Global 7500

Environmental Product Declaration

BOMBARDIER

Exceptional by design

As our world becomes evermore interconnected, and as our collective concern for protecting the environment increases, Bombardier Aviation knows it is important to provide its stakeholders with information regarding the environmental performance of its products. With this document, Bombardier is thrilled to make history with the release of business aviation's first-ever Environmental Product Declaration (EPD). As part of the company's overarching sustainability strategy, Bombardier has committed to communicating the environmental performance of all new aircraft programs through EPDs, and this EPD for the Global 7500 aircraft is our first.

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 and externally verified in accordance with the International Standard ISO 14025 and as developed by the International Organization for Standardization. With this EPD, Bombardier is providing its stakeholders with a comprehensive overview of the Global 7500 jet'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 being the largest and longest-range business jet, offering operators unprecedented connectivity, the Global 7500 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 the design for environment 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.

A large business jet designed with a reduced environmental footprint

The Global 7500 aircraft is the world's largest and longest range purpose-built business jet. It has been designed to provide passengers with unparalleled space and comfort with its four full size living spaces, kitchen and crew suite. Technologically advanced and exceptionally efficient, the Global 7500 aircraft was manufactured with design for the environment in mind. This philosophy also extends to its new GE Passport engines that produce lower emissions and less noise than previous generation propulsion systems. The industry defining Global 7500 aircraft is creating an entirely new class of business jet.

Communicating Environmental Performance – ISO 14025

Bombardier communicates the environmental performance of its products through Environmental Product Declarations (EPDs) in accordance with the International EPD® System. The EPD is based on verified life cycle analysis (LCA) 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.

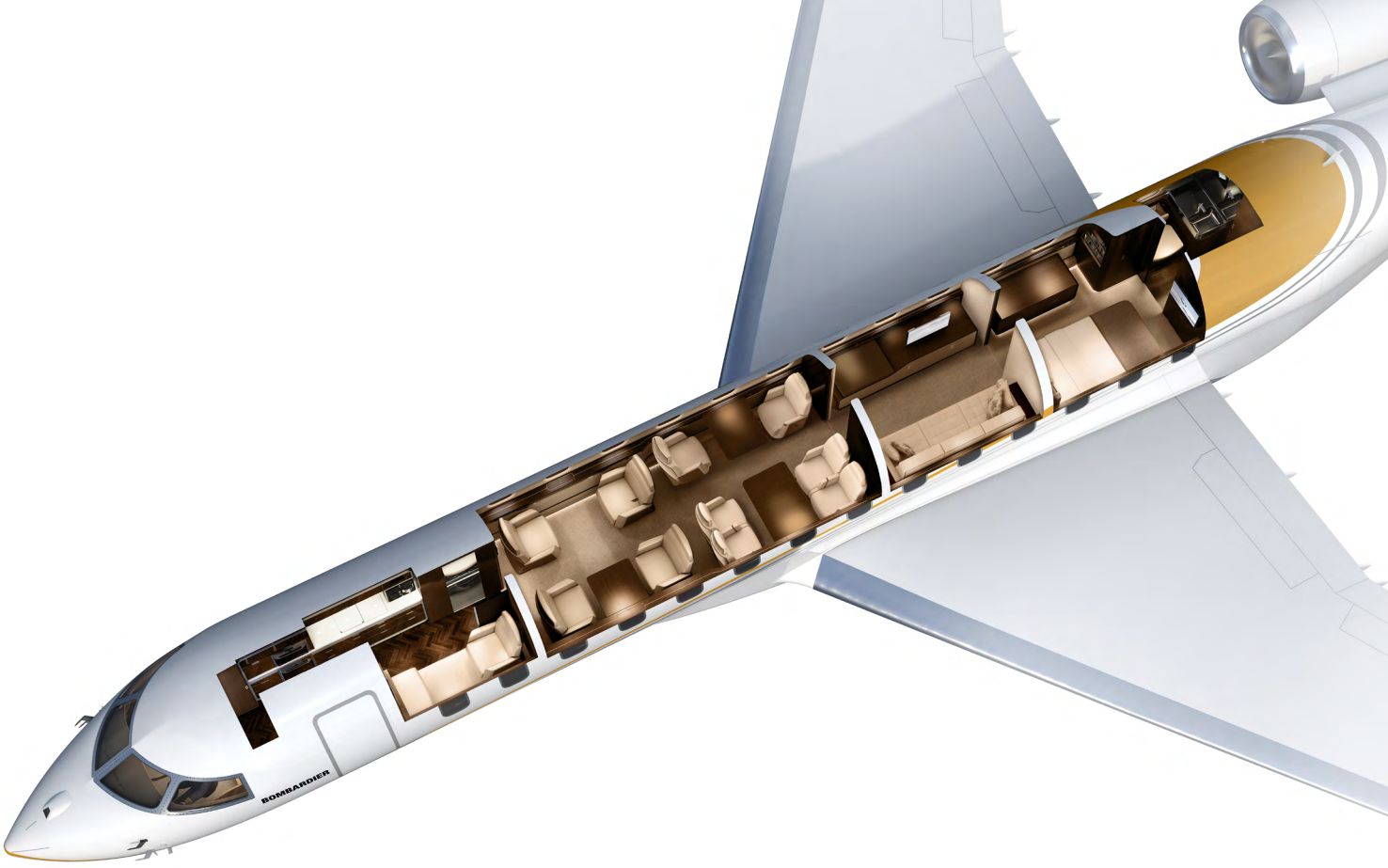
The EPD for the Bombardier Global 7500 aircraft was developed as per the Product Category Rules (PCR) for Business jets (PCR 2018:09 CPC code 49623) as well as with the principles and procedures of ISO 14025:2006.

