



## Lower Carbon Aviation Fuel (LCAF)

### Maximizing aviation's decarbonization potential

#### Introduction

To meet aviation's objective of net zero carbon emissions by 2050, multiple levers must be used in conjunction,<sup>1</sup> including new technologies, enhanced operations, and cleaner fuels. Among the latter, sustainable aviation fuels (SAF) and other cleaner aviation fuels are expected to provide the largest emission reductions, but their production and deployment still lack effective policy support, which has delayed scale-up.

Within the International Civil Aviation Organization (ICAO), a comprehensive set of frameworks guide the contribution of aviation fuels to global decarbonization, encompassing SAF and lower carbon aviation fuel (LCAF). The recognition of LCAF was reflected under the ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)<sup>2</sup>, the Declaration of the Third ICAO Conference on Aviation and Alternative Fuels (CAAF/3 Declaration)<sup>3</sup>, and the ICAO Long Term Aspirational Goal (LTAG). As defined by ICAO, LCAF is a fossil-based aviation fuel that meets the CORSIA Sustainability Criteria.<sup>4</sup> While SAF forms the long-term foundation and holds the highest potential for emissions reductions in ICAO's cleaner energy vision, LCAF is also recognized as a CORSIA Eligible Fuel (CEF), alongside SAF, and as part of the transitional landscape that can support early greenhouse gas (GHG) emissions reductions, particularly in regions where SAF supply remains limited in the short term and requires more time to scale.

This paper aims to illustrate the potential of LCAF as a transitional solution to decarbonize aviation, outlining the challenges associated with its production and use, and the actions that the aviation industry stakeholders can take to address them. Given the slower near-term scaling of key decarbonization solutions, such as SAF, the majority of jet fuel demand is expected to be met by fossil-based sources. In that context, LCAF can play a key role in maximizing the emissions reductions from the inevitable production of fossil jet fuel while renewable solutions continue to expand.

## Understanding emissions reductions from LCAF

In accordance with the CORSIA Sustainability Criteria set by ICAO, the production of LCAF must meet a minimum 10% life cycle GHG reduction from the fossil jet fuel baseline of 89 gCO<sub>2</sub>eq/MJ, in addition to adhering to all other sustainability criteria related to socio-economic and physical environment elements.<sup>2,4</sup> The emission reductions to produce LCAF are achieved by applying various measures and techniques within the well-to-tank (WTT) portion of the fossil jet fuel production lifecycle, covering emissions from crude extraction through fuel production and transport to the airport (Chart 1).

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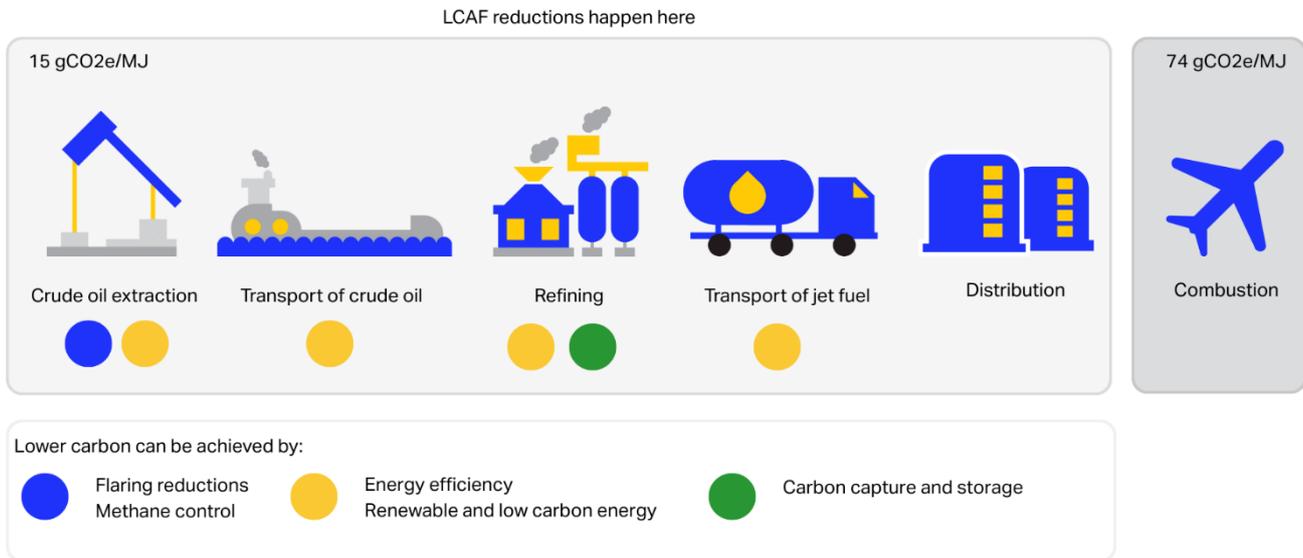
<sup>1</sup> <https://www.iata.org/en/programs/sustainability/flynetzero/roadmaps/>

