

Western Plains (WPE) CA-GREET Model

The applicant has conducted its analysis of direct effects on carbon intensity for this pathway using CA-GREET, v.1.8b (Dec. 2009) (See http://www.arb.ca.gov/fuels/lcfs/ca_greet1.8b_dec09.xls). The standard inputs and parameters specified in CA-GREET remain unchanged except as noted in the input table below. The input table below specifies the spreadsheet location of the CA-GREET inputs and other parameters that were claimed as confidential business information or trade secret by the applicant, but it does not disclose the actual value of such inputs and parameters because they are claimed to be confidential business information or trade secret.

WPE Input data table (Locations of cells containing Confidential Business Information are shown, but the actual values of such confidential information are not disclosed):

INPUTS & MODIFICATIONS to CA-GREET 1.8b

This section summarizes the specific input values which have been used to run the CA-GREET model to develop carbon intensity results for the proposed sub-pathways. While the scope of the analysis is well-to-wheels, modifications from the CA-GREET default sorghum and corn ethanol pathways are only necessary for the biorefinery operations, and the biogas production and sorghum farming practices.

BIOREFINERY

Table 6 presents the specific modifications that have been made to the CA-GREET model pertaining to the biorefinery efficiency, while

Table 7 shows a comprehensive list of all the modifications which have been needed to modify the process and the biogas production in this proposed pathway. The data below has been derived from annual aggregate data provided by WPE. Cumulative energy usage data has been provided and is normalized by gallon in the model. A structural change to the model was made so that biogas could be used as a process fuel at the biorefinery. The upstream emissions from biogas production are estimated using the existing dairy biogas to CNG pathway included in GREET. Plant energy use values, ethanol and DDG yield have all been updated to reflect WPE's process efficiency.

Table 6: Biorefinery Operations Input Modifications

<i>Modified Parameter</i>	<i>CA-GREET Cell Reference (Corn or Sorghum model)</i>	<i>WPE 10% Biogas, 100% Wet DGS</i>	<i>WPE 30% Biogas, 100% Wet DGS,</i>	<i>Midwest Sorghum; Dry Mill; Wet DGS, NG</i>	<i>Midwest, Dry Mill, Wet DGS, NG</i>
Yield (gallon/bushel)	Fuel_Prod_TS!D277			2.72	2.72
Total Plant Energy Use (Btu/gallon)	Inputs!C253 or Inputs!E253			26,100	26,100
Thermal Energy Use (Btu/gallon)	Inputs!C254 or Inputs!E254			22,430	22,430
Natural Gas Use (% fuels, Btu/gallon)	Inputs!C255 or Inputs!E255			85.9% * 26,100 = 22,430	85.9% * 26,100 = 322,430
DDG production rate (bone dry lb/gallon)	EtOH!C101 or EtOH!AF101			5.34	5.34
Grid Electricity Use (kWh/gallon)	Inputs!C258 or Inputs!E258			(100% - 92.7%) * 36,000 = 2,628	(100% - 92.7%) * 36,000 = 2,628

Table 7: Comprehensive list of modifications needed

<i>Modified Cell in CA-GREET (corn or sorghum)</i>	<i>New Value or Cell Reference</i>	<i>Comments</i>
Inputs!C253 or Inputs!E253	=WPE_Inputs!B24	B24, F24, or J24 depending on the DDG scenario evaluated
Inputs!C254 or Inputs!E254	=WPE_Inputs!B25	B25, F25, or J25 depending on the DDG scenario evaluated
Inputs!C255 or Inputs!E255	=WPE_Inputs!E22	E22, I22, or M22 depending on the DDG scenario evaluated
Inputs!C258 or Inputs!E258	Added formula = (C253-C254)/3412	To compute electric input
EtOH!C101 or EtOH!AF101		See reference calculations
Fuel Prod TS!D277		See reference calculations

Modified Cell in CA-GREET (corn or sorghum)	New Value or Cell Reference	Comments
NG!AA66	100%	Remove energy use for gas compression
NG!FO66	████████	Digester efficiency
NG!FO75	████████	Share of digester plant energy input at natural gas
NG!FO76	0.00%	Share of digester plant energy input as biogas
NG!FO79	████████	Share of digester plant energy input as electricity
NG!FO88	=10^6/(1/78%-1)*44.35%	Calculated biogas energy use for digester
NG!FP88	Modified formula	Include biogas use by digester plant in biogenic storage calculation
EtOH!DH172:DH180	Modified formulas	Delete calculations for emissions from solid biomass combustion
EtOH!L178 or EtOH!DH178	Modified formula	Added biogas CH4 combustion emission factor L164*(EF!C12+NG!H135*NG!\$\$123+NG!!135)/1000000
EtOH!L180 or EtOH!DH180	Modified formula	Added biogas CO2 combustion emission factor L164*(EF!C14+(NG!H137*NG!\$\$123+NG!!137))/1000000