Challenger 3500

Environmental Product Declaration

BOMBARDIER

Exceptional by design

As our world becomes evermore interconnected, and as our collective concern for protecting the environment increases, Bombardier knows it is important to provide its stakeholders with information regarding the environmental performance of its products. With this in mind, Bombardier is proud to release the Environmental Product Declaration (EPD) for the Challenger 3500 aircraft. As part of the company's overarching sustainability strategy, Bombardier has committed to communicating the environmental performance of all its aircraft programs through EPDs.

An EPD is a document that provides environmental transparency. It is a globally recognized, standardized and verified way of quantifying and communicating the environmental impact of a product across its life cycle. It is created in accordance with the International Standard ISO 14020, as developed by the International Organization for Standardization. With this EPD, Bombardier is providing its stakeholders with a comprehensive overview of the Challenger 3500 aircraft's environmental footprint throughout its life cycle, marking another key milestone in the transparency of the environmental performance of our new programs. By making environmental information available to our stakeholders, including operators, this EPD also supports the business aviation industry's broader goals to mitigate its impact on climate change.

In addition to offering the ultimate cabin experience, highest reliability, lowest operating costs in its class and exceptional performance capabilities, the Challenger 3500 aircraft was designed according to Bombardier's product innovation life cycle process. This approach embeds environmental considerations from design to end-of-life, and from tip to tail, making sustainability an integral part of how Bombardier innovates.

Sustainability is entrenched throughout Bombardier's business strategy and operations to ensure the longevity of our industry, and to make a positive, meaningful impact along the way. Bombardier wants clean skies for future generations. This document is a part of this vision, and Bombardier is proud to share it with you.

The most sustainably designed business jet in its class

Environmental transparency

The Challenger 3500 business jet is the first super mid-size aircraft with an Environmental Product Declaration which communicates, quantifies and provides transparency on the environmental impact of the product throughout its life cycle.

Exceptional comfort, lower environmental footprint

The Challenger 3500 aircraft offers a selection of innovative, high-quality and sustainable materials without compromising style or comfort. Choose from a host of environmentally friendly interior options—including upcycled fabrics, alternative wood options and natural fiber-based materials—to create your own eco-friendly masterpiece.

Industry-first carbon neutral flight test program

The Challenger 3500 aircraft's flight test program was the first in business aviation to be completely carbon neutral. This activity was underpinned by an environmental life cycle assessment (LCA), supported by the Sustainable Aviation Fuel Book and Claim system, and Gold Standard verified financial contributions.

Fueling the future. Leading the industry

Bombardier's leadership role in the promotion, adoption and scalability of Sustainable Aviation Fuel is helping chart a course toward a greener future. All Bombardier business jets, including the Challenger 3500 aircraft, can safely operate at their highest performance using Sustainable Aviation Fuel.

Sustainable manufacturing

The majority of Bombardier's Canadian manufacturing facilities are powered by hydropower—a renewable energy source that harnesses the power of moving water to produce electricity, thereby reducing the amount of CO_2 emissions.

Innovation that inspires. Performance that delivers.

The Challenger 3500 aircraft pushes the industry forward, setting the course to what private jet travel should be. Featuring the most technologically advanced cabin in its class, it introduces productivity enhancing features such as the industry's first voice-controlled cabin and the revolutionary Nuage seat. The Challenger 3500 aircraft provides the ultimate combination of sustainability, performance and reliability you can count on 365 days a year.

Communicating Environmental Performance

Bombardier communicates the environmental performance of its products through Environmental Product Declarations in accordance with the International Standards ISO 14020, ISO 14021 and follows ISO 14044:2006, which specifies requirements for environmental claims, and science-based life cycle analysis data. It summarizes and communicates comparable information about the environmental impact of a product at each phase of its life cycle in a transparent manner.

Challenger 3500 aircraft facts and figures

Commercial name	**Bombardier Challenger 3500**
Type Certificate Data Sheet (TCDS) Number	**A-234**
Date of certification	**May 2003 (Challenger 300)**
Certification body	**Transport Canada**
Propulsion system	**Turbofan**
Engine trade name	**Honeywell HTF7350**
Standard accommodation	**9 Passengers**
Maximum passenger seating capacity	**10 passengers**
Maximum takeoff weight	**18,416 kg (40,600 lb)**
Takeoff distance (SL, ISA, MTOW)	**1,474 m (4,835 ft.)**
Top speed	**882 km/h (0.83 Mach)**
Maximum operating altitude	**13,716 m (45,000 ft.)**
Maximum range*	**6,297 km (3,400 nm)**

*Theoretical range with NBAA IFR reserves, ISA, M 0.77, 4 pax / 2 crew. Actual range will be affected by speed, weather, selected options and other factors.

Challenger 3500 aircraft configuration

For this Environmental Product Declaration, the Life cycle assessment was performed on a baseline aircraft configuration and the following standard mission assumptions:

- four (4) passengers
- two (2) crew members
- 850 km/h cruise speed (M 0.80)
- NBAA IFR fuel reserves*
- ISA conditions

Customer-specific options are excluded from the consideration of this study.

