Progress in the production of low-Carbon-Intensity (CI) Biojet/Sustainable Aviation Fuels (SAF) from biogenic feedstocks

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Biojet/ Sustainable Aviation Fuels (SAF) will play a major role if the aviation sector is to significantly reduce its carbon footprint. To meet its carbon reduction targets large volumes of biojet fuel will be required (likely more than 100 billion litres per year). However, to date, commercialization has been slow and current policies preferentially incentivize the production of other fuels, such as bio/renewable diesel, from the limited available volumes of oleochemical/lipid feedstocks. Although alternative lower-carbon intensive propulsion systems based on electric, hybridelectric and hydrogen might be used in the future (for shorter flights), in the short-to-mid-term, biojet fuels will predominate. Biojet volumes have increased from<10 million litres in 2018, to more than 1 billion litres by 2023 (and potentially ~8 billion litres by 2030). However, the vast majority of this volume is derived from oleochemicals/lipids. The upgrading of fats, oils and greases (FOGs) to HEFA-SPK (hydrotreated esters and fatty acids synthesized paraffinic kerosene) is fully commercialized and biojet production is relatively simple. It is anticipated that increased volumes of biojet will be derived via this “conventional” pathway based on expansion of current facilities and the building of new facilities. However, as demonstrated by Neste, these facilities will be primarily used for renewable diesel production with biojet production “added on” after additional infrastructure investment, modified processing and incentivizing policies. Other technologies which could be producing commercial volumes of biojet fuel by 2025 will use biogenic feedstocks and include Fischer-Tropsch synthesized paraffinic kerosene (FT-SPK) (based on gasification), alcohol-tojet synthesized paraffinic kerosene (ATJ-SPK) and catalytic hydrothermolysis jet (CHJ). However, all of these processes produce multiple fuel products which typically include a biojet fuel fraction. Therefore, even though “stand-alone” biorefineries could produce more of the biojet fraction, this will be influenced by market demand, economics and policy drivers as currently, in many cases, the biojet-range molecules are diverted to the renewable diesel fraction due to policy drivers. For each of the technologies, although the percentage of the jet fraction within the total liquid fuels varies, processing conditions can be modified to increase the amount of the biojet fraction. Thus, if refiners were encouraged to produce biojet, in addition to renewable diesel, at least 15% of the current low-carbon, drop-in fuels produced could be biojet. As will be mentioned several times, although there are several ways to make biojet fuels form biogenic feedstocks, the vast majority of the biojet fuel used by 2030 will produced using lipid feedstocks. It is anticipated that this pathway will predominate for at least the next ten-to-fifteen years