AVIATION CLIMATE ACTION PLAN

2022 and 2023 REPORT

Government of Canada / Gouvernement du Canada

Canada

TP: 15429E
Catalogue No. T40-3E-PDF
ISSN 3110-9683

An electronic version of this publication is available at www.tc.gc.ca/aviation-emissions/.

For questions regarding this report or Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation, contact:
TC.AviationEmissions-Emissionsaviation.TC@tc.gc.ca

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EXECUTIVE SUMMARY

The Sustainable Aviation Task Force is pleased to present the first Report under Canada's renewed Aviation Climate Action Plan (2022-2030). Aviation plays a crucial role in the economy through the movement of people and goods, both in Canada and internationally. Nevertheless, aviation activities also result in the production of greenhouse gas (GHG) emissions, primarily through the use of fossil fuels. Coordinated action among stakeholders is necessary to address the challenge.

Canada's aviation sector, in partnership with the Government of Canada, has had a strong Action Plan in place since 2012. In 2022, recognizing the need to accelerate efforts to address emissions in alignment with Canada's Emissions Reduction Plan, signatories to the original Action Plan came together to develop a renewed Aviation Climate Action Plan for 2022-2030. Notably, this renewed plan includes a vision for net-zero aircraft emissions by 2050. Given the importance of Sustainable Aviation Fuels (SAF) to decarbonizing the aviation sector, it also sets an aspirational goal of 10 percent SAF use by 2030. The scope of the plan was also expanded to actions across the entire aviation ecosystem – encompassing aircraft emissions as well as airport operations. To oversee and guide the implementation of Canada's Aviation Climate Action Plan, a Sustainable Aviation Task Force was formed in 2023, co-led by Transport Canada and the National Airlines Council of Canada.

This report outlines early progress against the commitments in the renewed Action Plan, covering the 2022 and 2023 calendar years. For the first time, it includes reporting on airport emissions and on SAF use among Canadian carriers. Key findings of the report include:

- Traffic levels have recovered to levels close to 2019 following the pandemic's impact on the sector.
- Total operator domestic and international emissions have increased to 20.3 Mt in 2023, which is the fourth highest level since tracking began in 2005.
- Operational efficiency improved to a record level in 2023 – marking the continuation of a pre-pandemic trend toward an increasingly fuel-efficient Canadian aviation industry.
- Airport's Scope 1 and 2 emissions in 2022 amounted to 221,040 tonnes of CO_2, about 15 percent fewer emissions compared to 2012.
- An increasing trend of SAF uptake, with 5 million litres used in 2023.

Over the last two years, parties to the Action Plan have also continued to demonstrate their ongoing commitment to the pursuit of net-zero emissions across the aviation ecosystem. Their efforts are detailed in this report across the following decarbonization pathways:

- New Green Aerospace Technology;
- Improved Operations;
- Sustainable Aviation Fuels;
- Out of Sector Reductions;
- Non-Aircraft Emissions Reductions; and
- Non-CO_2 Impacts of Aviation on Climate

INTRODUCTION

In Canada, the aviation industry plays a critical role in the country's economy. Canada depends on its network of air services to promote both internal and international trade, grow our tourism industry and connect Canadians across our vast landscape. Many remote or isolated communities also depend on air transportation as their only means to move people and goods. However, flights and other operations associated with aviation can lead to the production of greenhouse gas (GHG) emissions through the use of fossil fuels. Domestic aircraft operations alone account for one percent of Canada's annual GHG emissions.

To take action, Transport Canada, along with the Air Transport Association of Canada (ATAC), signed the world's first voluntary agreement to reduce greenhouse gas emissions from aviation in 2005. Other associations joined from across the Canadian aviation sector, including the National Airlines Council of Canada (NACC), the Canadian Airports Council (CAC), the Canadian Business Aviation Association (CBAA), the Aerospace Industries Association of Canada (AIAC), and NAV CANADA. In 2012, the group jointly put forward *Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation* (2012-2022)), a voluntary initiative that built on the 2005 agreement, with a focus on increasing efficiencies, improving operations and incorporating new technologies to minimize GHG emissions from the sector. This first Action Plan set a 1.5 percent annual average fuel efficiency target and a 2 percent annual average fuel efficiency aspirational goal.

In 2022, recognizing the need to accelerate efforts to address GHG emissions in alignment with Canada's 2030 Emissions Reduction Plan, signatories to the original Action Plan came together to develop a renewed Aviation Climate Action Plan for 2022-2030 (the Action Plan). Notably, this renewed Action Plan put forward a vision for net-zero aircraft emissions by 2050. Given the importance of Sustainable Aviation Fuels (SAF) to decarbonizing the aviation sector, it also set an aspirational goal of 10 percent SAF use by 2030. For the first time, the Action Plan also outlined the various decarbonization pathways and actions that the Government of Canada and the aviation industry have agreed to undertake to improve efficiency and reduce GHG emissions from aviation activities across the value chain, encompassing aircraft emissions as well as airport operations.

Implementing and tracking progress under the Action Plan is led by the Sustainable Aviation Task Force (the Task Force). Established in June 2023, the Task Force is a government/industry groupco-led by Transport Canada and NACC. It builds on the work of a previous Action Plan Working Group, with broader representation from federal departments, provinces and territories, industry, non-government organizations, and academia. The membership is responsible for guiding actions, sharing knowledge, discussing progress, and tracking results over time. Progress on the Action Plan also contributes to six of the seventeen United Nations Sustainable Development Goals.

This 2022 and 2023 Report is the first report under the Canada's Aviation Climate Action Plan. Progress is examined across several different indicators, including aircraft emissions and fuel efficiency as well as – for the first time – SAF use and airport emissions. Descriptive updates from signatories and the Government of Canada are also provided against each of the decarbonization pathways and commitments in the Action Plan. Quantitative and qualitative data contained in this report was provided by Action Plan signatories and the Government of Canada. It was reviewed and approved by members of the Task Force for publication on Transport Canada's website.

RESULTS FOR 2022 and 2023

Impacts of the COVID-19 Pandemic and Green Recovery

Despite a continued recovery from the severe disruptions to air travel that began in 2020 with the COVID-19 pandemic, the sector continued to make progress in 2022 and 2023 toward a green transition. Some Canadian airlines were successful in their efforts to procure SAF, multiple airports undertook new decarbonization projects, and overall, the industry experienced improvements in fuel efficiency. The following sections capture the aggregated results of decarbonization efforts across the aviation sector for 2022 and 2023 including indicators on airline traffic, fuel use and SAF use, fuel efficiency and GHG emission reductions from aircraft and airports.[1]

Passenger and Cargo Traffic

Considering both the movement of passengers and cargo, air carriers reporting annual traffic under the Action Plan represent more than 90 percent of total activity by major operators in Canada[2]. Airlines' overall activity may be measured as RTK (Revenue Tonne Kilometres)[3]. Combined activity, including passengers and cargo on both domestic and international routes, was 19.9 billion RTK in 2022 and 25 billion RTK in 2023. Current traffic levels are now approaching the pre-pandemic 26.3 billion RTK reported in 2019 (more than three times the activity reported in 2020 at the onset of the pandemic).

Passenger traffic in RTK (both domestic and international flights) increased by 138 percent in 2022 from 2021 levels and climbed a further 30 percent in 2023. This dramatic rebound in 2022, followed by less extreme but still substantial growth in 2023, was the result of gradually loosened restrictions on passenger travel following the COVID-19 pandemic.

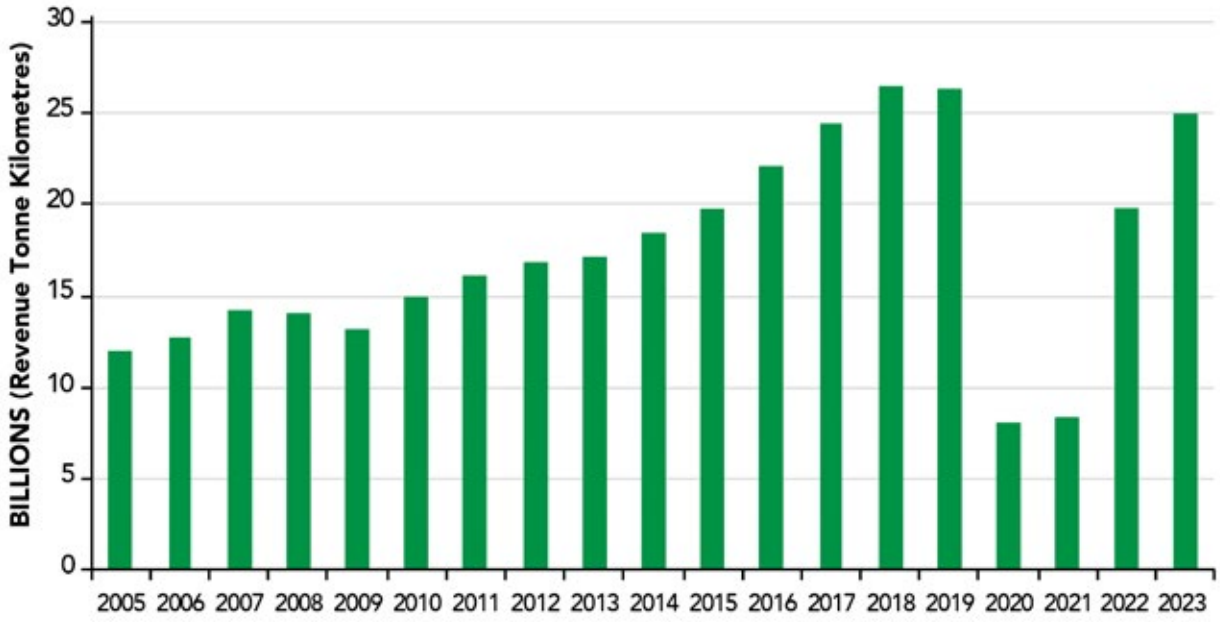
1 It should be noted that the number of aviation carriers that provide data under the Action Plan have changed from year to year. As a result, the statistics presented in this report may not be entirely comparable with those in other years.

2 Based on comparison with Statistics Canada aviation operating statistics for 2022. Table 23-10-0033-01 Civil aviation operating statistics, by type of service, Canadian air carriers, Levels I to III, annual

3 RTK is calculated as the total tonnes of passenger and freight multiplied by kilometres flown. The industry conventional assumption is that the average weight per passenger is 100kg or 0.1 tonnes. It is important to note that RTK may not be fully applicable to all market segments, such as business aviation whose operations are not fully analogous to other commercial carriers.

Cargo traffic in RTK (both domestic and international flights) experienced much more modest growth rates over this period. Traffic levels rose 6 percent in 2022, while 2023 cargo traffic showed a more modest increase of 3 percent from 2022. Chart 1 depicts the historical annual traffic between 2005 and 2023, inclusive of both passengers and cargo. More information on the passenger and cargo data is available in Table 1 in Appendix A of the report.

Chart 1 | Annual Traffic – Combined International and Domestic Operations, 2005-2023

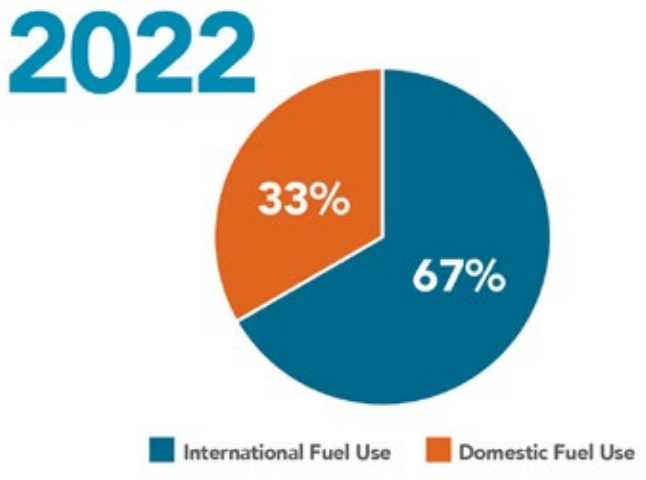


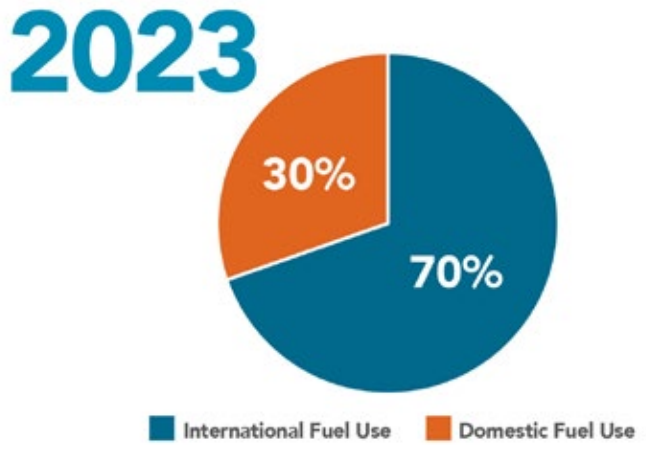
Fuel Use

Overall fuel use is reported based on international and domestic flights of Canadian air carriers based on data provided for the Action Plan. Consistent with the Intergovernmental Panel on Climate Change's definition of international and domestic activities, the Action Plan classifies international activity as flight segments that begin in Canada or end outside of Canada, whereas domestic activity includes flight segments within Canada. In 2022, Canada's aviation sector recorded 6.4 billion litres of fuel use, while in 2023, 7.9 billon litres of fuel was recorded, representing a 22 percent increase.

