IATA Sustainable Aviation Fuel (SAF) Accounting & Reporting Methodology

RECOGNIZING that sustainable aviation fuels (SAF) are expected to deliver over 60% of the carbon abatement needed to achieve air transportation industry's target of net zero carbon emissions by 2050;[1]

RECOGNIZING that SAF needs to be deployed in an economically feasible, cost-effective, and environmentally acceptable manner;

RECOGNIZING ALSO the need to have a standard industry best practice approach to account for and report the emissions reduction associated with the use of SAF, to meet the requirement of consistent and accurate calculation results for airlines and their stakeholders;

CONSIDERING that there are various greenhouse gas (GHG) regulatory and voluntary frameworks applying slightly different methodologies for accounting for the emissions reduction associated with the use of SAF;

CONSIDERING that prevention and avoidance of double counting is imperative in instilling confidence in the emissions reduction claims associated with the use of SAF;

It is therefore RECOMMENDED that the following principles and methodology are used to account for, and report the emissions reduction associated with the use of SAF.

1. SCOPE OF IATA METHODOLOGY

1.1. Purchase-based calculation

The emissions reduction calculation recommended in this methodology is based on the airlines' purchased and consumed volume or mass of SAF of equivalent energy content, irrespective of the chain of custody (CoC) models[2] employed in tracing the fuel molecules transported along the value chain. Even in cases where SAF molecules could be traced throughout the value chain until uplift to the aircraft, it is recommended to follow a purchase-based calculation for global consistency and simplicity. This aligns with the accounting methodology recognized under the ICAO's CORSIA[3] scheme as outlined in Annex 16, Volume IV, Section 2.2.4[4], as well as the simplified approach for accounting of biofuels outlined in Article 54(3) of the EU ETS[5] Monitoring and Reporting Regulation (MRR).[6]

1.2. Purpose of IATA SAF accounting and reporting methodology

The main purpose of this best practice is to outline a consistent and recommended methodology for airlines in calculating, accounting and reporting emissions reduction associated with the use of SAF by airlines[7], with the aim to address and prevent any types of double counting, or double claiming.

[1] Outlined in the IATA Net Zero Roadmaps: www.iata.org/en/programs/environment/roadmaps/
[2] Common chain of custody models are defined in the ISO 22905:2020 document, accessible here. Typical types of CoC models include physical segregation, mass balance as well as book and claim.
[3] ICAO stands for International Civil Aviation Organization, and CORSIA stands for Carbon Offsetting & Reduction Scheme for International Aviation.
[4] Outlined in the second edition of ICAO's Annex 16, Volume IV, Section 2.2.4 of the CORSIA SARPs, accessible here.
[5] EU ETS stands for the European Union Emissions Trading Scheme.
[6] Outlined in Article 54(3) of the implementing monitoring and reporting regulation of the EU ETS scheme, accessible here.
[7] Example of emissions reduction report includes but not limited to airline annual sustainability reports typically guided by the GHGP standards.

1.2.1. Examples of application to pre-flight accounting of emissions reduction from SAF:

- Estimation of carbon dioxide (CO_2) emissions reduction from the use of SAF to be purchased by airlines.
- Estimation of the volume of SAF to be procured by airlines to meet decarbonization requirements and goals.

1.2.2. Examples of application to post-flight accounting of emissions reduction from SAF:

- Estimation of emissions from SAF.
- Estimation of emissions reduction achieved from SAF purchased and consumed or uplifted by airlines.
- Estimation of emissions reduction associated with users of aviation services, e.g., passengers, shippers, and freight forwarders.

It is important to note that this recommended practice is not meant to replace other approaches for accounting and reporting SAF emissions reduction, especially in the existing SAF-related regulatory frameworks.[8] When calculating the emissions reduction for claims under these regulatory frameworks, airlines should refer to the accounting methodologies prescribed under the respective schemes. When reporting the emissions reduction from the purchase and use of SAF across voluntary and regulatory frameworks, airlines should take preventative measures to ensure no double counting or double claiming of emissions reduction from any given batch of SAF in non-overlapping inventories.

1.3. Life cycle greenhouse gas (GHG) emissions

The emissions reduction from SAF are calculated on a life cycle basis (well-to-wake, WTW). This involves conducting life cycle assessments (LCA), which consider the emissions associated with the feedstocks, production processes, and transportation of SAF. This is then compared against the LCA value of conventional aviation fuel (CAF).

1.3.1. Note: A SAF blend must meet the same specifications[9] as CAF, and, consequently, is considered to produce an approximately equal amount of carbon emissions per kilogram of fuel when combusted. However, SAF is made from non-fossil sources, including a range of biogenic and non-biogenic feedstocks, which means it can achieve significant environmental benefits across its entire life cycle when compared to CAF.

1.4. Biogenic GHG emissions

The Greenhouse Gas Protocol (GHGP) defines biogenic emissions as CO_2 emissions from the combustion of biomass, which is based on plant or animal material. SAF contains biogenic carbon (captured through biomass growth). This differs from CAF, which contain fossil carbon that is released into the atmosphere having previously been stored for millions of years. Although the same amount of CO_2 is produced by the combustion of SAF, as with CAF, its tank-to-wake (TTW) CO_2 emission factor (EF) is defined as 0 $kgCO_2/kg$ fuel due to the non-fossil origin of its carbon content. The GHGP requires direct CO_2 emissions from the combustion of biomass (biogenic emissions) to not be included in Scope 1 but reported separately.[10] As per the GHGP standard, airlines report TTW emissions as Scope 1 for CAF, Scope 3 category 3 for well-to-tank (WTT) emissions, and biogenic SAF combustion separately (out of scope) emissions.[11][12]

[8] Including but not limited to ICAO's CORSIA scheme and the EU ETS.
[9] Detailed technical specifications for SAF and CAF can be found in the IATA SAF Handbook (May 2024), Section 2.1.1, accessible here.
[10] GHGP, A Corporate Accounting and Reporting Standard (Revised edition), 2004, Chapter 9, Reporting GHG Emissions, pp. 63, accessible here.
[11] This reporting treatment is consistent with the CORSIA and EU RED II life cycle assessment methodologies, Greenhouse Gas Protocol (GHGP) standards, and the Intergovernmental Panel on Climate Change (IPCC) recommendations for national GHG inventories.
[12] Garg, Amit, and Melissa M. Weltz, "2.3.3.4 Treatment of Biomass", in Chapter 2: Stationary Combustion, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, pp. 4, IPCC, 2019, accessible here.

1.5. Non-biogenic GHG emissions

The reporting of combustion of non-biogenic SAF, such as those produced from captured CO_2 and CO gases from technology such as Carbon Capture and Storage (CCS) is not yet addressed by the GHGP and some regulatory schemes.[13] Most commercially available SAF today, and in the near term, are likely be biogenic SAF. Non-biogenic SAF GHG emissions should be calculated using the methodology covered here. However, fully accounted for and covered when the relevant type of SAF is addressed by the voluntary or regulatory scheme that an airline is reporting into.

1.6. Scope of emissions factor

This methodology provides flexibility in the emissions factor used to calculate the emissions reduction from SAF (refer to section 2.2 and section 3.2). The use of a WTW emissions factor includes the WTT emissions and TTW emissions. The TTW emissions accounts for the CO_2 released as a direct result of the fuel combustion; while the WTT emissions accounts for the upstream emissions from the production and processing of the fuel. The WTW emissions factor is given in CO_2e, as for example during the production, storage and transportation of the fuel, there are other emissions produced, such as methane, NO_x, SO_x, etc. that should be included and are converted into an equivalent CO_2 value.

