results

Throughout this document, data shown in tables has been rounded to two decimal points. This includes any totals shown, and numbers stated within the narrative, which are always calculated using unrounded data, and then rounded for display. Therefore, adding up data items may result in a different number than that presented as the total.

[5] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2025
[6] https://www.iata.org/en/publications/economics/fuel-monitor/
[7] https://www.reuters.com/markets/currencies/

3.1. GHG Assessment: Quantitative

3.1.1. Existing Baseline

LCY report their GHG emissions as part of their Sustainability reporting[8] and certification under ACI Airport Carbon Accreditation. Full flight emissions from 2024 are reported in Table 3-1 below.

Table 3-1: London Airport City Flight Emissions 2024

Source	CO_2e (Kilo Tonnes)	Fuel Use (tonnes)	kg CO2e/pax	kg Fuel/pax
LTO	31.75	9.99	8.90	2.80
CCD	157.75	49.64	44.21	13.91
Full Flight	**189.5**	59.63	53.11	16.71

3.2.1. GHG Emissions Do Nothing vs Do Something Option

Table 3-2 below details the full flight GHG emissions for the do nothing and do something option, and the change with do something in the opening year and each year until 2038 (year 12). The table also provides a cumulative total over the 12 years.

Table 3-2: GHG emissions for the do nothing and do something option 2027 to 2038

Year	**CO_2e (Kilo Tonnes)**		
	Do Nothing	**Do Something Option**	**Change with Option**
2027 (opening year)	250.52	232.29	-18.23
2028	265.86	255.89	-9.98
2029	276.50	273.99	-2.52
2030	285.42	284.35	-1.07
2031	290.91	284.24	-6.67
2032	296.51	288.31	-8.20
2033	305.82	311.71	5.89
2034	313.85	335.03	21.18
2035	322.50	368.90	46.40
2036	363.68	397.42	33.74
2037	415.35	397.42	-17.93
2038 (year 12)	458.42	397.42	-61.00
Cumulative 2027 to 2038	**3845.35**	**3826.97**	**-18.38**

[8] https://sustainability.londoncityairport.com

Table 3-3 below provides the same data as Kg CO_2e per passenger.

Table 3-3: Kg CO_2e per pax for the do nothing and do something option 2027 to 2038

Year	**Kg CO_2e per passenger**		
	Do Nothing	**Do Something Option**	**Change with Option**
2027 (opening year)	61.80	57.31	-4.50
2028	62.86	57.65	-5.21
2029	62.40	53.79	-8.61
2030	62.63	50.99	-11.63
2031	60.55	46.19	-14.37
2032	58.51	43.83	-14.68
2033	57.16	43.66	-13.50
2034	55.53	43.54	-11.99
2035	53.97	43.75	-10.22
2036	52.62	44.16	-8.46
2037	51.79	44.16	-7.63
2038 (year 12)	50.94	44.16	-6.78
Cumulative 2027 to 2038	**56.50**	**46.58**	**-9.93**

Appendix 1 provides GHG emissions for the do nothing and do something option from 2027 to 2038 broken out into traded and non-traded emissions.

3.2. Fuel Burn Assessment: Quantitative

Fuel burn has been calculated based on the GHG modelling and fuel costs using Jet Fuel price as detailed in the methodology.

3.1.2. Fuel Burn Do nothing vs Do Something Option

Table 3-4 below details the full flight fuel burn and costs for the do nothing and do something option, and the change with do something in the opening year and each year until 2038 (year 12). The table also provides a cumulative total over the 12 years.

Table 3-4: Full flight fuel burn and fuel costs for the do nothing and do something option

Year	Jet fuel (kilo tonnes)			Fuel Cost (£m)		
	Do Nothing	Do Something Option	Change with Option	Do Nothing	Do Something Option	Change with Option
2027 (opening year)	78.78	73.05	-5.73	46.35	42.98	-3.37
2028	83.61	80.47	-3.14	49.19	47.35	-1.85
2029	86.95	86.16	-0.79	51.16	50.70	-0.47
2030	89.75	89.42	-0.34	52.81	52.61	-0.20
2031	91.48	89.38	-2.10	53.83	52.59	-1.23
2032	93.24	90.66	-2.58	54.86	53.35	-1.52
2033	96.17	98.02	1.85	56.59	57.68	1.09
2034	98.69	105.36	6.66	58.07	61.99	3.92
2035	101.42	116.01	14.59	59.67	68.26	8.59
2036	114.36	124.97	10.61	67.29	73.54	6.24
2037	130.61	124.97	-5.64	76.85	73.54	-3.32
2038 (year 12)	144.16	124.97	-19.18	84.82	73.54	-11.29
Cumulative 2027 to 2038	**1209.23**	**1203.45**	**-5.78**	**711.52**	**708.12**	**-3.40**

4. Full Options Appraisal Findings

The results of the assessment lead to the following key findings;

1. The GHG emissions (and fuel use) in the opening year (2027) are marginally lower with the Do Something Option.
2. The GHG emissions (and fuel use) in year 12 (2038) are marginally lower with the Do Something Option.
3. The cumulative GHG emissions (and fuel use) over the 12-year period are marginally lower with the Do Something Option.
4. Over the 12-year period GHG emissions per passenger are materially (on average 17%) lower with the Do something Option. This reflects the shift to more fuel-efficient aircraft enabled by the airspace change.

5. Appendix 1: Detailed GHG Emission Results

Year	EMISSIONS (kTCO2e)								
	Do Nothing			Do Something Option			Change		
	Traded	Non-Traded	Total	Traded	Non-Traded	Total	Traded	Non-Traded	Total
2027	247.03	3.49	250.52	228.80	3.49	232.29	-18.23	0.00	-18.23
2028	262.23	3.63	265.86	252.26	3.63	255.89	-9.98	0.00	-9.98
2029	272.87	3.63	276.50	270.35	3.63	273.99	-2.52	0.00	-2.52
2030	281.64	3.78	285.42	280.57	3.78	284.35	-1.07	0.00	-1.07
2031	286.99	3.92	290.91	280.32	3.92	284.24	-6.67	0.00	-6.67
2032	292.44	4.07	296.51	284.25	4.07	288.31	-8.20	0.00	-8.20
2033	301.60	4.21	305.82	307.49	4.21	311.71	5.89	0.00	5.89
2034	309.49	4.36	313.85	330.67	4.36	335.03	21.18	0.00	21.18
2035	318.15	4.36	322.50	364.55	4.36	368.90	46.40	0.00	46.40
2036	359.32	4.36	363.68	393.06	4.36	397.42	33.74	0.00	33.74
2037	410.85	4.50	415.35	393.05	4.37	397.42	-17.80	-0.14	-17.93
2038	453.92	4.50	458.42	393.05	4.37	397.42	-60.86	-0.14	-61.00
TOTAL	**3796.55**	**48.80**	**3845.35**	**3778.44**	**48.53**	**3826.97**	**-18.11**	**-0.27**	**-18.38**