Aberdeen Airport Carbon Footprint 2023

Report for Aberdeen International Airport Ltd (part of AGS Airports Ltd)

31 May 2024

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Project Summary

- AGS Airports Limited, a partnership between Ferrovial and Macquarie Infrastructure and Real Assets (MIRA), owns Aberdeen International Airport Limited (ABZ). The airport operates 365 days per year and in 2023 served more than 2,300,000 passengers and handled more than 75,000 aircraft movements. As of the end of 2023, AGS Airports employed around 370 full time employees (FTE), of which around 90 were based in Aberdeen Airport, many of whom commute to the airport by car or public transport.
- This report presents the carbon footprint for the 2023 financial year for Aberdeen Airport, covering the period 1st January 2023 to 31st December 2023.
- To continue operating in an environmentally responsible manner, it is important for the airport to monitor and manage all its emissions from all operations – both those the airport is directly responsible for, and those it can influence under its Scope 3 emissions.
- The calculation of the annual carbon footprint will help AGS Airports Limited and the individual airports understand the different areas which contribute to their overall carbon footprint and monitor changes on a yearly basis. This process will help identify improvement opportunities, which will ultimately reduce AGS Airports' carbon footprint and associated costs. In addition, the success of any management strategies previously implemented can be evaluated year-on-year through monitoring emissions reductions.

Carbon Footprint – Introduction

- All emissions have been calculated in line with the Greenhouse Gas (GHG) Protocol Corporate Reporting Standard, Airport Carbon Accreditation (ACA) Level 3+ and ISO 14064-1.
- Emissions are reported using the market-based methodology unless clearly indicated otherwise. A location-based emissions profile can be seen towards the end of this report.
- The GHG Protocol requires organisations to report their GHG emissions under 3 scopes: Scope 1, 2 and 3. The emissions included within each scope of the footprint can be seen below. A detailed explanation of the methodology and assumptions used to estimate the footprint can be found in the appendix of this report.

Scope 1 *"Direct Emissions"*

- Natural gas consumed by Aberdeen Airport
- Fuel used by vehicles and ground support equipment (GSE) owned by Aberdeen Airport, generators and other equipment
- Materials and fuel burned during fire training
- Refrigerant gases lost to atmosphere from chillers and air conditioners
- Surface de-icer used on ground by Aberdeen Airport

Scope 2 *"Indirect Emissions"*

- Electricity used by Aberdeen Airport, reported using both market and location-based methodologies

Scope 3 *"Indirect Emissions"*

- Aviation emissions: landing take-off (LTO), auxiliary power units (APU) and engine testing
- Passenger surface access
- Fuel used in vehicles and GSE owned by third parties
- Staff commute and business travel
- Non-road construction vehicles and plant
- Tenant electricity and natural gas consumption
- Tenant refrigerant gases lost to atmosphere
- Waste disposal
- De-icer used on aircraft by third parties
- Water supply and wastewater treatment
- Electricity WTT and transmission and distribution (T&D) losses

Carbon Footprint – Market-Based Summary

- The market-based methodology as outlined in the GHG Protocol, allows for organisations to report their carbon emissions reflecting their energy procurement decisions.
- For Aberdeen Airport, their electricity is purchased under a zero emissions contract that is fully backed by Renewable Energy Guarantees of Origin (REGO) certificates. This means that under market-based reporting rules, the Scope 2 electricity emissions are reported as zero emissions. The following pages show the emissions reported under this methodology.

52,802 tCO_2e/year

94% from Scope 3 emission sources

Market-based emissions figures

18% decrease from 2022 emissions

Scope 3
"Indirect Emissions"

Emissions that arise as a consequence of the activities of the company, but occur from sources not owned or controlled by the company.

49,790 tCO_2e (94.3%)

Scope 1
"Direct Emissions"

Emissions produced from sources linked to a company's assets.

1,334 tCO_2e (2.5%)

Outside of Scopes
Emissions from fuels with biogenic content. Scope 1 impact of these fuels has been determined to be net "0".

1,677 tCO_2e (3.2%)

Scope 2
"Indirect Emissions"

Emissions produced by the generation of electricity purchased from third parties and consumed in the company's assets.

0 tCO_2e (0%)

Carbon Footprint – Annual Emissions (Market-Based)

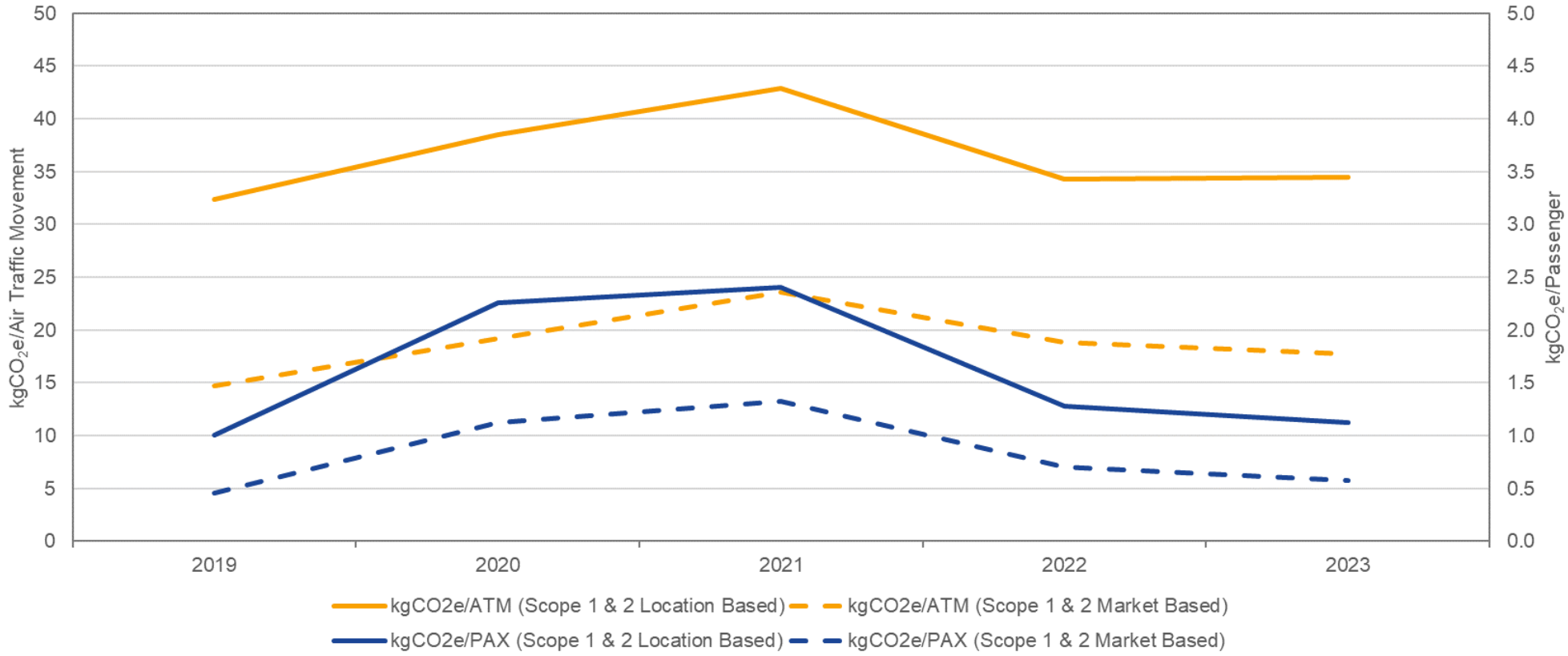
- The table below shows the figures from the charts on the previous page, as well as the % year-on-year (y-o-y) change of the different emissions scopes.

Emissions by Scope (tCO_2e)	2019	2020	2021	2022	2023
Scope 1	1,351.47	1,162.40	1,523.01	1,422.84	1,334.02
Scope 2	0.00	0.00	0.00	0.00	0.00
Scopes 1 and 2	1,351.47	1,162.40	1,523.01	1,422.84	1,334.02
Scope 3	71,003.97	39,572.30	47,096.63	63,254.44	49,790.35
Outside of Scope	6.03	6.19	7.83	28.02	1,677.17
Total emissions	**72,361.47**	**40,740.89**	**48,627.46**	**64,705.30**	**52,801.54**

Scope 1 % y-o-y change	-2.42%	-13.99%	31.02%	-6.58%	-6.24%
Scope 2 % y-o-y change	-100.00%	N/A	N/A	N/A	N/A
Scope 1 & 2 % y-o-y change	-53.78%	-13.99%	31.02%	-6.58%	-6.24%
Scope 3 % y-o-y change	1.40%	-44.27%	19.01%	34.31%	-21.29%
Outside of Scope % y-o-y change	50.75%	2.65%	26.49%	257.85%	5885.62%
Total % y-o-y change	**-0.81%**	**-43.70%**	**19.36%**	**33.06%**	**-18.40%**

Carbon Footprint – Annual Intensity Metrics

- Intensity metrics allow comparison over time against other factors that fluctuate and have an impact on the environmental performance of the airport. The two chosen key performance indicators are aircraft traffic movements (ATM) and passenger numbers (PAX).
- This chart shows intensity metrics for Scope 1 and 2 $kgCO_2e$/PAX and $kgCO_2e$/ATM for both location and market-based reporting methodologies. Note that the impacts of COVID-19 on airport operations led to increased carbon intensity per ATM and PAX in 2020 and 2021.



Carbon Footprint – Annual Intensity Metrics

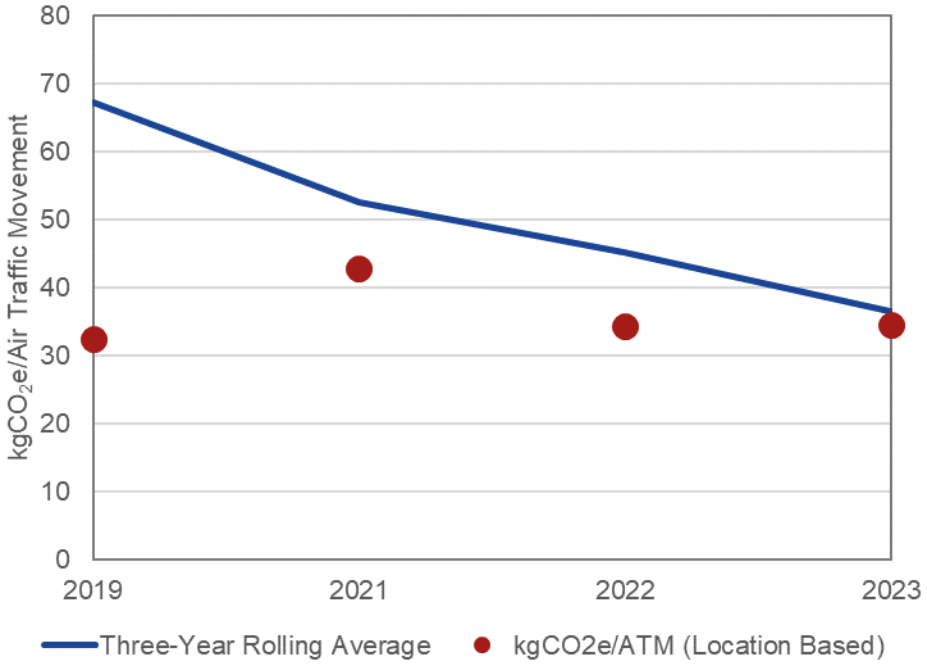
- This table presents the values plotted in the graph on the previous page.

