



Net Zero 2050

Progress Tracking Methodology

Background

In 2021, IATA member airlines approved a resolution to achieve net zero carbon emissions by 2050. Additionally, ICAO has recently adopted a Long Term Aspirational Goal (LTAG) for international aviation of net zero carbon emissions 2050. While these commitments have established an absolute goal with a clear end-date, no concrete plan has yet been formulated as to how progress will be monitored and tracked at an industry level.

The industry needs a consistent methodology and reporting mechanisms to be able to track progress towards the net zero by 2050 goal. If not, there is a risk for the industry: in the absence of industry initiatives, third parties may seek to position themselves in this regard, at the detriment of the industry with potential administrative burden and data ownership issues. False perceptions bring about a plethora of potential financial risks, such as mistargeted and ill-defined policy measures. In addition, public pressure to show progress on Net Zero will also create potential thorny situations if there is no consistency in the industry. Faced with these challenges, IATA had organized an industry support group¹, called TrackZero 2050, to leverage the members' expertise and focus on creating an industry-wide consistent Net Zero tracking mechanism.

Overall, achieving net zero is expected to be driven primarily by the increasing deployment of sustainable aviation fuel (SAF), next generation aircraft and propulsion technologies, infrastructure and operational improvements, complemented by carbon offsetting/removal of residual emissions. In turn, it is important to understand how these 'levers' contribute individually towards the realization of the net zero goal. The TrackZero 2050 industry support group identified the relevant emissions scope, sources, and appropriate process for tracking.

The group also provided recommendations with regards to aspects of data collection and data validation, with emphasis on the importance of maintaining data ownership within the industry. While external data may be readily available, ensuring the equal treatment of all airlines and maintaining data accuracy would be extremely challenging, if not impossible. The industry would not have control of the data narrative, which could in turn portray a wrong image of the industry's progress to the Net Zero target. The current proliferation of "Net Zero" calculators and methodologies only exacerbates the issue and poses new challenges in building trust and consumer confidence.

The industry stands united behind the Net Zero commitment, agreed on unanimously at the 2021 IATA Annual General Assembly, so it is only natural that IATA takes the leading role in monitoring the industry's progress towards the net zero target. This TrackZero Methodology, developed by industry experts and implemented through IATA, shall serve as the reference point for understanding where the industry stands on its path to decarbonization, and also serve as guidance for airlines' own reporting of their environmental performance to the general public, investors, and other stakeholders.

Annual data collection by IATA will ensure that IATA obtains a clear picture without unnecessary administrative burden, accurately and transparently. Building on IATA's proven track record of collecting and anonymizing

¹ TrackZero 2050 support group consists of 11 member airlines and four aircraft manufacturers.

performance data, airlines will be able to monitor their progress relative to each other, enhancing competition to further stimulate innovation and advancements in decarbonization.

Scope of Emissions

The net zero commitment² covers the following aviation activities:

- International and domestic flights
- Passenger and cargo flights, including business aviation
- Revenue and non-revenue flights
- Emissions/reductions scope:
 - CO₂ emissions only (non-CO₂ GHG emissions excluded);
 - tank-to-wake for conventional jet fuel;
 - well-to-wake for SAF;
 - well-to-wake for hydrogen and electric propulsion.

Emissions and Reduction Sources

Levers to reduce emissions are not all characterized in the same way, and there are substantial differences in technological maturity, availability of data, etc., which necessitates different sub-metrics and data collection processes for each. The following emissions and reduction sources have been identified:

1. **Conventional Jet Fuel:** conventional jet fuel use and related CO₂ emissions
2. **SAF³, Offsets and CDR/CCS⁴ Technologies:** CO₂ reductions resulting from SAF use (both voluntary and compliance-required), carbon offsets (both voluntary and compliance-required, but excluding opt-in passenger-funded offsets), and CO₂ reductions from CDR/CCS technologies
3. **New Aircraft Technologies:** CO₂ emissions related to hydrogen use, electric propulsion, and hybrid-electric aircraft usage

Key Metrics

The net zero commitment is an absolute target, meaning that by 2050 the net emissions of the airline industry will be zero. Nevertheless, the path to 2050 does not necessarily imply an immediate decrease in absolute emissions. The expected traffic growth in the near term may exceed the effects of the implemented mitigation measures, which could give a misleading impression of the industry’s efforts toward decarbonization.

