CABBI
CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION

Cost and Carbon Intensity Implications of Coprocessing Sustainable Aviation Fuel at Petroleum Refineries

Background/Objective

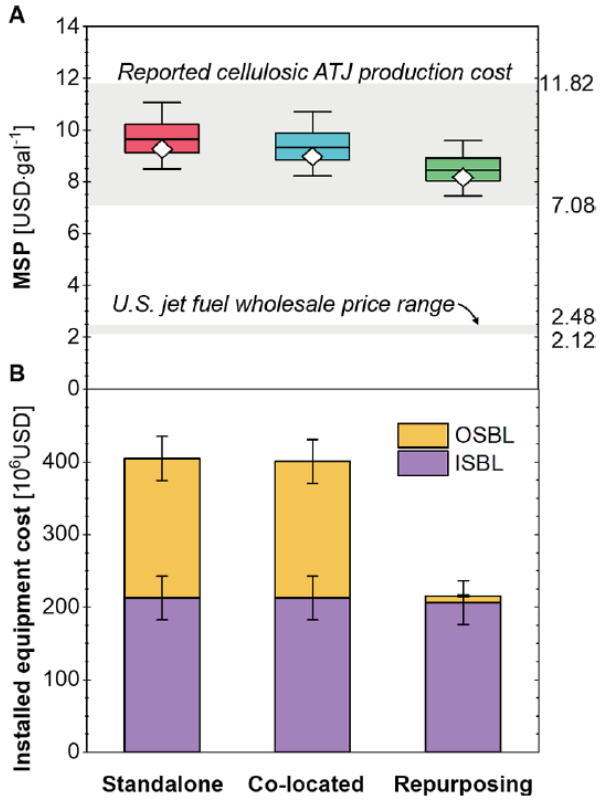
Sustainable aviation fuel (SAF) will play a key role in decarbonizing the aviation industry. Alcohol to jet (ATJ) stands out among SAF production pathways for its scalability, supported by abundant feedstock availability and a well-established bioethanol industry. However, significant reductions in SAF carbon intensity (CI) require the use of cellulosic feedstocks whose adoption is hindered by high capital costs for feedstock processing and ethanol upgrading. This work evaluates the financial viability and environmental implications of integrating an ATJ SAF biorefinery with a petroleum refinery using miscanthus and switchgrass as example feedstocks.

Approach

Researchers evaluated three ATJ SAF biorefineries (standalone [benchmark], colocated, and repurposing [coprocessing SAF within a petroleum refinery]) using miscanthus and switchgrass as example cellulosic feedstocks. Each biorefinery scenario was designed and evaluated using techno-economic analysis (TEA) and life cycle assessment (LCA) in BioSTEAM. Uncertainty and sensitivity analysis were conducted using Monte Carlo simulation with Latin Hypercube sampling (2000 simulations) for 49 uncertain parameters.

Results

The repurposing scenario demonstrated the lowest cost for SAF deployment, reducing baseline capital costs by 36% and SAF minimum selling price (MSP) by 12% to 8.14 USD gal^{-1}. This performance was consistent across both miscanthus and switchgrass feedstocks. CI remained stable across biorefinery scenarios. However, cellulosic feedstock use reduced CI by >70% relative to corn.



MSP (A) and installed equipment cost (B) of the three modeled scenarios.

Significance/Impacts

This work demonstrates that leveraging established petroleum infrastructure can facilitate SAF deployment via cellulosic ATJ coprocessing to enable cost-effective, low-carbon aviation fuels.

Guo et al. 2026. "Cost and Carbon Intensity Implications of Coprocessing Sustainable Aviation Fuel at Petroleum Refineries." *Environmental Science & Technology*. DOI: 10.1021/acs.est.5c17540.