Emissions by Scope (tCO_2e)	2019	2020	2021	2022	2023
ATM	91,711	60,440	64,503	75,377	75,237
PAX	2,966,389	1,029,767	1,148,982	2,026,453	2,302,571
% Change in ATM (year-on-year)	-1.33%	-34.10%	6.72%	16.86%	-0.19%
% Change in PAX (year-on-year)	-4.06%	-65.29%	11.58%	76.37%	13.63%
Scope 1 & 2 (tCO_2e) (Location-Based)	2,972.34	2,327.53	2,765.95	2,587.93	2,591.94
$kgCO_2e$/ATM	32.41	38.51	42.88	34.33	34.45
$kgCO_2e$/PAX	1.00	2.26	2.41	1.28	1.13
Scope 1 & 2 (tCO_2e) (Market-Based)	1,351.47	1,162.40	1,523.01	1,422.84	1,334.02
$kgCO_2e$/ATM	14.74	19.23	23.61	18.88	17.73
$kgCO_2e$/PAX	0.46	1.13	1.33	0.70	0.58

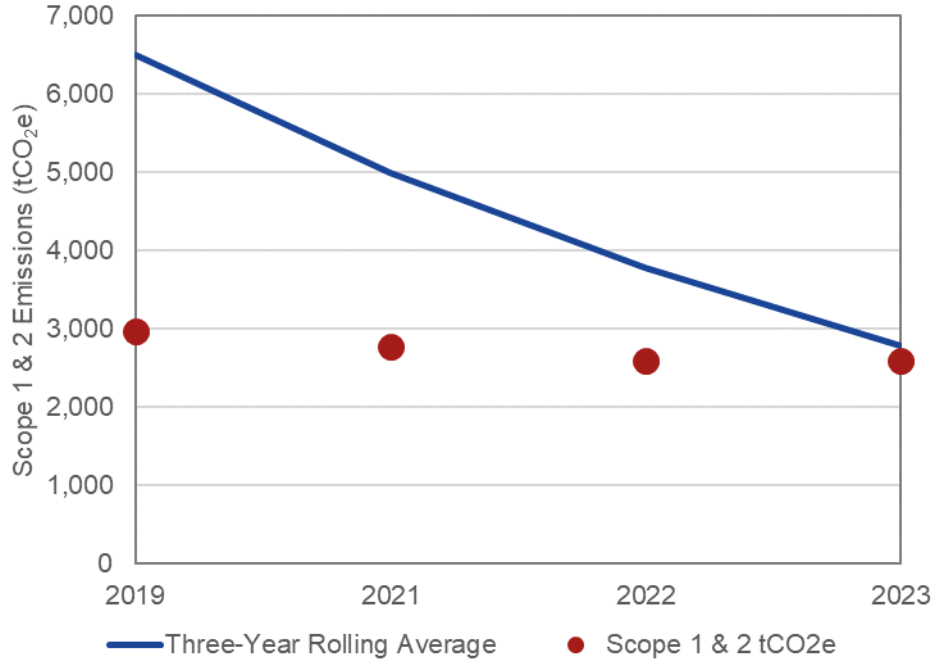
Carbon Footprint – 3 Year Rolling Average (Location-Based)

- As per the requirements of Level 3+ of the Airport Carbon Accreditation scheme, Aberdeen Airport have demonstrated a reduction in their Scope 1 and 2 emissions against the three-year rolling average, both in terms of absolute and intensity-based emissions, as shown in the charts below.
- *Note: due to impacts of COVID-19, 2020 data is not included within the three-year rolling average when reporting these figures for ACA purposes. Reduced passenger and flight numbers in 2021 also impacts the intensity-based emissions for 2021, but absolute emissions remained below the three-year rolling average.*

Intensity-Based Emissions ($kgCO_2e$/ATM)



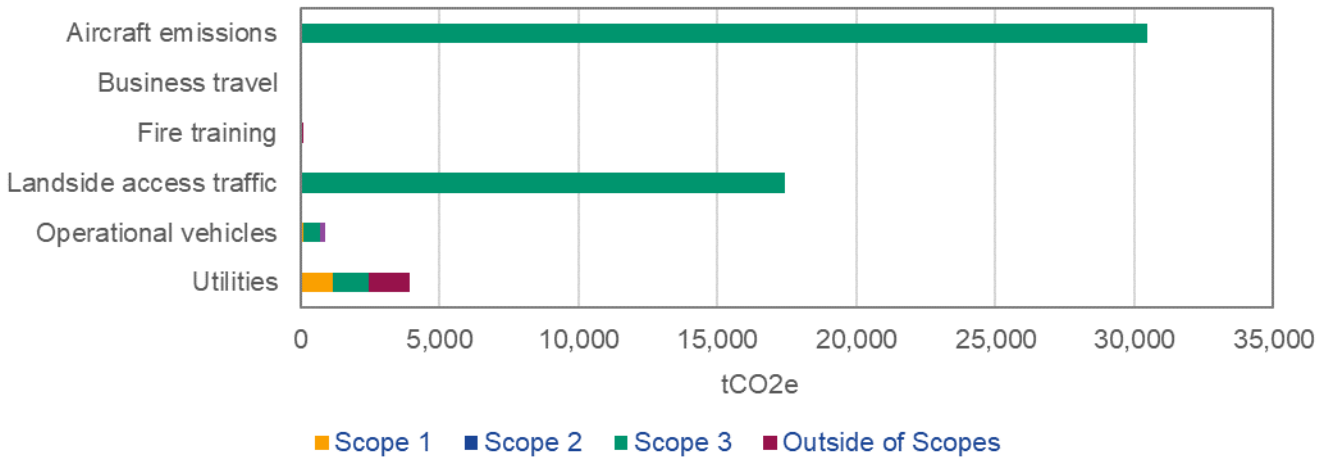
Absolute Emissions (tCO_2e)



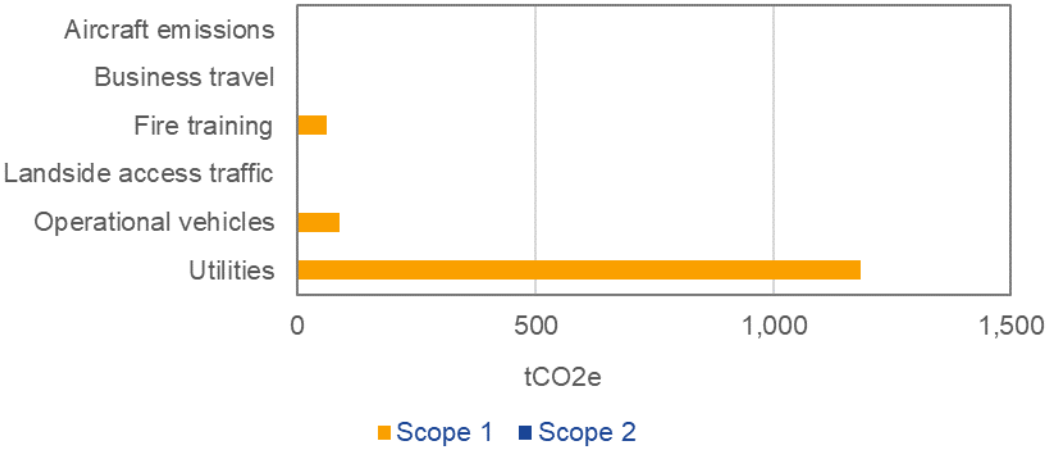
Carbon Footprint – By Emissions Source (Market-Based)

- Note, 'Aircraft emissions' includes emissions from LTO, APU and engine testing.

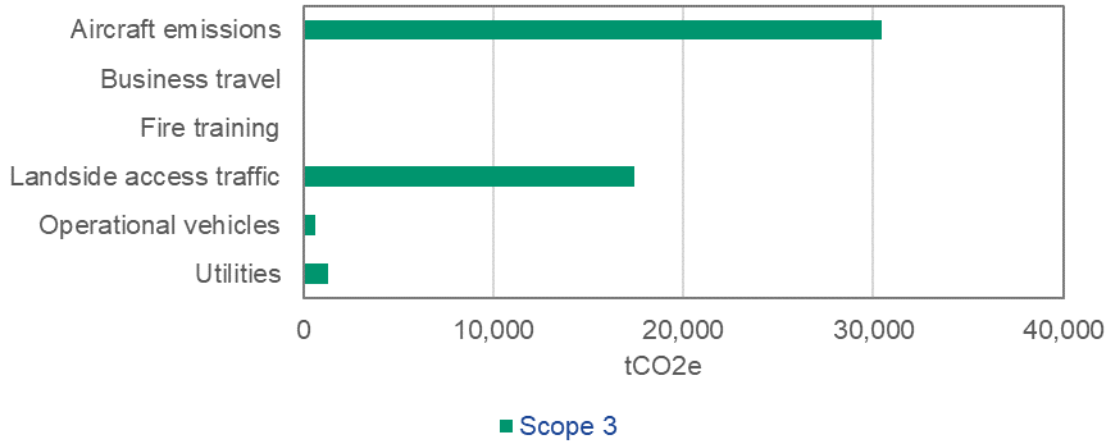
All Scopes Emissions Split by Source



Scopes 1 and 2 Emissions Split by Source



Scope 3 Emissions Split by Source



Carbon Footprint – By Emissions Source (Market-Based)

Summary Category	ACA Category	Emissions (tCO_2e)	% of Scope	% of Total Emissions
Scope 1 – Total		**1,334.02**	**100.00%**	**2.53%**
Mobile sources	Operational vehicles (Airport)	89.08	6.68%	0.17%
Stationary sources	Heating and generation	0.82	0.06%	0.00%
	Natural gas (Airport)	897.47	67.28%	1.70%
	Fire training	62.36	4.67%	0.12%
Process emissions	Refrigerant losses	0.00	0.00%	0.00%
	De-icing	284.30	21.31%	0.54%
Scope 2 – Total		**0.00**	**0.00%**	**0.00%**
Purchased electricity	Purchased electricity (Airport)	0.00	0.00%	0.00%
Scope 3 – Total		**49,790.35**	**100.00%**	**94.30%**
Category 1: Purchased goods and services	Water consumption	14.42	0.03%	0.03%
	Non-road construction vehicles	0.00	0.00%	0.00%
Category 3: Fuel- and energy-related activities	Purchased electricity (Airport) WTT	302.95	0.61%	0.57%
	Purchased electricity (Airport) T&D	108.83	0.22%	0.21%
Category 5: Waste generated in operations	Waste	4.63	0.01%	0.01%
	Wastewater	15.61	0.03%	0.03%
Category 6: Business travel	Business travel	8.33	0.02%	0.02%
Category 7: Employee commuting and home office	Staff commute	2,264.24	4.55%	4.29%
Category 11: Use of sold products	Aircraft LTO	29,431.43	59.11%	55.74%
	Aircraft engine testing	1,018.70	2.05%	1.93%
	Heating and generation (3rd party)	0.36	0.00%	0.00%
	Operational vehicles (3rd Party)	616.07	1.24%	1.17%
	Refrigerant losses	2.93	0.01%	0.01%
	De-icing	310.58	0.62%	0.59%
	Passenger surface access	15,177.81	30.48%	28.75%

