IEA-Advanced Motor Fuels

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Task 66

Technology Collaboration Programme
by iea

Task 66: Recent Progress in SAF Research

Project Duration	October 2024 – September 2027
Participants **Task sharing** **Observer**	 Austria, Brazil, China, Denmark, Germany, Spain, Switzerland USA
Total Budget	EUR 290,000 (USD 334,854)
Task Manager	Doris Matschegg BEST – Bioenergy and Sustainable Technologies GmbH Doris.matschegg@best-research.eu
Website	https://iea-amf.org/content/projects/map_projects/66

Purpose, Objectives and Key Question

Sustainable aviation fuels (SAF) are being promoted as an important way to reduce greenhouse gas (GHG) emissions from the aviation sector, which is responsible for about 2% of global GHG emissions, 14.4% of EU transport emissions, and 11% of US transport emissions. However, there is a gap between supply and demand of SAF as such fuels currently represent less than 1% of global aviation fuel consumption (about 2.4 billion liters in 2025). The International Energy Agency's (IEA's) 2023 update to the Net Zero by 2050 Roadmap shows the need for a significant ramp-up of biofuels, hydrogen, and hydrogen-based fuels in the aviation sector to almost 15% of energy consumed in 2030 and 80% in 2050. In October 2022, member states of the International Civil Aviation Organization (ICAO) agreed to a long-term aspirational goal (LTAG) of net-zero carbon dioxide (CO_2) emissions from aviation by 2050, with a simultaneous increase in traffic volume of about 3% per year. To achieve this ambitious target and to fill the gap between supply and demand, further research on SAF production, as well as on end-use aspects of SAF utilization, needs to be conducted. Task 66 organizes information exchange on recent research on sustainable aviation fuels between researchers and other stakeholders in the field of aviation.

The purpose of the SAF follow-up Task is to facilitate information exchange between the participating countries and beyond on recent SAF research through a series of online workshops. Topics for the online workshops are jointly defined during scoping meeting(s) and reflect the R&D interests and ongoing projects of the participants. Conducting these workshops also serves to enlarge the existing AMF network of SAF stakeholders by including additional stakeholders. This is important to ensure that the voices of stakeholders (industry, academia, policy makers, working groups, and initiatives) are heard, thereby increasing the relevance of the workshop topics within this Task for stakeholders.

Three key areas of interest have been identified: SAF production, SAF utilization, and policy recommendations. A number of key workshop topics within these areas of interest have already been identified in Task 63 and during the preparation of the Task description. Prioritization, sequence, and details of the workshops are further elaborated upon during scoping meetings during the Task implementation. For each topic, at least one partner takes the lead for the workshop supported by the Task Manager.

Activities

The activities of the SAF follow-up Task include a series of in-depth discussions in the form of thematic workshops about recent research work on sustainable aviation fuels to realize the potential of SAF and their emission reduction contribution to the net-zero target. Stakeholders in the field of aviation (industry, academia, policy makers, international organizations, finance sector), which have been identified during Task 63 (as well as additional stakeholders), are invited to participate in this information exchange.

In total, 10 online workshops will be organized. The workshops are listed on the Task 66 website, which serves as a central point of knowledge. Before each workshop, participants are provided with an information sheet, including a brief overview of the respective topic. During the workshop, selected speakers present their research on SAF, which is subsequently discussed with the participants. The findings and primary outcomes of the discussions are documented in summary sheets. At the end of the project, some Task members will develop national recommendations. The final Task report will be compiled from elements of the information and summary sheets and will highlight the most relevant findings. In addition, a key messages document will be prepared.

