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A review of the Fischer-Tropsch and methanol pathways for the production of jet fuel

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Abstract

Around 300 Mio. tons of kerosene are consumed for aviation each year. By 2050, the demand is expected to reach 450 Mio. tons. While the use of renewable-based fuels is still being discussed in other sectors, the decision has already been made in the hard-to-abate sectors such as aviation. By 2050, the global demand for kerosene is expected to come from sustainable and regenerative sources. On the one hand, in the *Fischer-Tropsch* pathway, the production of jet fuel from water and air is powered by renewable electricity, where the H_2 and CO_2 reactants are first heated and converted into *syngas*, followed by Fischer-Tropsch synthesis to produce multifunctional hydrocarbons that can be further processed into chemicals, oils and gas, subsequent product separation takes place in the distillation column. On the other hand, the *MeOH-to-jet* pathway involves the conversion of methanol to light olefins followed by oligomerization of the light olefins with hydrogenation. The process yields products in both the distillate and gasoline ranges and can be adjusted to shift the yield to the desired fraction range.

The focus is on presenting a comprehensive knowledge base on the pathways and in particular on the evaluation under the criteria of process design, material and energy efficiency. Last but not least, a potential assessment on the technology pathways in terms of technology bottlenecks, advantages and disadvantages and technology readiness level.