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Greenhouse Gas Accounting Procedures in Low Carbon Fuel Policies Overlook the Spatial Variability of Miscanthus-Derived Sustainable Aviation Fuel

Background/Objective

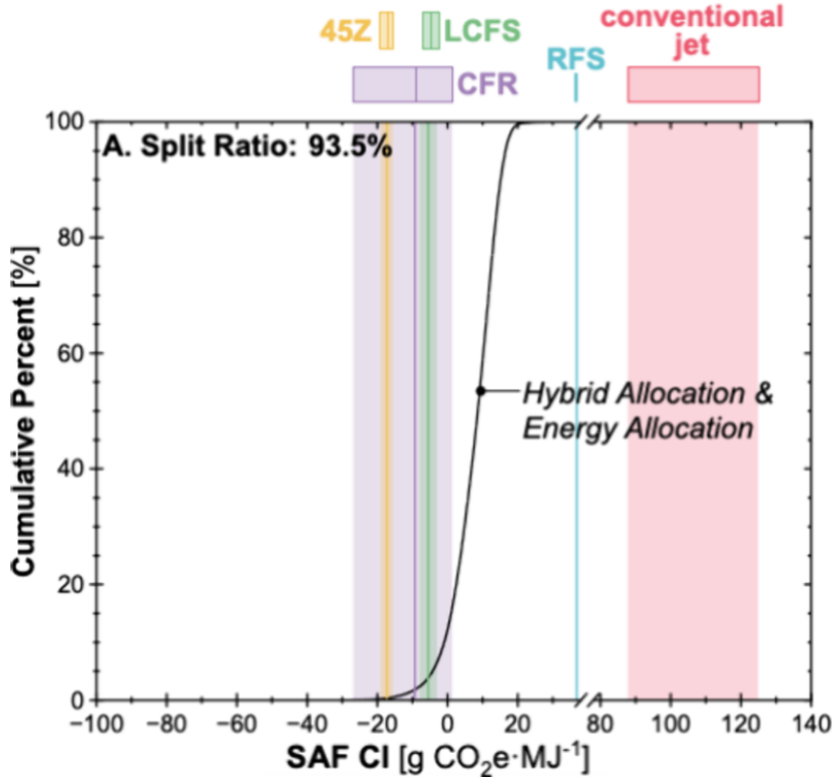
Low carbon fuel policies are intended to reduce greenhouse gas (GHG) emissions from transportation. However, rigid carbon intensity (CI) accounting procedures in current policies may limit CI responsiveness across candidate sites and facilities. This work examines a hypothetical biomass-to-sustainable aviation fuel (SAF) process to demonstrate how GHG accounting requirements drive estimates of biofuel CI and to explore potential CI and financial implications of scenario-specific life cycle assessment (LCA).

Approach

The CI of hypothetical SAF produced from miscanthus via the alcohol-to-jet (ATJ) pathway was calculated according to specifications from three low carbon fuel policies (U.S. Renewable Fuel Standard (RFS), Canada Clean Fuel Regulations (CFR), and California Low-Carbon Fuel Standard (LCFS)) and the 45Z tax credit. These were compared against modeling results tailored to specific feedstock-to-fuel scenarios (scenario-specific LCA) defined by feedstock and facility siting and feedstock split ratio (the proportion of miscanthus allocated to fuel production vs. electricity).

Results

GHG accounting using the CFR/LCFS can reasonably account for distinct levels of net electricity production by a biorefinery but only the CFR yields similar CI sensitivity to spatially explicit factors as scenario-specific LCA. Most GHG accounting frameworks do not capture CI variation across candidate sites in the United States.



Distribution of SAF CI based on spatially explicit LCA across 12,748 candidate sites in the U.S. compared to CIs of conventional jet fuel and calculated according to policy specifications.

Significance/Impacts

This work demonstrates the importance of LCA methodological specifications in low carbon fuel policies and tax credits and illustrates that policies that enable scenario-specific CI calculations could enhance crediting accuracy and more effectively support implementation of low-emission practices.

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