The following topics have been addressed in the online workshops so far:
- April 2025: Enabling the use of drop-in unblended SAF and SAF blends up to 100% (organized by Austria)
- May 2025: Identification of production process parameters and desirable end-use properties relevant to mixture preparation, combustion, stability, and emission formation through experiments and simulations (e.g., takeoff, cruise) (organized by Austria)
- December 2025: Monitoring of SAF research and development (R&D), demonstration projects, and production deployment (organized by Germany)

The following topics will be addressed next:
- April 2026: Status and developments of engine technology in aircraft using SAF (organized by Denmark)
- June 2026: Recommendations of new policy measures to further promote SAF production and utilization (organized by Brazil)

Further topics that might be addressed include the following:
- Evaluate the current and potential future costs of SAF via different production pathways
- Analyze the potential role of SAF in decarbonizing aviation in International Energy Agency (IEA) scenarios
- Integrate SAF into fuel distribution infrastructure
- Examine SAF deployment mechanisms in the marketplace
- Examine SAF evaluation, testing, qualification, and specification to support the development of new ASTM standards
- Evaluate impact of SAF utilization on non-CO_2 effects (e.g., contrails, spray formation)
- Complete synthesis of SAF promotion policies in different world regions
- Investigate novel jet fuels that offer performance or producibility advantages

Key Findings

The following key findings have been derived from workshop contents and discussions to date:
- The term **SAF** can be misleading, but it **generally refers to synthetic blending components (SBCs)**. These SBCs cannot be used alone as aviation fuel but must be blended with Jet A/A-1.
- The current requirements of ASTM D7566, based on fossil jet fuel specifications, mandate a **minimum aromatic content**. Synthetically produced aviation fuels are **typically aromatic-free**, and aromatics must be added to meet the existing specifications. Aromatics are necessary, for example, to ensure the swelling of seals, but they also contribute to **non-CO_2 effects**. From an environmental perspective, a lower aromatic content would be desirable. A key consideration is whether the specification should allow a reduced aromatic content (which would require adjustments to aircraft design) or whether the fuel should be adapted to meet the existing specification.
- Initial flight measurement campaigns using **100% SAF** were successful and demonstrated that **aromatic-free SAF** significantly reduces **non-CO_2 effects**, such as soot, particulate matter, and ice crystal formation.
- The market is **not yet ready for 100% SAF**, and airlines are unwilling to pay a premium for fully compatible fuel, which poses challenges for the economic viability of SAF production.
- Many SAF production projects that have been announced for technologies other than hydroprocessed esters and fatty acids (HEFA) have **low volumes** and are in **early technological stages**.
- **Scaling up production** is necessary to meet SAF demand and EU quotas beyond 2030.
- **Certification** is crucial for accessing new markets and must be considered early in the development phase.
- **Harmonized standards** are required to expand the global market.

Main Conclusions

The main conclusions for Task 66 concern the following identified research gaps and research, technology, and innovation (RTI) recommendations:

- A better understanding of the **functional requirements for aviation turbine fuels** and the interactions between different fuel properties is needed to help identify opportunities to **lower standardization requirements** for the use of **100% SAF** in new aircraft designs. For example, aromatics affect various properties, such as the **cetane number**. These interactions must be fully understood to define minimum standardization requirements and enable the use of **fully paraffinic (aromatic-free) SAF**.
- **Modifications in aircraft design** are required to enable the use of **100% SAF** under adapted standardization requirements.
- Assessment of the **environmental and climate benefits** of using **100% SAF** is necessary, particularly the contribution of **non-CO_2 effects** to the climate impact of aviation (e.g., different particle types responsible for ice crystal formation).
- **Development and scaling up** of new SAF production pathways and diversification of sustainable feedstocks are required to enable **100% non-drop-in SAF**.
- Research is needed to determine the effects of **multi-blending** different synthetic blend components (SBCs) and the resulting fuel properties.
- To facilitate the **ASTM approval process**, a better understanding of the performance of new SAFs in engines and all associated processes is required, which necessitates significant further research.
- From an **end-use perspective**, researchers must demonstrate that SAF can be safely used in aircraft with diesel engines. When purchasing certified SAF, fuel specifications may vary due to different blending ratios. This is particularly critical regarding the **cetane number range**.
- To advance technologies to **higher technology readiness levels (TRLs)**, further improvements in production technologies and feedstock flexibility are necessary.
- For **e-SAF (SAF based on electrolysis)**, reliable **CO_2 sources** must be identified, because **direct air capture (DAC)** of CO_2 is not yet sufficiently deployed.

Publications

The information and summary sheets for each workshop, as well as slides and recordings, are available on the Task Event Website.