In 2023, higher levels of international travel overall resulted in a minor shift in the distribution of fuel use between domestic and international operations (in comparison to 2022). As illustrated in Chart 2, of the 7.9 billion litres of total fuel consumed in 2023, 30 percent was consumed for domestic activity and 70 percent was consumed for international activity. The distribution pattern for 2022 and 2023 is very similar to pre-pandemic years (although 2020 and 2021 saw a slightly higher proportion of fuel use for domestic activity).

Chart 2 | Airline Fuel Use – International and Domestic Distribution

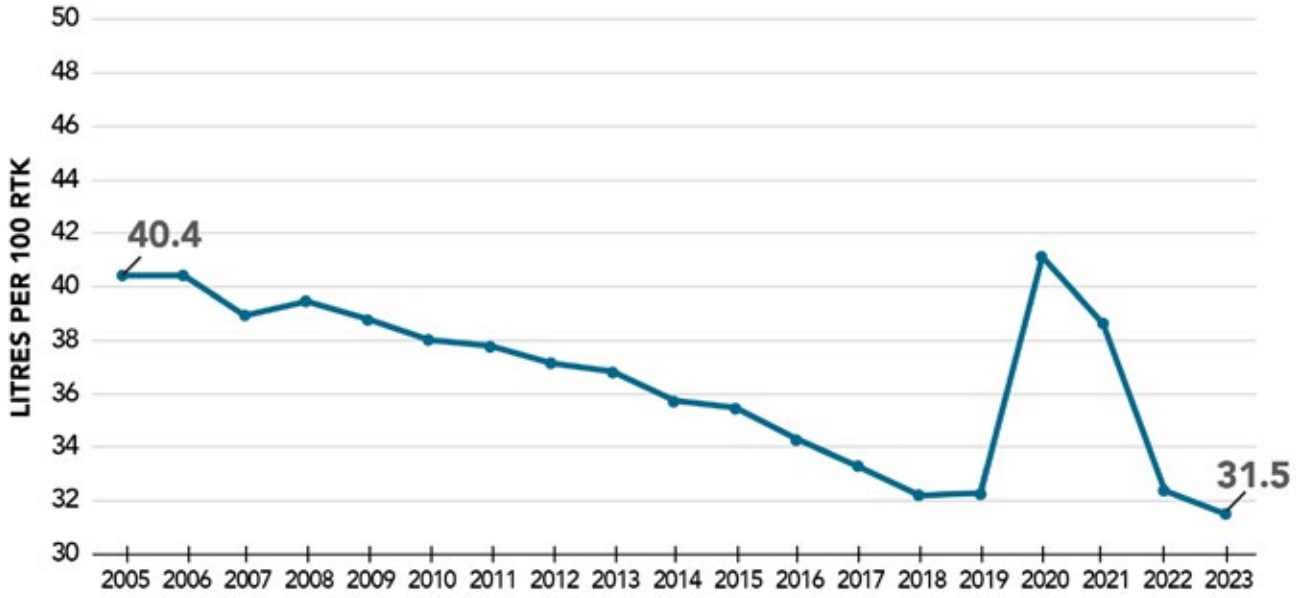




Fuel Efficiency

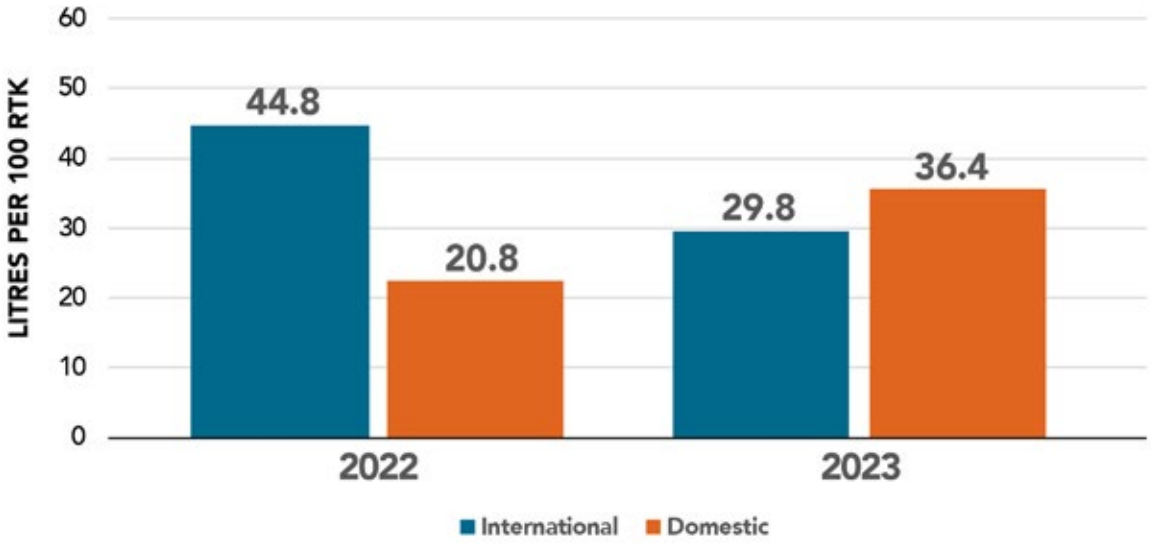
In aviation, fuel efficiency in an operational context is commonly measured by calculating the amount of fuel used to move 1 tonne over a distance of 100 kilometres. In 2022 and 2023, fuel efficiency for passengers and cargo (on combined domestic and international flights) was 32.4 litres per 100 RTK and 31.5 litres per 100 RTK respectively, compared to 38.7 litres per 100 RTK in 2021. The operational efficiency during the pandemic was negatively impacted by global flight restrictions and reduced air travel demand, as opposed to the technical attributes of aircraft. As these impacts resolved and further fuel efficiency measures were implemented in 2023, the Canadian aviation sector reached its most fuel-efficient level to date. It is expected that with sustained efforts across the sector efficiency gains could continue to be achieved in coming years, including through the procurement of more efficient aircraft and the implementation of operational improvements.

Chart 3 | Fuel Efficiency – Passengers and Cargo (Combined Domestic and International), 2005-2023



Examining the data in further detail, in 2023, the fuel efficiency of international operations was 29.8 litres per 100 RTK and 36.4 litres per RTK for domestic operations (see Chart 4). This represents a reversion back to historical patterns whereby longer international flights are more efficient on a revenue tonne basis. In general, longer international flights tend to be more efficient and burn less fuel per kilometer travelled compared to shorter domestic flights. This is due to the greater time spent at cruising altitude, which is when aircrafts operate most efficiently. There are many factors contributing to the observed differences in domestic and international fuel efficiency including: type and size of aircraft; capacity utilization; distance flown; cruising altitude; and speed. In 2023, increased capacity utilization was in part influenced by pent-up travel demand following the pandemic. For more information regarding international vs. domestic fuel efficiency, see Table 2 in Appendix A.

Chart 4 | Fuel Efficiency – International and Domestic, 2022 and 2023



Sustainable Aviation Fuel

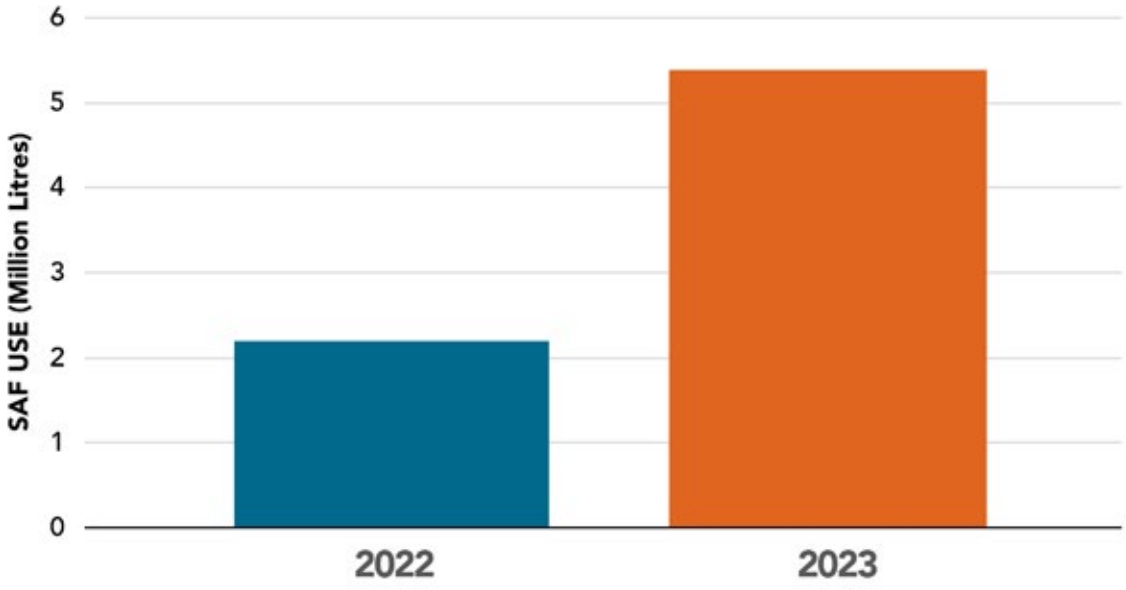
Canada's *Aviation Climate Action Plan (2022-2030)* identifies SAF as the most impactful in-sector pathway helping achieve Canada's net-zero by 2050 vision.

For the first time, this report provides initial insights into SAF use by Canadian operators. Chart 5 indicates that 2.2 million litres of neat SAF (i.e., not including the blended conventional aviation fuel component) were used by Canadian operators in 2022. Procurement rose to 5.4 million litres in 2023 – nearly 2.5 times as much. In total, taking into account both domestic and international flights, the use of SAF accounted for 0.03 percent of total aviation fuel use in 2022 and 0.07 percent in 2023 (See Appendix B for more information).

C-SAF LAUNCHED

In early 2022, Canadian aviation industry leaders joined forces to create the Canadian Council for Sustainable Aviation Fuels (C-SAF), with the mission to accelerate the deployment of sustainable aviation fuels (SAF) in Canada, and to ensure that the sector remains competitive as it transitions to a net-zero future while creating new economic opportunities for Canadians.