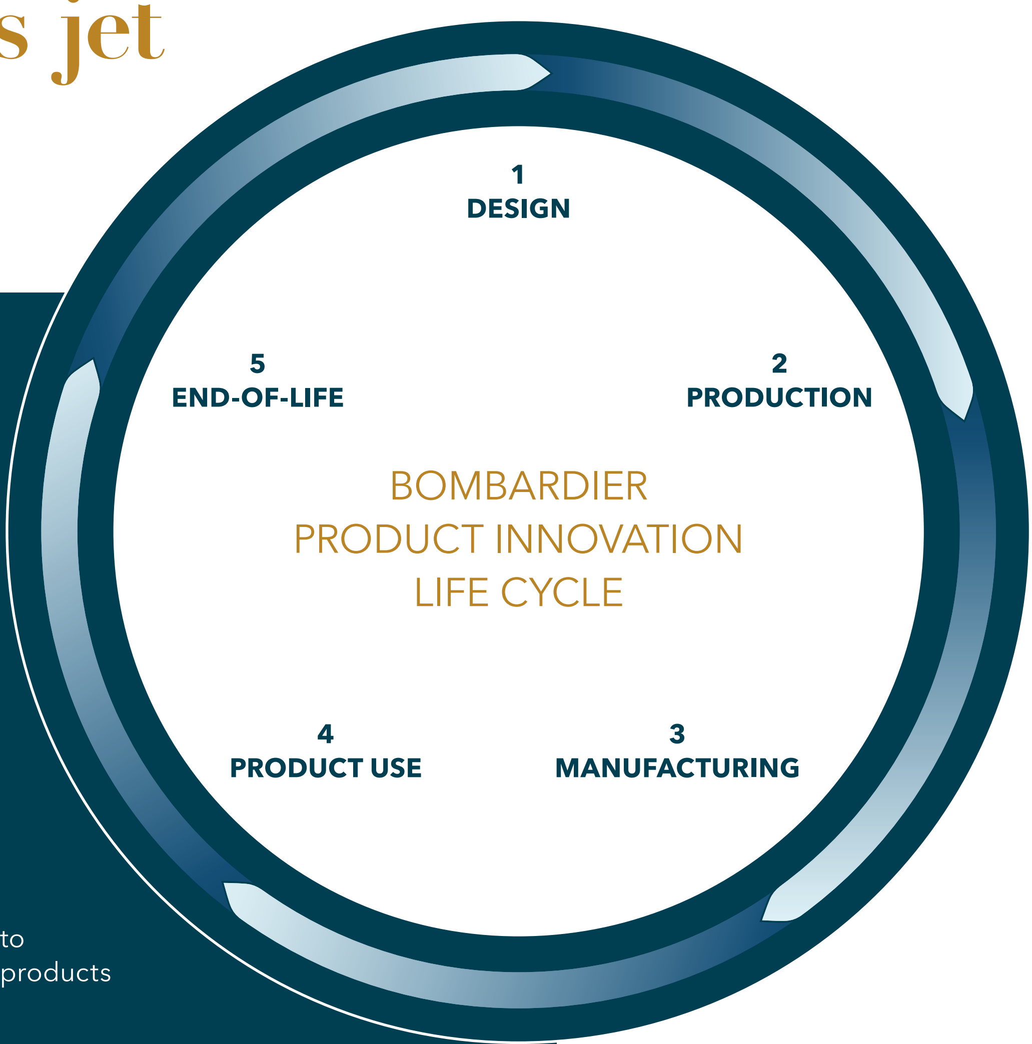
Aircraft category	**Medium****
Configurable cabin zones	**2**
Cabin volume***	**30 m³ (1,060 ft³)**

*2.34 litres per functional unit of fuel transported and not considered as burnt during the flight.

**Aircraft with a cabin volume of between 19.8 and 42.5 cubic meters and a flight distance of between 5,741.2 and 9,260 kilometers.

***The total accommodation volume includes all pressurized areas accessible to both crew and passengers at all cruise altitudes and without any limitations, with the following boundaries:
- Forward and aft boundaries are respectively the cockpit divider and the rear pressure bulkhead
- Cabin peripheral boundary is the cabin unfinished cross-section, limited to the furnishable area.

Environmental profile of the Challenger 3500 business jet



1) DESIGN

We consider safety, environment and efficiency in the design phase of our products to develop innovative mobility solutions.

2) SUPPLY CHAIN AND PRODUCTION

We undertake a rigorous supplier selection process to ensure we source the best products to bring our designs to life.

3) MANUFACTURING AND TESTING

We integrate health, safety and environmental considerations during manufacturing and conduct rigorous product testing.

4) PRODUCT AND MAINTENANCE

We actively engage with customers to achieve the ultimate passenger experience and the best environmental performance.

