

# ICAO CARGO AND PASSENGER CALCULATOR

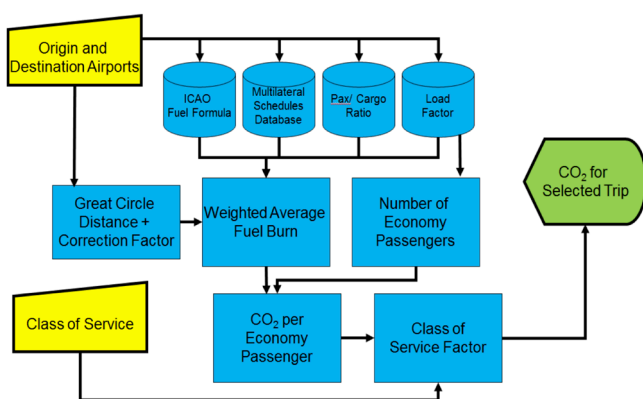
## BY ICAO SECRETARIAT

### ICAO Passenger Carbon Emissions Calculator

Today a large number of independently produced aviation carbon calculators is available to the public. These are developed by either NGOs, offsetting companies, international institutions, industry associations, academia, or a combination of all these. However all these carbon calculators provide very diverse results for the same flight that can differ by a factor up to four or more. The reasons for these variances rely in the availability and use of reliable and representative sets of data (such as aircraft configuration, load factors, freight load, engines and fuel burn), simplifications in the methodologies and scientific uncertainty.

Recognizing the need for a fully transparent and internationally approved calculator, ICAO began work on a methodology through its Committee on Aviation Environmental Protection (CAEP). In June 2008, ICAO launched an impartial, peer-reviewed and approved Carbon Emissions Calculator that estimates CO<sub>2</sub> emissions from passengers' air travel. The methodology used by the ICAO calculator<sup>1</sup> applies the best publicly available industry data to account for various factors such as aircraft types, route specific data, passenger load factors and cargo carried. ICAO fuel formula is used to estimate fuel consumption based on distance flown. Although the only inputs from the user are origin/destination airports and the class of service, the ICAO calculator uses a series of databases (Multilateral Schedules Database, Cargo/Passengers Ratio and Load Factors) for its calculations (see **Figure 1**).

The ICAO methodology is regularly improved and the databases used are periodically updated by a dedicated group of technical experts from CAEP (see related article page 10).



**Figure 1.** ICAO Carbon Emissions Calculator methodology

The online version of the ICAO Carbon Emissions Calculator is publicly available on the ICAO website: <http://www.icao.int/environmental-protection/CarbonOffset/Pages/default.aspx>.

In addition this tool is available in the Apple App Store as an iPhone and iPad application and in Google Play for Android devices. The ICAO Calculator webpage is the most visited of the ICAO website with more than 3,000 daily hits. In addition, it is the official tool for Global Travel Distribution Systems (GDS) such as Amadeus.

### Cargo Methodology

Following the growing interest from the UN, general public and freight forwarders to receive CO<sub>2</sub> information on cargo shipped by air, the capabilities of the ICAO carbon calculator have been further extended to estimate carbon emissions associated with these activities.

The first step was the development by CAEP of a methodology to estimate emissions associated with a future shipment that would complement a procedure that can be implemented by operators to compute the CO<sub>2</sub> emissions for shipments that have already occurred.

This ICAO methodology is articulated in three parts so that precise data on the aircraft type and routing can be used when known, and estimated otherwise. ICAO only adopted the use of Part 1 and Part 2 in the carbon calculator as Part 3 is not a predictive tool but a post-flight calculation. The three parts, shown in **figure 3**, can be described as follows:

- Part 1 – Predictive Methodology (Dedicated Cargo Aircraft) – is aimed at the typical consumer who wishes to ship a package by air. Users will likely not have access to any information beyond the origin and destination of their shipment and the weight of the item.
- Part 2 – Predictive Methodology (Belly Cargo) – assumes that a package is being shipped on board a passenger aircraft and that the user knows the origin and destination airport for the item as well as any intermediate airports that the item may transit.
- Part 3 – Post-flight Methodology (Dedicated Cargo Aircraft and Belly Cargo). To be implemented at the operator level.