The external validation of the EPD was carried out by an independent verifier approved by the technical committee of the International EPD® System.

Global 7500 aircraft facts and figures

Commercial name	**Bombardier Global 7500**
Type Certificate Data Sheet (TCDS) Number	**A-177***
Date of certification	**September 2018**
Certification body	**Transport Canada**
Propulsion system	**Turbofan**
Engine trade name	**GE Passport**
Standard accommodation	**17 Passengers**
Maximum passenger seating capacity	**19 passengers**
Maximum takeoff weight	**52,095 kg (114,850 lb)**
Takeoff distance (SL, ISA, MTOW)	**1,756 km (5,760 ft.)**
Top speed	**982 km/h (0.925 Mach)**
Maximum operating altitude	**15,545 m (51,000 ft.)**
Maximum range**	**14,260 km (7,700 NM)**

*Transport Canada designation. **Theoretical range with NBAA IFR reserves, ISA, M 0.85, 8 pax /4 crew. Actual range will be affected by speed, weather, selected options and other factors.



Global 7500 aircraft configuration

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

- eight (8) passengers;
- three (3) crew members;
- one (1) flight attendant;
- M 0.85 cruise speed;
- NBAA IFR fuel reserves*
- ISA conditions

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

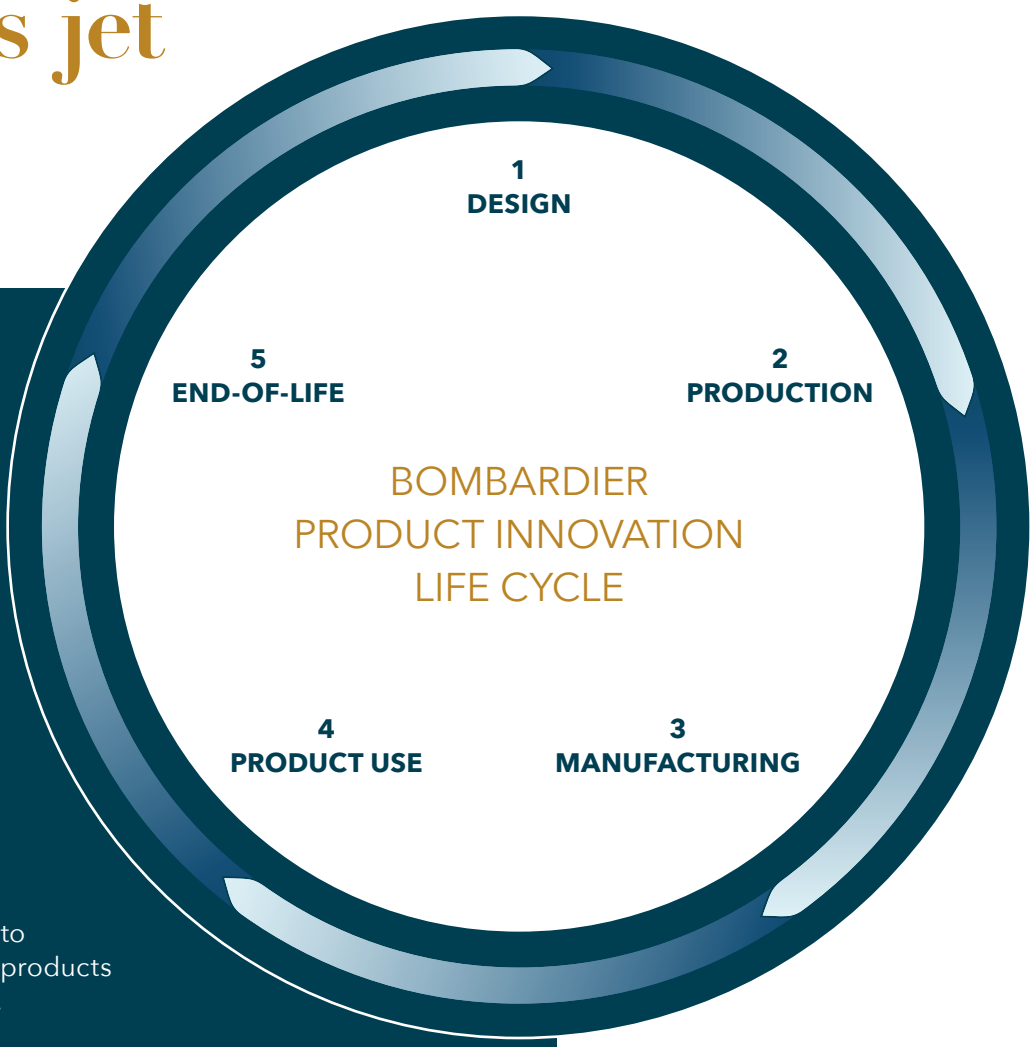
Aircraft category	**Large****
Configurable cabin zones	**4**
Cabin volume***	**74.58 m^3**