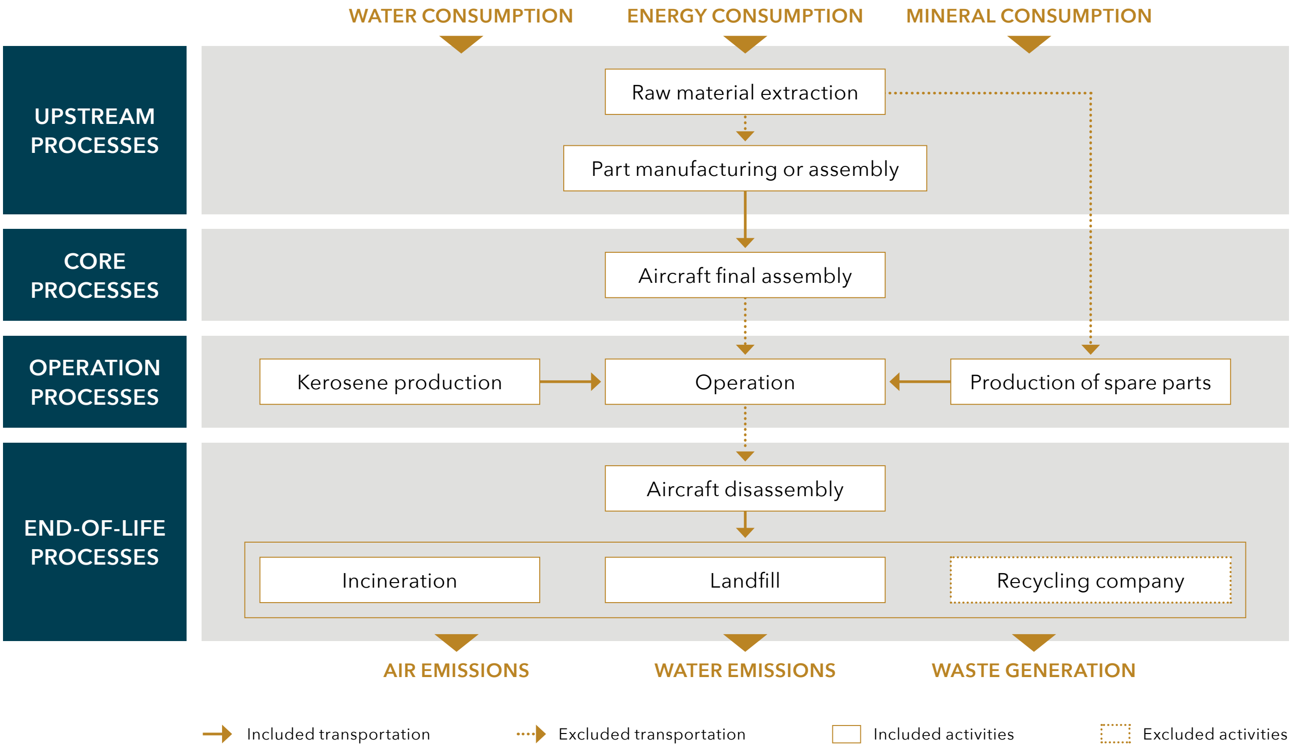
5) END-OF-LIFE

We work closely with the industry towards achieving our goal of increasing recyclability and recoverability rates of all new aircraft.

At Bombardier, life cycle thinking is an integrated feature of the design process, highlighting the significance of different design options and the true overall environmental impact these options offer.

Life cycle assessment

Resource efficiency, waste generation and overall environmental impacts were estimated throughout all life cycle phases of the Challenger 3500 business jet, following ISO 14044:2006 methodology. The life cycle assessment (LCA) covers all life cycle stages, from "cradle to grave", including the following system boundaries: Upstream, Core, Operation and End-of-life modules.