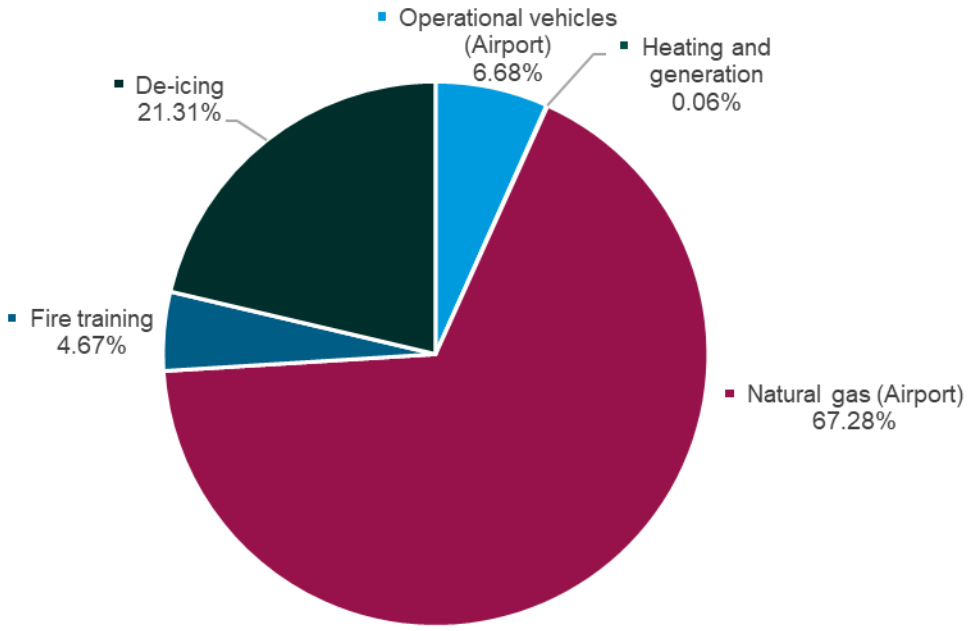
Carbon Footprint – By Emissions Source (Market-Based)

Summary Category	ACA Category	Emissions (tCO_2e)	% of Scope	% of Total Emissions
Category 13: Downstream leased assets	Purchased electricity (Tenant) WTT	332.15	0.67%	0.63%
	Purchased electricity (Tenant) T&D	119.32	0.24%	0.23%
	Natural gas (Tenant)	61.99	0.12%	0.12%
Outside of Scopes – Total		**1,677.17**	**100.00%**	**3.18%**
N/A	Heating and Generation	24.64	1.47%	0.05%
	Fire Training	7.40	0.44%	0.01%
	Operational Vehicles (Airport)	5.00	0.30%	0.01%
	Operational Vehicles (3rd Party)	174.66	10.41%	0.33%
	Business Travel	0.06	0.00%	0.00%
	Purchased electricity (Airport)	699.01	41.68%	1.32%
	Purchased electricity (Tenant)	766.40	45.70%	1.45%

Scope	Emissions (tCO_2e)	% of Total Emissions
Scope 1	1,334.02	2.53%
Scope 2	0.00	0.00%
Scope 3	49,790.35	94.30%
Outside of Scopes	1,677.17	3.18%
All Scopes	**52,801.54**	**100%**

Carbon Footprint – Scope 1

- Scope 1 emissions are produced from sources linked to a company's assets.
- For Aberdeen Airport, the major emissions sources in this category include the emissions from natural gas used in heating systems and airport de-icing. Other smaller sources include emissions from airport operational vehicles, fuel burnt during fire training and petrol used for heating and generation.



1,334 tCO_2e/year

2.5% of total emissions

Market-based emissions figures

6% decrease from 2022 emissions

Carbon Footprint – Scope 2

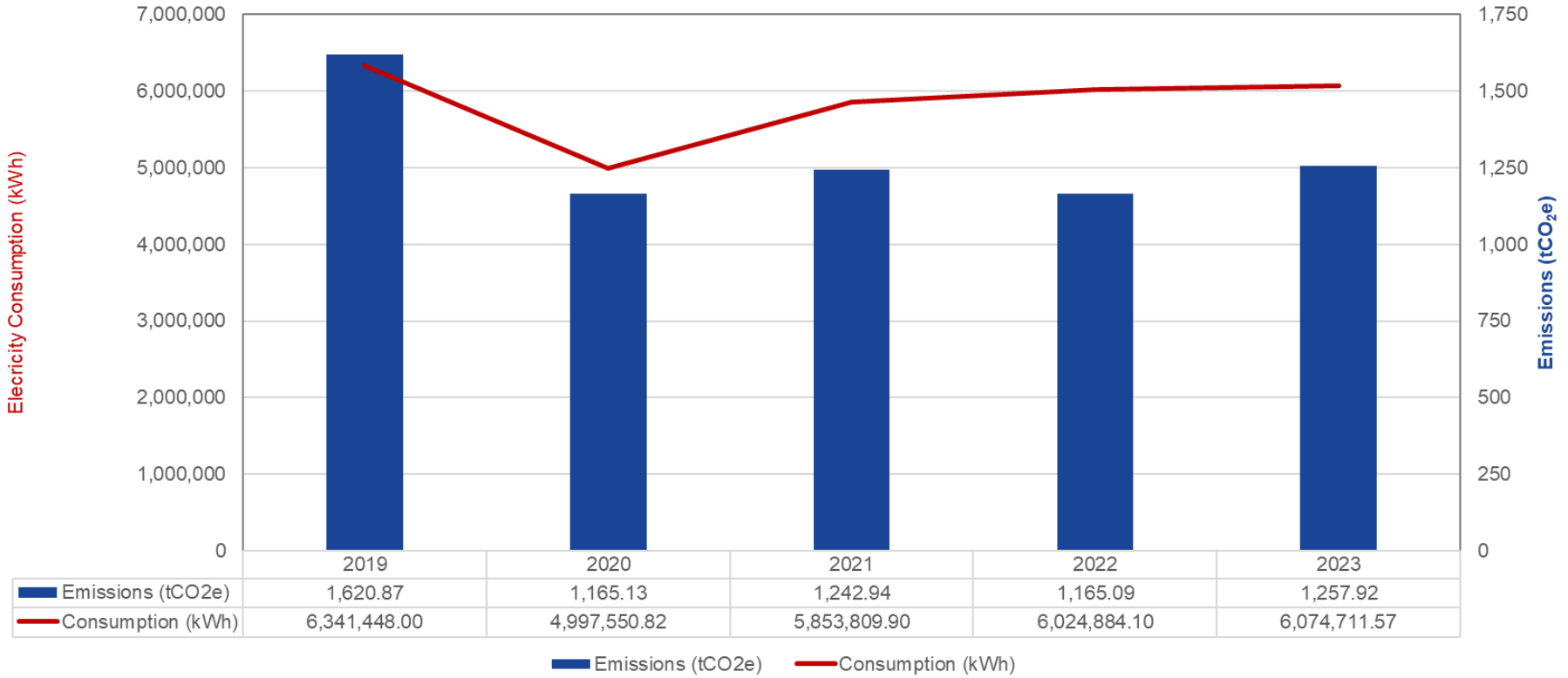
- Scope 2 emissions relate to the electricity consumption at the airport. These can be calculated using the following two methodologies:
  - **Location-based method:** this reflects the average emissions intensity of macro-scale (regional/national) electricity grids where energy consumption occurs. Companies reporting using this method should use the regional/National Grid average emission factor. In the UK, this would be sourced from the Department for Energy Security and Net Zero's UK Government conversion factors for Company Reporting. When multiplying the electricity consumption of 6,074,712 kWh supplied to Aberdeen Airport by the emission factor of 0.20707 $kgCO_2e/kWh$ calculates these emissions as 1,257.92 tCO_2e.
  - **Market-based method:** this reflects the emissions from the electricity that a company is purchasing. Energy suppliers in the UK are already required, by law, to disclose to consumers the fuel mix and GHG emissions associated with their portfolio or tariffs. This airport selects to purchase electricity that is greener than the National Grid average emissions factor.
    - In 2023, 100% of the 6,074,712 kWh of electricity consumption was supplied to Aberdeen Airport by a single supplier (Axpo UK). Aberdeen Airport requested REGO certificates from this supplier for 2023 to determine the market-based emissions associated with this electricity supply. The following breakdown was provided for the year-ending 31st December 2023:
      - Renewables - 100%
    - The weighted emission factor was provided as 0 gCO_2/kWh (or 0 $kgCO_2/kWh$). Multiplying the electricity consumption 6,074,712 kWh by the emission factor of 0 $kgCO_2/kWh$ calculates the emissions as 0 tCO_2e.
  - The advantage of procuring electricity that is higher in renewable energy content than that of the National Grid is outlined in the table below:

	Location-based (tCO_2e)	Market-based (tCO_2e)
Airport Electricity Emissions (Scope 2)	1,257.92	0.00

- The following page provides an annual comparison of the electricity consumption and relevant emissions at Aberdeen Airport.
- *Note: this is Scope 2 airport electricity only and does not include emissions from WTT or T&D losses.*