*5.54E-05 litres per functional unit of fuel transported and not considered as burnt during the flight.

**Based on the Business jets PCR (2018:09 v1.02).

***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 Global 7500 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.

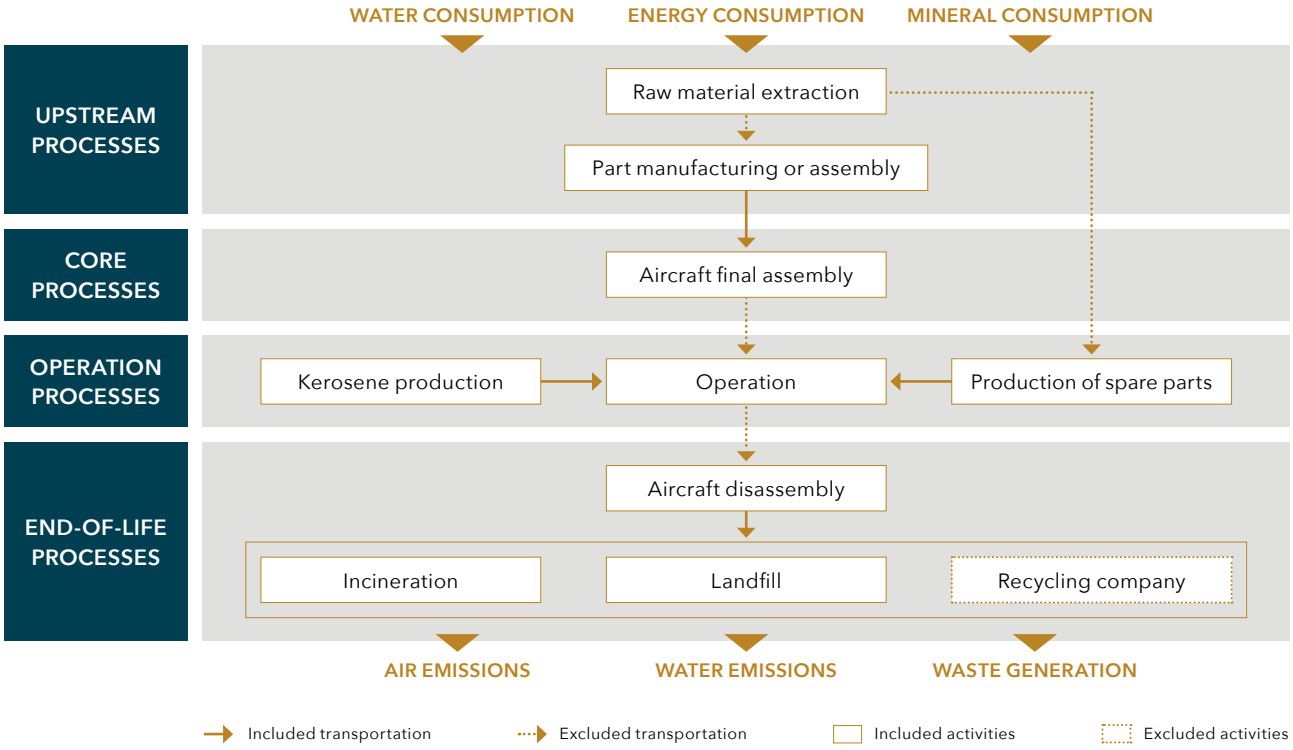
5) END-OF-LIFE

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 Global 7500 business jet, following ISO 14044:2006 methodology. The life cycle assessment covers the following system boundaries: Upstream, Core, Operation and End-of-life modules according to the Business jets PCR (2018:09). All life cycle stages are covered from"cradle-to-grave".