Chart 5 | Sustainable Aviation Fuel Use – International and Domestic, 2022 and 2023



AIR CANADA SAF PURCHASE

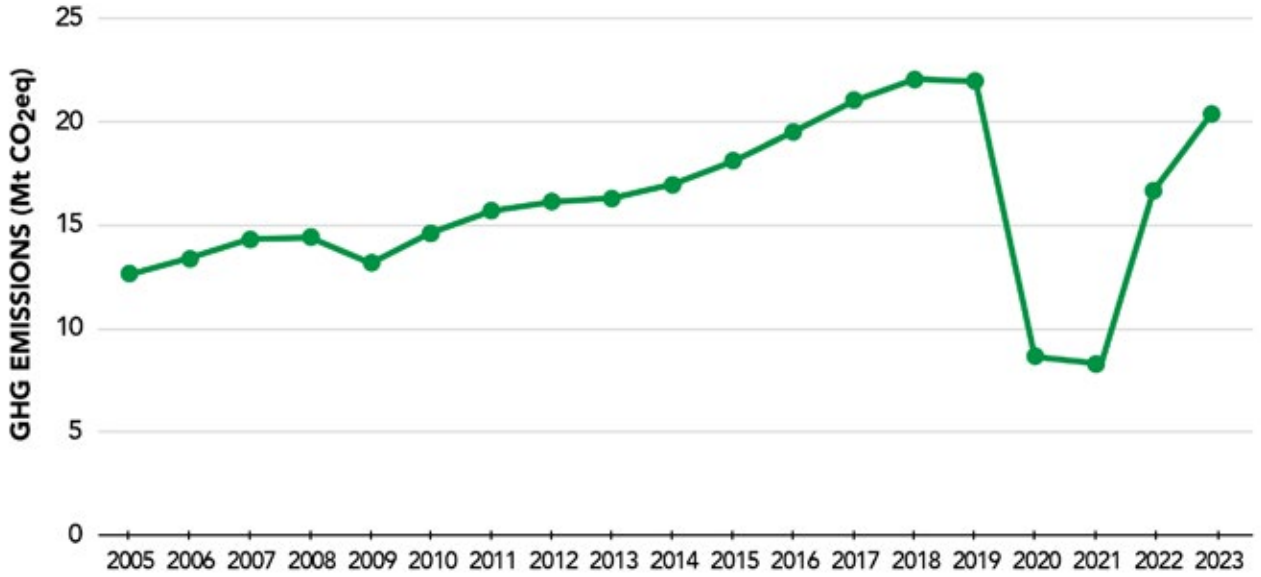
Air Canada is demonstrating leadership in its effort to decarbonize its operations, including through the use of SAF. On Earth Day 2023, Air Canada announced the purchase 9.5 million liters of Neste's SAF to be uplifted for flights from the San Francisco International Airport, representing an important step to Air Canada's target of 1 percent SAF by 2025.

Greenhouse Gas Emissions from Aircraft

There was a return to pre-pandemic GHG emissions trends from aircraft in 2022 and 2023, driven by a rebound in activity levels as pandemic restrictions were gradually lifted. The domestic portion of Canada's aviation GHG emissions account for approximately 1 percent of Canada's total emissions based on 2022 data.[4] Despite fuel efficiency improvements made over the time period, overall GHG emissions continued to rise, not only rebounding to pre-pandemic levels, but reaching their fourth-highest level since tracking began in 2005.

As displayed in Chart 6, GHG emissions increased by 100 percent from 2021 levels in 2022, and by an additional 22 percent in 2023, as a result of passenger demand. Despite the high level of activity, it expected that as impacts from the pandemic have subsided, the industry is likely to return to steadier, pre-pandemic-like growth rates. Chart 6 provides the historical trend in GHG emissions from 2005-2023.

Chart 6 | Greenhouse Gas Emissions from Aircraft, 2005-2023



4 National Inventory Report 1990-2022: Greenhouse Gas Sources and Sinks in Canada, Environment and Climate Change Canada. https://publications.gc.ca/collections/collection_2024/eccc/En81-4-2022-1-eng.pdf

SKY'S THE LIMIT CHALLENGE

The Sky's The Limit Challenge[5] took place as a national competition that focused on developing clean, sustainable and economically viable aviation fuel in Canada that allows the commercial aviation sector to reduce its carbon footprint. The final Grand Prize winner, Enerkem was announced in March 2022.

Greenhouse Gas Emissions from Canadian Airports

As part of the Aviation Climate Action Plan's commitment to expand efforts to reduce GHG emissions in the aviation sector, Transport Canada, in close collaboration with the Canadian Airports Council and airports across Canada, has developed a new dedicated section in this report that provides qualitative data on GHG emissions from airport operations in Canada.

The Scope 1 and Scope 2 data in this edition (from 2022) was gathered from a sample of ten Canadian airports, selected to create a representative group from regions across Canada[6]. The findings are contrasted with a previous sample that was collected in 2012.

Although not intended as a comprehensive inventory of emissions from all airports in Canada, the ten airports sampled account for over 90% of total air passenger volumes from Canadian airports. The inclusion of this emissions data is intended to offer a clearer understanding of sources of emissions at airports.

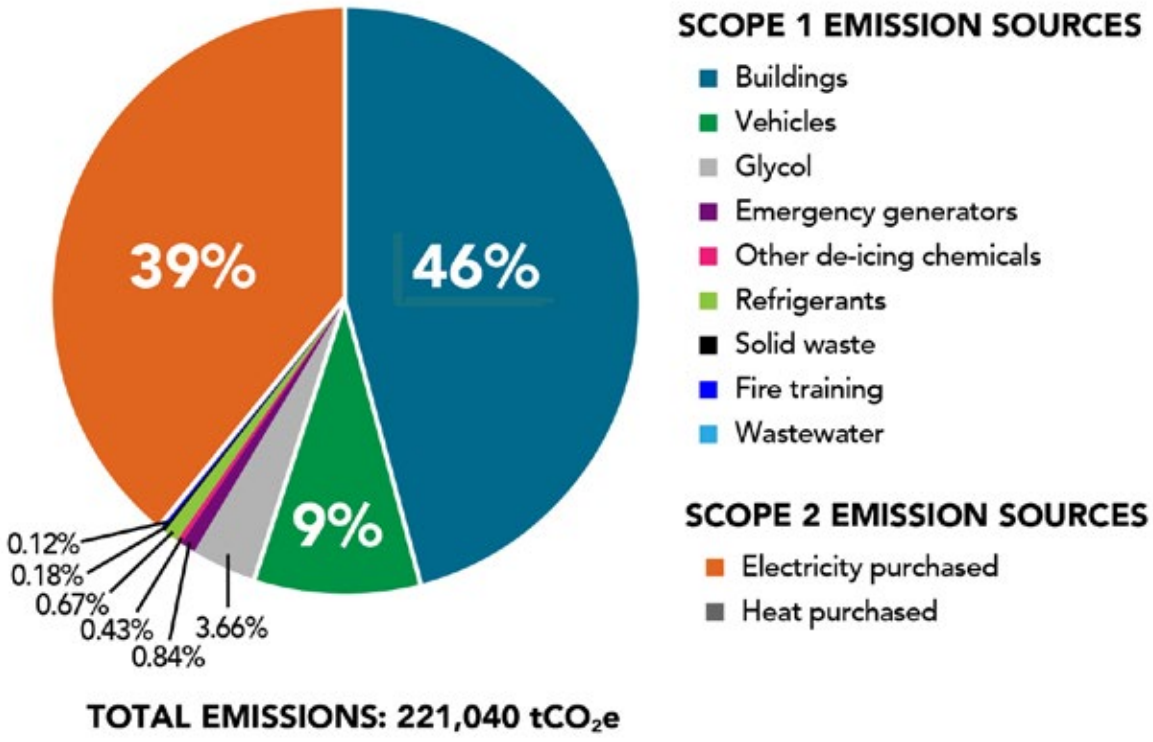
5 https://natural-resources.canada.ca/science-and-data/funding-partnerships/opportunities/grants-incentives/cleantech-challenges/impact-canada-cleantech-challenge-skys-the-limit/24463

6 While tracking Scope 3 emissions was not included in this study, several airports have been monitoring their Scope 3 emissions and taking active steps to reduce them.

Sources of Airport Emissions

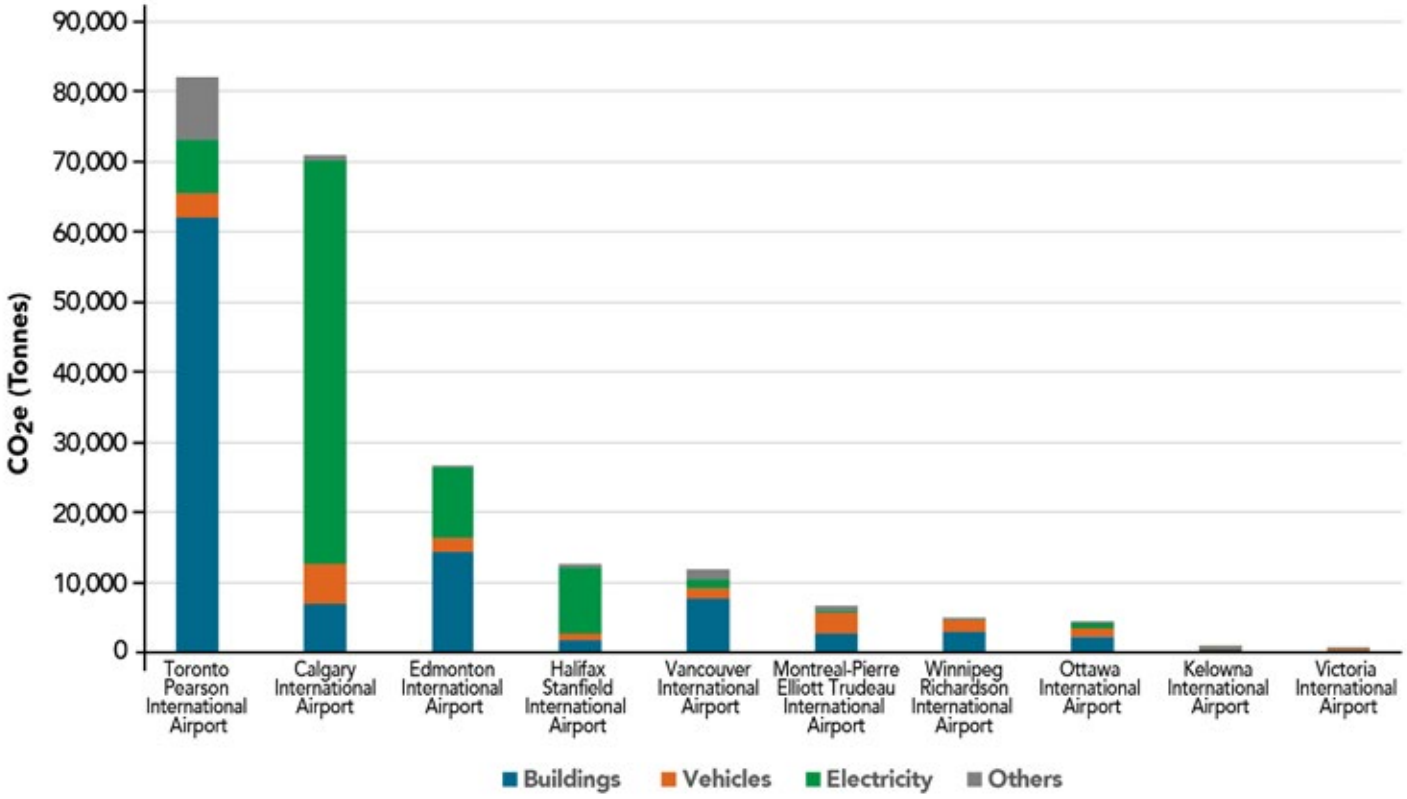
As depicted in Chart 7, the predominant sources of emissions from Canadian airports – not including emissions from aircraft – in 2022 were related to heating buildings and generating electricity. In total, these sources account for 85% of total emissions from airports. Fuel for vehicles contributed a further 9%. These sources are categorized as Scope 1, which are emissions from sources controlled by the airport operator, and Scope 2 emissions which are derived from the production of electricity purchased by the airport operator for all airport-related electrical systems and to a lesser extent, from purchased heat.

Chart 7 | Aggregated airport greenhouse gas emissions by source, 2022



As portrayed in Chart 8, airports across Canada demonstrate varied combinations of emission sources, with each airport's emissions profile shaped by unique factors such as location, access to clean electricity, size, and operational demands. These differences result in diverse emissions proportions across airports and regions.

Chart 8 | Greenhouse gas emissions by airport and by source, 2022



Historical comparison of airport emissions: 2012 to 2022

There were significant changes in GHG emission sources between 2012 and 2022, but on balance emissions at the representative airports were lower in 2022. As displayed in Chart 7, the aggregate Scope 1 and 2 emissions in 2022 amounted to 221,610 tonnes of CO_2, about 15 percent fewer emissions based when compared to previous values from 2012. On a per passenger basis, the average emissions released per passenger from the ten representative airports surveyed was 2,084 grams of CO_2. – ranging from 419 to 4,905 grams of CO_2. In comparison, the average GHG emissions released per passenger in 2012 for the same surveyed airports was 2,929 grams of CO_2.