Two intensity metrics will therefore complement the absolute emissions metrics to help illustrate the progress after accounting for changes in traffic, as presented in Table 1, below.

Metric	Description
Absolute: MtCO ₂	To track the evolution of total CO ₂ emissions, after accounting for all emissions and emissions reduction sources
Intensity 1: gCO ₂ /RTK	To track the evolution of CO ₂ emissions intensity, whilst accounting for changes in traffic volumes
Intensity 2: gCO ₂ /ATK	To track the evolution of CO ₂ emissions intensity, whilst accounting for changes in available capacity

Table 1: Key Metrics

² IATA (2021): <https://www.iata.org/contentassets/dcd25da635cd4c3697b5d0d8ae32e159/iata-agm-resolution-on-net-zero-carbon-emissions.pdf>

³ Including low carbon aviation fuels (LCAF).

⁴ CDR/CCS technologies include: CDR (carbon dioxide removal), CCS (carbon capture and storage), CCUS (carbon capture utilization and storage), BECCS (Bioenergy with carbon capture and storage), and DAC (direct air capture).

Traffic Data

Deriving the improvements over time within any intensity metric (e.g., gCO₂/RTK) requires emissions data to be complemented by air traffic information. IATA has access to traffic data covering 900+ airlines and has extensive experience in collecting and validating this information.

When collecting and processing traffic data, utmost consideration is given to statistical consistency and adherence to international standards, e.g., with regards to the classification of non-revenue passengers and no-shows. It is therefore recommended that IATA's existing database constitutes the source of traffic information.

Conventional Fuel

While SAF and new technologies are key decarbonization enablers, it is inevitable that the aviation industry will still be primarily fueled by conventional fuel for years to come. However, alongside advancements in SAF uptake and entry into service of new aircraft designs, continuous gains in fleet and operational efficiency are also expected. It is proposed to track CO₂ emissions from conventional fuel according to the information below.

CONVENTIONAL FUEL		
Data	Scope	Notes
<ul style="list-style-type: none"> • Total fuel consumption – tonnes • Optional breakdowns: <ul style="list-style-type: none"> ○ International vs. Domestic ○ Passenger vs. Cargo 	<ul style="list-style-type: none"> • All conventional jet fuel types: <ul style="list-style-type: none"> ○ Jet A/A-1 (or equivalent) ○ Jet B 	<ul style="list-style-type: none"> • Reported by member airlines to IATA on an annual basis for the preceding calendar year • Recommending CORSIA MRV practices be applied⁵

Table 2: Conventional Fuel

⁵ Using flight level monitoring based on five CORSIA Fuel Use Monitoring Methods and gap filling approaches for limited number of flights.

SAF, Offsets and CDR/CCS Technologies

Regardless of progress in new aircraft technologies between now and 2050, SAF is expected to be the primary contributor to the decarbonization of the airline industry, in line with the Net Zero 2050 commitment. It is therefore paramount to accurately monitor SAF usage over time.

Detailed SAF-related data is to be monitored and reported by airlines accordingly, which enables the tracking of both the quantity and quality (i.e., emissions savings per kilogram) of SAF, as outlined below. SAF accounting will follow the internationally recognized CORSIA principles⁶.

SAF		
Data	Scope	Notes
<ul style="list-style-type: none"> Total neat SAF delivered⁷ by SAF type – mass Total blended SAF delivered by SAF type – mass Lifecycle emissions factor per SAF type (LS_f) Total CO₂ emissions reductions from SAF 	<ul style="list-style-type: none"> All SAF based on ownership of environmental attributes in a calendar year 	<ul style="list-style-type: none"> Possibly some data to be collected by airlines from suppliers and/or reference databases Reported by member airlines to IATA on an annual basis for the preceding calendar year The recommended scope and calculation methodology may be subject to change should a widely accepted SAF Book & Claim system be developed

Table 3: SAF

Although SAF will bring a notable reduction in net carbon emissions for the airline industry, there will likely be some residual CO₂ emissions that are to be mitigated with carbon offsets and/or CDR/CCS technologies. Data related to carbon offsets and CDR/CCS technologies will be reported by member airlines to IATA, in tandem with their SAF data.