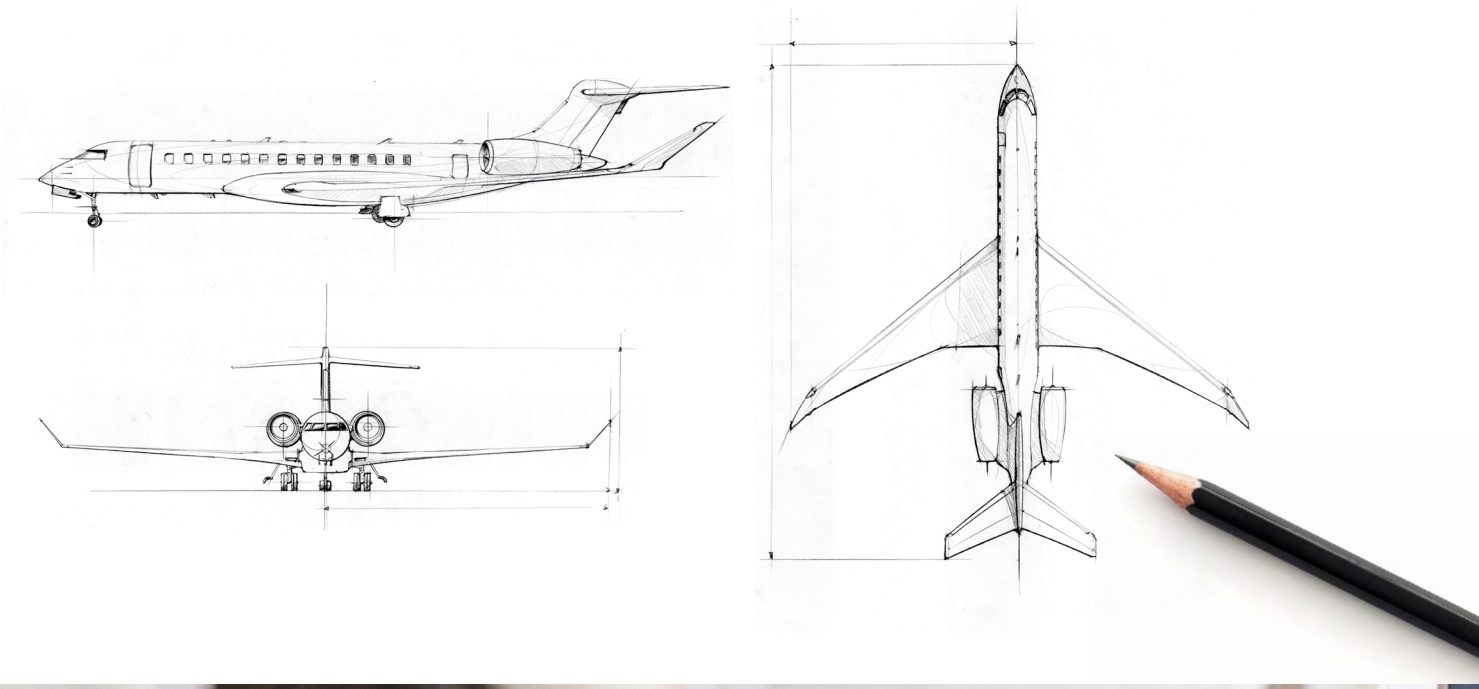
The results represent a functional unit of transport, one cubic meter of accommodation space for leisure or business purposes over 100 km for a given typical mission length. In the case of the Global 7500 aircraft, the LCA is based on a typical 2,408 km mission (1,300 NM).

The LCA was conducted based on the following assumptions: the aircraft will fly 17,000 times over its entire lifetime (i.e. nearly 50,000 hours) at a maximum of 15,545 m (51,000 ft) of altitude and a cruise speed of 903 km/h (M 0.85). It will consume 3,507 kg (7,733 lb) of fuel per 1,300 nautical mile (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. The Laurent Beaudoin Completion Center, where the Global 7500 business jet is delivered to customers, has been LEED* certified since October 2015.

*LEED: Leadership in Energy and Environmental Design



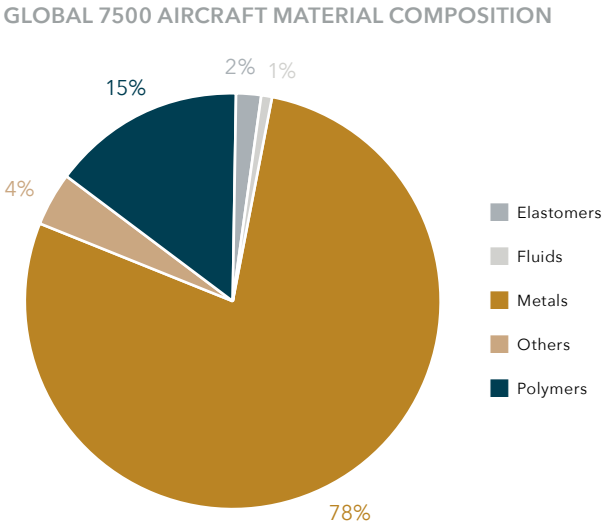
Design, material production and manufacturing life cycle stages

