The inclusion of non-CO2 effects into the EU ETS MRV framework

Background

The climate impact of aviation is a combination of direct aircraft engine emissions and their indirect effect on the atmosphere, particularly at high altitudes.

Some emissions can be easily estimated with fixed indices correlated to the fuel. For example, on average, 3.16 kg of carbon dioxide (CO2) and 1.25 kg of water vapor (H2O) are emitted for every kilogram of jet fuel burned. The direct climate impacts of CO2 and H2O are well quantified and understood. However, the amount of other aviation emissions, such as NOx, SOx, or soot particles, are more difficult to estimate as they depend on the engine design, ambient conditions, and fuel composition, among other variables.

The secondary climate effects of these emissions, including water vapor, vary with several factors, like the precise location of where they are released, the background atmospheric chemistry, the weather conditions at the time, and their consequent evolution. These effects are collectively known as non-CO2 effects of aviation, and there is a growing recognition that, at an aggregated level, they have a net warming impact on the climate. However, understanding the exact extent of this warming and validating these emissions on individual flights is still subject to scientific research and debate.

In this context, the inclusion of non-CO2 aviation effects in the Monitoring, Reporting, and Verification (MRV) requirements under the European Union’s Emissions Trading System (EU ETS) from 1 January 2025 raises the following concerns for airlines:

The infeasibility of non-CO2 MRV at this stage

1. A non-CO2 MRV framework will not reflect the actual non-CO2 effects of aviation, but an estimation.

   In contrast to CO2, which can be obtained by reporting one single parameter (total fuel burned), non-CO2 emissions and their impact cannot be monitored accurately or reported on a per-flight basis today. Any estimation of non-CO2 effects requires complex computations built on several parameters and assumptions, such as engine efficiency, atmospheric humidity, temperature and pressure, wind velocity, background atmospheric chemistry composition, engine-fuel particulate emission profile, and others. For this reason, the outcome can be widely different depending on the assumptions and the quality of the data used. Any estimate is analytically limited and fundamentally divorced from output based on actual observations. The proposed non-CO2 MRV framework could serve as a first-stage experiment that attempts to achieve a baseline estimation of the non-CO2 effects of aviation. However, it is currently not feasible to validate the output from the experiment to ensure that it accurately represents reality.

2. Including non-CO2 effects of aviation in the EU ETS MRV requirements precedes today’s science.

   There is scientific consensus that the non-CO2 effects of aviation, at a global aggregated and average level, are net warming. However, there is also consensus that non-CO2 emissions effects are quantified with a low confidence level, as opposed to CO2 emissions, which are quantified with a very high degree of confidence.
In the case of contrails, there is scientific maturity regarding the thermodynamic criteria (Schmidt-Appleman Criteria) that must be met for their formation. In contrast, agreement is lacking regarding the capacity to accurately forecast persistent contrails for individual flights and the climate impact of individual contrails. These are areas of active experimental and numerical modeling. Studies have shown that estimating the formation of individual contrails using past weather and trajectory data could lead to incorrect results 50-80% of the time.

An MRV system for non-CO₂ emissions today could support further research thanks to additional data, but the science is not mature enough to allow confidence in its implementation at a policy level. Any policy or regulatory framework that precedes scientific understanding risks producing erroneous and undesirable outcomes, including unintended climate consequences. It is conceivable that by attempting to avoid the formation of contrails and reduce reported non-CO₂ emissions, operators could inadvertently increase their CO₂ emissions. Given that CO₂ and non-CO₂ emissions affect the climate through different effects and timeframes (CO₂ lasts for centuries in the atmosphere, while most non-CO₂ effects are short-lived), scientific consensus is still required on the metrics and timeframes for comparison. The complex and likely trade-offs amongst different non-CO₂ emissions, and between these and CO₂ emissions are still poorly understood.

Aviation has always made decisions based on objective data to ensure that risks are mitigated effectively, whether these be safety, security, airworthiness, or environmental impact. The approach, as currently proposed by the Commission, moves away from this successful approach in aviation. To reduce the climate risks related to non-CO₂ effects, we must work in a collaborative, voluntary approach to ensure that future activity across the industry results in effective mitigation through the maturity of science and the development of well-established and proven technological and operational approaches.

3. The non-CO₂ MRV framework is unlikely to deliver a positive climate impact.

Considering all the challenges and uncertainties mentioned above, introducing an MRV system as early as January 2025 would not serve to mitigate aviation’s non-CO₂ effects under EU ETS. Under the MRV framework, airlines are requested to participate in a large-scale experimental project to set a non-CO₂ baseline, with no established mechanisms for scientific validation or improvement of the MRV output. This risks diverting resources to an area whose results are highly uncertain and potentially inaccurate, at the expense of other actions that could mitigate CO₂ and non-CO₂ climate effects more effectively in the near term.

Airlines are undertaking research to improve their understanding of non-CO₂ effects. For example, some operators participate in the IAGOS program to install humidity sensors on aircraft to better understand the humidity fields in the upper troposphere (vital for contrail prediction and assessing their climate impact). Other airlines are performing contrail avoidance trials, yet others are researching the non-CO₂ effects of alternative fuels, all of which could deliver tangible contributions towards reducing the climate impact of aviation.

The EU ETS legal text indicates the possibility of expanding its scope to include non-CO₂ effects as a mitigative measure. Taking mitigative action based on estimations rather than observations risks being ineffective and potentially counterproductive.

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IATA recommends

For the reasons stated above, IATA recommends that, given the experimental nature of the MRV framework, airlines’ participation framework should be voluntary.

The MRV framework, as it currently stands, should address the following concerns:

- **Participation in the framework should be voluntary**, and a first pilot phase should be established to test the process, accuracy, and effectiveness of the system, as well as allow operators to explore other measures.

- There should be **clear pathways for scientific validation of reported non-CO₂ effects** and a roadmap for reducing the differences between the modeled estimations and reality.

- The **application scope of non-CO₂ MRV provisions should be strictly intra-EU** to mirror that for CO₂. Any intention to expand beyond the current EU ETS application scope for aviation would imply a legal risk of extraterritorial impact and would work counter to any MRV implementation. Furthermore, the probability of contrail formation is highly dependent on the region: mid-latitudes have a higher probability of contrail formation than the tropics or the equator, so contrails affect different regions differently.

- Data gaps for volunteering airlines should be filled with **average values** and not worst-case scenario data, which induce unwarranted bias in the data, particularly on fuel properties.

- The timeframes and metrics chosen for combining CO₂ and non-CO₂ into single reports should be aligned with the latest scientific understanding and should avoid over-representing **short-lived non-CO₂ effects against the long-lasting effects of CO₂**.

- **Safeguards** should be included against unnecessary collection of sensitive data and their misuse.

- Airlines should be **encouraged to conduct their own research and participate in new and existing activities** to understand non-CO₂ effects better and to explore potential mitigation opportunities.