2. GENERAL PRINCIPLES

2.1. Purchase data and sustainability documentation to calculate CO_2 emissions reduction associated with the use of SAF

2.1.1. As mentioned in 1.1, the provision of this methodology considers SAF accounting irrespective of the chain of custody model employed.

2.1.2. The emissions reduction calculation is based on the SAF volume or mass purchased and consumed and compares the WTW LCA value of the SAF to CAF.[14] The information for the calculation can be found in the fuel purchase transaction records and fuel blending records obtained from a SAF supplier, as well as in the Proof of Sustainability (PoS) documents associated with a sustainability certification scheme (SCS).[15]

2.1.3. An explanation of the processes around SAF sustainability certification and the different types of SAF sustainability documentation can be found in the IATA guidance document on "Understanding SAF Sustainability Certification," which captures the must-know information and the most frequently asked questions on the topic. It can be accessed here.

2.1.4. SAF transaction and sustainability excerpts from a SAF registry, verified by an independent third party, and linked to the unique ID of the Proof of Sustainability (PoS) document, can also be used as a reference for the calculation.

2.1.5. Some GHG frameworks, such as the ICAO's CORSIA scheme, allow the use of default or actual LCA values, calculated by the SAF producers following a specific methodology prescribed by the framework. Refer to section 2.2 for further details.

2.1.6. If an actual life cycle emissions value is to be calculated, it is recommended to follow the CORSIA methodology for calculating the value.

---

[13] For example, but not limited to the ICAO CORSIA High Electricity Input (HEI) SAF methodology.

[14] Some methodology for calculating SAF emissions reduction considers the different energy intensity of SAF and CAF.

[15] Example of SCS including, but not limited to Roundtable for Sustainable Biomaterials (RSB), the International Sustainability and Carbon Certification (ISCC), and ClassNK. Note that in the future there may be more SCS for SAF and depends on the relevant regulation requirements such as, but not limited to CORSIA, EU RED, and/or any other relevant regional schemes.

2.2. Recommended standard values for calculation

2.2.1. The values given in this section are recommended values only. Airlines can choose a different standard value depending on its accounting and reporting requirements as long as they are being transparently disclosed and communicated. In case a different LCA value is used, airlines shall include an appropriate reference, irrespective of whether the value is taken from a prescribed LCA evaluation methodology, or actual value stated in the sustainability documentation provided by the fuel supplier.

2.2.2. **Default LCA value for SAF:** If actual LCA values are not provided by the fuel supplier, it is recommended to use the CORSIA default LCA values from the ICAO document entitled, "CORSIA Default Life Cycle Emissions Values for CORSIA Eligible Fuels" which is available on the ICAO's CORSIA website as an alternative to the actual life cycle emissions value.

2.2.3. **Baseline LCA value for CAF:** The ICAO's CORSIA energetic WTW emissions factors should be applied as a basis to calculate emissions reduction from the use of SAF. The values of 89 gCO_2e/MJ for Jet-A fuel, Jet-A1 fuel, Jet-B fuel, TS-1 fuel, or No. 3 Jet fuel, and 95 gCO_2e/MJ for AvGas are current at the time of writing, but in case of any disagreement, the official CORSIA values in force prevail. Individual operators may choose to also report using baseline LCA values from other models as appropriate to their jurisdiction.

2.2.4. **CAF well-to-wake (WTW) emissions factor:** A default value of 3.84 kg CO_2e/kg fuel should be used for the purpose of this methodology.[16]

2.2.5. **CAF tank-to-wake (TTW) emissions factor:** For the purpose of this methodology, the ICAO's fuel conversion factor under the CORSIA scheme[17], equal to 3.16 kg CO_2/kg fuel for Jet-A fuel, Jet-A1 fuel, TS-1 fuel, or No. 3 Jet fuel, and 3.10 kg CO_2/kg fuel for AvGas or Jet-B fuel, should be used. These values are also aligned with the values used under the EU ETS scheme[18] and the ISO 14083[19], but in case of any disagreement, the official CORSIA values in force prevail.

2.2.6. **Energy density/content of fuels:** As SAF LCA values are normally given in the form of energetic density/content (i.e., CO_2e/MJ), airlines should use the appropriate energy density/content of fuels (i.e., MJ/kg fuel), depending on the type of the feedstock, to convert the LCA values to emissions factors. The LCA values are normally found in the sustainability documentation or provided by the SAF producers/fuel suppliers. If the energetic content values cannot be obtained from the fuel supplier or the sustainability documentation, an alternative reference for energy content conversion values for each type of fuel (biomass-based) can be found here (Annex III, page 62)[20] or in the ISO 14083:2023 document.[21]

2.3. Accounting principles and avoidance of double counting

2.3.1. Airlines that are accounting for the emissions reduction from the purchase and use of SAF should follow the appropriate accounting principles to avoid any type of double counting, double claiming or

[16] This value is calculated by multiplying the CAF LCA value of 89 gCO_2eq/MJ to the energy content of CAF, 43.2 MJ/kg as defined in Table K.3 North American GHG emission factors for liquid fuels and electricity (page 90), ISO 14083:2023 Greenhouse gases – Quantification and reporting of greenhouse gas emissions arising from transport chain operations.
[17] Standard fuel conversion value for jet fuel as outlined in ICAO's Annex 16, Volume IV for CORSIA under section 3.3 accessible here.
[18] Table 1 of Annex III of Commission Implementing Regulation (EU) 2018/2066, accessible here.
[19] ISO 14083: 2023 Quantification and reporting of GHG emissions arising from transport chain operations, accessible here.
[20] EUR-Lex, "Directive (EU) 2018/ 2001 of the European parliament and of the Council of 11 December 2018 on the Promotion of the Use of Energy from Renewable Sources", Official Journal of European Union, OJ L 328, 21 December 2018, accessible here.
[21] As defined in Annex K (page 87), ISO 14083:2023 Greenhouse gases – Quantification and reporting of greenhouse gas emissions arising from transport chain operations.

double issuance. The IATA SAF accounting principles, accessible here, can be used as a reference in this accounting methodology.

2.3.2. Airlines should subtract any SAF (with its Scope 1 attributes) traded or sold to a third party from the total quantity of SAF purchased or consumed.

2.3.3. Airlines should provide a declaration (e.g., in their sustainability reports) of all GHG schemes in which they participate where the emissions reduction from the use of SAF is used or claimed. The declaration should also affirm that the emissions reduction has not been calculated, used, or claimed from the same batch of SAF purchased and consumed in multiple schemes with non-overlapping inventories. It is recommended that airlines subject this declaration to an audit by an independent third party for verification purposes.

2.3.4. To avoid double counting by multiple airlines or operators, it is recommended that airlines obtain a declaration from the fuel supplier that the SAF and the associated environmental attributes (i.e., Scope 1) belongs to the purchasing airline and have not been purchased or claimed by another party in the same emissions scope. An airline or other operator should not claim emissions reductions from a batch of SAF without a positive declaration from the fuel supplier that the environmental attributes have been assigned to the purchasing airline or other operator. For example, SAF producer, airline, and customer can each make claims against the same batch of SAF without creating a double claiming situation, but only one airline can make Scope 1 claims on the use of a given batch of SAF.

