

Equivalent CO₂ Emissions (New Equation)

$$m_{CO_2,eq} = \frac{EI_{CO_2} \cdot f_{NM}}{n_{seat,typical}} \cdot CF_{midpoint,CO_2} + \frac{EI_{NO_x} \cdot f_{NM}}{n_{seat,typical}} \cdot CF_{midpoint,NO_x}$$
$$+ \frac{R_{NM} \cdot f_{NM}}{R_{NM} \cdot f_{NM,ref} \cdot n_{seat,typical}} \cdot CF_{midpoint,AIC}$$

$$f_{NM,ref} = 4,74 \text{ kg/km}$$

The AIC contribution (contrail and contrail cirrus) have been defined now proportional to fuel burn with the introduction of the term

$$\frac{f_{NM}}{f_{NM,ref}} \cdot$$

The reference value of 4.74 kg/km is that of e.g. an Airbus A321. The calculation of the reference value as a weighted average fuel burn for the world fleet of passenger aircraft is given in an Excel spreadsheet.

The new equation is the same as the old equation for aircraft with an "average" absolute fuel burn (kg fuel per km flown) of 4.74 kg/km. The old equation calculated a world fleet average contrail contribution. As such, the old equation assumed the same contrail effect from a business jet and an A380. This was clearly not helpful, if the aim was to compare aircraft.

According to the new equation, different aircraft have the same contrail effect per passenger (seat), if they have the same fuel burn per passenger and fly at the same altitude.

The effect of different jet fuel types (SAF versus standard JET A-1) on contrail formation is not considered here. Reason for this approach:

1. The content of SAF in the kerosene will be small in the next years.
2. The content of SAF is regulated by the EU. It is unlikely that airlines will voluntarily use a higher SAF content than required.
3. SAF is supplied to the main kerosene fuel tank at the airport. This means that every aircraft is supplied with the same kerosene (and its SAF content).
4. Airlines can make use of "Book & Claim" (<https://doi.org/10.5281/zenodo.10371885>). In this way, an important positive and real contribution is made for the environment. This can be accounted for with a credit system. The above equation serves to estimate actual equivalent CO₂ from aircraft and avoids mixing this with a credit system.