Similar to the wide variation in GHG emissions sources observed between airports, the trends in the change in GHG emissions at each one of those airports varied over time as well. Emissions from vehicles decreased at several airports, while emissions from buildings increased at many others. One airport exhibited a substantial reduction in vehicle emissions, while another showed a considerable increase in emissions associated with building heating. However, in aggregate, emissions from electricity made up a proportionally smaller percent of total emissions in 2022 (40 percent) than it did in 2012 (69 percent).

UPDATES ON ACTION PLAN MEASURES FOR 2022 AND 2023

The Action Plan includes reporting on the following categories of measures that are expected to be needed for the Canadian aviation sector to reach net-zero by 2050:

- New Green Aerospace Technology;
- Improved Operations;
- Sustainable Aviation Fuels;
- Out of Sector Reductions;
- Measures to Reduce Non-aircraft Emissions; and
- Non-CO_2 Impacts of Aviation on Climate

The following table outlines activities under each measure and highlights the results achieved in 2022 and 2023.

DEVELOPMENT AND ADOPTION OF NEW GREEN AEROSPACE TECHNOLOGY

ACTIVITY	RESULTS
Innovation, Science Economic Development Canada (ISED), through the Strategic Innovation Fund (SIF), will continue to support innovation in the aerospace sector to accelerate the sector's green transformation to preserve its global leadership and competitiveness.	In June 2023, the Government of Canada announced an investment of $350 million through SIF into the Initiative for Sustainable Aviation Technology (INSAT), a pan-Canadian, industry-led aerospace network focused on funding collaborative research and development projects aimed at accelerating the green industrial transformation of the aerospace industry. INSAT funds projects focused on four key technology areas: hybrid and alternative propulsion; aircraft architecture and systems integration; transition to alternative fuels; and aircraft support infrastructure and operations.
NRC, through LEAP, will continue to support the development of fast, market-ready, sustainable solutions while also de-risking potential high-impact technologies.	NRC's LEAP program continues to make R&D advances in four key areas: • Novel aircraft configurations • Electric propulsion systems • Clean fuel technologies • Batteries in aviation NRC is working with industry to launch a national consortium to advance hydrogen-electric flight.

NRC will also complete an ongoing facility renewal strategy to identify key required enhancements and realignments to NRC's existing world-class clean energy and aviation research infrastructure to better support joint technology development in the aviation sector and key supply chains.	NRC through its Facility Renewal initiative – is investing in upgrades to: **1)** Altitude research test facility - include capabilities to support the development of hybrid-electric engines. **2)** Trisonic wind tunnel - supports world-leading aerospace research, including into novel green technologies. The funding will improve the reliability, safety and capabilities of the tunnel by replacing and upgrading outdated equipment and systems. **3)** Energy storage integration and battery testing facilities - Supports research and development in battery cell production, battery cell assembly and battery testing. The funding will enable the purchase of new equipment and the installation of specialized suites for battery fabrication and assembly.
Transport Canada will work with the NRC to support the development of the required standards and test methodologies for certification of new low-emission aircraft technologies. Transport Canada will continue to support the certification and regulatory approvals of new aircraft technologies. Transport Canada will continue to help fund a variety of projects that help reduce air pollutants and GHG emissions in the aviation through the Clean Transportation System – Research and Development (CTS-RD) Program.	TC and NRC have undertaken several projects to address certification challenges for electric aircraft (including test methodologies, failure modes, and whirl-mode flutter). The projects have investigated potential safety concerns associated with new and novel propulsion technologies and contributed to the development of methods of compliance to certification requirements.
Airlines will continue to pursue fleet renewal programs that reduce emissions and fuel use - including retiring older aircraft and introducing newer, more efficient aircraft.	Retirement of the CRJ200 fleet: Starting in 2023, Jazz began retiring from active service its fleet of 15 CRJ200 50-seat aircraft, with the last CRJ200 moving into storage in Arizona in June 2024. With the previous retirement of all Dash-8 300 50-seat aircraft in 2022, the operating Jazz fleet is now entirely comprised of aircraft with greater than 75 seat passenger capacity, yielding overall improved fuel efficiency per passenger kilometer flown. Jazz Aviation and Air Canada closely coordinate on efforts to reduce fuel consumption on Air Canada Express flights, such as weight savings through aircraft interior upgrades. In 2022, WestJet retired 2 B737-600s aircraft and 4 B737-700s while adding 6 B737-MAX8 and one B787-9. According to Boeing MAX8 fleet is 14% more fuel efficient with 40% smaller community noise footprint than 737-700s generation. Also one B787-9 is 20% more fuel efficient than any other similarly sized aircraft per Boeing. In 2023, WJA retired the remaining 11 B737-600s and also 2 B737-700s while boosting fleet efficiency with 12 new B737-MAX8s. WJA also launched 3 modified B737-800 cargo freighters that are able to serve niche cargo transportation markets with lower environmental footprint. In 2024, as a result of Fleet renewal efforts, Air Transat now has 19 A321neo LR for a total of 43 aircrafts.

Air Canada is committed to the continual modernization of its fleet through the acquisition and deployment of next-generation aircraft, prioritizing the purchase of fuel-efficient aircraft that yield significant environmental benefits. Between 2022 and 2024, Air Canada integrated to its fleet six A220-300s, nine 737 MAX 8s, one 777-300ER, two 787-900, and 2 767-3F freighter.

ATAC all-passenger air carriers continued to add more efficient aircraft such as Boeing 737-600/700/800.

Boeing 737 MAX 8, and Bombardier/De Havilland Canada Dash 8-400, ATR 42-500 and 700, and Embraer E2 aircraft to their fleets while replacing older less efficient fleet types. Operators of Boeing 737-200 aircraft have replaced almost all of these classic versions with Boeing 737-300/400/500 series aircraft with their more efficient CFM56 engines.

To improve efficiencies in cargo operations, operators have upgraded to more fuel-efficient aircraft such as Boeing 757-200F, Boeing 767-300F, and ATR 42 and ATR 72 freighters. Further efficiencies have been achieved with the utilization of combi variants of the 737-300/400/800, ATR 42 and 72 and DHC- 8-300/100 aircraft.

The few remaining Boeing 737-200 aircraft are currently being retained as they are combi freighter/ passenger aircraft equipped for operation on gravel runways and there is no direct replacement type of aircraft available with equivalent payloads.

The Canadian Business Aviation Association (CBAA) continued to build on its GHG reduction outreach efforts through its online forum and other member fora. The online forum increases awareness and provides a space for feedback on activities of interest to Canadian business aviation operators, including Canada's Action Plan. The CBAA will continue to encourage its members to take advantage of opportunities to reduce GHG emissions through fleet renewal.

Airlines will explore options to adopt advanced aircraft technologies when and where feasible, particularly for short-haul routes with smaller aircraft.

Industry action plan members will invest in future training programs that incorporate the usage of electric aircraft.

Jazz has purchased the Aircraft Flight Manual supplements and obtained TCCA approval to fly RNP AR Instrument Approach Procedures (IAP) on the Q400 and E175 fleets. All Q400 and E175 pilots are trained to conduct these procedures. Among the benefits are:

- Time and fuel savings due to shorter track miles flown. On average, RNP AR procedures can save in excess of 7 track miles flown.
- Estimated fuel savings are 3.0 kg/minute for the E175, 3.2 kg/minute for the Q400, and 4.5 kg/minute for the CRJ900.

Jazz is exploring the option of replacing Q400 passenger seats with a lighter version which will provide fuel savings.

Electronic Flight Bag (EFB) cellular connectivity: Jazz recently introduced cellular connectivity for all Jazz pilot EFBs. This strategy allows for the retrieval of electronic Operational Flight Plans (OFPs) which eliminates the requirement to print 10s of thousands of OFPs. The removal of the onboard (paper) library reduces the aircraft empty operational weight providing fuel savings in every flight.

ATAC members operating short-haul routes continue to evaluate advanced technological solutions appropriate to the aircraft fleet types currently in operation as well as replacement type aircraft for the near- and long-term future. A prime example is the powerplant electrification of ATAC member Harbour Air's fleet.

Harbour Air is currently in the process of certification of the major modifications to their fleet incorporating powerplant electrification. As part of this industry leading modification program they are training their flight and maintenance crews on the safe and efficient use of electric aircraft.

Business aviation will continue to explore advanced aircraft designs such as the Bombardier EcoJet as well as advanced air mobility solutions that use alternative propulsion systems (ie electric and hydrogen).

CBAA is proud to recognize that nearly all training is conducted on simulators, which are indoors and either powered by electric or hydraulic systems. This removes emissions from the sky while allowing for efficient and safe training for our professional air crews.

IMPROVED OPERATIONS

ACTIVITY	RESULTS
Transport Canada and Environment and Climate Change Canada will work with airports, airlines and third-party equipment owners and operators on an approach for supporting the adoption of electric/ low-carbon ground support equipment and green infrastructure, and to develop an inventory of ground support equipment and infrastructure to better understand the landscape.	This work was initiated in 2023 and continued after the end of this reporting period.
Transport Canada will work with and support NAV CANADA as they determine the optimum airspace design for the Canadian domestic airspace. Canadian air carriers will collaborate with Transport Canada and NAV CANADA to implement airspace redesign initiatives.	Transport Canada and NAV CANADA are supporting efforts under ICAO's Global Air Navigation Plan (GANP) and Aviation System Block Upgrades, as well as Transport Canada's Performance Based Navigation (PBN) State Plan for Canada, through planned upgrades on: • Communications; • Navigation; • Surveillance; and • Air Traffic Management. These upgrades maximize the benefits for operators of aircraft that are best equipped to take advantage of PBN procedures, while recognizing the needs for airspace access to operators not eligible for these procedures. NAV CANADA is undertaking a structured approach for tracking and monitoring ICAO participation, the goal of which is to target areas highlighted in the GANP following the 14th Air Navigation Conference and which impact corporate strategic priorities. This process will be shared with Transport Canada for alignment of resources where practicable.
The Government of Canada will continue to pursue adoption of international best practices, conducive to emissions reductions.	Canada (NRC and TC) led and participated in research campaigns with international collaborators to support and improve the measurement of nonvolatile particulate matter (nvPM), the newly regulated component of aviation gas turbine emissions. This included improvement of measurement instruments, calibration methods, reduction of uncertainties, all supporting reduced emissions quantification and reduced impacts on local air quality, human health, and climate.
Canadian air carriers will accelerate the implementation of industry best practices with respect to operational efficiencies from aircraft operations on the ground and in the air.	Objectives for fleet upgrades and operational improvements at Jazz Aviation are coordinated with Air Canada under the Capacity Purchase Agreement governing Air Canada Express operations. Operational efficiencies such as RNP AR approaches is one area that has been implemented to reduce track miles on certain approaches and therefore realizing fuel savings. (RNP AR currently apply to Q400 and E-175 operations). In 2023, Jazz initiated procedures to support single engine taxi operations whatever possible, providing substantial fuel savings. Furthermore, all Jazz pilots now utilise electronic flight bags (EFB) with full connectivity, allowing improved usage of electronic documents to support flight operations, thereby reducing use of paper and achieving overall weight reduction.

Examples of operation improvements at WJA include:

- Partnership with Aero Design Labs to reduce emission and improve fuel efficiency by testing and certifying a first-of-its kind modification kit designed to reduce drag and fuel burn, which helps improve the efficiency and longevity of our aircraft.
- Minimum bleed operations: A change in the operational procedures has been introduced by Bombardier on the DHC-8-400 fleet to allow the pilots to modify the setting of the air conditioning/pressurization system during climb and cruise phases provided a certain set of operational conditions are met. This results in a reduction of fuel consumption during these phases of flight.
- Continuous upgrade of the engines corresponding to Boeing regular engineering maintenance requirements and launching structured engine wash program in 2022-2023 helped to maintain both CFM and LEAP-1B engine efficiencies, durability, and reduced noise emissions,
- New livery used lightweight paint. Using lightweight paint helps to reduce weight to carry, and thus contributes to jet fuel savings.
- Fuel planning management system uses fuel load and pricing data to identify potential tankering opportunities to achieve most efficient fuel burn on the given route.
- Modification of the statistical taxi time determination process to lower the total fuel weight carried, which resulted in lower fuel burn and greenhouse gas emissions.
- Optimization of the published schedule and arrival margins to better align the flight speed with fuel efficient speeds instead of constantly accelerating flights to meet a too tight target. This results in a direct reduction of fuel burn (and GHG emissions) on numerous flights.