2.3.5. Careful consideration needs to be given in avoiding double counting for Scope 3 attributes from SAF. While two end users (for example, freight forwarder A and freight forwarder B), should not claim Scope 3 emissions reduction from the same batch of SAF, there are instances where two users within the same value chain (for example, freight forwarder A and shipper A) can report, under the same category, the same scope 3 emissions originated from the same scope 1 emissions without it being considered as double counting.[22]

2.3.6. If a SAF registry verified by an independent third party is used, the excerpts or reports from the SAF registry can also be referenced in the airlines sustainability report for the declarations mentioned above.

2.4. Specific accounting requirements for regulatory GHG frameworks

2.4.1. In claiming SAF emissions reduction under the specific regulatory GHG frameworks, airlines should consider and adhere to the specific accounting provisions under the scheme, for example the provision under Article 54, specific provisions of biofuels of the EU ETS MRR (similar to reference 6).

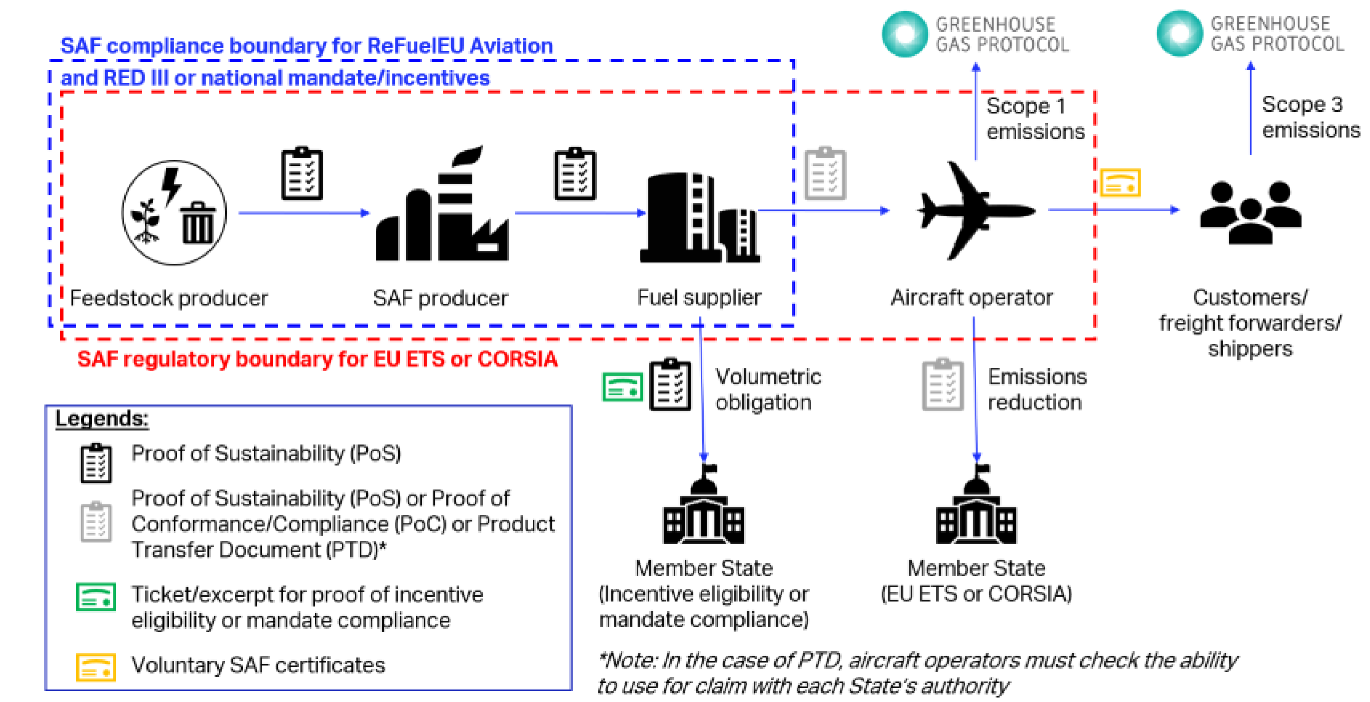
2.4.2. Some regulatory GHG frameworks may require accounting on a mass balance basis up to the point of fuel delivery and require that the quantity claimed in a reporting year does not exceed the total quantity of fuel consumed at that airport, in the same reporting year.

2.5. SAF accounting and reporting layout (simplified)

2.5.1 As a general principle, the following diagram illustrates a simplified layout of the jurisdictional authority for accounting and reporting of SAF emissions reduction across the SAF value chain:

[22] The GHGP allows Scope 3 accounting and reporting for multiple parties from the same Scope 1 sources in different Scope 3 categories. By extension, this principle can also apply to any environmental benefits associated with SAF within their value chain, ensuring it is not treated as double counting.

Chart 1: Simplified layout of SAF accounting and reporting across the aviation value chain.

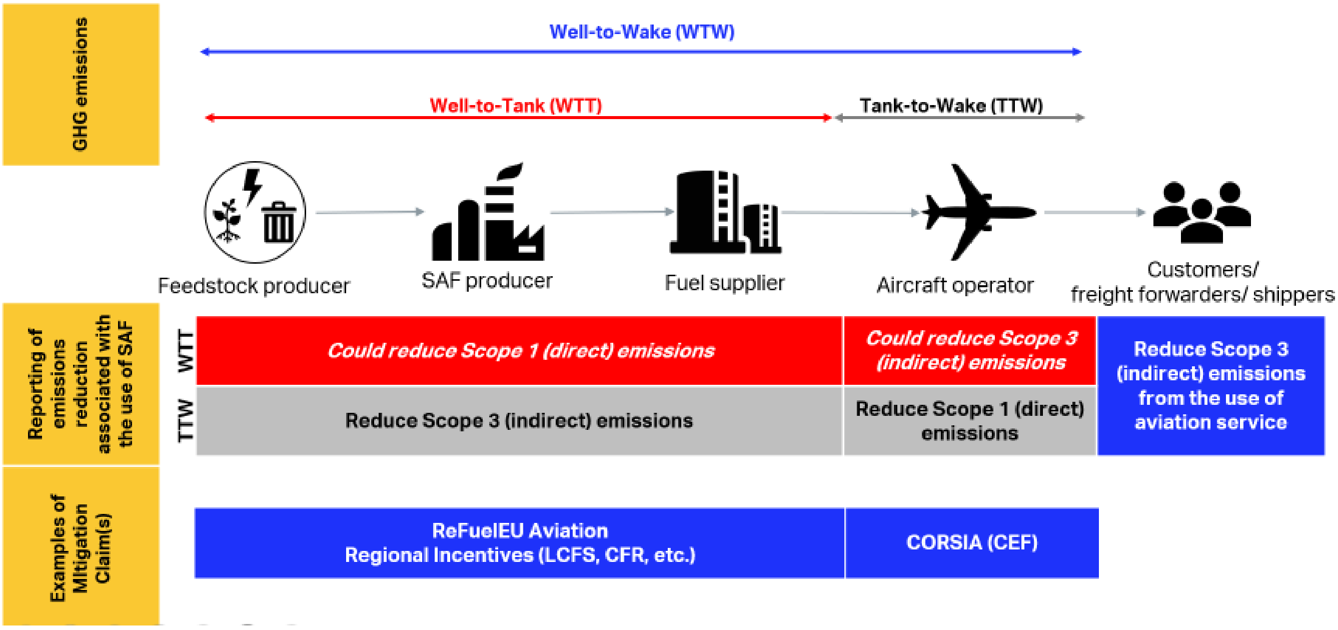


Source: IATA Sustainability & Economics

2.6. Reporting of SAF GHG emissions

2.6.1 Reporting of SAF CO_2 emissions can be done by different personas or actors across the SAF value chain, each of whom has different reporting and accounting responsibilities as defined by the GHGP or regulations relevant to their jurisdictions. To avoid any type of double counting as per the GHGP, the following emissions reporting is recommended:

Chart 2: Reporting of SAF emissions reduction across its value chain.



