Factsheet: Biokerosene and synthetic kerosene

Goal: Provide substantiation for the extra costs of biokerosene and synthetic kerosene, compared to kerosene from fossil origin that we use in the article on aviation on energy.nl, supported by numbers from authoritative sources.

BIOKEROSENE

Production routes:

1. The current production routes are almost exclusively based on oils and fats (whether or not from waste); this is a relatively simple technology; is already available on a significant commercial scale (from Neste Oil amongst others). However, the availability of raw materials is restricted and is additionally capped by provisions in the RED-II (see for example: https://www.emissieautoriteit.nl/onderwerpen/nieuwsbrief-energie-voor-vervoer/oktober-2018-ev-na-2020)
2. Another possible route is coupling gasification of (wood) biomass to the Fischer-Tropsch process. This route is still facing challenges and is not yet available at a commercial scale[1]. The raw materials, woody biomass, are widely available and often qualify for the dedicated target of List A of Annex IX of the RED II[2].
3. There are also additional routes to produce biokerosene that appear less cost effective for the time being. See for example Sierk de Jong (2018).

Costs: The price of biokerosene (and other biofuels) to a great extent is set by the costs of raw materials, as well as production costs (Uslu et al, 2017). Biokerosene is about twice as expensive as fossil kerosene[3] (Uslu et al. 2017; De Jong, 2018; TNO, 2020; Uslu et al., 2020).

SYNTHETIC KEROSENE (P-2-KEROSENE)

Production route:

Synthetic kerosene is made from (green) hydrogen (H_2) and carbon dioxide (CO_2). The hydrogen is created by electrolysis that uses renewable electricity (wind, solar). The required CO_2 can: (1) come from air capture, or (2) be captured in factories or power plants (both of which have processes that release CO_2, see for example Quintel en Kalavasta, 2018). To avoid a net release of CO_2 to the atmosphere, the source of must either be the air (from (1) or short-cycled (i.e. from biomass). If the point-source is fossil, then there is a net release of CO_2. Accounting rules shall determine which party shall be responsible for the CO_2 emissions. If all emissions are assigned to the first emitter (the factory or power plant), then the synthetic fuel shall be labeled “emissions-free”. The commercial roll-out of the production of synthetic kerosene is still in an early stage, but the first pilot plants are being built (see for example Schut, 2019).

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1 TNO (2020) says: “The production of biodiesel (chemically closely related to kerosene) in the Netherlands is currently essentially limited to conventional fuels made from (residual) oils, tallow, and fats. Advanced diesels produced via pyrolysis or Fischer-Tropsch are not available and are not expected to be so before 2030, except for some niche markets.

2 The use of woody biomass is a touchy societal topic, for which there are competing viewpoints (including on a scientific level), see for example http://www.nvde.nl/wp-content/uploads/2019/11/NVDE-Biomassa-10-puntenblad-en-Position-Paperv2.pdf
https://www.nrc.nl/nieuws/2019/11/29/bomen-stoken-in-centrales-waanzin-a3982185
https://www.nrc.nl/nieuws/2019/11/29/bomen-stoken-in-centrales-waanzin-a3982185

3 TNO (2020) says: “The costs of HVO (drop-in biodiesel) are about €22-€27 per GJ, about twice as diesel made from crude oil. Drop-in biodiesel is chemically closely related to drop-in biokerosene.

Costs: The cost estimates for synthetic kerosene strongly depend on the underlying assumptions for the costs of renewable electricity, CO_2 capture, scale and yearly operating times of the installations. The additional costs compared to fossil kerosene also depend, as for biokerosene, on the price of crude oil. Some authoritative sources say that the price of synthetic kerosene will be about 2-6 times the price of fossil kerosene in 2030, but that it could strongly drop further in the future (Detz et al., 2018; Quintel en Kalavasta, 2018).

References

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