Air Canada:

- Optimization of engine washing procedures, shifting from fixed calendar-based schedules to criteria-based washes triggered by loss-of-efficiency indicators. This proactive approach significantly enhances engine performance and fuel efficiency.
- Encouraging low-drag approaches and Continuous Descent Approach Operations resulting in lower fuel burn during the arrival and approach phases of flight
- Upgrade of aircraft avionics and gaining of Special Authorization/Specific Approval to enable the use of newly published approaches at specific airports that reduce distance, fuel burn and GHG emissions (e.g., RNP AR approaches with Radius-to-fix legs and Visual Guided Approaches)
- Continuing to encourage Single Engine Taxi operations. Use of a single engine for taxi out and taxi in (when safely possible) reduces fuel burn and GHG.
- During COVID, IATA health and safety recommendations required the Auxiliary Power Unit (APU) to provide cabin air conditioning to ensure proper HEPA filtration. Since then, we are trying to encourage the sparing use of the APU (i.e., use of airport external ground power and ground preconditioned air units to operate aircraft systems when parked at the gate. Reduced APU usage results in less fuel burned and less GHG emitted.
- Procedures for tactical step climbs using accurate and real time wind data uplinked to aircraft flight management systems have been developed. These procedures will help reduced GHG emission through the selection of the most efficient altitude to fly at.
- Noise abatement departure profiles are being optimized with consideration for direction of flight, weight, environmental conditions, etc. More informed and appropriate selection of noise abatement profiles will result in reduced fuel burn and GHG emissions.

The Canadian Business Aviation Association (CBAA) continued to encourage its members to take advantage of opportunities to reduce GHG emissions through operational improvements. The CBAA Forum will continue to give these issues greater visibility to operators.

The CBAA works closely with Transport Canada and NAV CANADA in the development of airspace operational efficiency improvements through the Canadian Performance-based Aviation Action Team and its various working groups.

The CBAA has created an Environmental Microsite where business aviation's efforts towards achieving social and corporate sustainability goals are promoted and documented.

NAV CANADA will implement Trajectory-Based Operations (TBO) to enhance system efficiencies, mitigate delays and enable aircraft to fly preferred routes, leading to the use of less fuel. NAV CANADA will design and implement Required Navigation Performance – Authorization Required (RNP AR) approaches, which provide opportunities to adequately equipped aircraft to fly continuous descent approach profiles and reduced track-milage, reducing fuel burn and GHG emissions. NAV CANADA will also implement Established on RNP AR (EoR) at major airports with parallel runway operations. NAV CANADA will explore collaborating with the Department of National Defense in identifying opportunities for Flexible Use Airspace, which will allow aircraft to fly preferred routes.	The Canadian Performance-based Aviation Action Team (CPAAT) is leading Canada's PBN Implementation Plan and will provide opportunities for ongoing consultation and involvement throughout implementation. The CPAAT facilitates the implementation of performance-based operations in Canadian airspace, including aspects of Communication, Navigation, Surveillance and Air Traffic Management (CNS/ATM). CPAAT is focused on improving operational efficiencies through the reduction of track miles flown, as well as opportunities to reduce aviation environmental impacts of emissions and noise exposure. RNP AR approaches allow aircraft to land using satellite-based navigation in place of ground-based navigation systems, the benefits of which include reduced flying time and GHG emissions. In Canada, RNP AR approaches continue to be implemented in very close consultation and collaboration with major Canadian airline operators. By the end of 2023, there were over 95 RNP AR public approach procedures published at airports across Canada. Transport Canada, NAV CANADA and other key stakeholders (including customers, airport authorities, noise consultations, procedure design and operational Air Traffic Control) continue to work through a collaborative process to make the necessary regulatory and procedural changes to take even greater advantage of RNP AR approaches. In August of 2023, the Automatic Dependent Surveillance–Broadcast (ADS-B) mandate became effective in Class A airspace which corresponded to a significant increase in aircraft equipage throughout the year. As a result, flights to airports not traditionally supported by ground-based radar have seen a reduction in delays. NAV CANADA is currently implementing a tool to measure customer efficiency and support emission reductions. This will strengthen our future ability to identify emission reductions across the industry as we continue to support these efforts. Further sustainability highlights can be found in NAV CANADA's Annual Report, as well as its annual Communication on Progress through the United Nations Global Compact. NAV CANADA is collaborating with Transport Canada to establish performance requirements and regulatory changes to support the implementation of an ADS-B Class B Mandate in Canadian Domestic Airspace (CDA). To help increase safety and efficiency of operations, NAV CANADA is seeking regulatory approval for use of ground-based ADS-B for separation standards of 3 miles. The company is also considering increased use of ground-based ADS-B to add resilience to the ATS surveillance system network.
Parties will explore alternatives to improve the efficiency of ground aircraft movement.	Jazz: Single Engine Taxi Out (SETO) and Single Engine Taxi In (SETI) procedures are now conducted on all fleet types when conditions permit. • SETO and SETI provide fuel savings with associated greenhouse gas reductions. • Estimated fuel savings are 4 kg/minute for the E175 and 3.4 kg/minute for the Q400, and 4.5 kg/minute for the CRJ 900. Updates to Jepp FD ProX. • IOS 5.0 introduced ADS-B Out traffic and taxi times. This enhancement provides additional tools for Flight Crews to determine when to use SETI and SETO procedures. ATAC members continue to evaluate, and implement as appropriate, alternative solutions for more efficient ground movement of aircraft such as single engine taxi and energy efficient ground towing operations.

SUSTAINABLE AVIATION FUELS

ACTIVITY	RESULTS
Parties of the Action Plan to collaborate with the Canadian Council for SAF (C-SAF) and others in developing a Canadian roadmap for SAF.	The Canadian Council for Sustainable Aviation Fuels (C-SAF) launched its Sustainable Aviation Fuels Roadmap on June 5, 2023 detailing its policy framework, its priority actions, and the next steps to ensure that the Canadian aviation sector remains competitive as it transitions to a net-zero future by 2050.
Natural Resources Canada to explore SAF as part of developing a BioEnergy Strategy to ensure Canada maximizes its bioenergy potential to reduce emissions while growing the economy.	Natural Resources Canada is engaging collaboratively with other federal Departments to refine the fundamental vision and strategic framework that could form the basis of a Bioenergy Strategy. A Bioenergy Strategy could provide a forward looking collaborative approach for the federal government on bioenergy, including exploring the potential for sustainable aviation fuel to advance environmental, economic and energy security benefits for Canadians.
The Government of Canada will explore how federal measures may be leveraged to create a policy environment to enable and accelerate SAF uptake in Canada. It will pursue having the Draft Regulations Amending the Fuel Charge Regulations made to provide relief from the federal fuel charge for bio-aviation fuel blended into aviation gasoline or aviation turbo fuel.	The Regulations Amending the Fuel Charge Regulations in order to provide relief from the federal fuel charge for bio-aviation fuel blended into aviation gasoline or aviation turbo fuel under Part 1 of the Greenhouse Gas Pollution Pricing Act (GGPPA) were published in the Canada Gazette Part II on April 12, 2023.
The Government of Canada will support SAF related initiatives through existing programs and will purchase SAF for its federal fleet through the upcoming Low-carbon Fuel Procurement Program.	The Low-carbon Fuel Procurement program has $134.9 million in funding over eight years (fiscal years 2023–24 to 2030–31).
Transport Canada to continue supporting ICAO Committee on Aviation Environmental Protection (CAEP) work to develop international standards for SAF, advocate for Canadian interests where relevant, and contribute expertise and experience.	Canada continues to contribute expertise and leadership in the technical groups relevant to SAF including the CAEP Fuels Task Group and the CORSIA working group. Discussions at ICAO CAEP continue to advance its tasks in the CAEP13 work cycle (2022-2025), focusing on topics such as high electricity input CORSIA eligible fuels, carbon capture and storage associated with SAF production, and other tasks such as evaluating the eligibility of new feedstocks and SAF production pathways.
Canadian air carriers will signal demand with offtake agreements as appropriate and financially sound.	Canada is monitoring ongoing air carrier developments with further information applicable following the 2023 reporting period (refer to 2024 Look Ahead section).

OUT OF SECTOR REDUCTIONS AND VOLUNTARY PROGRAMS

ACTIVITY	RESULTS
The Government of Canada will encourage companies within Canada's aviation sector to voluntarily participate in the Net-Zero Challenge.	The Net-Zero Challenge was officially launched in August 2022. Organizations that join the Challenge commit to developing and implementing credible and effective plans to transition their facilities and operations to net-zero emissions by 2050. In 2022-23, the Government reached out to several organizations within the Canadian aviation sector regarding the Net-Zero Challenge.
Explore opportunities for technologies such as direct air capture to generate sufficient supply of credits to respond to the need for out-of-sector reductions.	Canada is monitoring developments at the International Civil Aviation Organization (ICAO). Carbon Dioxide Removal (CDR) methods such as direct air capture are part of ongoing assessment at the ICAO Technical Advisory Body (TAB), with further updates expected to come in Fall 2025.

MEASURES TO REDUCE NON-AIRCRAFT EMISSIONS

ACTIVITY	RESULTS
Transport Canada will consult with airports that have not yet mapped their GHG emissions to better understand the challenges and opportunities to provide support.	This work was initiated in 2023 and continued after the end of this reporting period.
Major airports (airports in the National Airport System) will be requested by the Government to develop a net-zero plan and report regularly on progress, consistent with the Government's Net-Zero Challenge.	Several emission reduction initiatives are advancing at Canadian airports. Examples include: **Aéroports de Montréal (ADM)** Aéroports de Montréal (ADM) developed a Net Zero Roadmap along with its Energy Master Plan to achieve its goal of Net Zero in 2040. A Sustainability Plan 1.0 was also published to share the actions ADM wants to put forward on its journey to sustainability. The implementation of a new process for granting licences for ground handling services at YUL will require 100% of ground support equipment (GSE) to be electric where an electric alternative exists by the end of 2030. To accommodate that transition, multiple airsides charging stations were installed in the last years and more are coming. City side, a new parking lot with more than 30 charging stations was opened to the public. Addition of an energy-saving control sequence for the nighttime operation of the CE-173 and CE-174 electric water heaters. These water heaters serve YUL's domestic hot water system. ADM partnered with SOFIAC for the development of a large-scale energy efficiency and GHG emissions reduction project at YUL and YMX. This project, which will cover the entire airport infrastructure, will bring gains in terms of decarbonization, the implementation of innovative energy solutions and a significant reduction in energy consumption. Underway projects to convert the lights on runway 06R-24L to LED technology will reduce the power consumption of more than 90 lights. The downgrading of runway 10-28 to taxiway status also resulted in a 96% reduction in electricity consumption compared to the original load. RNG Utilization has gradually increased, from 7,5% to 25% in 2023. Starting in 2024, the proportion of RNG will represent 35% of the NG consumed at YUL. Alternative fuels for mobile equipment, such as biodiesel and renewable diesel, were tested in recent years. Gradual increase in the number of electric vehicles in the light duty vehicle fleet.

Ft. McMurray (YMM)

Fort McMurray Airport (YMM) has developed a Carbon Management Plan with an annual target of continuous carbon reduction established until 2030. This Plan is subject to routine auditing under the airport's Quality Management Program.

In addition, YMM implements a wide range of initiatives to support reduction effort, including:

- LED light upgrade for terminal and airside,
- Motion sensors for light fixture in terminal,
- Auto shut off escalators and baggage belt systems when not in active use,
- HVAC and Building Automation System (BAS) optimization,
- Fleet modernization
- Installation of vehicle telematics on fleet with high idling activity.
- Furthermore, to promote knowledge and awareness, carbon management has become part of YMM's Environmental Management training for onboarding employees.

Greater Moncton Roméo LeBlanc International Airport (YQM)

In 2023, Greater Moncton Roméo LeBlanc International Airport completed retrofitting of LED lighting in the underground parking garage, flood lights on Apron 8, and various airfield signage and lighting to decrease energy consumption.

