Technical Brief 1: SAF Production Process

Overview

CarbonCore's sustainable aviation fuel (SAF) production system is centered around a thermochemical biomass-to-liquids (BtL) pathway, optimized for carbon efficiency, modular deployment, and regulatory compliance. The process transforms biomass and forest-derived residuals into high-purity syngas, which is then synthesized into liquid hydrocarbons using Fischer-Tropsch (FT) technology. This technical brief outlines each stage of the process, from feedstock handling to fuel upgrading.

1. Feedstock Handling and Preparation

CarbonCore sources sustainably derived biomass, including forest waste, sawmill residuals, and selected agricultural byproducts. Feedstock is dried, size-reduced, and conditioned for optimal flow into the gasification system. Internal systems monitor feedstock consistency, energy density, and moisture content to ensure steady performance.

2. Gasification

The feedstock is converted to syngas via oxygen-blown fixed-bed or entrained-flow gasifiers, depending on local supply chain and site requirements. This process produces a high-temperature, low-tar synthesis gas composed primarily of H_2, CO, and CO_2. Gasifier tuning is optimized to minimize tar formation and enable downstream integration.

3. Syngas Cleanup and Conditioning

The raw syngas stream is scrubbed of particulates, sulfur compounds, tars, and trace contaminants using multi-stage cleanup systems. Acid gas removal, filtration, and catalytic reforming ensure that the gas meets the stringent purity requirements for Fischer-Tropsch synthesis. Conditioning also includes adjusting H_2:CO ratios for FT reactor performance.

4. Fischer-Tropsch Synthesis (CANS FT)

CarbonCore uses the CANS Fischer-Tropsch technology originally developed by Johnson Matthey and now owned by Honeywell UOP. This fixed-bed reactor system converts conditioned syngas into long-chain hydrocarbons under high pressure and moderate temperature conditions. The resulting FT waxes are suitable for clean fuel upgrading, with a carbon intensity significantly lower than Jet-A.

CarbonCore has developed proprietary process enhancements within the syngas conditioning and FT synthesis stages. These include internal catalyst tuning protocols and adaptive process control algorithms designed to improve selectivity, reduce energy consumption, and extend

catalyst life. While proprietary in nature, these refinements offer clear efficiency and carbon performance advantages over conventional deployments.

5. Product Upgrading and Separation

The FT wax is hydroprocessed and fractionated to produce jet-range hydrocarbons that meet ASTM D7566 and D1655 specifications for SAF blending. The upgrading stage includes isomerization and distillation, ensuring high energy density and compliance with industry standards. Naphtha and diesel-range co-products are also separated and can be sold or recycled into the process.

6. Environmental Performance

CarbonCore's SAF platform is engineered for low lifecycle carbon intensity. Integrated CO_2 capture, renewable electricity supply, and circular co-product management contribute to significant reductions in GHG emissions relative to fossil-based jet fuel. The system is designed to comply with CORSIA, LCFS, and RFS2 frameworks.

CarbonCore's SAF platform also integrates AI-based operational controls to continuously monitor syngas composition, reactor performance, and system loads. These systems enable predictive adjustments, improve stability, and contribute to reduced lifecycle emissions.