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# PROCESS EVALUATION FOR ELECTROLYZED SUSTAINABLE AVIATION FUEL (ESAF)

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**Abstract** – Electrolyzed sustainable aviation fuel (eSAF) produced from captured carbon dioxide and renewable hydrogen is a promising pathway to decarbonize aviation, yet it remains electricity intensive and cost sensitive. This study develops a plant-wide Aspen Plus® process model integrating: (i) CO<sub>2</sub> capture and conditioning, (ii) alkaline water electrolysis for green H<sub>2</sub> generation, and (iii) reverse water gas shift and Fischer Tropsch synthesis (RWGS-FTS) followed by product separation into eSAF and other hydrocarbon products, such as naphtha and renewable diesel. To improve system efficiency, FT tail gas is conditioned via water knock-out and hydrogen recovery prior to conversion in a proton exchange membrane fuel cell (PEMFC) to offset purchased electricity. A base-case eSAF capacity and ±30 % scale scenarios are evaluated to establish consistent mass, energy and carbon balances and to perform techno-economic analysis (TEA). The TEA framework estimates the minimum fuel selling price (MFSP) and quantifies dominant cost drivers of electricity, electrolyzer performance, and CO<sub>2</sub> capture energy, complemented by sensitivity analysis to identify the most influential parameters governing eSAF competitiveness.

**Keywords** – CO<sub>2</sub> utilization; fuel cell; sustainable aviation fuel; techno-economic analysis; water electrolysis

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