Halifax Stanfield International Airport (YHZ)

Halifax Stanfield International Airport (YHZ) upgraded to Airport Carbon Accreditation Level 3 – Optimization in 2023. Carbon reduction initiatives implemented included updating the approach lighting system for Runways 14 and 23 with all LED fixtures, carrying out ASHRAE Level 1 & 2 energy audits in the air terminal building, and installing Level 1 & Level 2 electric vehicle charging infrastructure in the public parking garage, as well as charging infrastructure for ground support equipment on the aircraft apron to support airline operations.

Ottawa International Airport Authority

The Ottawa International Airport Authority (YOW) has taken several steps to electrify its fleet. In 2022, Ottawa International Airport purchased its first electric van and has since purchased six new electric vehicles, and an electric bus. Several charging stations have been installed around the airport and new EGSE charging stations are now available for the airlines to use. Other efforts include investigating the role of renewable drop-in fuels for our larger field equipment, reducing electricity use wherever possible, making efforts to reduce and divert waste, and taking steps in converting natural gas equipment and heating systems to fully electric ones. A new partnership with Envari will also help guide Ottawa International Airport towards a more modern and optimal use of its Building Automation System (BAS).

Saskatoon Airport

Saskatoon Airport (YXE) identified that, compared to old incandescent bulbs, LED lights are up to 80% more efficient. Unlike fluorescent lights, LED lights convert 95% of their energy into light and only 5% is wasted as heat; while still using far less power to provide a strong and consistent output at a lower wattage. Rehabilitation of runway 15/33 presented the opportunity to replace all runway lights and signage and install LEDs. Same upgrades were done around the main terminal. After this change, compared to 2015, the airport had a reduction of 14% from 2015 airfield electricity consumption and overall reduction of 8.2% in terminal electrical consumption. Rehabilitation of 09/27 presented the opportunity to replace all runway lights and signage and install LEDs. After this change, compared to 2015, the airport had a reduction of 35% from 2015 airfield electricity consumption. Efficiency upgrades to terminal boilers have improved heat transfer and lowered natural gas consumption by 13%.

Toronto Pearson International Airport / Greater Toronto Airport Authority (GTAA)

Under the Pearson LIFT programs, the GTAA is implementing projects to progress toward the goal to be net-zero GHG no later than 2050. This includes expanded EV and eGSE charging, electrification of facility heating and maximizing use of on-site solar PV. The GTAA is exploring potential pathways to decarbonize its 117MW cogen plant which includes a small volume purchase of renewable natural gas via Power Purchase agreement (PPA) in 2024. The GTAA has also made its first renewable diesel purchase in 2024 to assist with fleet GHG reductions. Going forward all new GTAA light fleet vehicles will be zero emissions vehicles where market availability permits. Heavy fleet decarbonization will be supported via renewable diesel, hydrogen and possibly battery electric as applicable. Ontario's first publicly available hydrogen fill station with both 350 and 700 bar capability has been installed near the GTAA admin building on Convair drive and will be operational as of August 2024. The GTAA will add hydrogen vehicles to the light fleet starting in 2025. The GTAA is also pursuing other hydrogen pilots and partnerships including a study partnership with Airbus/ Zeroavia, Montreal and Vancouver airports to assess feasibility and requirements to support hydrogen flight. The GTAA has an ongoing energy efficiency program that continues to identify and implement opportunities to reduce energy consumption and demand.

Vancouver International Airport

Vancouver International Airport (YVR) is implementing a Roadmap to Net Zero by 2030, with four pathways – energy efficiency and conservation, greening the fleet, renewable energy and closing the gap through the purchase of carbon removals. YVR has been carbon neutral since 2020. Some key initiatives include:

- Providing ground power units for aircraft to plug in to BC's clean electricity while aircraft are at the gate.
- Installing 106 airside charging ports for electric ground support equipment.
- Replacing over 21,000 lights across the terminal with energy-efficient LEDs, saving enough energy to power over 200 BC homes every year.
- Completing major projects to optimize energy efficient heating and cooling that will save 375 tonnes of carbon reductions annually.
- Partnering with BC-based Moment Energy to deliver a new Battery Energy Storage System at the airport that repurposes retired electric vehicle batteries.
- YVR's fleet is now 21% electric and includes two hydrogen fuel-cell vehicles. All airside buses are fully electric.

Calgary International Airport

- Changing construction standards for pavement to include captured carbon. Carbon-capture concrete has been used on all airfield construction projects since 2019 (targets Scope 3 emissions).
- The Airport Authority has been replacing all lighting systems (indoor, outdoor and airfield) to LED with a full conversion at both YYC and YBW anticipated to be completed by 2027. Lighting is the single biggest source of electricity use at our airports (targets Scope 2 emissions).
- Enabling service providers and airlines to use zero emission ground handling equipment through the provisioning of eGSE charging stations in several locations around the main terminal, and gate power at all passenger boarding bridges (Airport Authority Scope 3 emission).
- A replacement of our baggage handling system, completed in 2020, to one of the most energy-efficient available (targets Scope 2 emissions).
- Centralising de-icing operations has allowed for the collection and recycling of record volumes of ethylene glycol, preventing fugitive air emissions from the decomposition of this product (Airport Authority Scope 3 emission).
- Implementation of water conservation and waste reduction programs to the Airport Authority's Scope 3 the emissions associated with water treatment, waste hauling and landfilling.

Transport Canada and Environment and Climate Change Canada will work with airports, airlines and third-party equipment owners and operators to develop an inventory of ground support equipment and infrastructure to better understand the landscape and help determine an approach for supporting the adoption of electric/low-carbon equipment and green infrastructure.	This work was initiated in 2023 and continued after the end of this reporting period.
Airlines and equipment owners will transition to an electric / low-carbon ground support equipment by replacing fossil fuel-based equipment, prioritizing equipment for which technology is readily available (baggage tractors) and exploring other types of low-emitting equipment as they become commercially available/viable (pushback tractors, belt loaders, etc.)	Jazz has committed to transitioning its fossil fuel-based equipment to electric ground support equipment. Current electrical ground support equipment operated by Jazz is: • Two (2) Belt Loader • Eleven (11) Fork Lifts • Eighty-one (81) Ground Power Units • Fifteen (15) Ramp Tractors • Ten (10) Towbarless Tug ATAC members continue to evaluate and implement electric ground support equipment wherever practical. ATAC members also encourage the airport electrification of power at aircraft gates in lieu of carbon fuel-based ground power units or aircraft auxiliary power units (APUs).

NON-CO_2 IMPACTS OF AVIATION ON CLIMATE

ACTIVITY	RESULTS
Over the next 3 years, ECCC will develop an experimental meteorological tool for the identification and prediction of contrail forming zones in the atmosphere for Canadian airspace. The tool could enable alternative flight paths that avoid persistent contrail formation when fuel burn penalties are negligible, should the experimental tool prove to be accurate and reliable. The project will be carried out in partnership with Transport Canada and with the advice of the National Research Council.	An ECCC post-doctoral research scientist, Zane Dedekind, began the project in August 2022. The research proceeded as per the project plan. During 2022-2023, he conducted a literature review, learned ECCC's numerical weather prediction system GEM, formulated project deliverable output formats, and used GEM to identify regions of contrail formation categorized as 1) natural cirrus, 2) clear sky with long-lived contrails, and 3) clear sky with short-lived contrails.
Environment and Climate Change Canada is working to develop modelling capability for aviation's non-CO_2 emissions and their effects on air quality and climate through the global air quality prediction model (GEM-MACH global). A comprehensive model assessment of the impact of aviation emissions on atmospheric composition and deposition will be carried out.	This work is ongoing. Progress during 2022 and 2023: • Processed 2015 EDGAR global methane and air pollutants emission inventories, including aviation sectors, to generate gridded 3-D, hourly emission inputs for the global air quality prediction model (GEM-MACH global). • Conducted initial model simulations, using GEM-MACH global, for the year 2015, both with and without the aviation emissions, and evaluated the impact of aviation emissions on atmospheric composition at surface level and cruising altitudes (upper troposphere and lower stratosphere, UTLS, region). • Continued modelling capacity development: (1) examined (and improved) model representation of gases and aerosols in the UTLS region; (2) evaluated model against observations and analysis; (3) explored the capability of diagnosing aviation emission impact on radiative forcing.
Canada will continue to work collaboratively with international partners on the topic of non-CO_2 climate impacts at ICAO through the Impacts and Science Group.	NAV CANADA continues to co-lead an ICAO Task Group on operational opportunities to reduce contrails, aviation-induced cirrus, and other non-CO_2 effects on climate change. ECCC participates in the ICAO Task Group on Contrail Impacts and Aviation Induced Cloudiness (AIC). Both Task Groups operate under the ICAO Committee on Aviation Environmental Protection (CAEP).
All partners will support and participate in scientific research as appropriate to better understand and quantify the impact of non-CO_2 terms such as PM, water vapor and contrails, on climate change to inform future mitigation measures as appropriate.	Canada (ECCC and TC) initiated work on the development of a Contrail Avoidance Tool (CoAT) for use in Canadian airspace.

LOOKING AHEAD

Building on actions taken in 2022 and 2023, this section provides a short preview of several expected updates for 2024 which are indicative of continued progress across the aviation ecosystem.

Air Carriers' Continued Fleet Renewal

- Air Canada taking delivery of nine Boeing 737 MAX 8s, two Boeing 767-300Fs, and five Airbus A220-300s. It retired five Boeing 767-3s.
- WestJet taking delivery of four new Boeing 737 Max 8 aircraft and will introduce three Boeing 787-9 aircraft into service. The 737 Max 8 deliveries will be conditional on the resolution of the 737 Max aircraft grounding.
- Rouge taking delivery of four Airbus A321-211 and six Airbus A320-214 aircraft.
- Sunwing to add Boeing 737 MAX 8 aircraft to its fleet.
- Air Transat to receive 5 A321 NEO LRs and operated a total of 31 aircraft compared to 23 in 2021.
- Rise Air taking delivery of a Next Generation ATR 42-500.
- Air North has acquired B737-800 aircraft to supplement/replace older less efficient aircraft.
- Porter Airlines has acquired a fast-growing fleet of Embraer E195-E2 aircraft, the latest fuel-efficient aircraft from Embraer for its North American route expansion, The E2 is the most environmentally friendly single aisle aircraft family, measured by sound and CO_2 emissions.
- Air Inuit is planning the phase out of its B737-200s which are being replaced with three B737-800 NG aircraft.
- Jazz single engine taxi out operations for the Q400 fleet will be further enhanced in the fall of 2024 where operationally possible.
- WestJet is aiming to retire one additional B737-700 aircraft in 2024 and add 10 B737-MAX8 tails as part of fleet renewal program.