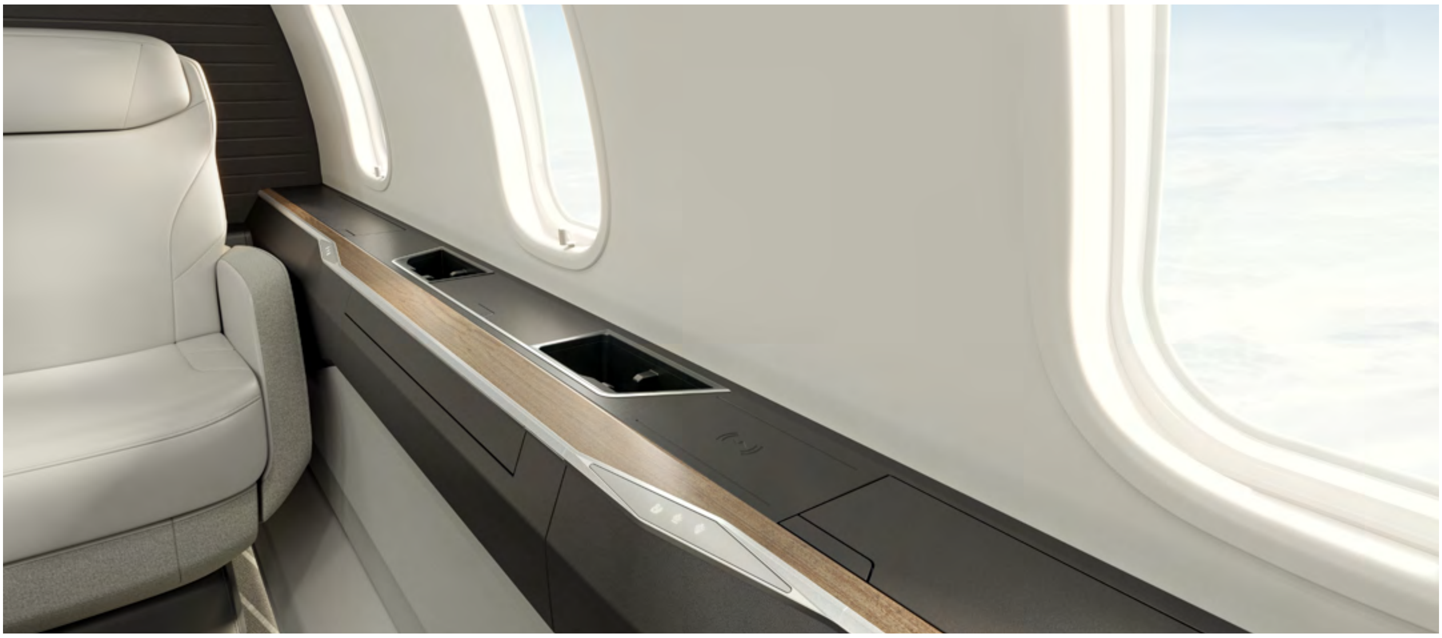
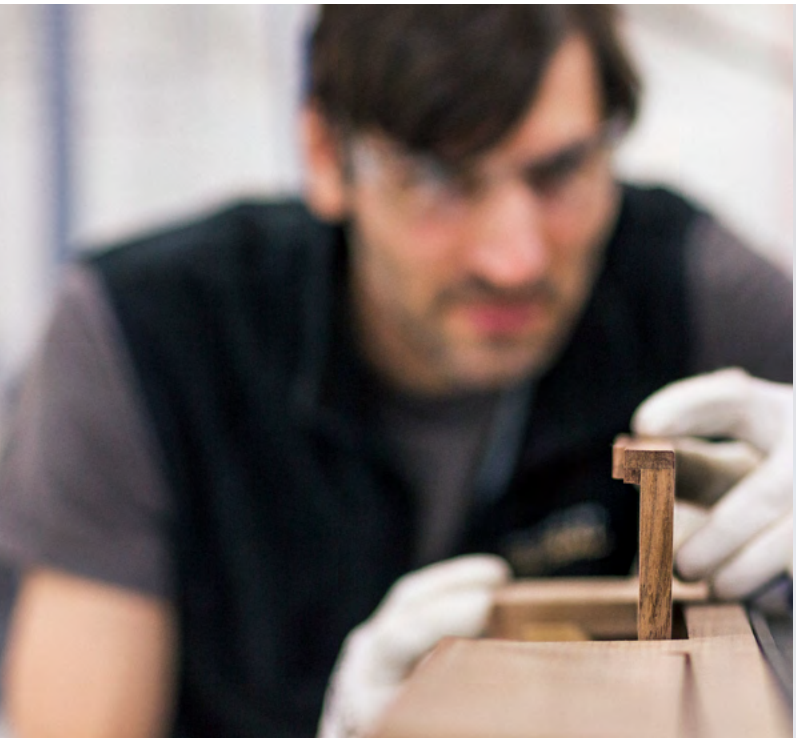


The results represent a functional unit of transport, one cubic meter of accommodation space for leisure or business purposes over 100 km for a given typical mission length. In the case of the Challenger 3500 aircraft, the LCA is based on a typical 1,482 km mission (800 nm).

The LCA was conducted based on the following assumptions: the aircraft will fly 15,000 times over its entire lifetime (i.e. nearly 32,000 hrs) at a maximum of 13,716 m (45,000 ft) of altitude and a cruise speed of 850 km/h (M 0.80). It will consume 1,512 kg (3,333 lb) of fuel per 1,482 km mission (800 nm) mission. The end-of-life phase of the life cycle is modeled according to technology available at time of publication.

All Bombardier sites are ISO 14001-certified

Bombardier's eligible locations are certified or in the process of obtaining their certification by external parties according to the ISO 14001:2015 Standard for Environmental Management.


