Sustainable Aviation Fuels in Italy: opportunities and research challenges faced by ENEA

Claudia Bassano, Nadia Cerone, Paolo Deiana, Giuseppina Vanga, Rosanna Viscardi
ENEA, Italian National Agency for New Technologies, Energy and Sustainable Economic Development, 00123 Rome, Italy
claudia.bassano@enea.it

According to the IEA, aviation contributed 2.5% of global energy-related CO_2 emissions in 2023, as travel rebounded post-Covid, emissions reached nearly 950 Mt CO_2, over 90% of pre-pandemic levels. The aviation sector aims to achieve net-zero carbon emissions by 2050 through enhanced efficiency, energy transition, and innovation. Among the measures to reduce its carbon footprint and dependence on fossil fuels, the aviation sector can adopt the use of Sustainable Aviation Fuel (SAF). SAF is an environmentally friendly, alternative jet fuel that does not rely on fossil sources. Its definition and terminology can vary depending on the regulatory framework, the type of raw materials used, the production methods involved and the pathway specification. SAF is fully compatible with existing jet engines and fuelling infrastructure, requiring zero additional investment. According to the ReFuelEU, the main key aspects include a minimum share of SAF at EU airports, which will gradually increase from 2% in 2025 to 70% in 2050. Currently, Italy's SAF production capacity is 0.4 Mt/y whit an announced capacity of 0.9 Mt/y. To achieve the EU's 2030 targets, the European market will require around 2.8 Mt/y of SAF and 0.6 Mt/y of synthetic aviation fuel. Accelerating SAF production will depend heavily on advancing research and innovation for the development and commercialization of advanced and diversified technologies, while simultaneously building sustainable feedstock supply chains and fostering the adoption of novel feedstocks. Expanding the feedstock base and the portfolio of conversion technologies requires continuous investment in R&D, supported by a regulatory environment that simplifies and harmonizes policies, thus reducing complexity and providing certainty for investors. ENEA's research focuses on innovative SAF production processes, with technical, economic, environmental and social assessments and evaluations. This work includes simulations, prototype design, and bench and field testing under selected operating condition. These activities range from catalyst development and reactor design to novel plant configurations. Key efforts include demonstrating one-step catalytic synthesis of e-kerosene from hydrogen and CO_2 and developing methods to evaluate crude e-fuels to ensuring compliance with standards.