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Carbon Emissions Calculator

One Way/Round Trip: Round Trip  
Cabin Class: Economy  
Number of Passengers: 1

Leg	From City/Airport	To City/Airport
1	YUL	FCO

Buttons: Delete All Location(s), Delete Leg, Add New Leg, Reset, Compute

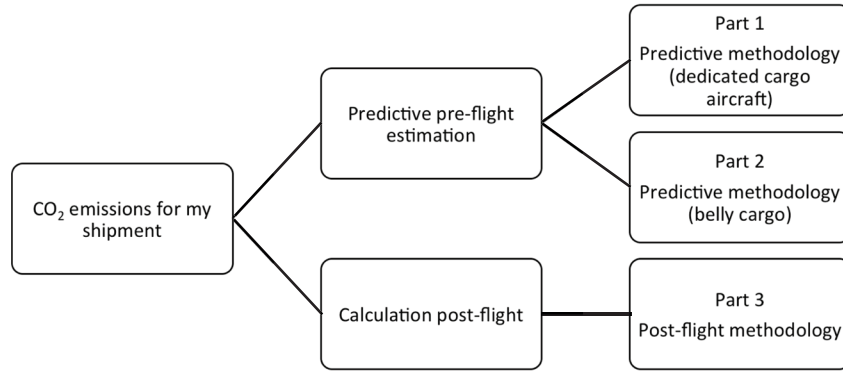
Metric: Standard (LBS / MI)

Total						
Dep Airport	Arr Airport	Passenger Number	Cabin Class	Trip	Total Fuel Burned (KG)	Total CO2 (KG)
YUL	FCO	1	Economy	Round Trip	83733.10	815.20

Flight Stage Detail					
Dep Airport	Arr Airport	Distance (KM)	Aircraft	Avg Fuel Burn/Fit (KG)	Avg CO2 per Passenger/Fit (KG)
YUL	FCO	6579.00	313, 332, 333, 763	41891.90	407.60
FCO	YUL	6579.00	313, 332, 333, 763	41841.20	407.60

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Figure 2. Screenshot of the online version of the ICAO Carbon Emissions Calculator



**Figure 3.** ICAO Cargo emissions methodology

Similar to the passenger methodology, Part 1 approach applies the ICAO fuel formula to estimate fuel consumption based on distance flown. The user enters the origin and destination city along with the weight of the package that is being shipped by air. Unlike the passenger methodology, the exact routing flown is not required, since air cargo often transits through a centralized facility for sorting while in transit. Depending on the region, there may be more than one hub due to market competition. Based on an analysis of dedicated air cargo traffic it is possible to identify the primary hubs within each region. As illustrated in **Figure 3**, data on the types of aircraft operating from the origin to the hub(s) and from the hub(s) to the destination are retrieved and used. Cargo load factor data are then used to apportion the emissions associated with each possible flight to the weight carried. Similar to the passenger methodology, a weighted average of the emissions is computed based on the observed traffic.

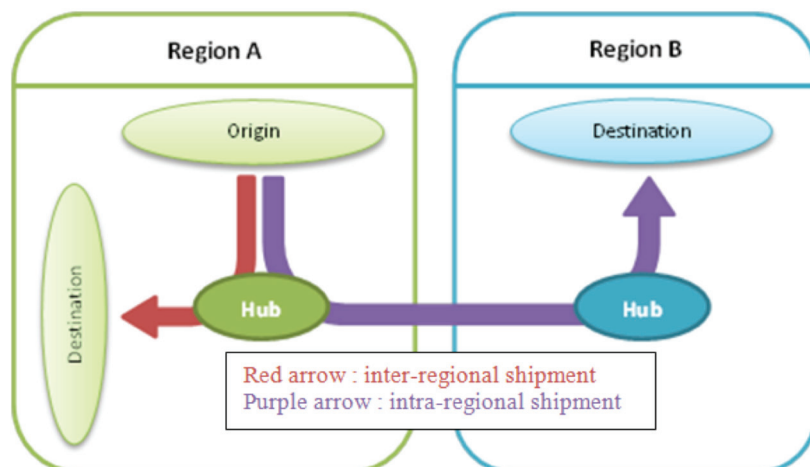
Due to a lack of information on the exact routing flown, the package is assumed to travel from an airport near the origin city to the hub within the region to an airport in the destination city. If the item is being shipped between regions, then it is assumed to travel from the origin city to a hub in the origin region then to a hub in the destination region, and then finally to the destination city, as illustrated in Figure 3. A weighted average is used when

more than one airport serves dedicated cargo traffic in either the origin or destination city. Similarly, a weighted average is computed based on possible routings if there is more than one hub in the region.