Design, material production and manufacturing life cycle stages

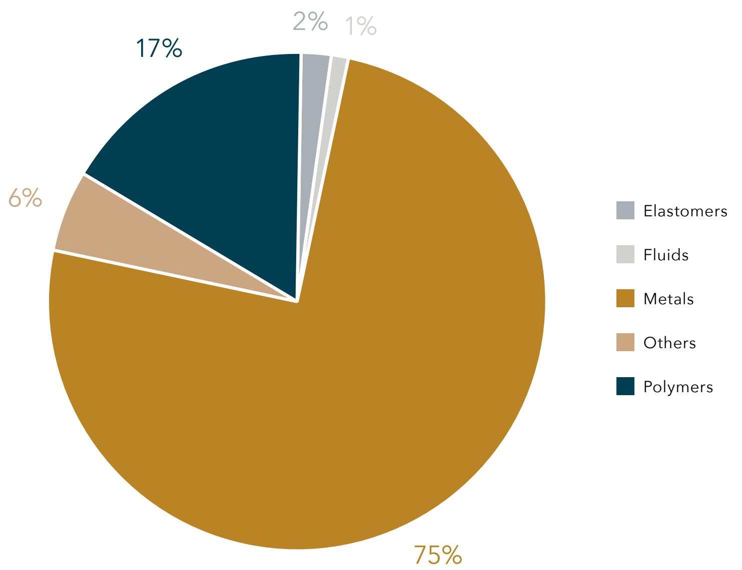
Eighty percent of the environmental impact of an aircraft can be determined at the design stage. This fact influenced our decisions from the beginning of the program.

The renewable energy source most used in the product life cycle is hydropower. This is due to the energy offered from the greener grid mix of Québec.

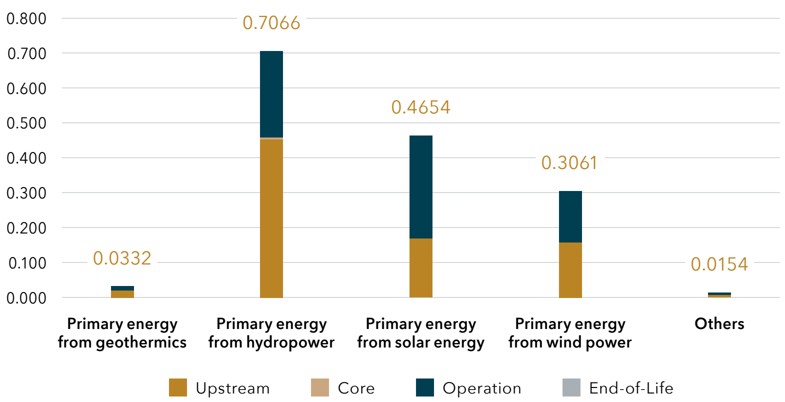
The Challenger 3500 aircraft is assembled and completed at Bombardier's Challenger production facilities in Montréal, Québec.

The following figure shows the typical material composition of a Challenger 3500 business jet by weight.

CHALLENGER 3500 AIRCRAFT MATERIAL COMPOSITION



RENEWABLE ENERGY RESOURCES CONSUMPTION (MJ PER FUNCTIONAL UNIT)



The three most used renewable energy resources are solar, hydropower and wind. All contributed in manufacturing the Challenger 3500 aircraft.

The above graph depicts energy consumed per functional unit of transport, defined as one cubic meter of accommodation space for leisure or business purposes over 100 km for a given typical mission length. In the case of the Challenger 3500 aircraft, the LCA is based on a typical 1,482 km mission (800 nm).

Operation life cycle stage

Over the last 40 years, the average fuel efficiency of business jets has improved by 40%*. Furthermore, the aerospace industry was the first major industry worldwide to set aggressive commitments in terms of its CO_2 emissions, including carbon neutral growth from 2020, achieving Net-Zero emissions by 2050 and continue improving fuel efficiency by 2% per year from 2020 until 2030.

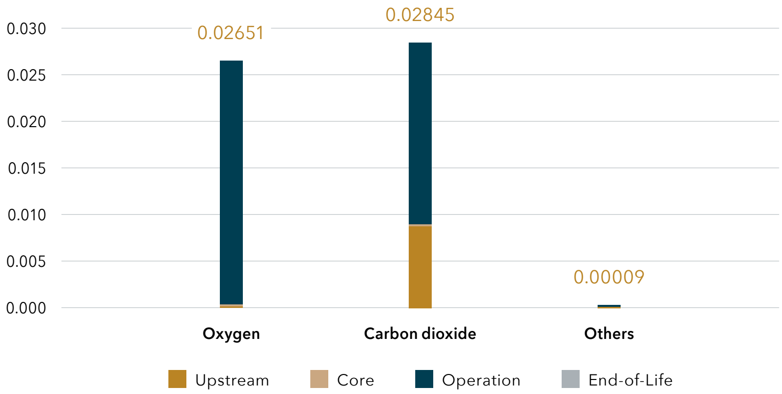
Effect of flight mission length on fuel burn

Mission (nm)	Block time (hr)	Fuel burned (litre per functional unit)
600	1.70	4.50
800	2.14	4.23
1,000	2.57	4.07
2,000	4.76	3.82