<sup>2</sup> ICAO SARPs – Annex 16 – Environmental Protection – Volume IV

<sup>3</sup> [https://www.icao.int/sites/default/files/sp-files/environmental-protection/GFAAF/Documents/ICAO-Global-Framework-on-Aviation-Cleaner-Energies\\_24Nov2023.pdf](https://www.icao.int/sites/default/files/sp-files/environmental-protection/GFAAF/Documents/ICAO-Global-Framework-on-Aviation-Cleaner-Energies_24Nov2023.pdf)

<sup>4</sup> <https://www.icao.int/sites/default/files/environmental-protection/CORSIA/Documents/CORSIA%20Eligible%20Fuels/ICAO-document-05-Sustainability-Criteria-June-2025.pdf>

Chart 1: Examples of measures applied during fossil jet fuel production to produce LCAF



\*For illustration purposes only

Source: IATA Sustainability and Economics, ICAO

There are also certain conditions within the “CORSIA Methodology for Calculating Actual Life Cycle Emissions Values” to be taken into account during the life-cycle emissions calculation when determining LCAF eligibility. The notable elements are:<sup>5</sup>

- Life-cycle emissions from the crude oil mix used are based on the 3-year average prior to the year when LCAF measures start to be implemented.
- LCAF measures (excluding measures to control or reduce methane venting, flaring, and fugitive emissions (VFF) and newly developed crudes) must be applied from at least 2018 (as the first year when LCAF measures are applied).
- VFF emissions reductions for the calculation of LCAF crediting are not allowed to exceed the industry average of 4.9 gCO<sub>2</sub>eq/MJ.
- Life-cycle emission values for newly developed crudes are determined based on Global Average values provided in the “CORSIA Methodology for Calculating Actual Life Cycle Emissions Values”.

## LCAF potential and landscape

In the ICAO LTAG, the projected global production of LCAF is expected to be approximately 14 Mt in 2030 for the F2 medium scenario<sup>6</sup>. This brings about 6 Mt of total CO<sub>2</sub>e reductions across well-to-wake (WtW), which is comparable to using 2.8 Mt of SAF with an emissions reduction factor of 50%. The F2 medium scenario in the

<sup>5</sup> <https://www.icao.int/sites/default/files/environmental-protection/CORSIA/Documents/CORSIA%20Eligible%20Fuels/ICAO-document-07-Methodology-for-Actual-Life-Cycle-Emissions-November-2025.pdf>

<sup>6</sup> Assumes moderate air traffic growth, increased policy enablers and fuel availability

LTAG predicts an international demand for jet fuel of 215 Mt<sup>7</sup>, and SAF production capacities for 2030 are expected to be about 20 Mt, but the actual production is likely to be lower.<sup>8</sup> This indicates that only a small share of total jet fuel demand is expected to be replaced by SAF at this point. Therefore, LCAF presents an option to maximize the potential of short-term emissions reductions as SAF continues to scale and replace a greater share of conventional fossil-based jet fuel. The total emissions reductions achieved by LCAF can also be higher if more policy and technology implementation and support are in place to enable LCAF production in the near term.

Some economic operators<sup>9</sup> producing fossil jet fuel could have favorable conditions to produce LCAF or already have the capabilities to do so. In certain countries within the Middle East, such as the Kingdom of Saudi Arabia (KSA) and Qatar, the average WtW CIs are below the global average of 88.7 gCO<sub>2</sub>eq/MJ (approximately 81~82 gCO<sub>2</sub>eq/MJ in 2017). This can be influenced by, but not limited to, advanced adoption of methane abatement and flaring reduction measures, the types of crude utilized, new and efficient refinery infrastructures, and policy roadmaps that support the production and implementation of LCAF in the region. By implementing additional LCAF measures, these regions may be able to meet the minimum reduction in life-cycle emissions required by CORSIA. Some other countries with lower WtW CIs for fossil jet fuel than the global average include Norway, Angola, Azerbaijan, and Japan, which may also have high potential to produce LCAF.<sup>10</sup>

To illustrate how high-potential regions could contribute to the production of LCAF, the share of the Middle East region in the global production of fossil jet fuel in 2030 is expected to be 11%, or 38 Mt. This further emphasizes the high near-term potential to reduce total CO<sub>2</sub> emissions from LCAF, if it can replace even a fraction of the total production in the region. Similarly, other high-potential regions with a large share of projected fossil jet fuel production in 2030, such as Asia Pacific (42%) and North America (25%), can also benefit from adopting LCAF.<sup>11</sup>

## Challenges: production, market adoption, and traceability

**Production and technical considerations:** while there are several high-potential regions where LCAF can be produced, it is important to note that production may not be feasible for all fossil jet volumes in these regions, and other regions will face significant challenges in producing LCAF due to a mix of technical and economic factors. Well-established crude oil supply chains, high costs of modifying refineries, and aging oil and gas infrastructure constrain the achievable level of GHG reductions. Currently, limited policy support and incentives also contribute to a lack of LCAF production. It is essential to recognize that the feasibility and challenges of LCAF production vary across jet fuel supply chains. IATA has been in continuous dialogue with various economic operators to better understand these unique technical and economic challenges.