OFFSETS AND CDR/CCS TECHNOLOGIES		
Data	Scope	Notes
<ul style="list-style-type: none"> Total number of offsets retired in a calendar year, broken down by: <ul style="list-style-type: none"> Mandatory vs. voluntary CORSIA-eligible vs. Other schemes Total CO₂ removed/captured using CDR/CCS technologies⁸ 	<ul style="list-style-type: none"> All types of certified offsets are accepted Opt-in passenger-funded offsets/ removals may voluntarily be reported to IATA but shall not be accounted for in progress towards Net Zero 2050 	<ul style="list-style-type: none"> Reported by member airlines to IATA on an annual basis for the preceding calendar year

Table 4: Offsets and CDR Technologies

⁶ ICAO: <https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-Eligible-Fuels.aspx>

⁷ "Delivery" refers to the delivery/handover of environmental attributes from supplier to airline.

⁸ Excluding DAC in relation to production of synthetic aviation fuels.

New Aircraft Technologies

New aircraft technologies are also anticipated to have a prominent role in reaching net zero CO₂ emissions by 2050. The anticipated advancements can loosely be grouped into three categories: hydrogen aircraft, electric aircraft, and hybrid-electric aircraft. Tracking CO₂ emissions for these technologies is somewhat similar, however, each technology has specific nuances.

HYBRID-ELECTRIC AIRCRAFT		
Data	Scope	Notes
<ul style="list-style-type: none"> Total electricity charged and used for aircraft propulsion⁹ – GWh Total emissions from the electricity charged and used for aircraft propulsion – CO₂ Total fuel consumption – mass 	<ul style="list-style-type: none"> Lifecycle CO₂ emissions of electricity use for aircraft propulsion (production, transport, storage, etc.) Recommended CORSIA MRV practices be applied for conventional fuel 	<ul style="list-style-type: none"> Possibly some data to be collected by airlines from airports/OEMs/reference databases (e.g., IEA¹⁰) before being reported to IATA Reported by member airlines to IATA on an annual basis for the preceding calendar year

Table 5: Hybrid-electric Aircraft

ELECTRIC AIRCRAFT		
Data	Scope	Notes
<ul style="list-style-type: none"> Total electricity charged and used for aircraft propulsion – GWh Total emissions from the electricity charged and used for aircraft propulsion – CO₂ 	<ul style="list-style-type: none"> Lifecycle CO₂ emissions of electricity used for aircraft propulsion (production, transport, storage, etc.) 	<ul style="list-style-type: none"> Possibly some data to be collected by airlines from airports/OEMs/reference databases (e.g., IEA) before being reported to IATA Reported by member airlines to IATA on an annual basis for the preceding calendar year

Table 6: Electric Aircraft

HYDROGEN AIRCRAFT		
Data	Scope	Notes
<ul style="list-style-type: none"> Total hydrogen used – in mass per hydrogen type¹¹ Total emissions from hydrogen use – CO₂ per hydrogen type 	<ul style="list-style-type: none"> Lifecycle CO₂ emissions of hydrogen use (production, transport, storage, compression, liquefaction etc.) 	<ul style="list-style-type: none"> Possibly some data to be collected by airlines from hydrogen producers/airports/OEMs before being reported to IATA Reported by member airlines to IATA on an annual basis for the preceding calendar year

Table 7: Hydrogen Aircraft

⁹ For hybrid-electric, electric, and hydrogen aircraft, the scope of available data is unclear, hence a limit to "propulsion" energy use. Should more detailed data be readily available, consumption from all flight-related activities (including, e.g., consumption at a gate) will be included.

¹⁰ International Energy Agency: <https://www.iea.org/>

¹¹ There are different production processes of hydrogen that lead to different amounts of CO₂ emissions. Therefore, it is important to report the use and emissions per type of hydrogen. Currently, the most common types are **grey** hydrogen (Steam Methane Reforming (SMR) based on natural gas), **blue** hydrogen (SMR with CCS), **green** hydrogen (Electrolysis based on renewable electricity), and **pink** hydrogen (Electrolysis based on nuclear power).

Supporting metrics

While the three key metrics can provide a larger picture of the progress toward net zero, they fail to capture the details related to how that progress is being achieved. IATA will therefore utilize the data collected from airlines to derive a number of supporting sub-metrics.