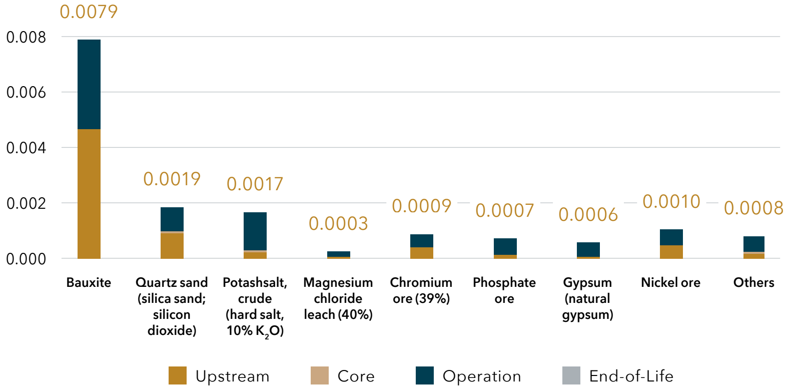
*Reference www.ebaa.org/about-business-aviation

The primary consumption of renewable material resources and non-renewable energy resources occurs during the operation phase. The upstream phase of the product life cycle, which includes raw material extraction and the production of components, is the phase during which more renewable energy resources are consumed.

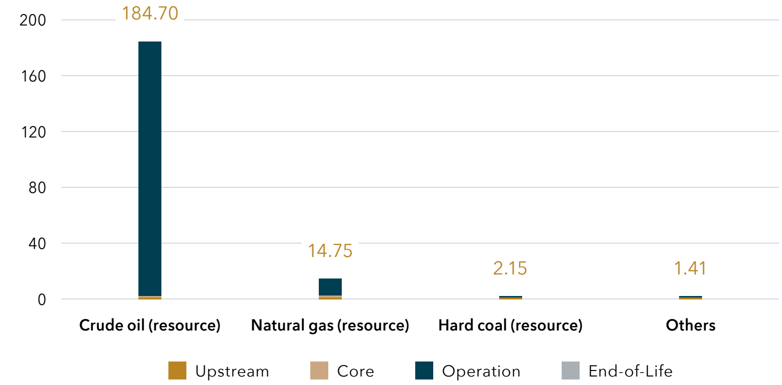
RENEWABLE MATERIAL RESOURCES CONSUMPTION (KG PER FUNCTIONAL UNIT)



NON-RENEWABLE MATERIAL RESOURCES CONSUMPTION (KG PER FUNCTIONAL UNIT)



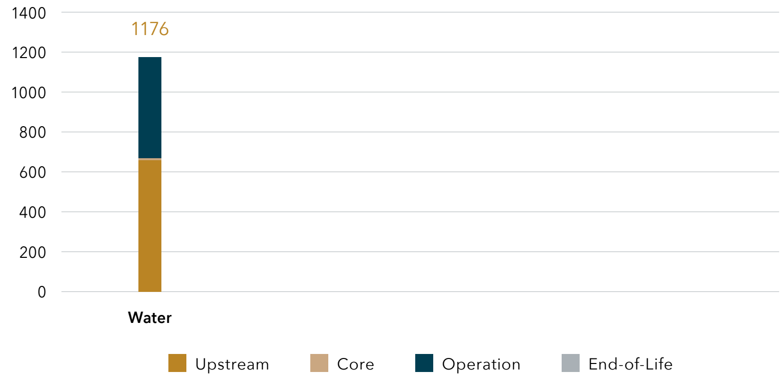
NON-RENEWABLE ENERGY RESOURCES CONSUMPTION (MJ PER FUNCTIONAL UNIT)



Water consumption occurs primarily during the upstream and operation phases.

The upstream phase contributes to 56.47% of total water consumption. The operation phase, which includes maintenance and aircraft use, contributes to 43.42% of total water consumption.

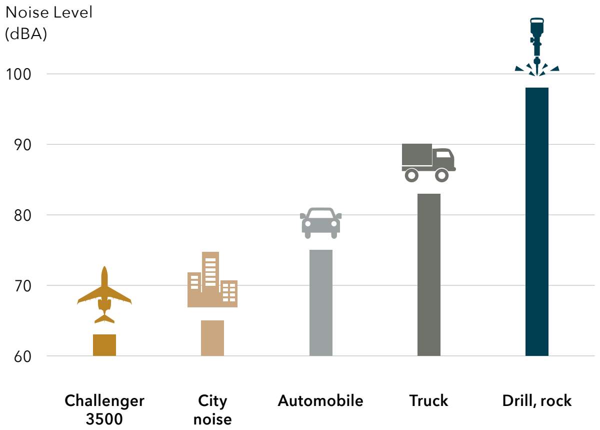
WATER CONSUMPTION (KG PER FUNCTIONAL UNIT)



The above graphs depict material, energy and water consumed per functional unit of transport, defined as one cubic meter of accommodation space for leisure or business purposes over 100 km for a given typical mission length. In the case of the Challenger 3500 aircraft, the LCA is based on a typical 1,482 km mission (800 nm).

Noise levels of common urban sources

To provide perspective on the noise level of the Challenger 3500 aircraft, the graph below compares the Challenger 3500 aircraft noise level to other urban sounds:



A-weighted decibels (dBA) are an expression of the relative sound intensity as perceived by the human ear. The noise level of the Challenger 3500 aircraft corresponds to noise under the departure flight path, 6.5 km from break release.