Source: IATA Sustainability & Economics

2.6.2 Detailed reporting scope categories by each SAF value chain persona/actor are laid out in the following table:[23]

Table 1: Detailed reporting scope categories by each SAF value chain actor.[24]

<table>
<tr><th colspan="2" rowspan="2"></th><th rowspan="2">SAF Producers/ Fuel Suppliers</th><th colspan="2">Passenger</th><th colspan="3">Freight</th></tr>
<tr><th>Airlines</th><th>Corporate Travelers</th><th>Carriers</th><th>Shippers</th><th>Freight Forwarders</th></tr>
<tr><td rowspan="2">Emissions boundary[25]</td><td>Well-to-tank (WTT)</td><td>Scope 1, 2, and/or 3*</td><td>Scope 3 Category 3</td><td rowspan="2">Scope 3 Category 6</td><td>Scope 3 Category 3 and 4</td><td>Scope 3 Category 3 and/or 4*</td><td>Scope 3 Category 3 and/or 4*</td></tr>
<tr><td>Tank-to-wake (TTW)</td><td>Scope 3 Category 11</td><td>Scope 1</td><td>Scope 1</td><td>Scope 3 Category 3 and/or 4*</td><td>Scope 3 Category 3 and/or 4*</td></tr>
<tr><td>Reporting boundary[26]</td><td>SAF Environmental Attributes</td><td>N/A</td><td>Scope 1</td><td>Scope 3 Category 6</td><td>Scope 1</td><td>Scope 3 Category 3 and/or 4*</td><td>Scope 3 Category 3 and/or 4*</td></tr>
</table>

Source: IATA Sustainability & Economics

Note: *Depending on the operational boundary[27] of the reporting organization

2.7. Generation of SAF environmental attributes

2.7.1 Emissions reduction associated with the use of SAF should not be created in a SAF registry until after proof of delivery of the blended SAF into a common fuel infrastructure or direct proof of combustion. In the value chain, once SAF is delivered into a common fuel infrastructure, it is assumed it will subsequently be uplifted and consumed in a flight. For reporting purposes, no emissions reduction should be claimed/reported before the environmental attributes are allocated to the reporting entity. Such provision ensures no environmental benefit claims arise from SAF that, for whatever reason, is unused and has not displaced a corresponding quantity of conventional jet fuel.

2.7.2 It is recommended that SAF environmental attributes are created simultaneously in a SAF registry. Unlike out-of-sector market-based mechanisms, multi-scope recognition across the value chain is possible for SAF. Scope 1 and Scope 3 attributes result from the use of SAF by an operator that displaces fossil fuel. Scope 3 end user attributes can only be assigned as a result of the use of SAF and in tandem should require an operator to be assigned the corresponding Scope 1 attribute, as described above. Both the Scope 1 and Scope 3 attributes should be linked to a specific batch of fuel in the registry.

2.7.3 No Scope 3 attributes should be claimed/reported by an end-user without the associated Scope 1 being assigned to an airline. This ensures that no orphan Scope 1 scenario can occur. Creating a dependency between the allocation of Scope 1 emissions reduction to an airline and Scope 3

[23] Definitions of different emissions scopes and its categories are as per defined by the GHG Protocol, accessible here.
[24] The list here are non-exhaustive as there may be other scenarios with other categories of Scope 3 emissions.
[25] Emissions boundary defines how a persona along the SAF value chain defines their emissions sources in the different emissions categories as defined by the GHGP.
[26] Reporting boundary summarizes how the emissions boundary is reported by a persona along the SAF value chain.
[27] An operational boundary defines the scope of direct and indirect emissions for operations within a company's established organizational boundary.

attributes provides additional assurance for the Scope 3 customer that the batch of SAF fuel is consumed by an aircraft operator, thereby preserving the environmental integrity of the Scope 3 claims.

2.7.4 In alignment with the CORSIA provisions, there should be no geographical limitations on the claiming and allocation of Scope 1 attributes relative to the uplift location of the physical SAF. The claiming of the environmental attributes from SAF by airlines can be done on a purchase basis.

2.7.5 Scope 3 attributes will need the ability to be reassigned prior to redemption[28]. Assigned but unredeemed Scope 3 attributes may only be transferred within their respective scopes and scope categories. Scope 3 attribute re-assignment may only occur downstream or among those who can make an applicable Scope 3 claim. Scope 3 air freight customers may allocate Scope 3 attributes to their downstream customers.

2.7.6 Any volume of SAF should be considered as additional[29] with exceptions for SAF consumed as part of a mandatory obligation put to airlines under a specific regulation. It is important to note that it is not common for airlines to be the obligated party to purchase and consume SAF under a blending mandate. Interpretation and implementation of each of these mandates is highly complex in terms of how fuel suppliers, airlines, and end customers are affected in the marketplace and what voluntary actions they each can take. Whether a given transaction should be considered additional and eligible for the creation of Scope 3 attributes should be determined on a case-by-case basis by those involved in the transaction, with guidance consideration from the GHGP and applicable government policies.

2.7.7 Voluntary SAF purchases that benefit from economic incentive programs are eligible for the generation of Scope 1 and Scope 3 attributes, depending on the decision of the purchaser of the SAF environmental attributes.

2.7.8 SAF purchases claimed and redeemed as an airline's emissions reduction under CORSIA and EU ETS are voluntary and additional as well as eligible for generation of Scope 3 attributes. Such claims shall be made transparent to the purchaser.

3. METHODOLOGY

3.1. Step 1: Collect SAF data and its associated LCA values

3.1.1. Upon retrieval of SAF transaction records and its appropriate sustainability documentations, airlines should extract the following data for the calculation:

- Mass in kg or tonnes, or volume in liters, m^3, or US gallons of neat SAF purchased
- Default or actual LCA value for a specific batch of SAF purchased, in gCO_2e/MJ

3.1.2. If the mass or volume of the neat SAF is not clearly stated in the sustainability documentation, the value should be derived from the following data:

- Mass in kg or tonnes, or volume in liters, m^3, or US gallons of the SAF blend
- SAF blending ratio, expressed as a percentage of SAF in the blend compared to CAF

[28] Redemption refers to the retirement of environmental attributes in a SAF registry whereby upon retirement, the allocation can no longer be changed. In the absence of a SAF registry, redemption could refer to the claiming of the SAF attributes.
[29] Additionality is typically defined as accounting principles that can drive emissions reduction more significantly than what is required by regulations or what is considered as business-as-usual activities. Additionality can be perceived differently with different level of stringencies. IATA methodology does not prejudge additionality decisions by parties claiming the emissions reduction from SAF, but rather emphasize in transparency on what has been claimed.

3.1.3. Note: If the fuel is procured based on volume units, the airline should convert the volume to mass by using a conversion value to be agreed between the airline and its fuel supplier, reflecting the product's actual density. An example of a conversion can be found in Article 5.2 of IATA's Aviation Fuel Supply Model Agreement (AFSMA), accessible here.