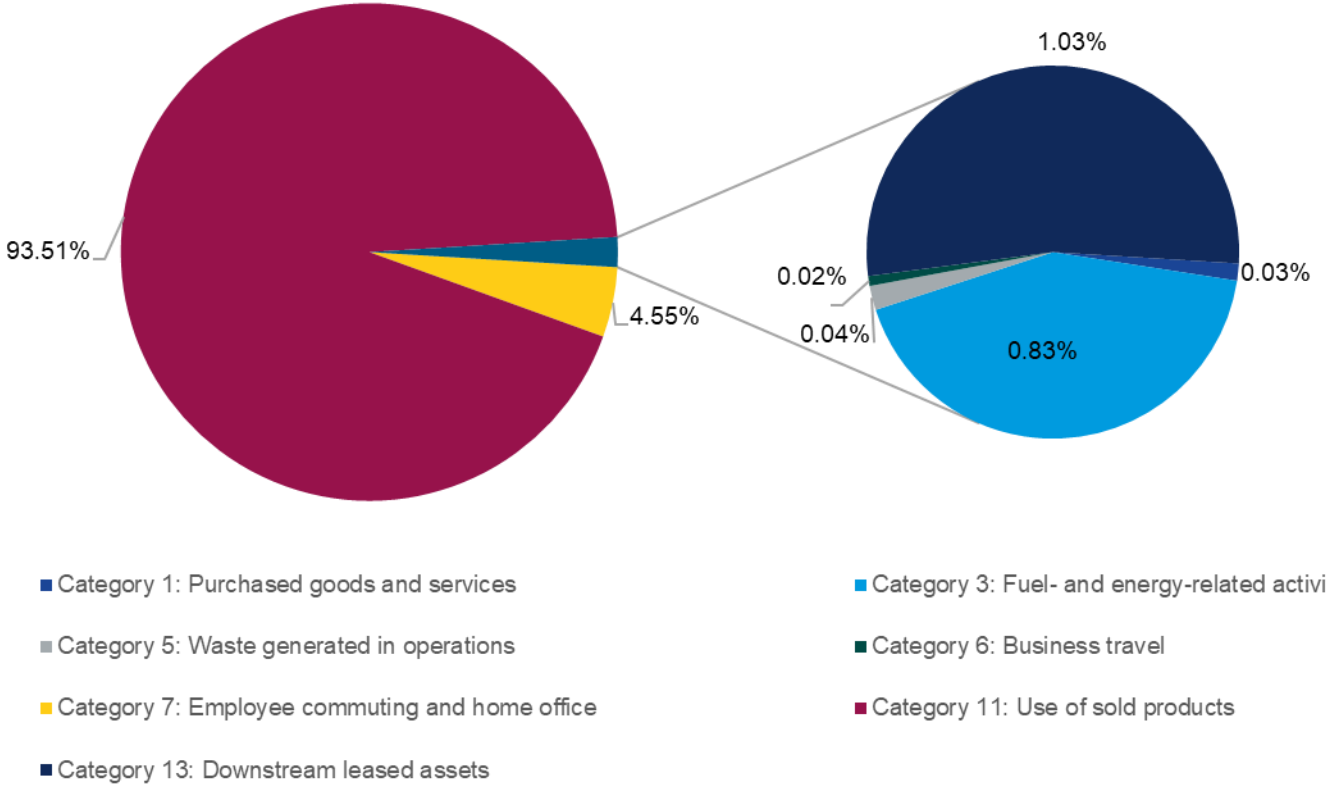
Carbon Footprint – Scope 2 – Annual Emissions

- The emissions in the figure show the location-based electricity emissions.
- There has been little deviation in total electrical consumption since 2019, aside from the sudden drop in electricity consumption in 2020 due to the COVID-19 pandemic. Despite only 4% decrease in electricity consumption (kWh) from 2019 to 2023, emissions decreased by 22% over the same period – this reduction is due to the decarbonisation of the UK grid.
- *Note: the figures for electricity consumption below include only airport (Scope 2) electricity use. Tenant (Scope 3) electricity use, Transmission and Distribution (T&D) and WTT emissions are accounted for in the following Scope 3 section.*



Carbon Footprint – Scope 3 (Market-Based)

- Scope 3 emissions are those that arise as a consequence of the activities of the company but occur from sources not owned or controlled by the company.
- For Aberdeen Airport, the major emissions sources in this category include the emissions from aircraft and passenger surface access (Category 11: Use of sold products). Other sources include third party electricity and operational vehicle fuel, staff commuting, business travel, waste and water supply/treatment.



49,790 tCO_2e/year

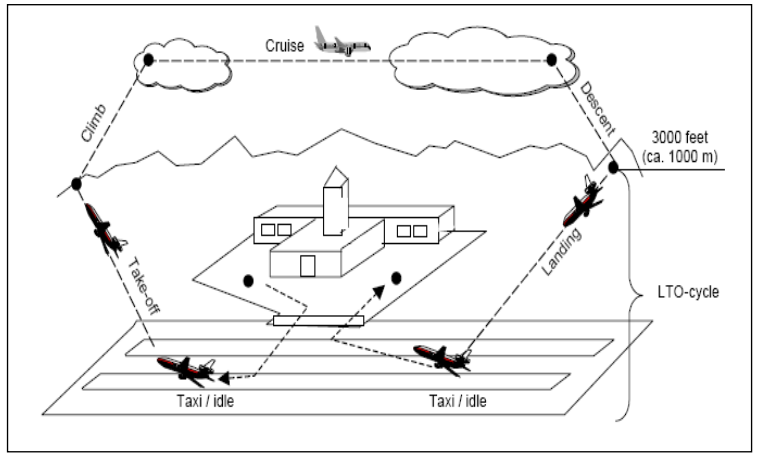
94% of total emissions

Market-based emissions figures

21% decrease from 2022 emissions

Carbon Footprint – Scope 3 – LTO Cycle Emissions

- Carbon emissions from the LTO stage of flights have been calculated and included within Aberdeen Airport's footprint since 2018. The LTO cycle is split into several stages which are shown in the diagram below and consist of all fuel-consuming aircraft movements below 1,000 m altitude.
- Efforts have been made to improve the assumptions around the time aircraft spend in each stage of the LTO cycle, using real taxi time data for fixed-wing aircraft for example.
- For 2023, the Ricardo aircraft emissions calculators have been updated to reflect the most recent aircraft database from EMEP/EEA air pollutant emission inventory guidebook 2023, and updates to fuel flow databases including the ICAO Databank. The EMEP/EEA database now includes next-generation aircraft types, so assumptions are no longer used to account for the reduction in emissions in comparison to last-generation aircraft they replace. The calculations also now include a full helicopter database from FOCA.
- Fuel usage for each aircraft from the LTO cycle are calculated by using fuel burn rates (kg/second) from the ICAO Databank (jet engines), FOCA Aircraft Piston Engine Database (piston engines) or FOI Turboprop Emissions Database (not publicly available) for each aircraft, multiplied by the time the aircraft spends in each stage of the LTO cycle (e.g. taxi out, climb). Fuel use is then converted to carbon emissions using the emissions factor for aviation fuel provided by the UK Government.