Community noise certification numbers

The Challenger 3500 aircraft, with a 16.4 margin to the ICAO Chapter 4 cumulative noise limit*, meets the most stringent international noise standards.

Noise	(EPNdB[1])
Approach	89.5
Lateral	89.1
Flyover	76
Total (cumulative)	254.6

Configuration

MTOW: 40,600 lb
MLW: 34,150 lb
Engine: Honeywell HTF7350 (SL 7,323 lbf)

* https://www.easa.europa.eu/document-library/type-certificates/noise/easaima080

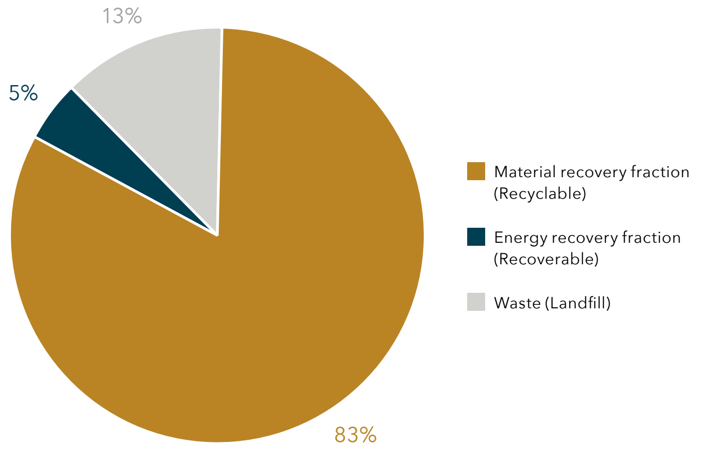
[1] Effective Perceived Noise in decibels (EPNdB).

End-of-life stage

Using materials featuring high recyclability rates maximizes the overall recoverability of the Challenger 3500 business jet. Material recycling and energy recovery aggregate to an 88% recoverability rate by weight.

Bombardier is involved in research projects to improve the recyclability and recoverability rates of all of its new aircraft.

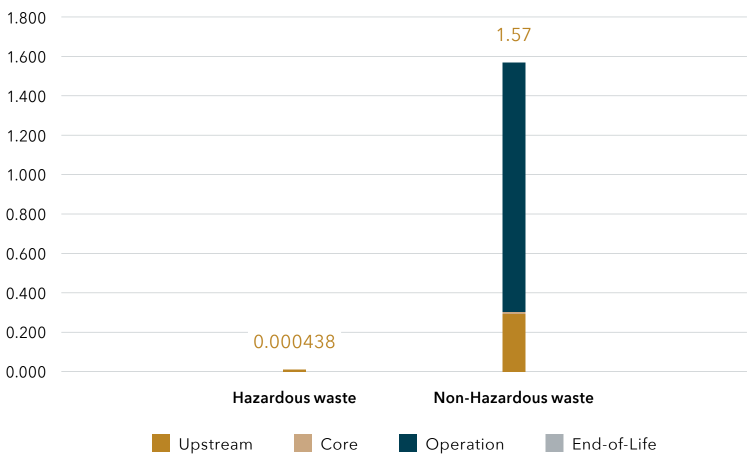
CHALLENGER 3500 AIRCRAFT RECYCLABILITY AND RECOVERABILITY RATE BY WEIGHT



Bombardier puts a strong focus on minimizing the use of hazardous materials and related toxic emissions.

99.97% of waste quantity generated over the life cycle of the aircraft is non-hazardous as shown in the graph below:

WASTE GENERATION (KG PER FUNCTIONAL UNIT)



The above graph depicts waste generated per functional unit of transport, defined as one cubic meter of accommodation space for leisure or business purposes over 100 km for a given typical mission length. In the case of the Challenger 3500 aircraft, the LCA is based on a typical 1,482 km mission (800 nm).

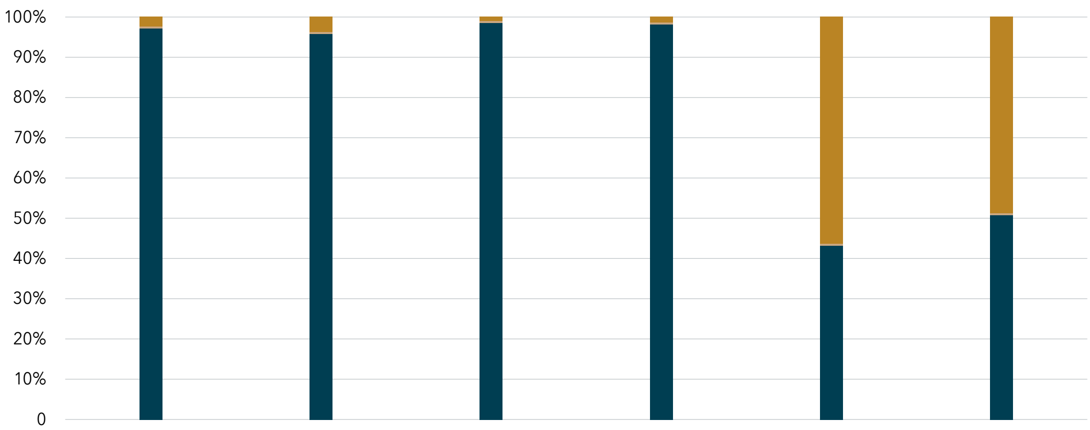
Environmental impact in detail

LCA calculations were performed by using GaBi TS software and databases version 10. CML2001, version August 2016 methodology* is used for the first four impact indicators (Acidification Potential, Global Warming Potential, Eutrophication Potential and Photochemical Ozone Creation Potential). As for Water Scarcity Potential, the WSI (Water Scarcity Index)** is used. All specific data collected through 2021 is valid for a global market.

