



IATA RECOMMENDED PRACTICE 1678

Cargo CO₂ Emissions Measurement Methodology

RECOGNIZING there is a growing interest from shippers to receive CO₂ information from their transportation providers;

RECOGNIZING ALSO that, with multiple measurement methodologies available, there is a need and value to have one consistent international standard to measure CO₂ emissions generated by air cargo in order to support requirements from regulators and shippers;

ACKNOWLEDGING that methodologies and emission factors are available for other modes of transport (maritime, road, rail);

It is therefore RECOMMENDED that:

Where Members wish to measure the CO₂ emissions of their air cargo services, the following principles and methodology described herein shall be used.

1. SCOPE OF RECOMMENDED PRACTICE

- 1.1.** This Recommended Practice defines a standard methodology for airlines and any third party to measure the CO₂ emissions generated by air cargo at shipment level covered by a single Air Waybill (AWB).
 - 1.1.1.** The CO₂ emissions are calculated from the fuel consumption linked to the vehicle operational processes as defined in the IATA Recommended Practice 1726 on Passenger CO₂ Calculation Methodology.
 - 1.1.2.** The upstream emissions are not included. Note: the calculation of upstream emissions might be required by local regulations. In such cases, the airlines have to follow the associated guidelines and multiply the CO₂ emissions by a given factor.
 - 1.1.3.** The handling processes (such as cargo storage in the warehouse, handling devices and vehicles, and loading and offloading activities) are not included.
 - 1.1.4.** The administrative processes or overhead (such as the operation of buildings, staff commuting, and IT infrastructure) are not included.
 - 1.1.5.** The non-CO₂ emissions are not included.
- 1.2.** The implementation of this Recommended Practice demonstrates the willingness of IATA Members to introduce a harmonized and agreed industry-wide solution to address and comply with the challenges of the air cargo carbon footprint measurement and reporting.

2. GENERAL PRINCIPLES

2.1. Allocation

- 2.1.1. All the CO₂ emissions generated by a commercial flight shall be allocated to revenue load (passengers, cargo, and mail).
- 2.1.2. All CO₂ emissions from full freighter operations are allocated to revenue load (cargo and mail).
- 2.1.3. In order to align with existing methodologies, the use of the incremental approach (marginal accounting) is not recommended for belly cargo.
- 2.1.4. For belly cargo, in order to provide an equitable split of CO₂ emissions between passengers and cargo and to achieve alignment and harmonization within the industry, airlines shall refer to the principles developed in the IATA Recommended Practice 1726.

2.2. Data

- 2.2.1. It is recommended that airlines use their own historical data (fuel burn, payload, etc.) based on flown data to calculate the CO₂ emissions of their operating flights.
- 2.2.2. Considering that using real-time data and fuel burn for each individual flight on which a shipment is transported would be nearly impossible and misleading for the shippers, and it would also introduce other factors that are out of the control of members (e.g., weather, traffic, seasonality), it is therefore recommended that airlines calculate averages based on their historical data. The recommended time range for such calculation is the previous calendar year (as per the IATA Recommended Practice 1726). Still, airlines may want to choose equivalent time ranges, such as the previous fiscal year or the last twelve months. The data in relation to the timeframe must be representative, reflecting the airlines' performance during a normal period of operation, and should not include periods that were affecting the operations with a grave impact on the performance of airlines (e.g., due to COVID)
 - 2.2.2.1. Note: in cases where the data sets available cover a shorter time range than 12 months, for example, where a new flight destination was introduced during the calendar year, data can be complemented with data stemming from other destinations that cover a similar distance serviced by the same aircraft type over a 12-month period. This approach would be provisional, and the underlying data should be replaced with the actual data originating from the new destination as soon as the full 12 months data set is available.
- 2.2.3. It is recommended that the fuel burn data used as a basis for calculating CO₂ emissions has been audited by an external and independent verification organization. The role of the verification organization is to validate the completeness and accuracy of fuel data used, with the recommendation to repeat the auditing of data each calendar year (or equivalent time range) or whenever a new fuel data set is being used for the calculation of CO₂ emissions

2.3. Accounting of Sustainable Aviation Fuels (SAFs) [Extract from Recommended Practice 1726]

2.3.1. SAF CO₂ reductions claimed by passengers or third parties

Lifecycle emissions in relation to SAF use claimed by passengers or third parties (e.g., corporate businesses or cargo customers) cannot be claimed or reduced as part of the CO₂ calculation for attribution to general passengers. This reporting is in accordance with the Greenhouse Gas Protocol (GHG) protections against double counting. Members and third parties can report emissions reductions as part of their scope 1 and scope 3 emissions respectively and in accordance with the GHG protocol.