29,431 tCO_2e/year

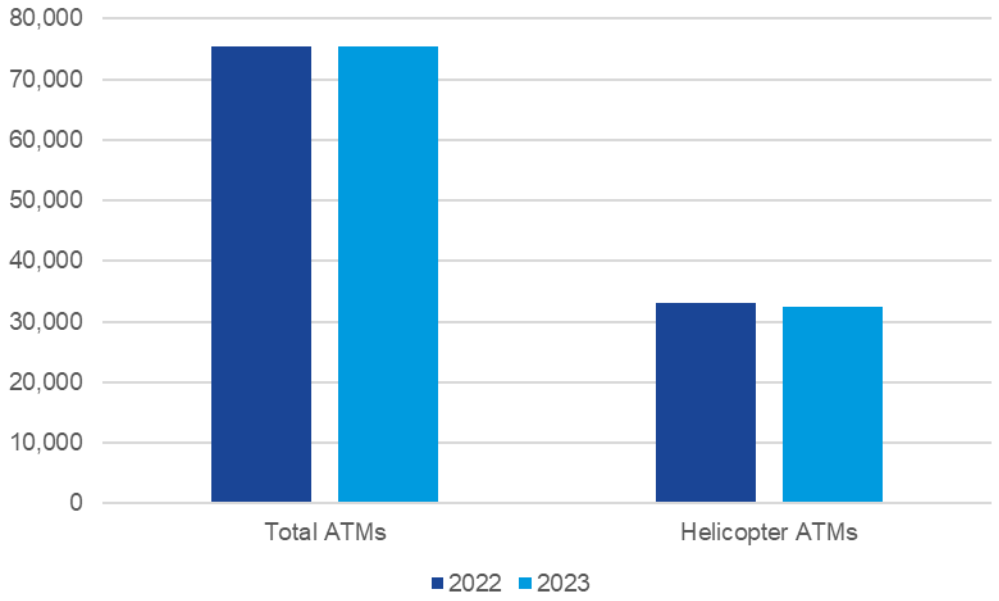
56% of total emissions

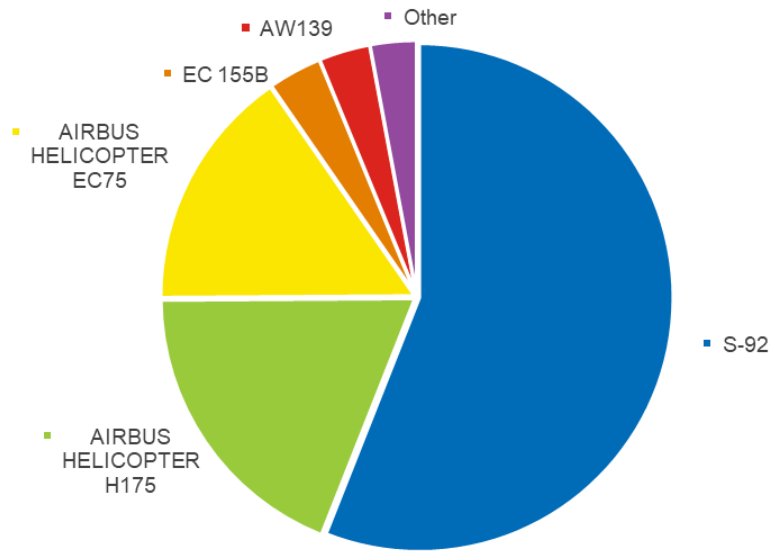
Market-based emissions figures

35% decrease from 2022 emissions

Updates to LTO Calculations for 2023

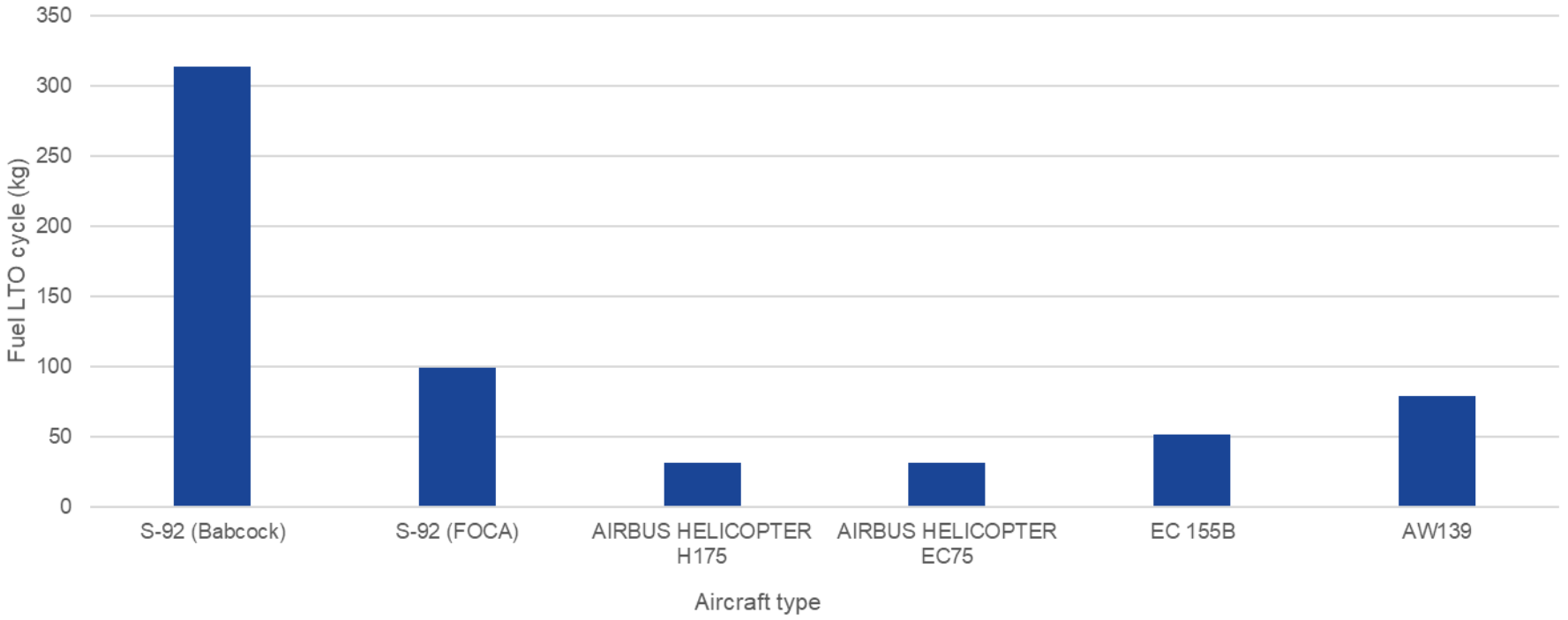
- The previous page highlights a 35% decrease in LTO emissions from 2022. As the graph below shows, there has been only a small change in ATMs between reporting periods – this decrease is due to an update in the assumptions used to calculate helicopter emissions from the LTO cycle.
- The 2022 LTO calculations based fuel burn for all helicopters on that for the S-92 aircraft, as this model accounted for over 60% of helicopter ATMs at Aberdeen Airport. The fuel burn information per each stage of the LTO cycle for the S-92 model was provided by AGS Airports.
- This year, the methodology to estimate fuel burn in the LTO cycle has been updated using the Federal Office of Civil Aviation (FOCA) helicopter emissions database. FOCA publishes a calculated table with fuel consumption and emission factors per helicopter type. This method has provided greater accuracy in emissions results as estimated fuel burn has been based on the helicopter type for all aircraft movements. To enable year-on-year comparisons to be made, it is recommended to update historic LTO emissions with the new assumptions.





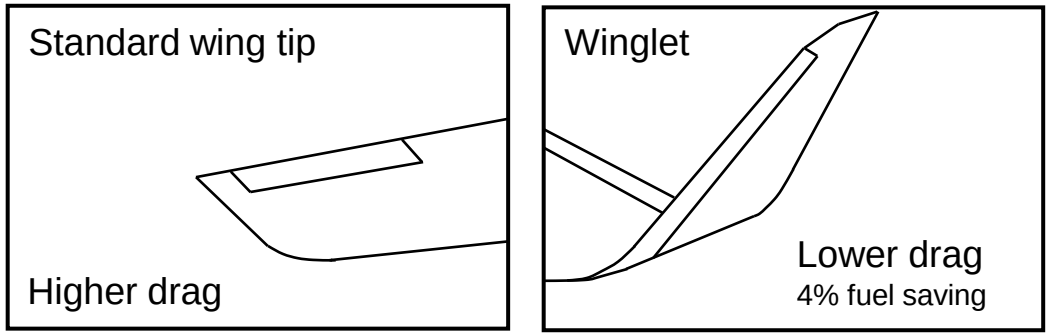
Updates to LTO calculations for 2023

- Comparison between results for 2022 and 2023 suggests a decrease in emissions between the reporting periods. However, this result is not reflective of a real change in emissions, rather of an update in calculation assumptions. For the last reporting period, AGS provided data from Babcock for fuel usage of an S-92 aircraft, which was used as a proxy for all helicopter ATMs. As show in the graph below, this data from Babcock for the S-92 aircraft estimates significantly higher fuel burn in the LTO cycle than the respective FOCA data. Use of the FOCA database also highlighted that the other aircraft with the most material ATMs had lower fuel burn in the LTO cycle than the S-92 aircraft. This has led to a historical overestimation in emissions from helicopters and is the main reason for this apparent decrease in emissions from 2022.
- Where aircraft were not available in the FOCA database, proxy aircraft with similar engines were used. Note that the Airbus helicopters H175 and EC75 used aircraft A119 as a proxy.



Carbon Footprint – Scope 3 – LTO Cycle Emissions

- Additional efforts have been made to improve the accuracy of the LTO calculations in 2022 and 2023 to reflect the impact of aircraft fuel efficiency improvements that were not otherwise captured by the methodology used in previous years. One improvement to the methodology was accounting for the fuel savings from the use of wingtips on aircraft. New designs for the tips of the aircraft wings can reduce drag and improve fuel efficiency. An example of a modern wingtip design is shown below.
- Wingtips can reduce fuel burn by 4-6% for larger aircraft, which reduces the carbon emissions by the same amount. A 4% reduction in fuel use was used as a conservative estimate of fuel burn savings for the LTO calculations. This reduction was not applied to next-generation aircraft (such as the Airbus Neos and Boeing 737 MAX 8) with winglets or sharklets as the efficiencies are assumed to already be accounted for in the fuel burn data in the ICAO Databank.
- Note that wing tip fuel burn savings only apply to the following LTO stages: take-off, initial climb and climb out.



In 2023, **1.3% of all aircraft** flying through Aberdeen Airport had either winglets or sharklets installed. This has resulted in **emissions savings of 35 tCO_2e** compared to if the aircraft did not have winglets or sharklets installed.

In 2023, **1.6% of all flights** through Aberdeen Airport were next-generation more fuel-efficient aircraft.

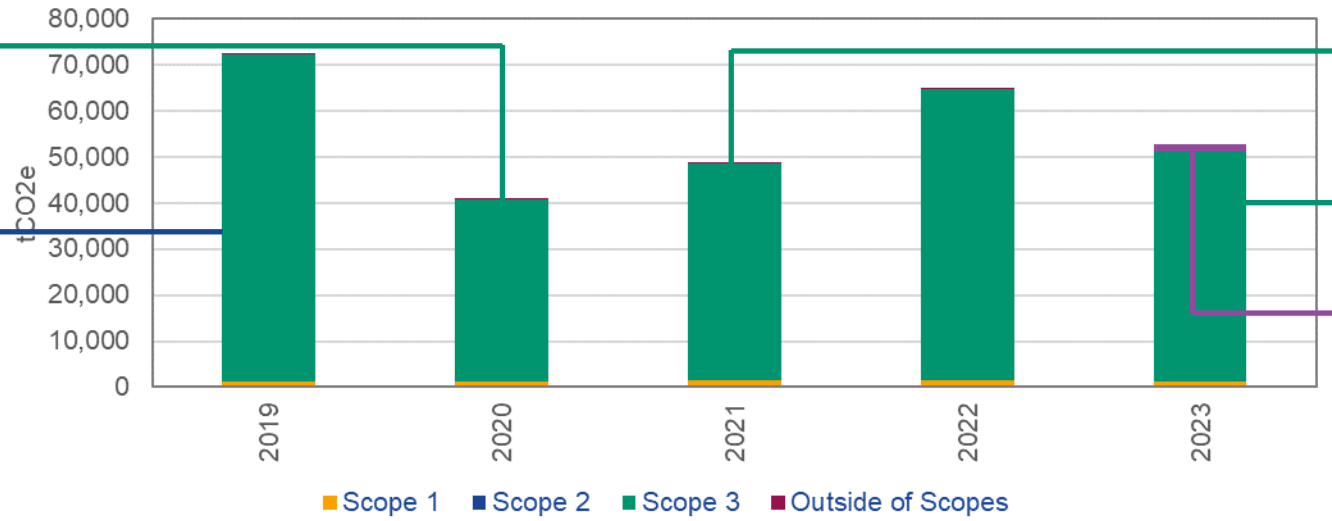
These next-generation aircraft are up to 30% more fuel efficient than their last-generation models*.

*Based on a comparison of the total fuel consumed in the landing take-off cycle for engines used in these aircraft from the ICAO Databank .

Annual Summary – Market-Based Reporting

COVID-19 pandemic – decrease in Scope 3 emissions

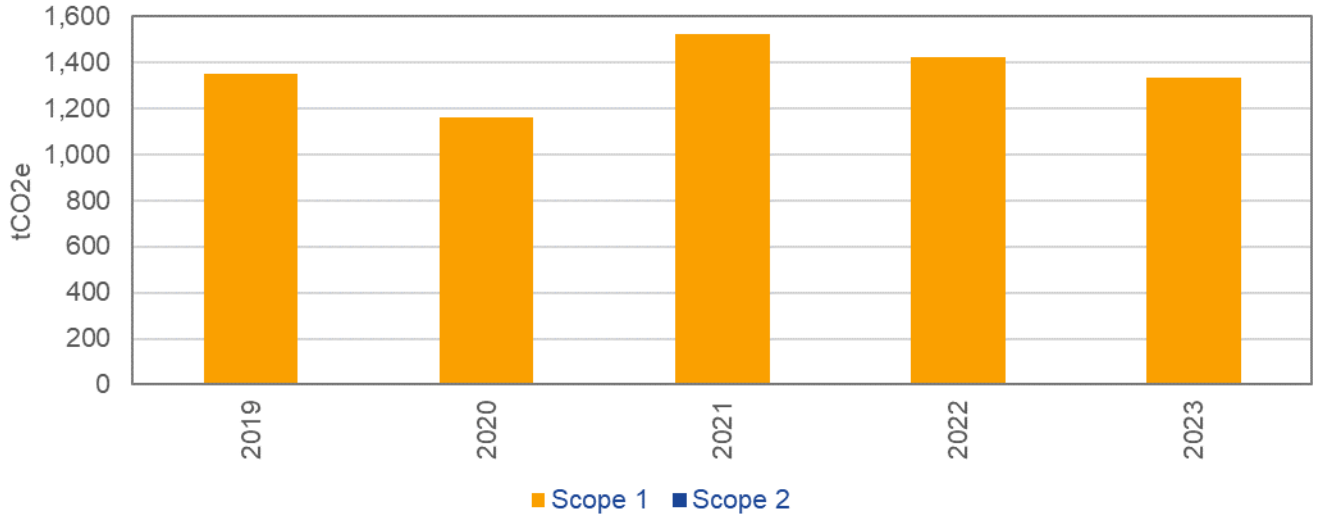
100% renewable electricity from 2019



Increase in emissions due to removal of travel restrictions

Decrease in emissions due to change in LTO methodology

Increase in outside of scopes emissions due to reporting of additional sources



Annual Emissions Trends

- There was an overall 18% decrease in emissions from 2022 to 2023, driven by the apparent decrease in LTO emissions from updates to the methodology. This overall decrease is not representative of overall emissions trends, as the change in emissions for all sources except LTO is a 19% increase from 2022 to 2023.
- Emissions sources driving this increase from 2022:
  - Engine testing 109% increase from 2022. This is due to an additional effort in 2023 to include the high-level engine testing data provided for CHC and NHV using assumptions on engine test duration, number of engines tested, time at low thrust and time at high thrust.
  - Business travel emissions increased by 42% as business travel was limited in 2022 and increased throughout 2023.
  - Passenger surface access emissions have increased 14% because of increased PAX numbers. This methodology is based on a historic survey so does not represent changes in emissions intensity of the transport method used by passengers travelling to the airport.
  - Outside of scopes emissions category has increased by 5,886% due to expanding of reporting to all relevant sources with biogenic content.
  - Use of kerosene for fire training was categorised within heating and generation in the 2022 reporting period and was moved to the fire training category for the current reporting period. As a result, fire training emissions appear to have increased by 26%.

