Perspective
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Advances in Sustainable Biofuels for Aviation, as well as Resource Management for the Future

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Perspective

Prior to COVID-19, aviation contributed approximately 2-3% of global CO_2 emissions. Despite the fact that the pandemic caused a significant decline in air travel, demand is expected to return to pre-pandemic levels and continue to climb. This disruption provides an opportunity to decarbonize the sector, which will be required in order to fulfil net-zero CO_2 emissions commitments. Making the transition to net-zero flying the centrepiece of the sector's long-term recovery strategy would develop economic resilience and competitiveness, as well as the overall industry's environmental sustainability. This necessitates a comprehensive effort to decarbonizing all aspects of the aviation sector's value chains. Much progress toward net-zero aviation may be made by producing sustainable future aviation fuels. A possible solution consists of a combination of alternative drop-in fuels, such as biofuels and e-fuels, aided by the introduction of more efficient aircraft onto the market. Planes powered by batteries or hydrogen are two more radical approaches.

This Research Topic discusses recent developments in the production of sustainable biofuels for aviation, as well as related value chains. It is commonly acknowledged that biofuels will play a key role, particularly for mid- to long-distance flights, because they can be used as drop-in fuels for existing aircraft, allowing existing fleets and ground infrastructure to be used without incurring large sunk expenditures. Bio-aviation fuel, often known as bio-jet fuel, is a mixture of synthetic paraffinic kerosene (SPK) created from biomass and jet fuel derived from petroleum. SPK can be produced using a variety of methods, including hydro treatment of fats and oils, Fischer-Tropsch, direct sugars to hydrocarbons, pyrolysis, alcohol-to-jet, and aqueous phase reforming. As a result, there is a diverse spectrum of potential bio-feed stocks (1G, 2G, and 3G), offering flexibility.

However, biofuel supply chains are complex, making it difficult to ensure a sustainable supply. Biofuels for land transport have sparked debate due to concerns about deforestation, biodiversity loss, competition with food production, and direct and indirect emissions from land use change. Additional biofuel demand from aircraft could compound these negative effects. To make bio-aviation fuel commercially competitive and address sustainability difficulties, next-generation bio-feed stocks, innovative SPK production methods, and the design of sustainable biofuel value chains will be required. Civil aviation provides flight services via networked operations provided by multiple companies. Many different organisations and corporations collaborate in this interesting industry to ensure the safe and efficient transportation of passengers and freight around the world. The aviation business includes a diverse spectrum of entities, from aviation-specific organisations such as airlines, airports, ground handlers, and manufacturers to numerous types of suppliers with varying degrees of maturity (start-ups to established enterprises). They work in a complicated and convoluted system that collects and processes massive quantities of data in order to provide safe, time- and cost-efficient, dependable, and customer-friendly services.

We are looking for original research pieces, reviews, and perspectives on the following topics

• Next-generation biofuels for aircraft, including but not limited to used oils and fats, energy crops, cellulosic biomass, agricultural and forestry leftovers, culinary and municipal waste, and algae.

• Bio-feedstock sustainability, including life-cycle assessment, triple-bottom-line analysis, valuing ecosystem services, implications on biodiversity and the environment, food vs. fuel, and social impacts.

• Pathways for producing synthetic paraffinic kerosene from biomass, including but not limited to: hydro treatment of fats and oils, Fischer-Tropsch, direct sugars to hydrocarbons, pyrolysis, alcohol-to-jet, and aqueous phase reforming.

• Design of long-term supply and/or value chains: techno-economic analysis, modelling, and optimization

• New infrastructure needs, as well as integration with energy networks

• Market, regulatory, and legal structures

• Comparison with various alternative aviation fuels, such as electrically propelled planes, aviation hydrogen, and e-fuels

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