**Market entry and adoption:** One of the major barriers to market entry is the absence of approved sustainability certification schemes (SCS) for LCAF. As of January 2026, there is no approved SCS under ICAO's CORSIA scheme that certifies LCAF as CEF. All approved SCS currently certify only SAF as CEF. The supply chain and sustainability verification requirements for LCAF differ from those for SAF, as LCAF is produced within the conventional fossil fuel supply chain. As a result, developing an appropriate certification framework may require additional time. Nevertheless, it is essential to be transparent about the technical, economic, and political challenges associated with developing and implementing LCAF certification. This enables the SCS, economic operators, and other industry stakeholders to collaborate to identify and implement suitable solutions. Delays

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<sup>7</sup> Report on the Feasibility of a Long-Term Aspirational Goal Appendix M5 APPENDIX M5 LTAG-TG FUELS SUB-GROUP REPORT. (n.d.). Available at: [https://www.icao.int/sites/default/files/sp-files/environmental-protection/LTAG/Documents/ICAO\\_LTAG\\_Report\\_AppendixM5.pdf](https://www.icao.int/sites/default/files/sp-files/environmental-protection/LTAG/Documents/ICAO_LTAG_Report_AppendixM5.pdf) [Accessed 9 Jan. 2026].

<sup>8</sup> <https://www.iata.org/en/iata-repository/pressroom/presentations/progressing-towards-net-zero-carbon-emissions-by-2050/>

<sup>9</sup> Entities that are part of the supply chain for CEF

<sup>10</sup> Jing, L. et al. (2022). Understanding variability in petroleum jet fuel life cycle greenhouse gas emissions to inform aviation decarbonization. *Nature Communications*, 13(1). DOI: <https://doi.org/10.1038/s41467-022-35392-1>.

<sup>11</sup> S&P Global Energy CERA

and uncertainty in the implementation of LCAF certification pose challenges to economic operators being able to verify emissions reductions and related sustainability criteria toward LCAF production. This creates a bottleneck to global adoption, reduces confidence among producers considering investment, and prolongs uncertainty about the future market role for LCAF. IATA has been in regular discussions with the relevant SCS, fuel producers and suppliers, ICAO, and other relevant stakeholders to better understand and address the technical, economic, and political challenges of implementing LCAF certification.

**Tracking and claiming emissions reductions from LCAF:** As LCAF is still made from fossil-based feedstock and is physically indistinguishable from fossil-based jet fuel that does not meet the CORSIA Sustainability Criteria, it becomes even more important to accurately verify its environmental attributes to support credible emissions reduction claims. First, a certification framework is necessary to set the rules and standards for tracing these environmental attributes back to the economic operators. Once certification is in place, registries<sup>12</sup> will facilitate airlines and corporate customers in making claims under regulatory frameworks and voluntary schemes, ensuring that every LCAF-related claim is properly recorded, verified, and safeguarded against double-counting. This will create a trusted environment for all stakeholders and reinforce confidence in the integrity of reported reductions and potentially enable book-and-claim mechanisms that allow aircraft operators to account for the environmental attributes of LCAF separately from physical fuel consumption, likewise for SAF.

## Key recommendations for scaling up LCAF

Scaling up the production of LCAF involves resolving both technical and economic challenges, while ensuring that supportive policies are in place in the regions where the potential for production is highest. When LCAF volumes are already available, it is crucial to accelerate certification so LCAF can be brought to the market, thus permitting aviation to track and monitor emissions reductions from the use of LCAF. To accelerate aviation's energy transition through the use of LCAF, the following is urgently needed:

- **Support the development of LCAF certification** to ensure a robust and transparent sustainability certification that is aligned with current industry protocols for clean fuels.
- **Identify and promote LCAF production potential** in geographic areas where LCAF can be produced, to support the development of policies and incentives in these regions.
- **Leverage the global and robust SAF accounting framework, including book and claim**, to widen market access and bridge gaps between demand and supply of LCAF by enabling robust tracking and accounting of its environmental attributes across the supply chain, using existing platforms such as the CADO Registry.

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<sup>12</sup> The [CADO Registry](#) introduces unique capabilities for purchasing SAF, LCAF, and other clean energy solutions for claim purposes, regardless of production location, in line with CORSIA provisions for claiming the use of CEF.