2.3.2. SAF CO₂ reductions claimed solely by the members

Members having purchased SAF, and using the SAF on flights that transport passengers, can reduce the CO₂ intensity of a given passenger per flight in accordance with the environmental attributes for the quantity or batch of SAF used. In absence of a global SAF book and claim system, the reduction in carbon intensity only applies to the routes (and per passenger CO₂ calculations) departing the airport where SAF was deployed, with the recommendation to use the CORSIA Default Life Cycle Emissions Values for calculating the reduction values.

With the introduction of a global book and claim system, allowing the tracing of SAF investment of members and feedstock-related lifecycle emissions, the CO₂ reduction claim can be disconnected from the physical use of SAF and therefore becomes part of an overall reduction of carbon intensity of flights. The exact accounting rules will have to be determined as part of the global SAF book and claim system.

2.4. Voluntary carbon offsets [Extract from Recommended Practice 1726]

2.4.1. Passenger-invested carbon offsets (e.g., voluntary passenger offset programs)

Where passengers or other third parties have purchased carbon offsets from an airline voluntary program, the GHG and related emissions accounting rules to protect against double counting must be applied. As such, the Member should report their full emissions (i.e., all emissions associated with fuel burn) under Scope 1 of the GHG in their reporting.

2.4.2. Member invested carbon offsets to meet voluntary or mandatory offset requirements (e.g., CORSIA)

Member-invested carbon offsets shall not be used as part of this methodology to reduce the per-passenger CO₂ calculated result(s). The calculated result(s) is a representation of the real CO₂ emissions values (and related fuel burn) for the purpose of providing the passenger(s) with information about the environmental impact of a given flight.

3. METHODOLOGY

The three-step approach described hereafter shall be followed:

- Step 1: identify the different legs comprising the complete transportation service
- Step 2: calculate the CO₂ emissions for each leg
- Step 3: sum the results for all legs

3.1. Step 1: identification of the different legs of the transportation service

3.1.1. When measuring the CO₂ emissions at shipment level, the scope that shall be taken into account is the transportation service from Origin to Destination as per the MAWB.

3.1.2. The contracted transportation service may include several segments, which can be:

- Air segment operated by the airline
- Air segment operated by another airline (interline, codeshare)
- Road segment (known as "Road Feeder Service")
- Waterborne segment
- Rail segment

3.2. Step 2: calculation of CO₂ emissions for each leg

3.2.1. Calculation of CO₂ emissions at shipment can be to derive pre-flight or post-flight cargo CO₂ data. As the routing may not be definitively known at the booking stage, it should be indicated that the pre-flight calculation is an estimate.

3.2.1.1. Recommended application of pre-flight CO₂ calculations:

- Online cargo agents
- Cargo booking systems

3.2.1.2. Recommended application of CO₂ calculations based on post-flight data averages:

- Cargo carbon offset solutions
- Customer offset programs

3.2.2. For non-air segments, it is recommended to use the recognized methodologies.

3.2.3. For air segments, two options are recommended for the calculation of the CO₂ emissions allocated to a shipment. These two options are equally valid.

3.2.3.1. Option 1 – Leg-based

Shipment weight (kg) * Leg-based emission factor (kgCO₂/kg)

Where

Shipment weight (kg) is the mass of the cargo carried as per the MAWB. It includes the weight of any packaging provided by the shipper, but excludes the tare weight of aircraft Unit Load Device (ULD).

Leg-based emission factor (kgCO₂/kg) is the average CO₂ emissions generated by the transportation of one kilogram of cargo on a given city-pair.

For each defined city-pair, the leg-based emission factor is calculated as follow:

$$\frac{\text{Average total fuel burn for leg}_x \text{ (kg)}}{\text{Average total payload for leg}_x \text{ (kg)}} * 3.16 = \text{Leg}_x \text{ emission factor (kgCO}_2 \text{ /kg)}$$

The calculation of the average total fuel burn will be done in accordance with IATA Recommended Practice 1726 (see Attachment A).

3.16 is the internationally recognized constant representing the number of kilograms of CO₂ produced by burning a kilogram of aviation fuel.

For belly cargo, the calculation of the average total payload will be done in accordance with Recommended Practice 1726 (see Attachment B).

For full freighter, as the weight of the seats for passengers transported in full freighter aircrafts is negligible, the calculation of the average total payload will be done as follow:

Total payload (kg) = total cargo weight (kg) + total mail weight (kg)

3.2.3.2. Option 2 – Network-based

Shipment weight (kg) * Distance (km) * Network-based emission factor (kgCO₂/kgkm)

Where

Shipment weight (kg) is the mass of the cargo carried as per the MAWB. It includes the weight of any packaging provided by the shipper but excludes the tare weight of aircraft Unit Load Device (ULD).

Distance (km) is the Great Circle Distance (GCD).