- Emissions sources that decreased from 2022:
  - As stated above, a change in categorisation of kerosene usage has caused an apparent change in emissions within these categories. As kerosene usage for fire training was categorised under fire training for this reporting period, heating and generation emissions have decreased by 96%.
  - Emissions from Scope 1 refrigerants decreased by 100% due to no reports of leakage in 2023. It is recommended that AGS carry out an in-depth review of records for the next reporting period to ensure completeness.
  - Airport operational vehicle emissions decreased by 21% due to a decrease in fuel usage of similar magnitude between reporting periods.

Annual Emissions Trends (Market-Based)

Market-based emissions (tCO_2e)	ACA Category	2019	2020	2021	2022	2023
Scope 1 – Total		**1,351.47**	**1,162.40**	**1,523.01**	**1,422.84**	**1,334.02**
Mobile sources	Operational vehicles (Airport)	136.62	84.74	134.21	112.18	89.08
Stationary sources	Heating and generation	7.51	33.07	21.19	21.08	0.82
	Natural gas (Airport)	988.48	986.07	1,109.49	984.90	897.47
	Fire training	175.40	54.75	51.18	49.35	62.36
Process emissions	Refrigerant losses	43.01	3.73	7.73	10.44	0.00
	De-icing	0.00	0.00	199.21	244.89	284.30
Scope 2 – Total		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Purchased electricity	Purchased electricity (Airport)	0.00	0.00	0.00	0.00	0.00
Scope 3 – Total		**71,003.97**	**39,572.30**	**47,096.63**	**63,254.44**	**49,790.35**
Category 1: Purchased goods and services	Water consumption	36.39	33.63	14.04	16.98	14.42
	Non-road construction vehicles	0.00	0.00	0.00	0.00	0.00
Category 3: Fuel- and energy-related activities	Purchased electricity (Airport) WTT	0.00	0.00	758.64	637.10	302.95
	Purchased electricity (Airport) T&D	323.64	237.43	236.87	223.26	108.83
Category 5: Waste generated in operations	Waste*	556.00	51.89	152.87	4.09	4.63
	Wastewater	71.15	65.76	24.35	29.45	15.61
Category 6: Business travel	Business travel	10.51	2.46	0.23	5.87	8.33
Category 7: Employee commuting and home office	Staff commute	5,475.54	1,211.01	2,387.45	2,210.91	2,264.24
Category 11: Use of sold products	Aircraft LTO	43,633.67	28,967.03	34,205.60	45,254.71	29,431.43
	Aircraft engine testing	250.55	968.64	125.94	488.24	1,018.70
	Heating and generation (3rd party)	0.00	0.00	0.00	0.00	0.36
	Operational vehicles (3rd Party)	630.65	412.48	435.45	594.73	616.07
	Refrigerant losses (new for 2023)	0.00	0.00	0.00	0.00	2.93
	De-icing	0.00	168.82	240.75	376.71	310.58
	Passenger surface access	19,894.62	7,395.84	8,466.76	13,358.34	15,177.81

* 2019 to 2021 reports virgin material production under this category.

Annual Emissions Trends (Market-Based)

Market-based emissions (tCO_2e)	ACA Category	2019	2020	2021	2022	2023
Category 13: Downstream leased assets	Purchased electricity (Tenant) WTT**	0.00	0.00	0.00	0.00	332.15
	Purchased electricity (Tenant) T&D**	0.00	0.00	0.00	0.00	119.32
	Natural gas (Tenant)	121.25	57.32	47.67	54.05	61.99
Outside of Scopes – Total		**6.03**	**6.19**	**7.83**	**28.02**	**1,677.17**
N/A	Heating and Generation	0.00	0.00	0.00	0.00	24.64
	Fire Training	0.00	0.45	0.00	2.09	7.40
	Operational Vehicles (Airport)	6.03	5.74	7.83	25.93	5.00
	Operational Vehicles (3rd Party)	0.00	0.00	0.00	0.00	174.66
	Business Travel	0.00	0.00	0.00	0.00	0.06
	Purchased electricity (Airport)	0.00	0.00	0.00	0.00	699.01
	Purchased electricity (Tenant)	0.00	0.00	0.00	0.00	766.40

Scope	2019	2020	2021	2022	2023
Scope 1	1,351.47	1,162.40	1,523.01	1,422.84	1,334.02
Scope 2	0.00	0.00	0.00	0.00	0.00
Scope 3	71,003.97	39,572.30	47,096.63	63,254.44	49,790.35
Outside of Scopes	6.03	6.19	7.83	28.02	1,677.17*
All Scopes	**72,361.47**	**40,740.89**	**48,627.46**	**64,705.30**	**52,801.54**

* Increase in OoS emissions category due to expanding of reporting to all relevant sources with biogenic content.

** Prior to 2023, tenant WTT and T&D emissions were reported in Category 3: fuel- and energy-related activities.

APPENDICES

Location-Based Emissions

Methodology

Glossary

Location-Based Emissions

Carbon Footprint – Location-Based Summary

- Location-based emissions by scope for Aberdeen Airport for 2023, reflecting the average emissions intensity of the grid on which the electricity consumption occurs.
- All emissions have been calculated in line with the GHG Protocol, to ACA Level 3+ standard and ISO 14064-1.

55,439 tCO_2e/year

92% from Scope 3 emission sources

Location-based emissions figures

17% decrease from 2022 emissions

Scope 3
"Indirect Emissions"

Emissions that arise as a consequence of the activities of the company, but occur from sources not owned or controlled by the company.

51,170 tCO_2e (92.3%)

Scope 1
"Direct Emissions"

Emissions produced from sources linked to a company's assets.

1,334 tCO_2e (2.4%)

Outside of Scopes
Emissions from fuels with biogenic content. Scope 1 impact of these fuels has been determined to be net "0".

1,677 tCO_2e (3.0%)

Scope 2
"Indirect Emissions"

Emissions produced by the generation of electricity purchased from third parties and consumed in the company's assets.

1,258 tCO_2e (2.3 %)

Carbon Footprint – Annual Emissions (Location-Based)

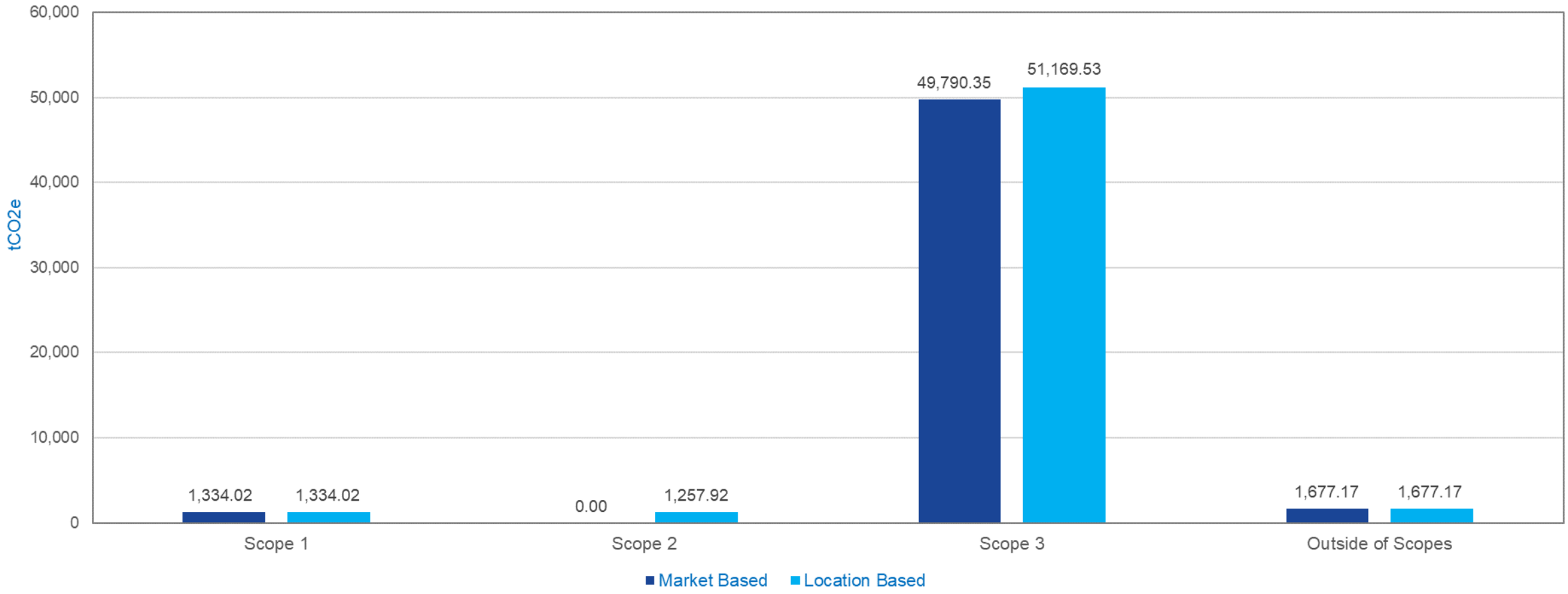
- The table below shows the figures from the charts on the previous page, as well as the % year-on-year (y-o-y) change of the different emissions scopes.