3.2. Step 2: Determination of the emissions factor to use (TTW vs WTW)

3.2.1. Depending on the purpose of the accounting and reporting, determine whether to apply TTW or WTW emissions factor: [30]

Table 2: Recommended Emissions Factor Options.[31]

Option	Value	Unit
Option 1: TTW Emissions Factor	3.16	kg CO_2/kg fuel kg or tonnes CO_2/tonnes fuel
Option 2: WTW Emissions Factor	3.84	kg CO_2e/kg fuel kg or tonnes CO_{2e}/tonnes fuel

3.3. Step 3: Accounting of emissions reduction from SAF purchased or consumed

3.3.1. Airlines should calculate the absolute emissions reduction from SAF purchased by using the emissions factor chosen in section 3.2:

Table 3: Formula for calculating absolute WTW emissions from SAF purchased or consumed.

Data	Unit	Formula
Absolute emissions reduction from SAF purchased or consumed	tonnes of CO_2 or CO_2e	$ER_y = EF \times \left[\sum m_{SAF,y} \times \left(1 - \frac{LCA_{SAF}}{LCA_{CAF}}\right)\right]$

Whereby:

ER_y = emissions reduction from a specific batch of SAF in a given year, y

EF = emissions factor of choice, as defined in section 3.2

$m_{SAF,y}$ = total mass of a neat SAF (in tonnes) purchased in a given year, y

LCA_{SAF} = LCA value of neat SAF, can be actual or default value as defined in 2.2.1

LCA_{CAF} = LCA value of CAF, i.e., 89 gCO_2e/MJ for Jet-A1 fuel (as defined in 2.2.2)

Note: Special attention to appropriate unit conversions needs to be paid during calculations to ensure accurate results.

3.4. Step 4: Data aggregation

3.4.1. Depending on the reporting requirements of each airline, the data calculated can be aggregated in the following manner:

- The total network-wide emissions reduction based on an appropriate reporting period timeline (normally on an annual basis).

3.5. Step 5: Reporting of GHG emissions from SAF purchased or consumed

3.5.1. Based on the data calculated in the previous section, airlines should include the following indicators in their report:

[30] Consistency in the use of CO_2 and CO_2e in calculations must be maintained depending on the use of the standard values and its emissions scopes.
[31] Refer to section 2.2 for standard values recommended to be used in calculation.

Table 4: Data to be reported for GHG emissions from SAF.

Emissions sources	Data to be reported	Unit
Conventional Aviation Fuel (CAF)	▪ TTW Scope 1 Emissions	kg or tonnes of CO_2
	▪ Optional: WTT Scope 3 category 3 emissions	kg or tonnes of CO_2e
Sustainable Aviation Fuel (SAF)	▪ SAF (biogenic) emissions[32]	kg or tonnes of CO_2
	▪ Absolute emissions reduction from SAF purchased or consumed	kg or tonnes of CO_2 or CO_2e

4. CALCULATION EXAMPLE

Assume Airline A uses 10,000 tonnes of SAF in a year, purchased from a single batch of SAF with the following information:

Table 5: Data example for SAF accounting and reporting.

Data	Value	Unit	Source
Type of SAF purchased or delivered	HEFA (used cooking oil)	N/A	PoS
Amount of SAF purchased or delivered	10,000	Tonnes of SAF	PoS
SAF Energy density by mass	44	MJ/kg	PoS
The energy content of SAF	440,000,000	MJ	PoS
Actual LCA value of SAF	16.7	gCO_2e/MJ	PoS
CAF LCA value	89	gCO_2e/MJ	ICAO CORSIA and/or PoS
CAF Energy density by mass	43	MJ/kg	ICAO CORSIA
% GHG life cycle emissions reduction compared to fossil (CAF) baseline*	81.2	%	Calculated but also available in the PoS

Note: * % GHG life cycle emissions reduction = $\frac{(89 - 16.7)\ gCO_2e/MJ}{89\ gCO_2e/MJ}$ x 100% = 81.2%

Calculation Results:

$$ER_y = EF \times \left[\sum m_{SAF,y} \times \left(1 - \frac{LCA_{SAF}}{LCA_{CAF}}\right)\right]$$

Option 1 (using TTW Emissions Factor):

ER TTW CO_2 = $3.16 \times \left[10{,}000 \times \left(1 - \frac{16.7}{89}\right)\right]$ = **25,670.56 tonnes CO_2**

Or

Option 2 (using WTW Emissions Factor):

ER WTW CO_2e = $3.84 \times \left[10{,}000 \times \left(1 - \frac{16.7}{89}\right)\right]$ = **31,194.61 tonnes CO_2e**

Note: When calculating the emissions reduction for a specific GHG regulatory framework, airlines should follow calculation guidance specifically prescribed by the respective framework (e.g., ICAO's CORSIA, EU ETS, UK ETS, etc.).

[32] SAF WTW emissions only reflects emissions from fuel production and logistics since SAF TTW EF is 0 kg CO_2/kg fuel due to the non-fossil origin of its carbon content. The GHGP importantly defines that direct emission from biomass shall not be reported in scope 1 but reported separately.

Example of Airline A Reporting Disclosure

Note: The scenarios below are illustrative and conceptual, and do not represent recommendations of the actual data reporting.

(1) Business as usual scenario (if SAF is not used):

Assume Airline A annual fuel consumption (CAF) in year *X* = 10,000 tonnes

Table 6: Emissions data disclosure by Airline A in year X under scenario (1).

Data	Value	Unit
Year *X* Scope 1 emissions ***(TTW, fossil fuel emissions)***	10,000 x 3.16 = 31,600	Tonnes of CO_2

(2) 40% SAF use scenario:

Assume Airline A uses 40% of SAF in Year *X, not 100%:*

Table 7: Emissions data disclosure by Airline A in year X under scenario (2).

Data	Value	Unit
Year *X* Scope 1 emissions ***(TTW, fossil fuel emissions)***	6,000 x 3.16 = 18,960	Tonnes of CO_2
Year *X* SAF emissions ***(TTW, biogenic emissions) – reported as a separate scope***	4,000 x 3.16 = 12,640	Tonnes of CO_2
Emissions mitigated from SAF **Option 1: TTW EF** **Or** **Option 2: WTW EF**	$3.16 \times \left[4,000 \times \left(1-\frac{16.7}{89}\right)\right]$ = 10,268.22 **Or** $3.84 \times \left[4,000 \times \left(1-\frac{16.7}{89}\right)\right]$) = 12,477.84	Tonnes of CO_2 **Or** Tonnes of CO_2e

(3) 100% SAF use scenario:

Assume Airline A uses 100% of SAF in Year *X:*

Table 8: Emissions data disclosure by Airline A in year X under scenario (3).

Data	Value	Unit
Year *X* Scope 1 emissions ***(TTW, fossil fuel emissions)***	0	Tonnes of CO_2
Year *X* SAF emissions ***(TTW, biogenic emissions) - reported as a separate scope***	10,000 × 3.16 = 31,600	Tonnes of CO_2
Emissions mitigated from SAF **Option 1: TTW EF** **Or** **Option 2: WTW EF**	$3.16 \times \left[10,000 \times \left(1-\frac{16.7}{89}\right)\right]$ = 25,670.56 **Or** $3.84 \times \left[10,000 \times \left(1-\frac{16.7}{89}\right)\right]$ = 31,194.61	Tonnes of CO_2 **Or** Tonnes of CO_2e

Note: Airline A's Scope 1 emissions are 0 tonnes because it used 100% SAF in year *X*. The biogenic emissions from SAF are reported in a different category.

5. SAF ACCOUNTING IN PER-PASSENGER AND PER-SHIPMENT EMISSIONS CALCULATIONS

5.1. Scope of Applicability

This section of the broader SAF Accounting and Reporting Methodology aims to provide recommendations and best practices for applying emissions reduction from SAF to individual passengers and shipments. As such, it complements the IATA RP 1726 and RP 1678 that provide guidance on the methodology of calculating passenger- and shipment-specific CO_2 impacts at the flight level. In case of any discrepancy on SAF-related items, this methodology supersedes any information already contained in RP 1726 (section 2.5) and/or RP 1678 (section 2.3).