Sub-metric	Description
Total neat SAF delivered (mass)	Monitoring the progress in neat SAF uptake
Total blended SAF delivered (mass)	Monitoring the progress in blended SAF uptake
Average SAF blend ratio (%)	Derived from the above sub-metrics
Average LS _f emissions reductions (%)	SAF carbon intensity tracking
Percentage of neat SAF of all fuel globally (%)	Tracking the share of SAF in global jet fuel use
Total number of offsets retired, broken down as: <ul style="list-style-type: none"> ○ Mandatory vs. voluntary ○ CORSIA-eligible vs. other 	Monitoring the use of offsets by the airline industry, with a breakdown to help illustrate the motivation behind offset retirements (regulatory compliance or voluntary actions) as well as their composition (CORSIA-eligible offsets or all other offset types)
CO ₂ removed by CDR/CCS technologies ¹²	Tracking the emissions reductions arising from the use of CDR technologies
Average kg CO ₂ /kWh	Monitoring the carbon intensity of the electricity used to power hybrid-electric and electric aircraft
Average share of electric propulsion in hybrid-electric aircraft	Determining the distribution between electricity and jet fuel (in terms of energy) in powering of electric aircraft To be calculated by IATA with the underlying data provided by airlines
Average kg CO ₂ /kg H ₂	Monitoring the carbon intensity of hydrogen used to power hydrogen aircraft
CO ₂ avoided as a result of new technologies	To be calculated by IATA and provide insights into the contribution of different mitigation pathways

Table 8: Sub-metrics

¹² Excluding DAC in relation to production of synthetic aviation fuels.

Unresolved Items

In identifying the relevant metrics and data sources, a number of items were identified for which further investigation and discussion will be needed:

- **CDR/CCS:** There is currently no universal set of CO₂ accounting rules and principles in relation to CDR/CCS and similar technologies. To avoid double-counting, it is necessary to clarify what exactly gives one the right to ownership of the mitigated emissions using CDR/CCS. This is likely to be similar to offsets, and related metrics have been proposed accordingly.
- **SAF:** SAF accounting principles are not harmonized across the world, which creates an administrative burden to airlines and increases the risk of inaccurate data being reported. To resolve this, it should be considered a key priority to create globally accepted CO₂ and SAF accounting principles, followed by a worldwide recognized Book & Claim system.
- **Intermediate target(s):** Prompted by increased public interest in the topic and demand for accountability, evaluating the feasibility of setting intermediate intensity-based targets to achieve Net Zero 2050, including the availability of necessary data for accurate modeling and analysis.
- **Conventional fuel emissions scope:** Inconsistency in the scope of emissions has been identified, namely in that for conventional fuels tank-to-wake emissions are considered, whereas for new technologies well-to-wake emissions are considered, which also adds complexity in SAF accounting. An investigation of the possibility of including the well-to-tank emissions of conventional jet fuels is recommended, recognizing that it would increase the required CO₂ to be mitigated to achieve the Net Zero 2050 target.

Appendix A – Airline Reporting Example

To better illustrate what the proposed tracking would entail, we can consider an example case of Alpha Airlines. Alpha is a passenger-only airline that monitors fuel consumption using block-off/block-on method. In the previous year, the total jet fuel consumed was 100,000 tonnes (excluding hybrid-electric aircraft), with 80,000 tonnes on international flights and the remaining 20,000 on domestic flights.

Alpha Airlines has taken delivery [of environmental attributes] for two kinds of SAF: 2,000 tonnes of neat HEFA-produced and 1,000 tonnes of neat alcohol-to-jet (ATJ, isobutanol), with used cooking oil and agricultural residues as feedstock, respectively. The HEFA SAF was a 25% blend, and the ATJ was a 20% blend, resulting in 8,000 tonnes of blended HEFA and 5,000 tonnes of blended ATJ SAF. Alpha opted to use the CORSIA-default lifecycle emissions factors (LS_f), which are 13.9 gCO₂e/MJ and 29.3 gCO₂e/MJ, respectively. The associated emissions reductions were calculated just like in CORSIA:

$$\text{Emissions Reduction } (ER)_{HEFA} = (3.16 * 2,000) * \left(1 - \frac{13.9}{89}\right) = 6320 * 0.8438 = 5,333 \text{ tCO}_2$$

$$\text{Emissions Reduction } (ER)_{ATJ} = (3.16 * 1,000) * \left(1 - \frac{29.3}{89}\right) = 3160 * 0.6708 = 2,120 \text{ tCO}_2$$