Part 2 approach is directly derived from the passenger methodology, which already includes as passenger to cargo ratio for passenger aircraft.

Part 3 is intended to be implemented, once the delivery has concluded, by an operator with perfect knowledge of the routing flown, load factor, and the aircraft types used for a given shipment. This method provides the highest accuracy of result, but also requires the most data and cannot be used to estimate the emissions in advance of a shipment.

Parts 1 and 2 have been added to the ICAO carbon calculator for use by the public, the UN system, and other users. Although this predictive methodology is limited to the air travel related portion of the shipment - and not to the entire shipment which might also include other modes of transport - it complements the ICAO carbon calculator for passenger and enhances ICAO's contribution to the UN-system-wide Climate Neutral UN initiative and other offset programmes.

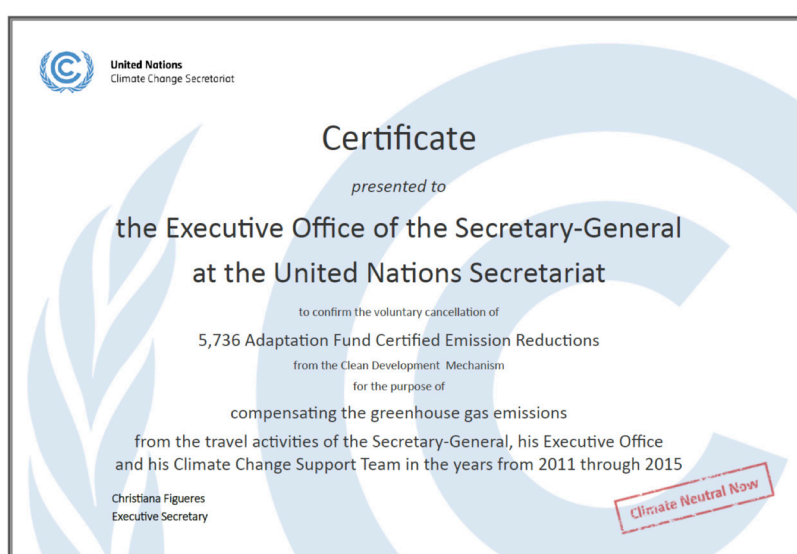


**Figure 4.** Use of hubs for inter and intra-regional air cargo shipment

### UN-system-wide use of the ICAO Calculator

In April 2009 the UN Environmental Management Group (EMG) adopted the ICAO Carbon Emissions Calculator as the official tool for all United Nations entities to quantify their air travel CO<sub>2</sub> footprint, in support of the United Nations Climate Neutral initiative. Since then, interfaces to the calculator have been made available to United Nations environmental sustainability focal points, travel offices and enterprise resource planning (ERP) systems, as well as through a special agreement with GRS companies such as Amadeus. Some UN travel offices have integrated the ICAO Calculator directly into their travel reservation and approval systems, providing real-time information to assist travel planning decisions.

Almost all United Nations organizations reporting their GHG inventories to the UN EMG through the UNEP Sustainable UN (SUN) are using the ICAO air travel carbon emissions calculator. Indeed the use of a common UN methodology and interface across the UN-system facilitates the aggregation of air travel emissions data and guarantees integrity and consistency of reported inventories. The ICAO calculator was recently used to estimate the carbon emissions generated by UN meetings such as the UNFCCC COPs, the UN Climate Summit and the UN Environmental Assembly. This ICAO tool was also used to estimate the carbon footprint of official travels of the UN Secretary General Ban Ki-moon and his Climate Change Support Team.



**Figure 5.** Transaction statement confirming the cancellation of 5,736 CERs representing the equivalent of the unavoidable remaining GHG emissions from the travel activities of the Secretary-General, his Executive Office and his Climate Change Support Team.

### Sustainable Development Goals



### References:

1. <http://www.icao.int/environmental-protection/CarbonOffset/Pages/default.aspx>