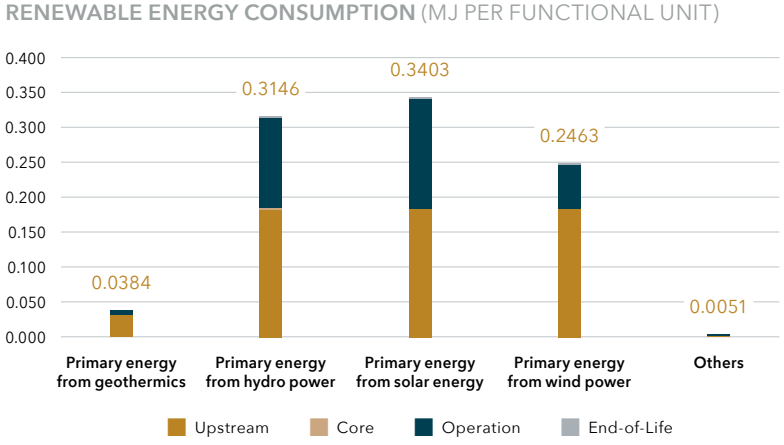
Eighty percent of the environmental impact of an aircraft could be determined at the design stage. This fact influenced our decisions from the beginning of the program.

The renewable energy source most used in the product life cycle is solar energy. This is due to the energy offered from the greener grid mix and independent system operators in many U.S. states (for example, California and Arizona), where many Global 7500 aircraft suppliers are based.

The Global 7500 aircraft is assembled at Bombardier's Toronto, Ontario facility and is completed at the Laurent Beaudoin Completion Centre in Montreal, Quebec.

The following figure shows the typical material composition of a Global 7500 business jet by weight.





The three most used renewable energy resources are solar, hydropower and wind. All contributed in manufacturing the Global 7500 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 Global 7500 aircraft, the LCA is based on a typical 2,408 km mission (1,300 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 by 2020, and a 50% reduction in 2050 compared to 2005 levels.

Bombardier has designed the state-of-the-art Global 7500 business jet using best-in-class technologies. The Global 7500 aircraft is powered by the all-new GE Passport engine incorporating advanced technologies and materials to improve durability, deliver a lower noise output, and fuel consumption of approximately 2.5 litres per functional unit, and even lower for some longer range missions. Its new high-speed transonic wing cuts down on drag, reduces fuel burn, and lowers emissions*, offering a smooth ride, as well as excellent short-field and high-speed performance. The table here provides examples on how fuel consumption varies in accordance with the flight length.

*The ICAO Aircraft Engine Emissions Databank contains information on exhaust emissions of production aircraft engines, measured according to the procedures in ICAO Annex 16, Volume II, and where noted, certified by the States of Design of the engines according to their national regulations (https://www.easa.europa.eu/easa-and-you/environment/icao-aircraft-engine-emissions-databank)

Effect of flight mission length on fuel burn

Mission (NM)	Flight time (hr)	Fuel burned (litre per functional unit)
1,000	2.4	2.54
1,300**	2.9	2.43
3,000	6.5	2.33

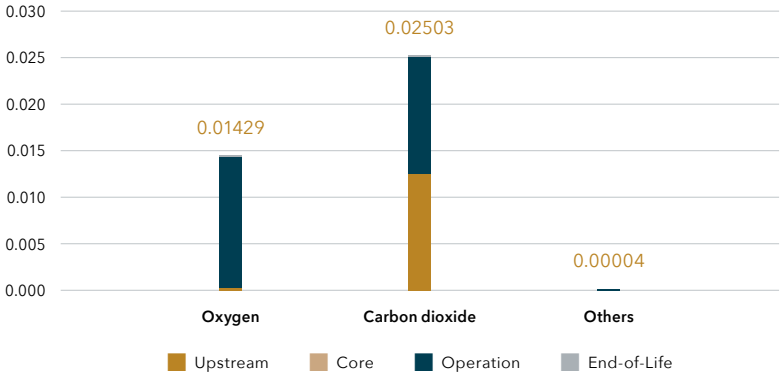
**The LCA was conducted based on a 1,300 nautical mile (NM) mission.

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.

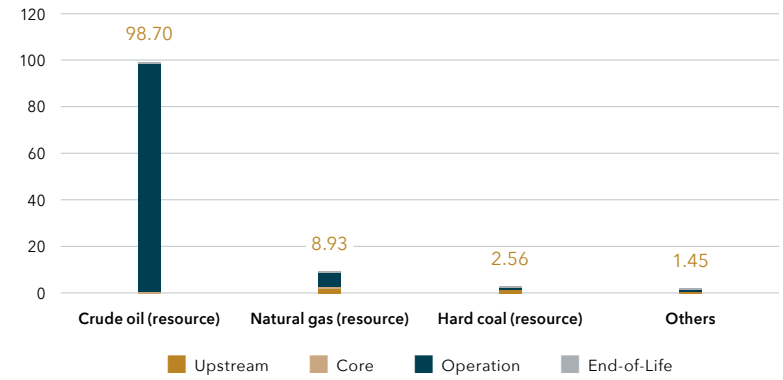
Water consumption occurs primarily during the upstream and operation phases.