Emissions by Scope (tCO_2e)	2019	2020	2021	2022	2023
Scope 1	1,351.47	1,162.40	1,523.01	1,422.84	1,334.02
Scope 2	1,620.87	1,165.13	1,242.94	1,165.09	1,257.92
Scopes 1 and 2	2,972.34	2,327.53	2,765.95	2,587.93	2,591.94
Scope 3	73,195.20	41,167.94	48,530.35	64,529.97	51,169.53
Outside of Scope	6.03	6.19	7.83	28.02	1,677.17
Total emissions	**76,173.57**	**43,501.66**	**51,304.12**	**67,145.92**	**55,438.64**

Scope 1 % y-o-y change	-2.42%	-13.99%	31.02%	-6.58%	-6.24%
Scope 2 % y-o-y change	-61.63%	-28.12%	6.68%	-6.26%	7.97%
Scope 1 & 2 % y-o-y change	-47.01%	-21.69%	18.84%	-6.44%	0.15%
Scope 3 % y-o-y change	3.59%	-43.76%	17.88%	32.97%	-20.70%
Outside of Scope % y-o-y change	50.75%	2.65%	26.49%	257.85%	5885.62%
Total % y-o-y change	**-0.13%**	**-42.89%**	**17.94%**	**30.88%**	**-17.44%**

Carbon Footprint – Location and Market-Based Comparison

- Emissions totals by scope calculated using either the location or market-based emissions factors. Tenant energy is included in Scope 3.



Carbon Footprint – By Emissions Source (Location-Based)

Summary Category	ACA Category	Emissions (tCO_2e)	% of Scope	% of Total Emissions
Scope 1 – Total		**1,334.02**	**100.00%**	**2.41%**
Mobile sources	Operational vehicles (Airport)	89.08	6.68%	0.16%
Stationary sources	Heating and generation	0.82	0.06%	0.00%
	Natural gas (Airport)	897.47	67.28%	1.62%
	Fire training	62.36	4.67%	0.11%
Process emissions	Refrigerant losses	0.00	0.00%	0.00%
	De-icing	284.30	21.31%	0.51%
Scope 2 – Total		1,257.92	**100.00%**	**2.27%**
Purchased electricity	Purchased electricity (Airport)	1,257.92	**100.00%**	**2.27%**
Scope 3 – Total		**51,169.53**	**100.00%**	**92.30%**
Category 1: Purchased goods and services	Water consumption	14.42	0.03%	0.03%
	Non-road construction vehicles	0.00	0.00%	0.00%
Category 3: Fuel- and energy-related activities	Purchased electricity (Airport) WTT	302.95	0.59%	0.55%
	Purchased electricity (Airport) T&D	108.83	0.21%	0.20%
Category 5: Waste generated in operations	Waste	4.63	0.01%	0.01%
	Wastewater	15.61	0.03%	0.03%
Category 6: Business travel	Business travel	8.33	0.02%	0.02%
Category 7: Employee commuting and home office	Staff commute	2,264.24	4.42%	4.08%
Category 11: Use of sold products	Aircraft LTO	29,431.43	57.52%	53.09%
	Aircraft engine testing	1,018.70	1.99%	1.84%
	Heating and generation (3rd party)	0.36	0.00%	0.00%
	Operational vehicles (3rd Party)	616.07	1.20%	1.11%
	Refrigerant losses	2.93	0.01%	0.01%
	De-icing	310.58	0.61%	0.56%
	Passenger surface access	15,177.81	29.66%	27.38%

Carbon Footprint – By Emissions Source (Location-Based)

Summary Category	ACA Category	Emissions (tCO_2e)	% of Scope	% of Total Emissions
Category 13: Downstream leased assets	Purchased electricity (Tenant)	1,379.19	2.70%	2.49%
	Purchased electricity (Tenant) WTT	332.15	0.65%	0.60%
	Purchased electricity (Tenant) T&D	119.32	0.23%	0.22%
	Natural gas (Tenant)	61.99	0.12%	0.11%
Outside of Scopes – Total		**1,677.17**	**100.00%**	**3.03%**
N/A	Heating and Generation	24.64	1.47%	0.04%
	Fire Training	7.40	0.44%	0.01%
	Operational Vehicles (Airport)	5.00	0.30%	0.01%
	Operational Vehicles (3rd Party)	174.66	10.41%	0.32%
	Business Travel	0.06	0.00%	0.00%
	Purchased electricity (Airport)	699.01	41.68%	1.26%
	Purchased electricity (Tenant)	766.40	45.70%	1.38%

Scope	Emissions (tCO_2e)	% of Total Emissions
Scope 1	1,334.02	2.41%
Scope 2	1,257.92	2.27%
Scope 3	51,169.53	92.30%
Outside of Scopes	1,677.17	3.03%
All Scopes	**55,438.64**	**100%**

Annual Emissions Trends (Location-Based)

Location-based emissions (tCO_2e)	ACA Category	2019	2020	2021	2022	2023
Scope 1 – Total		**1,351.47**	**1,162.40**	**1,523.01**	**1,422.84**	**1,334.02**
Mobile sources	Operational vehicles (Airport)	136.62	84.74	134.21	112.18	89.08
Stationary sources	Heating and generation	7.51	33.07	21.19	21.08	0.82
	Natural gas (Airport)	988.48	986.07	1,109.49	984.90	897.47
	Fire training	175.40	54.75	51.18	49.35	62.36
Process emissions	Refrigerant losses	43.01	3.73	7.73	10.44	0.00
	De-icing	0.00	0.00	199.21	244.89	284.30
Scope 2 – Total		1,620.87	1,165.13	1,242.94	1,165.09	1,257.92
Purchased electricity	Purchased electricity (Airport)	1,620.87	1,165.13	1,242.94	1,165.09	1,257.92
Scope 3 – Total		**73,195.20**	**41,167.94**	**48,530.35**	**64,529.97**	**51,169.53**
Category 1: Purchased goods and services	Water consumption*	36.39	33.63	14.04	16.98	14.42
	Non-road construction vehicles	0.00	0.00	0.00	0.00	0.00
Category 3: Fuel- and energy-related activities	Purchased electricity (Airport) WTT	0.00	0.00	758.64	637.10	302.95
	Purchased electricity (Airport) T&D	323.64	237.43	236.87	223.26	108.83
Category 5: Waste generated in operations	Waste*	556.00	51.89	152.87	4.09	4.63
	Wastewater	71.15	65.76	24.35	29.45	15.61
Category 6: Business travel	Business travel	10.51	2.46	0.23	5.87	8.33
Category 7: Employee commuting and home office	Staff commute	5,475.54	1,211.01	2,387.45	2,210.91	2,264.24
Category 11: Use of sold products	Aircraft LTO	43,633.67	28,967.03	34,205.60	45,254.71	29,431.43
	Aircraft engine testing	250.55	968.64	125.94	488.24	1,018.70
	Heating and generation (3rd party)	0.00	0.00	0.00	0.00	0.36
	Operational vehicles (3rd Party)	630.65	412.48	435.45	594.73	616.07
	Refrigerant losses (new for 2023)	0.00	0.00	0.00	0.00	2.93
	De-icing	0.00	168.82	240.75	376.71	310.58
	Passenger surface access	19,894.62	7,395.84	8,466.76	13,358.34	15,177.81

* 2019 to 2021 reports virgin material production under this category.

Annual Emissions Trends (Location-Based)

Location-based emissions (tCO_2e)	ACA Category	2019	2020	2021	2022	2023
Category 13: Downstream leased assets	Purchased electricity (Tenant)	2,191.23	1,595.63	1,433.71	1,275.53	1,379.19
	Purchased electricity (Tenant) WTT**	0.00	0.00	0.00	0.00	332.15
	Purchased electricity (Tenant) T&D**	0.00	0.00	0.00	0.00	119.32
	Natural gas (Tenant)	121.25	57.32	47.67	54.05	61.99
Outside of Scopes – Total		**6.03**	**6.19**	**7.83**	**28.02**	**1,677.17**
N/A	Heating and Generation	0.00	0.00	0.00	0.00	24.64
	Fire Training	0.00	0.45	0.00	2.09	7.40
	Operational Vehicles (Airport)	6.03	5.74	7.83	25.93	5.00
	Operational Vehicles (3rd Party)	0.00	0.00	0.00	0.00	174.66
	Business Travel	0.00	0.00	0.00	0.00	0.06
	Purchased electricity (Airport)	0.00	0.00	0.00	0.00	699.01
	Purchased electricity (Tenant)	0.00	0.00	0.00	0.00	766.40

Scope	2019	2020	2021	2022	2023
Scope 1	1,351.47	1,162.40	1,523.01	1,422.84	1,334.02
Scope 2	1,620.87	1,165.13	1,242.94	1,165.09	1,257.92
Scope 3	73,195.20	41,167.94	48,530.35	64,529.97	51,169.53
Outside of Scopes	6.03	6.19	7.83	28.02	1,677.17*
All Scopes	**76,173.57**	**43,501.66**	**51,304.12**	**67,145.92**	**55,438.64**

* Increase in OoS emissions category due to expanding of reporting to all relevant sources with biogenic content.

** Prior to 2023, tenant WTT and T&D emissions were reported in Category 3: fuel- and energy-related activities.

Methodology

Methodology

- This section provides a summary of the methodology followed by Ricardo to calculate the 2023 carbon footprint for Aberdeen Airport.
- The standard approach to carbon footprinting is to use the GHG Protocol Corporate Accounting and Reporting Standard developed by World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI). This approach has been adhered to in the production of this footprint. Reporting is based on operations over which Aberdeen Airport has operational control and is aligned with the GHG Protocol 'operational control' approach, under which a company accounts for 100% of emissions from operations over which it, or one of its subsidiaries, has control to make decisions. The carbon footprint is also calculated in line with the requirements of ISO 14064-1, Specification with Guidance at the Organisation Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals. Sector specific guidance for airports is provided by the Airport Carbon Accreditation (ACA) Scheme and the carbon footprint calculations have been completed to meet the requirements of Level 4 of the ACA Scheme. The GHG Protocol requires organisations to report their GHG emissions under 3 scopes:

SCOPE 1 EMISSIONS

Scope 1 emissions are defined as direct GHG emissions arising from sources that are owned or controlled by the company. The emissions result from activities that the company can have direct influence on through its actions. AGS Airports' emissions that are included are: natural gas use, company owned vehicles fuel use, fuel use for heating or in generators or equipment, refrigerant gas use (from leaks during maintenance or malfunction), surface de-icer and fuel (such as wood pallets and diesel) used for fire training.

SCOPE 2 EMISSIONS

Scope 2 emissions are associated with the use of electricity imported from the grid or from a third-party energy supplier in the form of heat or electricity. These indirect emissions are due to upstream emissions from the production and delivery of fuel to power stations. The airport can influence the amount of electricity it uses; however, it has little control over the generation of the electricity and these emissions are therefore classed as Scope 2. The footprint includes dual reporting using location and market-based approaches for electricity consumption to reflect use of a renewable electricity contract.

SCOPE 3 EMISSIONS

Scope 3 emissions are defined as those arising as an indirect consequence of the use of goods or services provided by the company. The airport does have some influence over Scope 3 emissions, but the activities are not under its control. Sources included by the airport include aircraft LTO and engine testing, employees commuting to the airport, passenger surface access, airside vehicle activities by third-party operators, waste disposal, water (supply and treatment), airport business travel, tenant utilities consumption, aircraft de-icer used by third parties, fuel used for non-road construction vehicles, and electricity T&D losses and WTT emissions.