This guidance primarily concerns emissions reduction displayed and applied to aircraft operators' customers, i.e., incorporating SAF emissions reduction into baseline conventional aviation fuel (CAF) emissions estimates, prior to any (further) customer action. Any mechanisms that aircraft operators may implement to share the green premium between different stakeholders and within the air transport value chain, such as the sales of Scope 3 environmental attributes to businesses (corporates, shippers, freight forwarders, etc.) and/or individual customers, remain at each aircraft operator's discretion.

References to "per-passenger" and "per-shipment" processes are used interchangeably and, unless explicitly noted otherwise, should apply to both scenarios. Similarly, references to CO_2 emissions also apply to CO_2e emissions in the context of the WTW accounting approach.

5.2. Purpose of calculation

This guidance is aimed at accounting for emissions reduction associated with the use of SAF on a per-passenger and per-shipment level for both pre-flight estimates and year-end reporting. Specifically, the pre-flight estimates support the display of SAF emissions reduction in booking engines and other customer booking offerings at the time of ticket purchase, whereas the year-end reporting may support environmental reporting to/by other stakeholders reflecting actually realized activity.

5.3. General principle

5.3.1. For the purpose of accounting for SAF in per-passenger and/or per-shipment emissions estimates, aircraft operators should allocate, report, and benefit from the SAF emissions reduction only when they maintain ownership of both scope 1 and the associated Scope 3 emissions reductions for the pertinent SAF. Specifically, operators should calculate per-passenger and/or per-shipment emissions using the Scope 1 emissions reductions associated with SAF reported in their carbon inventories only when the Scope 3 emissions reduction related to these Scope 1 emissions are owned by the aircraft operator. When the Scope 3 emissions associated with SAF have been passed on to the operator's customers, the SAF should be reported as CAF for the purposes of this guidance.

5.3.2. It is recommended that SAF emissions reduction be audited/verified by an independent third party to maintain the credibility and transparency of the aircraft operator's claim. The verification should encompass the emissions within the scope defined by this methodology as well as the adherence to the allocation principles outlined in section 5.4 and the calculation guidance in section 5.6.

5.4. Allocation of emissions reductions

5.4.1. It is recommended that aircraft operators apply SAF emissions reduction equally across their entire network, as a percentage (%) reduction of the CAF emissions estimates, based on the ratio of the quantity of SAF eligible for reductions, per 5.3.1, and the total jet fuel consumption by the operator in the previous accounting period (assumed to be 100% CAF).

5.4.2. As an alternative to the recommendation in section 5.4.1, aircraft operators may allocate emissions reduction disproportionately across their network, including but not limited to allocations to (individual or groups of) routes based on the quantity of SAF emissions reduction, per 5.3.1, and the total jet fuel consumption by the operator in the previous accounting period (assumed to be 100% CAF), if the calculations are transparent, independently audited/verified, and clearly communicated to customers.

5.4.3. Aircraft operators may also follow different allocation principles if required to comply with regulatory requirements.

5.4.4. In the context of this methodology, accounting period refers to the historical performance that is utilized as the basis of the SAF emissions reduction calculations. It is recommended that aircraft operators use the previous calendar year as the pertinent accounting period once the relevant data is available. Aircraft operators may alternatively opt for a different 12-month period, e.g., a "January year y-1" to "December year y-1" period, followed by a "July year y-1" to "June year y", to reflect the changes in SAF use more accurately. In such instances, the third-party audit/verification recommended in section 5.3.2 should be adapted accordingly, so that each update of SAF data undergoes verification prior to use.

5.4.5. Considering the risks of added administrative burden, audit/verification requirements and costs, and potential difficulty in conveying SAF reduction data across numerous sales channels, aircraft operators may wish to refrain from updating SAF reduction data more than twice per year.

5.4.6. In the interest of transparency, aircraft operators are recommended to follow consistent accounting periods and refrain from regularly alternating between different allocations. SAF eligible for allocation at a certain moment in time should only be allocated once, even if it is included in two different accounting periods. For example, SAF used in "October year y-1", allocated to route AAA-BBB in accounting period "January year y-1" to "December year y-1", should remain allocated to route AAA-BBB in "July year y-1" to "June year y" period, and not be reallocated to other routes (e.g., BBB-AAA, BBB-CCC, CCC-DDD).

5.4.7. Aircraft operators are recommended to maximize consistency in emissions data displayed across different sales/booking channels (e.g., own website, OTAs, etc.). Aircraft operators' choice of allocation approach and accounting period should not negatively impact the consistency of emissions data display.

5.5. Special considerations

5.5.1. **Per-passenger versus per-shipment allocations:** This guidance supports both per-passenger and per-shipment CO_2 calculations resulting from the use of SAF compared to the CAF CO_2 baseline. CO_2 emissions of a flight, as well as reductions associated with SAF, are allocated proportionally based on mass between passengers and cargo. For the purpose of this calculation, the allocation to shipments should initially be based on a hypothetical shipment with a mass of 100 kg, consistent with the standard mass used for passengers and their luggage. The CO_2 emissions should subsequently scale proportionally with the mass of the actual shipment being subject to the CO_2 reductions.

5.5.2. **SAF subject to mandates and/or used in regulatory schemes:** Aircraft operators should not assume SAF delivery solely based on the existence of a supply mandate. Aircraft operators should have received the SAF environmental attributes to be able to support their claims with proper sustainability documentation. Aircraft operators should refrain from accounting for SAF in cases where the necessary sustainability documentation is not available.

Therefore, the general principle of an aircraft operator owning both Scope 1 and Scope 3 attributes to be eligible for per-passenger or per-shipment emissions reductions also applies to SAF provided under a mandate or SAF used by an aircraft operator to voluntarily reduce emissions obligations, prior to any mandatory action in a regulatory scheme (e.g., CORSIA, ETS).

5.5.3. **Forward-looking estimates:** Offtake agreements should not form the basis for estimating future SAF emissions reductions at this time, as there is still uncertainty about the delivery timing and exact environmental attributes of such SAFs. It is recommended to use verified SAF data from the previous accounting period (as described in section 5.4) for estimating SAF emissions reduction of future flights.

5.5.4. **Opt-in emissions reduction programs/products:** The per-passenger/shipment emissions reduction associated with SAF use as described in this methodology are not intended to replace any opt-in emissions reduction/compensation programs or products, which remain entirely at each aircraft operator's discretion. This methodology should instead be used to form a baseline prior to any opt-in action, i.e., the emissions for a passenger or a shipment if no further customer action is taken.

5.6. Calculation of SAF emissions reductions

5.6.1. The emissions reduction associated with the use of SAF should be calculated with a comparable and consistent accounting approach as the per-passenger/shipment emissions. For example, in the case of calculating per-passenger CAF emissions as "tank-to-wake (TTW) CO_2", SAF emissions reductions should utilize the "TTW CO2" guidance, section 5.6.4, without conflicting with the LCA approach and provisions as set out in section 1.3.

5.6.2. As per RP 1726 and RP 1678, it is recommended to follow TTW CO_2 accounting approach for per-passenger/shipment emissions calculations. In line with 5.6.1, the recommended accounting approach for SAF emissions reductions is also TTW CO_2.