The upstream phase contributes to 51.3% of total water consumption. The operation phase, which includes maintenance and aircraft use, contributes to 48.4% of total water consumption.

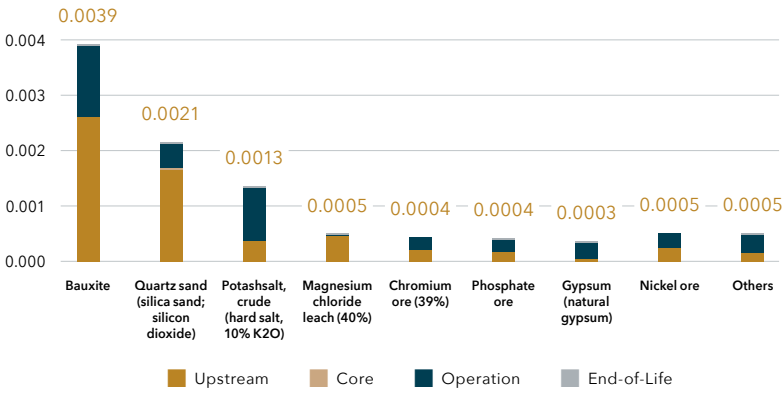
RENEWABLE MATERIAL CONSUMPTION (KG PER FUNCTIONAL UNIT)



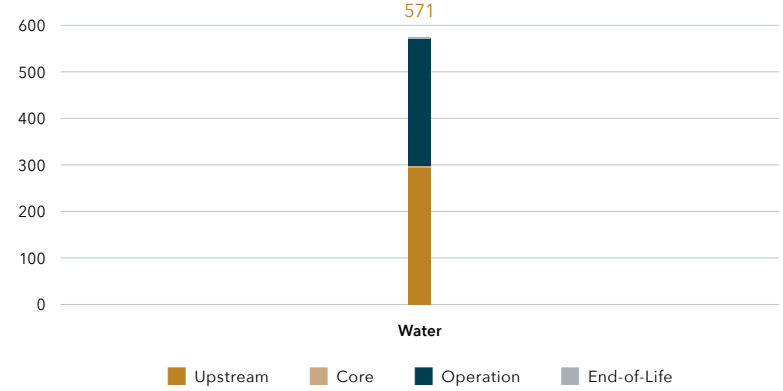
NON-RENEWABLE ENERGY CONSUMPTION (MJ PER FUNCTIONAL UNIT)



NON-RENEWABLE MATERIAL CONSUMPTION (KG PER FUNCTIONAL UNIT)



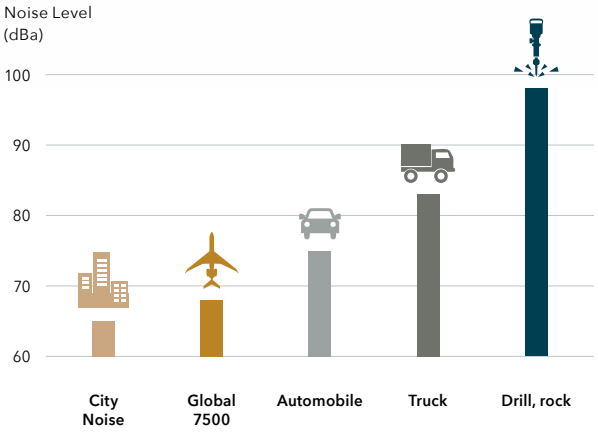
WATER CONSUMPTION (KG PER FUNCTIONAL UNIT)



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 Global 7500 aircraft, the LCA is based on a typical 2,408 km mission (1,300 NM).

Noise levels of common urban sources

To provide perspective on the noise level of the Global 7500 aircraft, the graph below compares the Global 7500 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 Global 7500 corresponds to noise under the flight path, 6.5 km from take-off roll.

Community noise certification numbers

The Global 7500 aircraft, with a 13.6 margin to ICAO Chapter 4 threshold*, meets the most stringent international noise standards.