As for the overall transportation industry, the operation phase is the most significant contributor to all life cycle impact indicators. The table below details Challenger 3500 aircraft life cycle impacts, for instance: 97.04% of the Acidification Potential impact, 98.36% of the Global Warming Potential impact, 98.06% of the Photochemical, Ozone Creation Potential impact, 95.61% of the Eutrophication Potential, and finally 50.75% of the Water Scarcity Potential.

*https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors
**https://gabi.sphera.com/international/support/gabi/gabi-lcia-documentation/aware-and-wsi/

IMPACTS INDICATORS



	Acidification Potential (kg SO_2-eq)	Eutrophication Potential (kg Phosphate-eq)	Global Warming Potential (kg CO_2-eq)	Photochem. Ozone Creation Potential (kg Ethene-eq)	Total freshwater use (kg)	Water Scarcity Potential (m^3-eq)
Upstream[1]	1.43E-04	7.14E-05	2.07E-01	2.94E-05	6.61E+02	1.90E-02
Core[2]	1.82E-05	5.88E-06	2.73E-02	4.75E-06	1.22E+00	2.14E-05
Operation[3]	5.28E-03	1.69E-03	1.41E+01	1.73E-03	5.08E+02	1.96E-02
End-of-Life[4]	8.51E-08	2.71E-07	2.18E-04	5.75E-08	7.87E-02	1.32E-07
Total	**5.44E-03**	**1.77E-03**	**1.43E+01**	**1.76E-03**	**1.17E+03**	**3.86E-02**

Note: These results are valid only for this range and this configuration. No linear assumption can be made to extrapolate the environmental impact for any other distance, configuration or aircraft type. 1) Raw material extraction and component production. 2) Final assembly and completion. 3) Use, maintenance and spare parts production. 4) Aircraft disassembly and end-of-life processes.

2.46 kg of water are also emitted during the operation phase as part of the combustion. Water vapour emitted was quantified directly from the fuel burned as follows: 1,260 grams of water per kilogram of fuel burned.

Glossary of terms

Life cycle assessment

Life cycle assessment (LCA) is the process used to measure a product's environmental impact at any point for any activity or use over its whole lifetime from raw material extraction through materials processing, manufacturing, distribution, use, repair and maintenance, and disposal or recycling.

Acidification potential

The aggregate measure of the acidifying potential of some substances, calculated through the conversion factor of sulphur oxides and nitrogen and ammonia into acidification equivalents (SO_2).

Global warming potential

Global warming potential is the aggregate measure of the warming potential of greenhouse gases emitted over all phases of the life cycle. It is expressed in CO_2 equivalents.

Eutrophication potential

The aggregate measure of the inland water eutrophication potential of some substances, calculated through the conversion factor of phosphorous and nitrogen compounds (waste water discharges and air emissions of NO_x and NH_3) into phosphorous equivalents.

Photochemical ozone creation potential

The aggregate measure of the ground level ozone creation potential of some substances, calculated through the conversion factor of ethylene equivalents that contribute to the formation of photochemical oxidants.

Water scarcity

The aggregate measure of geographic and temporal mismatch between freshwater demand and its availability. It results in the diminution of groundwater resources, an increase of salinity, nutrient pollution, the loss of floodplains and wetlands and more. It is expressed in m^3 equivalents.

Recyclability and recoverability

The recyclability and the recoverability rate of a new aircraft vehicle are expressed as a percentage of the mass of the aircraft vehicle that can potentially be recycled (recyclability rate), or recovered, or both (recoverability rate).

Environmental Sustainability

At Bombardier, integrating environmental sustainability into our product development function is a fundamental aspect of our process to design state-of-the-art aircraft, and is a core value.

Applying a complete life cycle perspective to aircraft design is central to our product responsibility strategy. Maximizing energy and resource efficiency, eliminating hazardous substances and related toxic emissions, as well as enhancing the overall product recoverability rate, are the result of a high quality working process applied to product design and cascaded to our supply chain.

For more information on Sustainability at Bombardier and Environmental Product Declarations please visit **bombardier.com/en/sustainability**

Bombardier
400 Côte-Vertu Road West
Dorval, Québec, Canada H4S 1Y9
bombardier.com

Date of publication: version 1.0 was published 2022-05-22.
Last revision: 2023-07-19 (Version 1.01)