Alpha Airlines voluntarily offsets all domestic flights with CORSIA-eligible offsets and has therefore retired 20,000 offsets in the previous calendar year. Alpha also offers passengers the possibility to offset their flights, however those retired offsets are not accounted for in the progress towards Net Zero 2050. In other words, the 20,000 offsets Alpha voluntarily retired are in addition to those retired through passenger contribution. On top of the offsets, Alpha has permanently removed 1,500 tonnes of CO₂ via Carbon Capture and Storage (CCS).

In addition to their conventional-fuel fleet, Alpha operates a regional hybrid-electric turboprop, which has used 1,095 tonnes of Jet A-1 and 13 GWh of electricity in the previous calendar year. The average emissions factor of the used electricity (grid emissions factor) was 0.5 kgCO₂/MWh, and hence the electricity-related emissions were 6,500 t CO₂.

In summary, Alpha Airlines would undergo an “expanded” CORSIA verification to ensure the accuracy of the pertinent data, and would subsequently report the following to IATA by June 30th for the previous calendar year:

Source	Data point reported to IATA	Value & unit
Conventional Fuel	Total conventional jet fuel consumption: Jet A-1	100,000 tonnes, of which: <ul style="list-style-type: none"> 80,000 international 20,000 domestic
SAF	Total neat SAF delivered: HEFA	2,000 tonnes
	Total blended SAF delivered: HEFA	8,000 tonnes
	Lifecycle emissions factor (LS_f): HEFA	13.9 gCO ₂ e/MJ
	Total neat SAF delivered: Alcohol-to-jet (ATJ)	1,000 tonnes
	Total blended SAF delivered: ATJ	5,000 tonnes
	Lifecycle emissions factor (LS_f): ATJ	29.3 gCO ₂ e/MJ
	Total emissions reductions from use of SAF	7,453 tonnes CO ₂
Offsets	Total offsets retired	20,000 offsets, corresponding to 20,000 t CO ₂ offset Of which, all 20,000 were CORSIA-eligible offsets
CDR/CCS	Total carbon permanently stored/removed	1,500 tonnes CO ₂

Source	Data point reported to IATA	Value & unit
New Technologies	Hybrid aircraft: total electricity used for propulsion	13 GWh
	Hybrid aircraft: total emissions for electricity used for propulsion	6,500 tonnes CO ₂
	Hybrid aircraft: total conventional fuel use (Jet A-1)	1,095 tonnes

After receiving the above data, IATA will complement it with traffic data, and calculate the key metrics as shown below. For illustration purposes, Alpha Airlines had 1,800,000 ATK and 1,530,000 RTK.

Metric	Description	Alpha Airlines
Absolute: MtCO ₂	To track the evolution of total CO ₂ emissions, after accounting for all emissions and emissions reduction sources	297,007 tonnes CO ₂ [0.297007 MtCO ₂]
Intensity 1: gCO ₂ /RTK	To track the evolution of CO ₂ emissions, whilst accounting for changes in traffic volumes	194.122 gCO ₂ /RTK
Intensity 2: gCO ₂ /ATK	To track the evolution of CO ₂ emissions, whilst accounting for changes in available capacity	165.004 gCO ₂ /ATK

Detailed breakdown of the calculations:

Help table – calculation check	Emissions/reduction source	Amount
Absolute emissions	Conventional jet fuel: 100,000 t Jet A-1	$100,000 * 3.16 = 316,000$ t CO ₂
	SAF reductions	-7,453 t CO ₂
	Offsets: 20,000	-20,000 t CO ₂
	CCS/CDR	-1,500 t CO ₂
	Hybrid: electricity	6,500 t CO ₂
	Hybrid: 1,095 t of Jet A-1	$1,095 * 3.16 = 3,460$ t CO ₂
	TOTAL	
Intensity gCO ₂ /RTK	gCO ₂ = 297,007*1,000,000 = 297,007,000 RTK = 1,530,000	gCO ₂ /RTK = 194.122
Intensity gCO ₂ /ATK	gCO ₂ = 297,007*1,000,000 = 297,007,000 ATK = 1,800,000	gCO ₂ /ATK = 165.004