Noise	(EPNdB[1])
Approach	88.8
Lateral	91.6
Flyover	80.3
Total	260.7

Configuration

MTOW: 114,850 lb

MLW: 87,600 lb

Engine: GE Passport 20-19BB1A (18,650 lbf take-off SLS)

* European Union Aviation Safety Agency Type-Certificate Data Sheet for Noise (BD700-2A12: pag 7): https://www.easa.europa.eu/sites/default/files/dfu/TCDSN%20EASA.IM_.A.009%20Issue4.pdf

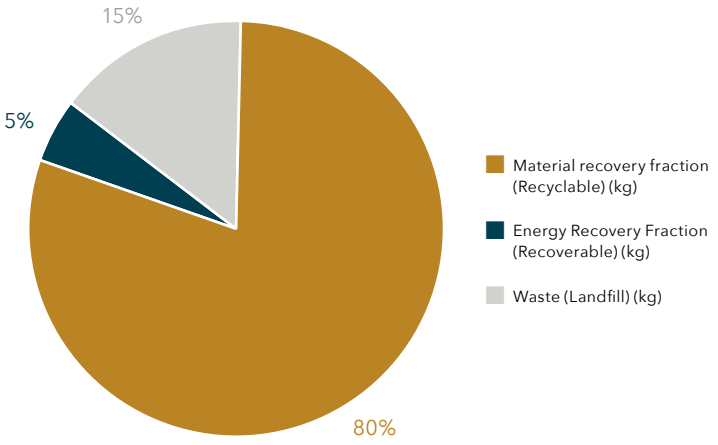
[1] Community noise certification is regulated by the International Civil Aviation Organization (ICAO) and expressed in Effective Perceived Noise in Decibels (EPNdB).

End-of-life stage

Using materials featuring high recyclability rates maximizes the overall recoverability of the Global 7500 business jet. Material recycling and energy recovery aggregate to an 85 percent recoverability rate by weight.

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

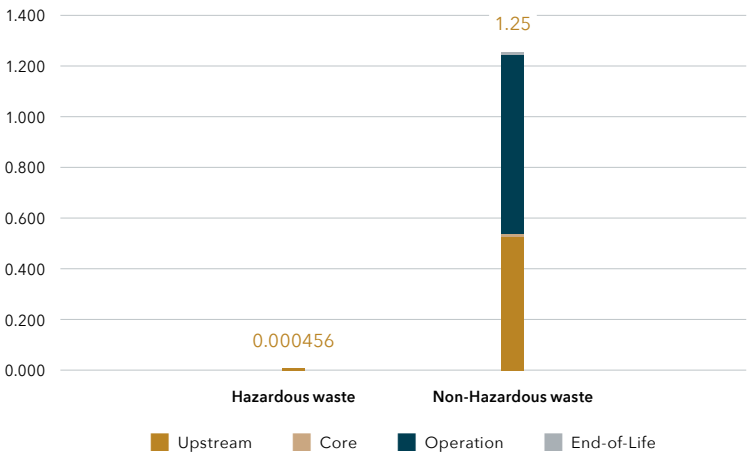
GLOBAL 7500 AIRCRAFT
RECYCLABILITY AND RECOVERABILITY RATE



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

99.96 percent 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 Global 7500 aircraft, the LCA is based on a typical 2,408 km mission (1,300 NM).

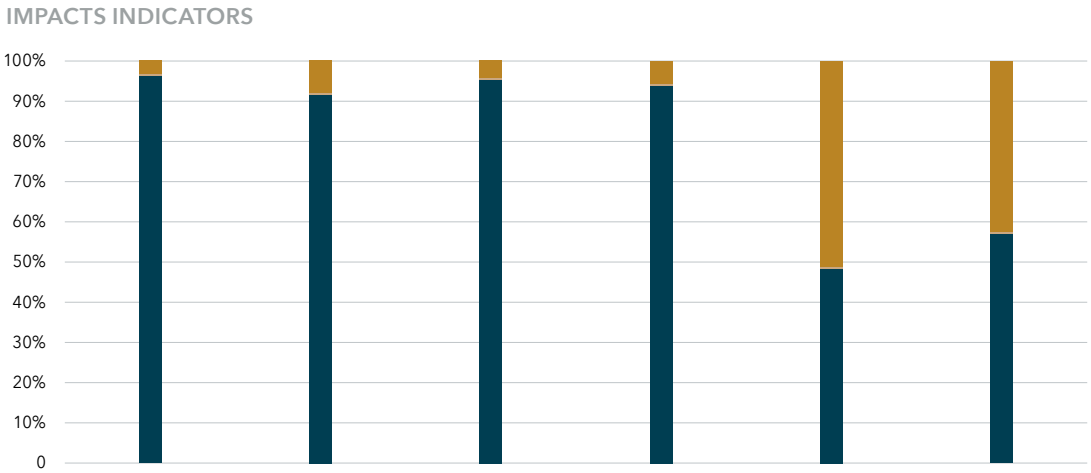
Environmental impact in detail

LCA calculations were performed by using GaBi TS software and databases version 8. The Life Cycle Impact Assessment (LCIA) methodologies selected to characterize the potential environmental impacts of the product follow the recommendations of the General Programme Instructions of the International EPD® System, version 3.0.*

CML2001, version April 2013 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 2017-2018 remains unchanged for 2019 and 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 Global 7500 aircraft life cycle impacts, for instance: 96.36% of the Acidification Potential impact, 95.07% of the Global Warming Potential impact, 93.59% of the Photochemical, Ozone Creation Potential impact, 91.55% of the Eutrophication Potential, and finally 56.89% of the Water Scarcity Potential.