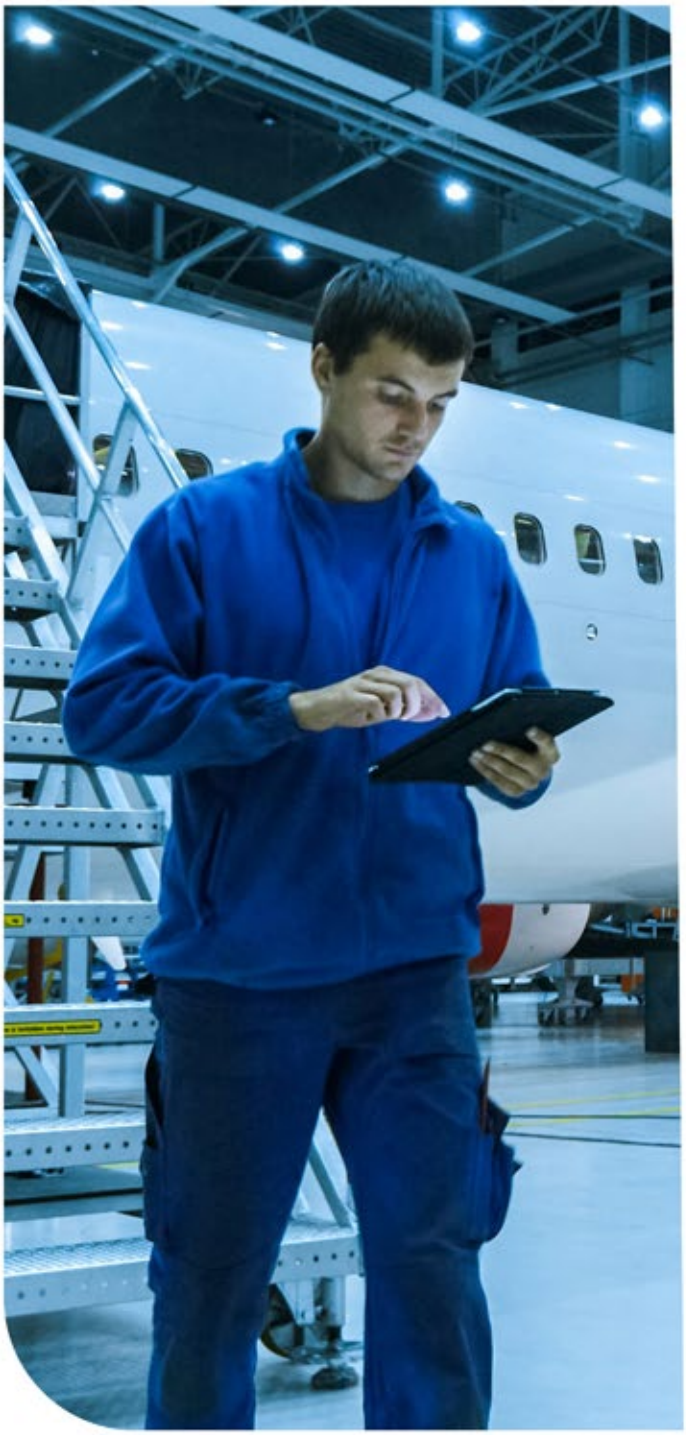
Aerospace Manufacturers

AIAC and its members are working to develop and produce aircraft and engines that meet or exceed ICAO requirements for fuel efficiency and emissions. Canadian aerospace manufacturers are working to find solutions by developing and investing in new technologies and foster innovation. AIAC alongside the Canadian aerospace manufacturers are working closely with international partners, through ICCAIA, to achieve the industry's net-zero emission goals by 2050.

Air Traffic and Performance Based Navigation

NAV CANADA Performance Based Navigation (PBN) projects:

- Required Navigation Performance Authorization Required (RNP AR) and PBN airspace project work continues, with small-scale projects underway in Northern Ontario and large-scale projects underway in Vancouver. Further implementations of the new ICAO separation standard, established on RNP AR (EoR) are being planned for Vancouver International.
- Continuing to evolve air traffic management through space-based Automatic Dependent Surveillance-Broadcast (ADS-B) in Class B airspace. An ADS-B mandate for Class B airspace was implemented in 2024, after which stakeholder consultation began to assess mandates for Class C, D, and E airspace.
- NAV CANADA to seek regulatory approval for use of ground-based ADS-B for separation standards of 3 miles and less, to increase the efficiency of the ATS surveillance infrastructure.



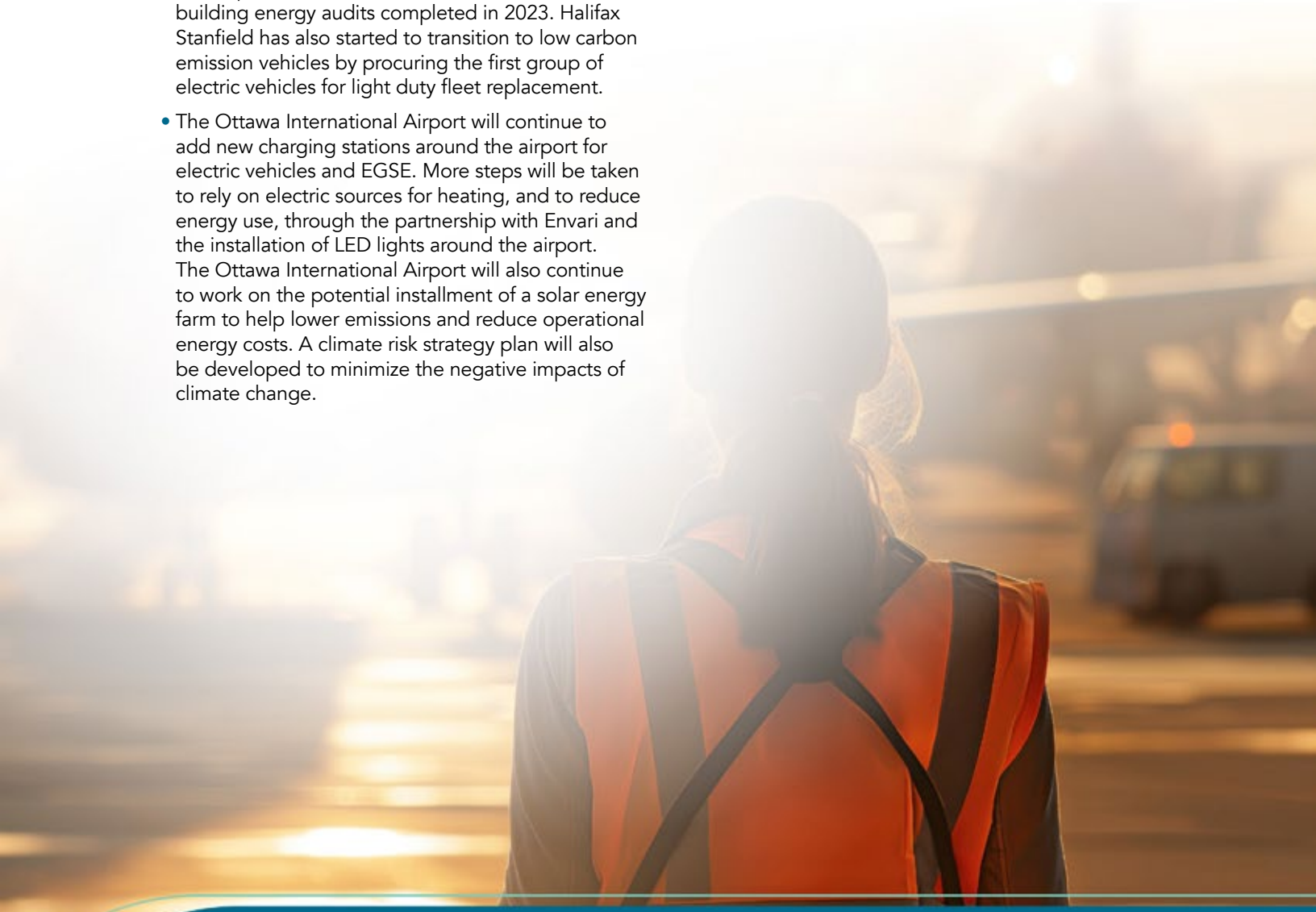
WESTJET SAF PURCHASE

On April 19, 2024, WestJet announced that it has purchased Canada's first batch of SAF from Shell Aviation. This effort, which follows their earlier breakthroughs in Winglets and drag reduction technology, demonstrates WestJet's leadership in sustainability within the aviation industry.

Through Avelia, a blockchain-enabled digital system, WestJet and Shell Aviation track the environmental benefits of SAF in a transparent and trustworthy manner.

Airports

- Toronto Pearson International Airport to continue replacing its light fleet with green vehicles and continuing to reduce emissions across all 3 scopes.
- Aéroports de Montréal continues to convert its light vehicle fleet to electric but has also created a committee that evaluates every vehicle acquisition based on different factors such as low emissions vehicles, pooling capacity, usage and needs optimisation. ADM also partners with SOFIAC (*Société de financement et d'accompagnement en performance énergétique*) to accompany them in multisite study will identify potential projects to reduce greenhouse gas emissions and increase energy efficiency.
- Halifax Stanfield is developing a waste management strategy for the air terminal building to reduce waste sent to landfill. An implementation plan is being developed to address the results of the air terminal building energy audits completed in 2023. Halifax Stanfield has also started to transition to low carbon emission vehicles by procuring the first group of electric vehicles for light duty fleet replacement.
- The Ottawa International Airport will continue to add new charging stations around the airport for electric vehicles and EGSE. More steps will be taken to rely on electric sources for heating, and to reduce energy use, through the partnership with Envari and the installation of LED lights around the airport. The Ottawa International Airport will also continue to work on the potential installment of a solar energy farm to help lower emissions and reduce operational energy costs. A climate risk strategy plan will also be developed to minimize the negative impacts of climate change.
- Saskatoon Airport is proceeding with a planned 1 MW solar facility that will significantly lower CO_2e from terminal operations. A request for proposal will be sent out to all parties interested.
- Vancouver International Airport hot water systems: In addition to heating some of its terminal water with solar thermal heating, YVR is in the process of reducing carbon emissions from the remaining hot water systems to zero by installing air source heat pumps. This technology is four times more efficient than using electricity alone, and it will reduce YVR's carbon emissions by 855 tonnes per year. The first system will be installed in 2024. YVR has also signed an MOU with the Province of BC and the BC Aviation Council to develop a net zero airports action plan for the entire B.C. airport network.



AIRPORT HYDROGEN

The busiest airports in Canada—Toronto Pearson, Montréal–Trudeau, and Vancouver International Airport—have teamed up with Airbus and ZeroAvia to investigate the viability of hydrogen infrastructure. As part of a common goal to attain net-zero carbon emissions by 2050, this partnership attempts to lead the way in hydrogen for aircraft in Canada. To assist the growth of a hydrogen aviation ecosystem, the feasibility study will concentrate on hydrogen aircraft ideas, infrastructure, and refueling requirements. In line with Canada's abundant renewable energy resources, this project seeks to bring in a new era of environmentally friendly aviation by decarbonizing airport ground and aviation transportation.

Sustainable Aviation Fuels and Emissions Offsetting

- Vancouver International Airport is advancing the SAF industry by uniting industry leaders to explore a supply chain for made-in-British Columbia SAF, through BioPortYVR. YVR is partnering with the Province of BC to complete a sustainable aviation fuel opportunities study in collaboration with partners in academia, aviation and energy.
- Parkland's Burnaby Refinery produced nearly 101 000 litres low carbon aviation fuel, which was purchased by Air Canada.
- Air Canada and Neste agreed on supply of 77.6 million liters of unblended, neat Neste My Sustainable Aviation Fuel for use on flights from Vancouver International Airport.
- The Government of British Columbia (BC) has implemented a Low Carbon Fuel Standard (LCFS) for aviation fuel, which requires fuel suppliers to decrease the carbon intensity of aviation fuel over time by blending conventional jet fuel with SAF. It also has volumetric renewable content requirements for jet fuel supplied to BC (starting at 1% in 2028 and increasing 1% annually to 3% in 2030).

Federal Measures

- The Clean Fuels Fund (CFF) is a $1.5B investment over 5 years that was announced in Budget 2021 to increase Canadian clean fuel production capacity. Budget 2024 subsequently announced a retool of the fund and extension of the program to 2029-30. The fund provides capital investment support to expand existing or build new clean fuel production facilities, including SAF. Support is also available for feasibility and front-end engineering and design (FEED) studies. In 2024, the Canada Infrastructure Bank, the Clean Fuels Fund and the Government of Manitoba partnered to support Azure's FEED study for SAF production in Canada.
- The Government of Canada through the Low-carbon Fuel Procurement Program will be rolling out SAF procurements in the coming years to reduce GHG emissions generated from the consumption of jet fuel in federal aviation fleet operations.
- Through the Sustainable Aviation Task Force, Transport Canada is developing a SAF Blueprint, which will lever the C-SAF roadmap and identify what is needed from both the public and private sectors to ensure sufficient access to clean fuels to meet Canada's 10% aspirational SAF use goal by 2030.
- As of the end of 2024, 27 organizations within Canada's aviation sector have joined the Net-Zero Challenge. This includes 6 airports and 21 construction companies, engineering, and project management firms who provide services to airports.

Domestic and International Coordination

- Continue to have open channels of coordination and providing support such as through ICAO's Assistance, Capacity Building, and Training for SAF (ACT-SAF) programme and through the UK-led International Aviation Climate Ambition Coalition.
- ASCENT 100 has been initiated by FAA, focusing on exploring and/or optimizing US-CAN SAF supply chain, including feedstock, refinery, trade among other areas.