5.6.3. Aircraft operators may wish to use a different accounting approach for per-passenger/shipment SAF emissions reduction, e.g., "well-to-wake (WTW) CO_2e" with corresponding guidance in section 5.6.5, if required to ensure consistency in emissions factors accounting scope described in section 5.6.1 and/or to align with any customer or regulatory requirements.

5.6.4. TTW CO_2 SAF reduction calculation:

$$TTW\ CO_2\ emissions\ reduction = 3.16\frac{kg\ CO_2}{kg\ fuel} * (neat\ SAF\ mass) * (1 - \frac{LCA_{SAF}}{LCA_{CAF}})$$, where:

LCA_{SAF} refers to the total SAF LCA value (actual or default), and LCA_{CAF} refers to the standard LCA value for CAF. It is recommended to use ICAO CORSIA LCA value for CAF (currently 89 gCO_2e/MJ), although airlines may use a different value if needed to achieve consistency with regulatory requirements. The definitions equally apply to the calculation in section 5.6.6.

The calculation above should be applied to all eligible SAF batches individually and subsequently totalled to determine the total emissions reductions from eligible SAF.

5.6.5. WTW CO_2e SAF reduction calculation:

$$WTW\ CO_2e\ emissions\ reduction = 3.84\frac{kg\ CO_2e}{kg\ fuel} * (neat\ SAF\ mass) * \left(1 - \frac{LCA_{SAF}}{LCA_{CAF}}\right)$$

The calculation above should be applied to all eligible SAF batches individually and subsequently totalled to determine the total emissions reductions from eligible SAF.

5.6.6. Aircraft operators may use formulas and/or emissions factors different from those described in sections 5.6.4 and 5.6.5 to calculate SAF emissions reduction, if needed to achieve consistency with regulatory requirements.

5.6.7. Per-passenger/shipment emissions that incorporate SAF emissions reductions should be calculated in the following steps:

i. Calculate total emissions reduction associated with the use of eligible SAF, using the appropriate emissions guidance (5.6.4 for TTW CO_2; 5.6.5 for WTW CO_2e). This number forms the total emissions reduction from SAF achieved.

ii. The aircraft operator allocates the SAF emissions reduction:

a. In the case of using the network-wide allocation (section 5.4.1), the total SAF emissions reduction should be compared to the aircraft operator's total CAF emissions, i.e., assuming a 100% CAF supply. The ratio of these two numbers is the SAF reduction ratio (%), which should then be applied to all CAF baseline per-flight emissions estimates across the entire network, as shown in the formula below. The unit (CO_2 vs. CO_2e) of the adjusted emissions should match those of the CAF emissions, depending on the accounting approach (TTW vs. WTW, respectively).

$$SAF\ reduction\ ratio = \frac{total\ SAF\ emissions\ reduction}{total\ CAF\ emissions}$$

$$adjusted\ emissions\ per\ flight = CAF\ emissions\ per\ flight * (1 - SAF\ reduction\ ratio).$$

b. In the case of using route-specific allocation, the total emissions reduction from SAF calculated in step (i) are available for assignment to different routes. Once the aircraft operator assigns a certain amount of reduction to a route, the reduction should be compared to the total CAF emissions on the route, assuming a 100% CAF supply. The ratio of these two numbers is the [route-specific] SAF reduction ratio (%), which should then be applied to all CAF baseline per-flight emissions estimates on this route as per the formula above. The process should be repeated for each route until all SAF emissions reduction have been assigned to the selected routes.

c. The process to allocate emissions to individual passengers and/or shipments remains unchanged and aligned with RP1726 (section 3) and RP1678 (section 3). In case of use of air cargo emission intensity factors as per section 3.2 of RP1678, the (CAF) emission factors (network- or leg-based) should be multiplied by $(1 - SAF\ reduction\ ratio)$. The resulting adjusted emission factors are subsequently used to calculate shipment-level emissions.

$$adjusted\ emission\ factor = CAF\ emission\ factor * (1 - SAF\ reduction\ ratio)$$

d. In the instance of any other allocation, aircraft operators should follow the examples and calculation principles presented in this guidance.

5.6.8. Note: The "adjusted emissions per flight" estimates calculated in (ii) should not be used as a baseline for calculating the following accounting period's SAF reduction calculations. Instead, CAF emissions should always serve as the baseline for determining SAF emissions reductions.

5.7. Display of SAF-inclusive emissions data to customers

5.7.1. Aircraft operators are recommended to communicate the inclusion of SAF emissions reduction transparently to customers, referencing the methodology options followed where flexibility is provided, as well as unambiguously identifying any deviations from this guidance. Aircraft operators may also wish to comment on the overall effect of the deviations, e.g., "By using a WTW emissions factor of 3.8359 instead of 3.84 recommended in section 5.6.5., the calculated SAF emissions reduction differ by approx. 0.1%."

5.7.2. If aircraft operators provide emissions intensity information in their reporting disclosures, it is recommended to clearly identify the inclusion of SAF in the reported data. To enhance transparency, operators may wish to provide both the overall system intensity that considers all SAF used (inclusive of SAF where the operator has allocated/sold Scope 3 attributes to specific customers) and the intensity applicable to a general customer, that incorporates SAF reductions per this Methodology (i.e., where the operator owns both Scope 1 and Scope 3 attributes). An illustrative example for Airline XB is included below for reference.

Table 9: Illustrative example of SAF inclusion in Airlines' emissions data disclosure.

Description	Value	Unit
System-wide emissions intensity	790 gCO_2/RTK (TTW)	This intensity figure considers all SAF for which Airline XB claimed Scope 1 emissions reduction in this reporting period, including SAF for which Airline XB passed on the ownership of Scope 3 emissions attributes to a specific customer/party. It should not be used for reporting purposes by Airline XB's customers.
General-use customer emissions intensity	800 gCO_2/RTK (TTW)	This intensity figure considers only SAF for which Airline XB claimed Scope 1 emissions reduction in this reporting period and maintained ownership of Scope 3 emissions attributes, in accordance with the IATA SAF Accounting & Reporting Methodology guidance on the inclusion of SAF emissions reduction in per-passenger/shipment emissions calculations. The approach enables the use of this figure for reporting by Airline XB's customers, as it mitigates the risk of double claiming.

5.8. Calculation examples

Example: Airline XB's annual jet fuel consumption is 150,000 tonnes. Calculating the SAF emissions reduction per passenger/shipment of a hypothetical flight XB111 with the following information using a CAF TTW CO_2 factor of 3.16 and WTW CO_2e factor of 3.84. The allocation of emissions from a flight to passengers/cargo follows the process described in RP1726 section 3.6.

Table 10: Reference data examples for Airline XB, Scenarios 1 and 2.

Data	Value	Unit
Type of SAF purchased	HEFA (used cooking oil)	N/A
Amount of SAF purchased	10,000	tonnes
Actual lifecycle emissions value of SAF	16.7	gCO_2e/MJ
SAF TTW Emissions Reductions	$3.16 \times 10{,}000 \times (1 - \frac{16.7}{89}) = 25{,}670.56$	tonnes CO_2
SAF WTW Emissions Reductions	$3.84 \times 10{,}000 \times (1 - \frac{16.7}{89}) = 31{,}194.61$	tonnes CO_2e

Table 11: Data example for Scenario 1.