Network-based emission factor (kgCO₂/km) is the average CO₂ emissions generated by the transportation of one kilogram of cargo per kilometer for a defined network.

Examples of network emission factors: by airline (whole fleet), for domestic/regional/international flights, for wide/narrow-body aircraft, by operated aircraft, etc.

For each defined network, the network-based emission factor is calculated as follows:

$$\frac{\text{Average total fuel burn for network}_x \text{ (kg)} * 3.16}{\sum_{i=1}^n (\text{average total payload for flight}_i \text{ (kg)} * \text{distance flown for flight}_i \text{ (km)})} \\ = \text{Network}_x \text{ emission factor (kgCO}_2\text{/kgkm)}$$

The calculation of average total fuel burn will be done in accordance with IATA Recommended Practice 1726 (see Attachment A).

3.16 is the internationally recognized constant representing the number of kilograms of CO₂ produced by burning a kilogram of aviation fuel.

The calculation of the distance flown will be done in accordance with the Great Circle Distance method.

For belly cargo, the calculation of average total payload will be done in accordance with Recommended Practice 1726 (see Attachment B).

For full freighter, as the weight of the seats for passengers transported in full freighter aircrafts is negligible, the calculation of average total payload will be done as follow:

Total payload (kg) = total cargo weight (kg) + total mail weight (kg).

- 3.2.4.** When historical data do not exist (new route or new aircraft for instance), the airline will use equivalent data (similar city-pair or aircraft for instance) or airline's fleet emission factor or data available on the public domain.

3.3. Step 3: sum of the results for each leg

- 3.3.1.** Airlines may publish results on a shipment level or may aggregate results by shipper for all transportation services within a given timeframe.

4. DEFINITIONS

For purpose of this Recommended Practice, the following definitions apply:

CO₂ (CARBON DIOXIDE): this is the main global greenhouse gas and, thus, the largest contributor to man-made climate change, produced by burning fossil fuels and deforestation.

UPSTREAM EMISSIONS: emissions linked to energy operational processes such as extraction or cultivation of primary energy, refining, transformation, transport and distribution of energy.

GREAT CIRCLE DISTANCE (GCD): this is the IATA recommended practice to be used for all aerodrome-to-aerodrome distance calculations. GCD is defined as the shortest distance between any two points on the surface of the earth, using the Vincenty distance formula associated with the World Geodesic System. The latitude and longitude of the aerodromes can be taken either from aerodrome data published in the national Aeronautic Information Publication (AIP) or from a source using such data (e.g. ICAO).

BELLY CARGO: cargo transported in passenger aircraft.

5. REFERENCES

IATA RECOMMENDED PRACTICE 1726 PER PASSENGER CO₂ CALCULATION METHODOLOGY:

Methodology to calculate and allocate CO₂ emissions to passengers developed by IATA. It provides the most accurate CO₂ calculation for organizations and individuals to make informed choices about flying sustainably. The recommended practice includes decisions on investing in voluntary carbon offsetting or sustainable aviation fuel (SAF) use.

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Attachment "A"

Definition of Fuel Consumption (Extract from IATA Recommended Practice 1726)

3.3.1. The CO₂ emissions calculation is based on recorded fuel consumption on a per-flight basis. For any given flight, to determine at which point monitoring of fuel consumption starts and ends (including subsequent calculations), it is recommended to align with the existing monitoring method and procedures already applied for the purpose of CORSIA monitoring and reporting.

Fuel consumption excludes:

- Training flights
- Ferry flights
- Maintenance flights
- Aircraft delivery flights
- State flights
- Search & rescue flights
- Transporting head of state and government ministers
- Police flights
- Military flights

3.3.2 When estimating the fuel burn average of scheduled flights, fuel consumption of non- scheduled flights may be excluded.

3.3.3. Converting volume to mass using density values:

If the amount of fuel used is determined in units of volume (e.g., litres) the Member must convert this volume to mass by using either of the two options consistently when applying to fuel data:

Option 1: Adjusted Density Value - adjusted density means density expressed as kg/litre and determined for the applicable temperature or region for a specific measurement.

Option 2: Standard Density Value - a standard density value of **0.8** kg/litre must be applied.

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Attachment "B"

Calculation of total payload for belly cargo (Extract from IATA Recommended Practice 1726)

Calculation of passenger and cargo weight

The calculation of the total weight carried is based on the:

Total passenger weight:

Number of revenue and non-revenue passengers occupying a seat multiplied 100kg standard weight, or airline-specific weight.

Total cargo weight:

Revenue and non-revenue freight and mail, actual or standard mass, (e.g., as derived from the mass and balance documentation) combined equals the total cargo weight.

Total weight carried: Total passenger weight + Total cargo weight.