Aviation Environmental Research and Development

- In November 2024, industry partners and the NRC launched the H2CanFly consortium to build a national hydrogen flight research platform that is accessible to and inclusive of all parts of the Canadian ecosystem. Work will continue to build this consortium and start developing the flight research platform.

APPENDIX A:
DATA TABLES

Table 1 | Annual Results of Domestic and International Operations, 2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Fuel use (million litres)	4,887	5,186	5,543	5,575	5,098	5,659	6,089	6,256	6,314	6,579
GHG emissions (megatonnes CO_2e)	12.622	13.393	14.316	14.399	13.167	14.615	15.725	16.157	16.307	16.991
Traffic (billions)										
Revenue passenger-kilometres (RPK)	105.2	113.0	124.2	125.5	117.6	128.8	141.3	148.7	150.9	161.6
Passenger revenue-tonne-kilometres (pass. RTK)*	10.5	11.3	12.4	12.6	11.8	12.9	14.1	14.9	15.1	16.2
Cargo revenue-tonne-kilometres (cargo RTK)	1.6	1.5	1.8	1.6	1.4	2.0	2.0	2.0	2.1	2.2
Total revenue-tonne-kilometres (RTK)	12.1	12.8	14.2	14.1	13.1	14.9	16.1	16.8	17.1	18.4
Fuel consumption rates										
Litres/RPK	0.0464	0.0459	0.0446	0.0444	0.0433	0.0439	0.0431	0.0421	0.0418	0.0407
Litres/Total RTK	0.4043	0.4043	0.3895	0.3947	0.3879	0.3802	0.3780	0.3716	0.3683	0.3574
Emission rates**										
CO_2e grams/RPK	120	119	115	115	112	113	111	109	108	105
CO_2e grams/Total RTK	1,044	1,044	1,006	1,019	1,002	982	976	960	951	923

* Note that Passenger RTK are calculated by multiplying RPK by 100 kg (or 0.1 tonnes), which is the industry's conventional assumption of the average weight per passenger, including baggage.

** All GHG emissions included in this report have been calculated based on the emissions factors used in Environment and Climate Change Canada's (ECCC) National Inventory Report 1990-2021

Annual Results of Domestic and International Operations, 2015-2023

	2015	2016	2017	2018	2019	2020	2021	2022	2023
Fuel use (million litres)	7,023	7,555	8,137	8,543	8,498	3,357	3,223	6,440	7,874
GHG emissions (megatonnes CO_2e)	18.128	19.501	21.004	22.052	21.936	8.666	8.319	16.623	20.326
Traffic (billions)									
Revenue passenger-kilometres (RPK)	175.7	194.0	212.1	230.0	230.4	59.7	51.2	164.8	214.7
Passenger revenue-tonne-kilometres (pass. RTK)*	17.6	19.4	21.2	23.0	23.0	6.0	5.1	16.5	21.5
Cargo revenue-tonne-kilometres (cargo RTK)	2.2	2.6	3.2	3.5	3.3	2.2	3.2	3.4	3.5
Total revenue-tonne-kilometres (RTK)	19.8	22.0	24.4	26.5	26.3	8.2	8.3	19.9	25.0
Fuel consumption rates									
Litres/RPK	0.0400	0.0389	0.0384	0.0371	0.0369	0.0562	0.0629	0.0391	0.0367
Litres/Total RTK	0.3546	0.3428	0.3331	0.3222	0.3229	0.4114	0.3865	0.3239	0.3152
Emission rates:									
CO_2e grams/RPK	103	101	99	96	95	145	162	101	95
CO_2e grams/Total RTK	915	885	860	832	833	1062	998	836	814

* Note that Passenger RTK are calculated by multiplying RPK by 100 kg (or 0.1 tonnes), which is the industry's conventional assumption of the average weight per passenger, including baggage.

Table 2 | International Vs. Domestic Aviation Activity

2022

	Operations Classification		
	International	**Domestic**	**Total**
Fuel use (million litres)	4,304	2,136	6,440
Greenhouse gas emissions (millions of tonnes of CO_2e)	11.11	5.51	16.62
Traffic (billions)			
Revenue passenger-kilometres (RPK)	77.5	87.2	164.8
Passenger revenue-tonne-kilometres (pass. RTK)	7.8	8.7	16.5
Cargo revenue-tonne-kilometres (cargo RTK)	1.9	1.6	3.4
Total revenue-tonne-kilometres (RTK)	9.6	10.3	19.9
Fuel consumption rates			
Litres/100 RTK	44.8	20.8	32.4
Emission rates:			
CO_2e grams/Total RTK	1,156	537	836

2023

	Operations Classification		
	International	**Domestic**	**Total**
Fuel use (million litres)	5,483	2,391	7,874
Greenhouse gas emissions (millions of tonnes of CO_2e)	14.15	6.17	20.33
Traffic (billions)			
Revenue passenger-kilometres (RPK)	156.9	57.8	214.7
Passenger revenue-tonne-kilometres (pass. RTK)	15.7	5.8	21.53
Cargo revenue-tonne-kilometres (cargo RTK)	2.7	0.8	3.5
Total revenue-tonne-kilometres (RTK)	18.4	6.6	25.0
Fuel consumption rates			
Litres/100 RTK	29.8	36.4	31.5
Emission rates:			
CO_2e grams/Total RTK	769	938	814

APPENDIX B:
PROGRESS TOWARDS ACTION PLAN GOAL

2050 Net-Zero Vision

The updated data provided through the annual reporting aligns with the projections developed as part of Canada's *Aviation Climate Action Plan (2022-2030)*. While the previous modelling projected data starting in 2024, the latest data provides updated historical emissions data consistent with the pathway. The overall gap to net-zero emissions is presented below based on the 2022 and 2023 data, based on reaching the level of 2050 emissions from the Action Plan resulting from in-sector measures.

Table 3 | Remaining Gap to Action Plan Net-Zero Vision Emissions Level

	Greenhouse gas emissions (millions of tonnes of CO_2e)	Gap to Aviation Climate Action Plan Net-Zero Vision (2050)[7] (millions of tonnes of CO_2e)
2022	16.6	4.0
2023	20.3	7.7

Canada's *Aviation Climate Action Plan (2022-2030)* Aspirational SAF Use Goal

Canada's *Aviation Climate Action Plan (2022-2030)* sets an aspirational goal of 10 percent SAF use by 2030. The table below presents an initial reporting of the volumes of SAF used on an annual basis:

Table 4 | Sustainable Aviation Fuel Use

	2022	2023
Conventional Aviation fuel use (million litres)	6440	7874
Sustainable Aviation Fuel use (million litres)	2	5
Sustainable Aviation Fuel – Share of total fuel (%)	0.03%	0.07%

7 Based on the gap to the Aviation Climate Action Plan (2022-2050) pathway level (before out of sector reductions) of 12.6 Mt CO_2e.

APPENDIX C:
GLOSSARY OF KEY TERMS AND ACRONYMS

KEY AVIATION ACTIVITY MEASUREMENTS

Revenue Passenger-Kilometres (RPK): is a measure of traffic showing revenue-paying passengers carried, multiplied by distance flown.

Passenger Revenue Tonne-Kilometres (Passenger RTK): is the total tonnes of revenue-paying passengers carried, estimated by converting RPK into weight using the industry's convention of 100 kg (220 lbs) per passenger, multiplied by distance flown.

Cargo Revenue Tonne-Kilometres (Cargo RTK): is the total tonnes of revenue-generating cargo (freight and mail) multiplied by distance flown (reflects actual cargo carried).

Total Revenue Tonne-Kilometres (Total RTK): is the total tonnes of passengers, freight, and mail carried (revenue load) multiplied by distance flown.

ACRONYMS

ACA: Airport Carbon Accreditation

ACI: Airports Council International

AIAC: Aerospace Industries Association of Canada

ASCENT: Aviation Sustainability Center

ATAC: Air Transport Association of Canada

ATAG: Air Transport Action Group

ATM: Air Traffic Management

CAEP: Committee on Aviation and Environmental Protection

CAC: Canadian Airports Council

CBAA: Canadian Business Aviation Association

CFR: Clean Fuel Regulations

CO_2: Carbon Dioxide

CO_2e: Carbon Dioxide Equivalent

CORSIA: Carbon Offsetting and Reduction Scheme for International Aviation

CPAAT: Canadian Performance-based Aviation Action Team

C-SAF: Canadian Council for Sustainable Aviation Fuels

ECCC: Environment and Climate Change Canada

EoR: Established on RNP AR

FAA: Federal Aviation Administration

GARDN: Green Aviation Research & Development Network

GHG: Greenhouse Gas

GSE: Ground Support Equipment

ICAO: International Civil Aviation Organization

ICCAIA: International Coordinating Council of Aerospace Industries Associations

Mt: Megatonnes

NACC: National Airlines Council of Canada

NPA: Notice for Proposed Amendment

NRC: National Research Council

OEM: Original Equipment Manufacturer

PBN: Performance-based Navigation

RNP: Required Navigation Performance

RNP AR: RNP Authorization Required

RPM: Revenue Passenger-Miles

RPK: Revenue Passenger-Kilometres

RTM: Revenue Tonne-Miles

RTK: Revenue Tonne-Kilometres

SAF: Sustainable Aviation Fuel

APPENDIX D:
CALCULATIONS AND CAVEATS

The following factors and formulas were applied in preparation of the aggregated report from ATAC and NACC. Note that industry statistics are still maintained in imperial units, including miles and tons, which are converted to International System (SI) units (kilometres and tonnes) for the present report. The emissions factors for all calendar years are the latest factors from ECCC's National Inventory Report 1990-2022.

AVIATION JET FUEL EMISSION FACTORS

2,560 grams CO_2 per litre

2,582 grams CO_2e per litre

CONVERSION MILES TO KILOMETRES

1 mi = 1.609344 km

CONVERSION TONS TO TONNES

1 ton = 0.907185 tonnes

FORMULA USED TO CALCULATE ANNUAL FUEL EFFICIENCY

Compound Annual Growth Rate (CAGR) = (ending value/ beginning value) (1/# of years) -1

FORMULAE FOR CO_2-EQUIVALENTS

CO_2e (grams)/RPK = (Fuel Used x 2,583) / (RPM x 1.609344)

CO_2e (grams)/Cargo RTK = (Fuel Used x 2,583) / (Cargo RTM x 1.609344 x 0.907185)

CO_2e (grams)/Total RTK = (Fuel Used x 2,583) / {(RPM x 1.609344 x 0.907185) + (Cargo RTM x 1.609344 x 0.907185)}

Reports by ATAC and NACC members have been revised from time to time, notably of activity statistics. The consolidated statistics presented in this report include all the latest figures reported by ATAC and NACC carriers, including all such revisions. It should be noted that the statistics are not entirely comparable between years.

The reported annual emission statistics do not account for 100 percent of Canadian aviation operations, and therefore will not be directly comparable to ECCC's annual National Greenhouse Gas Emissions Inventory. Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation, and therefore this report, does not cover private aviation, military and other government operations, or foreign carriers' operations in Canada.

There has been some variability in reporting from year to year, particularly from including more carriers. Coverage in 2022 and 2023 was close to that of previous reporting with member reporting indicated in Appendix E. Changes in the number of carriers does not substantially affect the industry-wide ratios and longer-term trends computed for fuel use and emissions per unit of traffic.

APPENDIX E:
LIST OF SIGNATORIES AND AVIATION MEMBER COMPANIES REPORTING

Signatories of the Aviation Climate Action Plan (2022-2030) include:

- Aerospace Industries Association of Canada;
- Air Transport Association of Canada;
- Canadian Airports Council;
- Canadian Business Aviation Association;
- National Airlines Council of Canada;
- NAV CANADA; and
- Transport Canada.

All four members of NACC contributed 2022 and 2023 data for this annual report, including:

- Air Canada (including Air Canada Rouge);
- Air Transat;
- Jazz Aviation; and
- WestJet.

The ATAC member carriers who contributed 2022 and 2023 data for this annual report were:

- Air North;
- Canadian North/First Air;
- Harbour Air;
- KF Aerospace;
- Morningstar;
- Nolinor;
- North Cariboo Air;
- Perimeter Aviation (incorporating Bearskin Airlines);
- Porter; and
- Sunwing.

Individual carriers reporting were:

- Flair; and
- Cargojet.