Flight	Average fuel burn (tonnes)	Aircraft body type	Passengers (J, W, Y)	Cargo (kg)
XB111	25	widebody	200 (21, 35, 144)	1,000

- **Option A:** Average total CO_2 Emissions of Flight XB111 (TTW): 25 × 3.16 = 79 tonnes CO_2
- **Option B:** Average total CO_2e Emissions of Flight XB111 (WTW): 25 × 3.84 = 96 tonnes CO_2e

Total annual jet fuel consumed by the entire XB network: 150,000 tonnes

- **Option A:** Total CAF Emissions (TTW): 150,000 × 3.16 = 474,000 tonnes CO_2
- **Option B:** Total CAF Emissions (WTW):150,000 × 3.84 = 576,000 tonnes CO_2e

<u>Scenario 1: XB follows network-wide allocation scope of SAF emissions reduction (ref. section 5.4.1):</u>

A. TTW approach:

$$\text{SAF reduction ratio} = \frac{25{,}670.56}{474{,}000} = 5.4157\%$$

Adjusted CO_2 per XB111 flight = 79 × (1 – 5.4157%) = 74.72 tonnes CO_2

$$\text{Adjusted } CO_2 \text{ per economy pax} = \frac{74.72 \times 1{,}000 \times \left[\frac{200 \times 100}{(200 \times 100) + 1{,}000}\right]}{(21 \times 4) + (35 \times 1.5) + 144} = 253.70 \text{ kg } CO_2$$

$$\text{Baseline } CO_2 \text{ per economy pax} = \frac{79 \times 1000 \times \left[\frac{200 \times 100}{(200 \times 100) + 1{,}000}\right]}{(21 \times 4) + (35 \times 1.5) + 144} = 268.23 \text{ kg } CO_2$$

$$\text{Adjusted } CO_2 \text{ per 100 kg shipment} = 100 \times \frac{74.72 \times 1{,}000 \times \left[\frac{1{,}000}{(200 \times 100) + 1{,}000}\right]}{1{,}000} = 355.82 \text{ kg } CO_2$$

B. WTW approach:

SAF reduction ratio = $\frac{31{,}194.61}{576{,}000}$ = 5.4157 %

Adjusted CO_2e per XB111 flight = 96.00 × (1 – 5.4157%) = 90.80 tonnes CO_2e

Adjusted CO_2e per economy pax = $\frac{90.80 \times 1{,}000 \times \left[\frac{200 \times 100}{(200 \times 100) + 1{,}000}\right]}{(21 \times 4) + (35 \times 1.5) + 144}$ = 308.30 kg CO_2e

Baseline CO_2e per economy pax = $\frac{96.00 \times 1{,}000 \times \left[\frac{200 \times 100}{(200 \times 100) + 1{,}000}\right]}{(21 \times 4) + (35 \times 1.5) + 144}$ = 325.95 kg CO_2e

Adjusted CO_2e per 100 kg shipment = 100 × $\frac{90.80 \times 1{,}000 \times \left[\frac{1{,}000}{(200 \times 100) + 1{,}000}\right]}{1{,}000}$ = 432.39 kg CO_2e

Scenario 2: XB follows route-specific allocation scope of SAF emissions reduction (ref. section 5.4.2):

Calculate the CO_2 per passenger for flights XB 222, XB 333, and XB 444, considering that the aircraft operator allocates a specific amount of SAF emissions reduction with TTW approach per route as follows:

Table 12: Data example for Scenario 2

Flight	Route	Annual jet fuel consumption (tonnes)	SAF TTW reduction allocation (tonnes CO_2)	Aircraft body type	Ave. flight fuel burn (tonnes)	Passengers (J, W, Y)	Cargo (kg)
XB 222	AAA-BBB	6,000	10,000	narrowbody	17	130 (10, 0, 120)	0
XB 333	CCC-DDD	8,000	7,000	narrowbody	22	140 (0, 0, 140)	200
XB 444	YYY-ZZZ	136,000	8,670.56	widebody	25	200 (21, 35, 144)	1,000

Calculating the SAF reduction ratios on each route:

- SAF reduction ratio on AAA – BBB = $\frac{10{,}000}{6{,}000 \times 3.16}$ = 52.7426%
- SAF reduction ratio on CCC – DDD = $\frac{7{,}000}{8{,}000 \times 3.16}$ = 27.6899%
- SAF reduction ratio on YYY – ZZZ = $\frac{8{,}670.56}{136{,}000 \times 3.16}$ = 2.0175%

Calculating the adjusted CO_2 per passenger/ per 100kg shipment for each flight per route:

Flight XB 222

Adjusted CO_2 per XB 222 flight = 17 × 3.16 × (1 - 52.7426%) = 25.39 tonnes CO_2

Adjusted CO_2 per economy pax on XB 222 = $\frac{25.39 \times 1{,}000}{(10 \times 1.5) + 120}$ = 188.05 kg CO_2

Baseline CO_2 per economy pax on XB 222 = $\frac{17 \times 3.16 \times 1{,}000}{(10 \times 1.5) + 120}$ = 397.93 kg CO_2

Flight XB 333

Adjusted CO_2 per XB 333 flight = 22 × 3.16 × (1 - 27.6899%) = 50.27 tonnes CO_2

$$\text{Adjusted } CO_2 \text{ per economy pax on XB 333} = \frac{50.27 \times 1{,}000 \times \left[\frac{140 \times 100}{(140 \times 100) + 200}\right]}{140} = 354.01 \text{ kg } CO_2$$

$$\text{Baseline } CO_2 \text{ per economy pax on XB 333} = \frac{22 \times 3.16 \times 1{,}000 \times \left[\frac{140 \times 100}{(140 \times 100) + 200}\right]}{140} = 489.58 \text{ kg } CO_2$$

$$\text{Adjusted } CO_2 \text{ per 100kg shipment on XB 333} = 100 \times \frac{50.27 \times 1{,}000 \times \left[\frac{200}{(140 \times 100) + 200}\right]}{200} = 354.01 \text{ kg } CO_2$$

$$\text{Baseline } CO_2 \text{ per 100 kg shipment on XB 333} = 100 \times \frac{69.52 \times 1{,}000 \times \left[\frac{200}{(140 \times 100) + 200}\right]}{200} = 489.58 \text{kg } CO_2$$

Flight XB 444

Adjusted CO_2 per XB 444 flight = 25 × 3.16 × (1 - 2.0175%) = 77.41 tonnes CO_2

$$\text{Adjusted } CO_2 \text{ per economy pax on XB 444} = \frac{77.41 \times 1{,}000 \times \left[\frac{200 \times 100}{(200 \times 100) + 1{,}000}\right]}{(21 \times 4) + (35 \times 1.5) + 144} = 262.82 \text{ kg } CO_2$$

$$\text{Baseline } CO_2 \text{ per economy pax} = \frac{25 \times 3.16 \times 1{,}000 \times \left[\frac{200 \times 100}{(200 \times 100) + 1{,}000}\right]}{(21 \times 4) + (35 \times 1.5) + 144} = 268.23 \text{ kg } CO_2$$

$$\text{Adjusted } CO_2 \text{ per 100kg shipment on XB 444} = 100 \times \frac{77.41 \times 1{,}000 \times \left[\frac{1{,}000}{(200 \times 100) + 1{,}000}\right]}{1{,}000} = 368.60 \text{ kg } CO_2$$

$$\text{Baseline } CO_2 \text{ per 100 kg shipment on XB 444} = 100 \times \frac{79 \times 1{,}000 \times \left[\frac{1{,}000}{(200 \times 100) + 1{,}000}\right]}{1{,}000} = 376.19 \text{ kg } CO_2$$

The calculation logic for WTW CO_2e follows the example above with appropriate adjustments to the emissions and the emissions reductions, as described in prior sections of this guidance.