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Summary of the CA-GREET Model Pathway for Biodiesel Produced in the Midwest from Used Cooking Oil

The Midwestern used cooking oil biodiesel (UCO BD) pathway described in this summary yields a higher carbon intensity (CI) than the approved California UCO BD pathway.[1] Tables 1 through 5, below, describe the CI differences between these pathways. Except for the final distribution and use of the fuel, all of the production steps for the Midwestern product occur in the Midwest. The carbon intensity differences between the Midwestern and California pathways are due to: (1) differences in the energy mix used to generate electricity in the two regions, and (2) the distances the finished biodiesel must be transported for final use.

Table 1 summarizes the CI differences between the existing California and the proposed Midwestern UCO pathways

Table 1: California and Midwestern UCO Pathway Carbon Intensities

	California CI	Midwestern CI
No Cooking	11.76	13.83
Cooking Required	15.84	18.72

The only difference between the cooking and non-cooking pathways in both California and the Midwest is the additional energy required for the cooking process. That additional energy requirement results in higher greenhouse gas emissions.

Tables 2 through 5 summarize the rendering and transportation differences between the California and Midwestern pathways that result in the CI differences shown in Table 1. Table 2 shows how greenhouse gas emissions differ between the California and Midwestern "cooking required" pathways. The UCO used in biodiesel production can be rendered using either a relatively energy-intensive cooking process, or a lower-energy non-cooking process.

[1] California Environmental Protection Agency, Air Resources Board. September 23, 2009. Detailed California-Modified GREET Pathway for Biodiesel Produced in California from Used Cooking Oil. Stationary Source Division, Version: 2.0. http://www.arb.ca.gov/fuels/lcfs/092309lcfs_uco_bd.pdf. This document describes a pathway that was approved for inclusion in the Low Carbon Fuel Standard Lookup Table.

Table 2: Carbon Intensity Comparison—BD produced in the Midwest versus BD produced in CA (Cooking Required)

	New Midwest Pathway Emissions (gCO_2e/MJ)	**Existing CA Pathway Emissions (gCO_2e/MJ)**
Rendering of UCO	5.69	4.73
UCO Transport (after rendering)	0.30	0.31
Biodiesel Production	6.06	5.56
Biodiesel Transport	2.19	0.76
Total (Well To Tank)	14.24	11.36
Total (Tank To Wheel)	4.48	4.48
Total (Well To Wheel)	18.72	15.84

Table 3 shows the differences in greenhouse gas emissions between the cooking and non-cooking pathways. As mentioned, the only difference between these two pathways in both regions is that the cooking pathways generate more greenhouse gas emissions than their non-cooking counterparts.

Table 3: Comparison of Rendering Carbon Intensities (Cooking versus Non-cooking)

	New Midwest Pathway Emissions (gCO_2e/MJ))	**Existing CA Pathway Emissions (gCO_2e/MJ**
UCO Rendering (Cooking)	5.69	4.73
UCO Rendering (No cooking)	0.80	0.65

Table 4 summarizes the differences between the non-cooking pathways in the Midwest and California. This comparison demonstrates the effects of the differences in both the electrical energy generation mix and the BD transportation distance.

Table 4: Comparison of Carbon Intensities of BD produced in the Midwest and BD produced in CA (No Cooking Required)

	New Midwest Pathway Emissions (gCO_2e/MJ)	**Existing CA Pathway Emissions (gCO_2e/MJ**
Rendering of UCO	**0.80**	**0.65**
Total (Well To Tank)	9.35	7.28
Total (Tank To Wheel)	4.48	4.48
Total (Well To Wheel)	**13.83**	**11.76**

The electrical generation fuel mix differences responsible for the well-to-tank differences shown in Table 4 are summarized in Table 5.

Table 5: Electrical Generation Fuel Mix Differences Between the California and Midwestern UCO Pathways

	Natural Gas	**Coal**	**Biomass**	**Other (Solar Wind, Hydroelectric, etc.)**
Midwest	33.5%	51.6%	5.8%	9.1%
California	78.7%	0.0%	0.0%	21.3%

The differences in biodiesel transport distances are as follows:

- Approved California pathway: 50 miles to bulk terminals and 90 miles to distribution points, all by heavy-duty diesel truck;
- New Midwestern pathway: 1,400 miles by rail to California; 80 percent transported 50 miles by heavy-duty diesel truck to bulk or blending terminals; 20 percent offloaded to bulk or blending terminals adjacent to the rail yard; 100 percent transported by heavy-duty diesel truck 90 miles to distribution points.

Staff estimated the CIs of these Midwestern UCO BD pathways using the best available information. As with all LCFS pathways, direct CI estimates were calculated using the CA-GREET model. Staff is satisfied that the pathway CIs presented in this summary are reasonable and recommends that the Executive Officer approve both pathways.