*http://www.environdec.com/en/The-International-EPD-System/General-Programme-Instructions/#.VfMzeZDh1-0 **http://cml.leiden.edu/software/data-cmlia.html#downloads ***http://www.gabi-software.com/fileadmin/GaBi_Databases/Introduction_to_Water_Assessment_in_GaBi_2017.pdf



	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]	2,68E-04	1,56E-04	3,70E-01	6,97E-05	2,93E+02	2,01E-03
Core[2]	1,91E-05	6,35E-06	1,97E-02	4,26E-06	1,46E+00	1,29E-05
Operation[3]	7,61E-03	1,76E-03	7,51E+00	1,08E-03	2,76E+02	2,67E-03
End-of-Life[4]	5,51E-08	1,62E-07	1,23E-04	3,66E-08	4,66E-02	2,61E-08
Total	**7,90E-03**	**1,92E-03**	**7,90E+00**	**1,15E-03**	**5,71E+02**	**4,69E-03**

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.

3.13 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

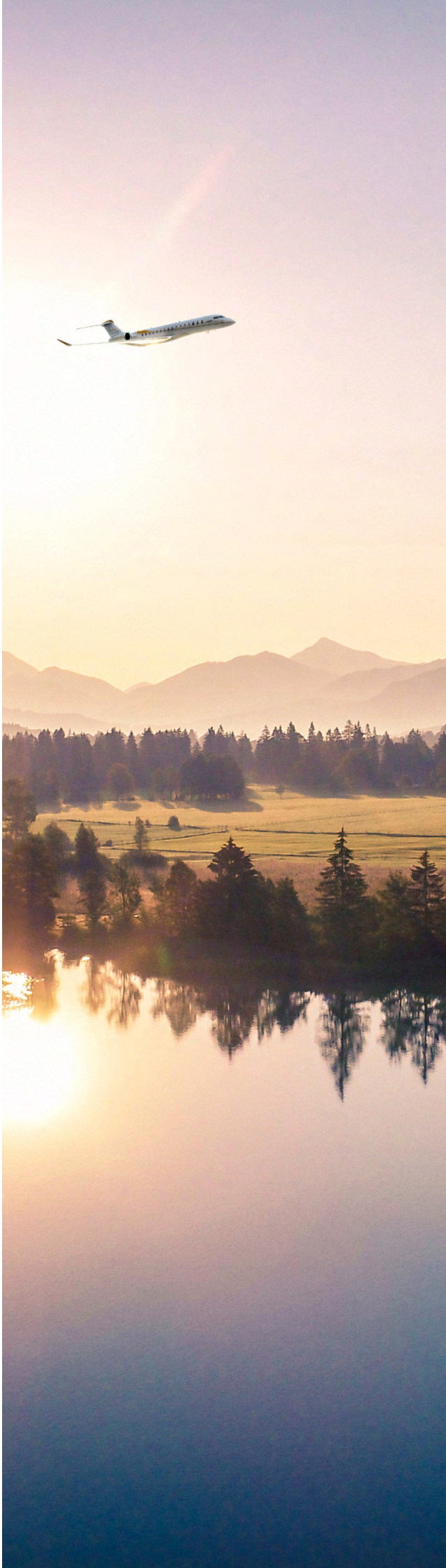
The aggregate measure of the ground level ozone creation potential of some substances, calculated through the conversion factor of ethylene equivalents that contribute to the formation of photochemical oxidants.

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).



Eco-Design

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. The Bombardier Eco-Design and Environmental Affairs team, together with its network, acts as a catalyst by providing the essential tools, expertise and central coordination in projects worldwide.

PCR review was conducted by the technical committee of the International EPD® System:

The Technical Committee of the International EPD® System
email: info@environdec.com

Independent verification of the declaration and data, in accordance to ISO 14025:2006

☐ Internal ☑ External

Third party verifier: **ANGELA FISHER**
Co-Founder & Director
Aspire Sustainability LLC
email: **angela@aspiresustainability.com**

Approved by: The International EPD® System
EPD International AB
Box 210 60, SE-100 31
Stockholm, Sweden
info@environdec.com

Environmental Product Declarations within the same product category, but from different programs may not be comparable.

This EPD is valid until **2025-06-22**

Registration No. **S-P-01292**

UN CPC 49623

Date: **2020-06-30**

EPD®

Note: an EPD® should provide current information, and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at **www.environdec.com**

For more information on Eco-Design and Environmental Product Declarations at Bombardier: **http://www.bombardier.com/en/sustainability.html**

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