OUTSIDE OF SCOPE EMISSIONS

As per UK Government GHG Conversion Factors for Company Reporting guidance, Outside of Scope factors have been used to account for the direct carbon dioxide (CO_2) impact of burning biomass and biofuels. The emissions are labelled 'outside of scope' because the Scope 1 impact of these fuels has been determined to be a net '0' (since the fuel source itself absorbs an equivalent amount of CO_2 during the growth phase as the amount of CO_2 released through combustion). As a result, full reporting of any fuel from a biogenic source have included the 'outside of scope' CO_2 value, documented to ensure complete accounting for the emissions created.

Methodology

- The uncertainties associated with carbon footprint calculations can be broadly categorised into scientific uncertainty and estimation uncertainty. Scientific uncertainty arises when the science of the actual emission is not completely understood. For example, GWP values involve significant scientific uncertainty. Estimation uncertainty arises any time emissions are quantified. Estimations have been made within this footprint where areas of uncertainty have arisen. These are detailed in the methodology descriptions below.
- Emissions factors are sourced from the Department for Energy Security and Net Zero's 2023 UK Government GHG Conversion Factors for Company Reporting. De-icer emissions factors are sourced from the Airport Carbon and Emissions Reporting Tool (ACERT) provided by the ACA Scheme. Emissions are reported in carbon dioxide equivalent (CO_2e), which allows different GHGs to be compared on a like-for-like basis.

UTILITIES

Utility emissions include electricity and natural gas (Aberdeen Airport and third parties), fuel used for heating and power generation, water supply and wastewater treatment, de-icer usage (aircraft and ground), and refrigerant lost to atmosphere from cooling systems (including from third-party units). Data was provided by Aberdeen Airport and converted to emissions using the appropriate emissions factors from UK Government and ACERT for de-icer.

Scope 3 refrigerant emissions were assumed to be nil where stated by the tenants, and otherwise estimated using default assumptions from IPCC Good Practice Guidelines on average refrigerant charge and annual leakage rate where refrigerant type or leaked volume information was missing.

OPERATIONAL VEHICLES

Operational vehicle fuel use was calculated by using fuel volume data provided by Aberdeen Airport for their own and third-party operations, including fuel used in off-road construction vehicles. Fuel volume was converted to emissions using the appropriate emissions factors from UK Government GHG Conversion Factors for Company Reporting.

FIRE TRAINING

Records of fuel and material consumed by fire training were reviewed and converted to emissions using the appropriate emissions factors from UK Government.

PASSENGER SURFACE ACCESS

Emissions are based on a survey undertaken in 2019, scaled to 2023 Aberdeen Airport passenger numbers. Information was collated on the mode of travel and location of those who answered the survey to estimate distance travelled by each mode of transport.

Methodology

STAFF COMMUTE

For emissions due to staff commuting, the 2022 staff travel survey for AGS employees data was utilised. There were 46 respondents out of 816 staff members (including both AGS and third-party staff), giving a response rate of 6%, so final data was scaled to the full headcount of Aberdeen and AGS staff in 2023. The survey respondents provided information on their modes of transport, distance travelled to work, number of days worked per week and number of days worked from home per week. This was scaled up to reflect a full working year by assuming that there are 47 working weeks per year (Mon-Fri), each staff member has 25 days of leave per year and there are 8 working hours in each day (used to estimate emissions produced by staff working from home). Total annual distance travelled was converted to emissions using the appropriate emissions factors from UK Government.

BUSINESS TRAVEL

Accounts data was provided for business travel (Scope 3) for the 2023 financial year. Purchased fuel and travel ticket data was provided in £ value and converted to fuel volume using the cost/litre assumptions from the Carbon Footprint and Project Register Tool (CFPRT). The CFPRT collates cost data for all forms of public transport across the UK and is managed and updated by Sustainable Network Scotland and Resource Efficient Scotland.

Reported distance travelled by grey fleet was converted to emissions using the appropriate emissions factors from UK Government. Where destination and transport data had been provided, online distance calculators were employed to estimate the distances travelled, from which emissions were calculated. Where information about the journey was missing, the ticket price was used to estimate distance travelled, again using the CFPRT. The following assumptions were made in the calculations: all flight, bus and train tickets assumed to be for single passenger, return journeys unless otherwise stated; and all taxi tickets were assumed to be for single passenger, one-way journeys unless otherwise stated. Within the ‘Coach, Bus and Rail’ spend category, there were some lines for which transport mode was not stated – an equal split between national rail and local bus journeys was assumed.

WASTE

A full breakdown of waste type, tonnage and destination (e.g. combustion, recycling, landfill) was provided by Aberdeen Airport’s waste management provider for 2023. The emissions produced during waste disposal were calculated by using the appropriate factors from UK Government GHG Conversion Factors for Company Reporting. A 95% sewerage rate was assumed for all water supplied to the airport.

Methodology

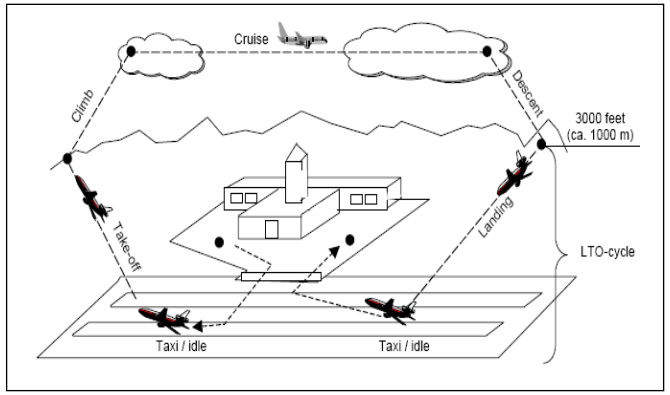
LANDING TAKE-OFF CYCLE (LTO)

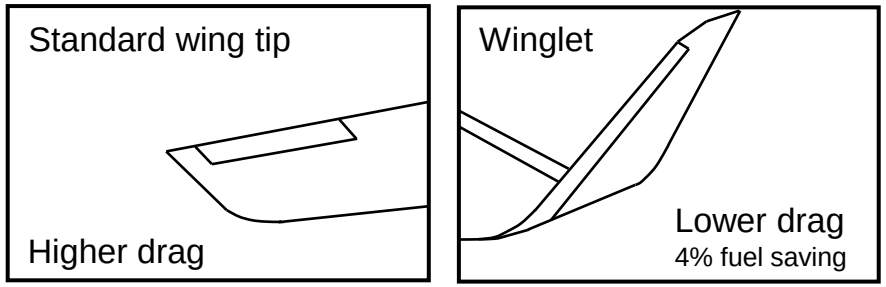
The LTO cycle is split into several stages which are shown in the diagram below and consist of all fuel consuming movements below 1,000 m altitude.

Fuel usage for each aircraft from the LTO cycle are calculated by using fuel burn rates (kg/second) from the ICAO Databank (Jet engines) or FOCA Aircraft Piston Engine database (Piston engines) for each aircraft, multiplied by the time the aircraft spends in each section of the LTO cycle (e.g. Taxi Out, Initial Climb). Fuel use is then converted to carbon emissions using the emissions factor for aviation fuel provided by the UK Government. Efforts have been made to improve the assumptions around the time aircraft spend in each stage of the LTO cycle, using real taxi time data for fixed-wing aircraft for example.

For 2023, the Ricardo aircraft emissions calculators have been updated to reflect the most recent aircraft database from EMEP/EEA air pollutant emission inventory guidebook 2023, and updates to fuel flow databases including the ICAO Databank. The EMEP/EEA database now includes next-generation aircraft types, so assumptions are no longer used to account for the reduction in emissions in comparison to last-generation aircraft they replace. The calculations also now include a full helicopter database from FOCA.

Additional efforts have been made to improve the accuracy of the LTO calculations in 2022 and 2023 to reflect the impact of aircraft fuel efficiency improvements that were not otherwise captured by the methodology used in previous years. One improvement to the methodology was accounting for the fuel savings from the use of wingtips on aircraft. New designs for the tips of the aircraft wings can reduce drag and improve fuel efficiency. An example of a modern wingtip design is shown below. Wingtips can reduce fuel burn by 4-6% for larger aircraft, which reduces the carbon emissions by the same amount. A 4% reduction in fuel use was used as a conservative estimate of fuel burn savings for the calculations for Aberdeen Airport's LTO emissions. Note that wing tip fuel burn savings only apply to the following LTO stages: Take-off, Initial climb, Climb out.





Methodology

AIRCRAFT ENGINE TESTING

To calculate the emissions from engine testing at Aberdeen Airport, the aircraft ICAO type, date of test and duration of test was provided. A similar process was carried out to identify the aircraft engine type and fuel used per second as per the LTO cycle, using the EMEP/EEA guidebook and engine fuel flow from the ICAO Databank and others. Other assumptions used for the calculations are:

- If the number of engines tested is not stated, this is assumed to be 2 engines.
- High power testing occurred for 5% of the full test time if not otherwise specified.
- If engine information is not available from the databases, average fuel flow information is sourced from available data.

Glossary

Term	Definition
ATM	Air traffic movements – an aircraft take-off or landing at an airport. For airport traffic purposes one arrival and one departure is counted as two movements.
Carbon dioxide equivalent (CO_2e)	The carbon dioxide equivalent (CO_2e) allows the different greenhouse gases to be compared on a like-for-like basis relative to one unit of CO_2. CO_2e is calculated by multiplying the emissions of each of the six greenhouse gases by its 100-year global warming potential (GWP).
Carbon footprint	A carbon footprint measures the total greenhouse gas emissions caused directly and indirectly by a person, organisation, event or product. A carbon footprint is measured in tonnes of carbon dioxide equivalent (tCO_2e).
Emission factor	An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.
GHG	Greenhouse gas – a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are water vapour, carbon dioxide, methane, nitrous oxide, and ozone.
Outside of Scope (OoS)	All fuels with biogenic content (e.g. 'Diesel and petrol (average biofuel blend)') should have the 'Outside of Scope' emissions reported to ensure a complete picture of an organisations' emissions are created. The emissions are labelled 'Outside of Scope' because the Scope 1 impact of these fuels has been determined to be a net '0' (since the fuel source itself absorbs an equivalent amount of CO_2 during the growth phase as the CO_2 is released through combustion).
PAX	Number of passengers.
APU	Auxiliary power unit.
CAA	Civil Aviation Authority
LTO	Landing and Take Off (LTO) is defined as the modes of operation by an aircraft below 1,000m altitude – idle, taxiing, approach, climb out and take off. Emissions in this category are from fuel used in aircraft engines during these modes of operation.
WTT	Well-To-Tank (WTT) emissions are the emissions associated with extracting, processing and transporting fuel before application.