Abengoa Bioenergy Biomass of Kansas
Pathways for Ethanol Derived from
Corn Stover and Wheat Straw Residues at Hugoton, Kansas

Input Changes to the CA-GREET Model

Draft CA-GREETv.2.0 (December 2014)

http://www.arb.ca.gov/fuels/lcfs/ca-greet/ca-greet.htm

Pursuant to title 17, section 95486 (b)(1) of the California Code of Regulations, alternative models were additionally utilized to compute the life cycle GHG emissions impacts of the proposed pathways. The applicant has conducted its analysis of direct effects on carbon intensity for this pathway using the draft CA-GREET v2.0 (December 2014) model, as well as the ecoInvent database (Version 3).[1] The standard inputs and parameters specified in draft CA-GREETv2.0 remain unchanged, except as noted in the input table below. The input table below specifies the spreadsheet location of the draft CA-GREETv2.0, or ecoInvent 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.

[1] http://www.ecoinvent.org/database/ecoinvent-version-3/

Input Changes Table 1

ABBK Hugoton Corn Stover Pathway

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

Parameters	Draft CA-GREETv2.0, or ecoInvent	Draft CA-GREETv2.0, or ecoInvent	ABBK Hugoton
	Worksheet Location	Default Cell Value	Corn Stover Pathway Values
Biomass Feedstock			[redacted]
Farming Collection Energy	Inputs!K279	192,500 Btu/dry ton	
N Fertilizer Mix			
N Fertilizer mix: Urea (NH2CONH2)	Ag_Inputs!X76	31%	
N Fertilizer mix: Ammonium Nitrate (NH4NO3)	Ag_Inputs!Y76	23%	
N Fertilizer mix: Urea-Ammonium Nitrate Solution	Ag_Inputs!Z76	29%	
N Fertilizer mix: Monoammonium Phosphate	Ag_Inputs!AA76	32%	
N Fertilizer mix: Diammonium Phosphate	Ag_Inputs!AB76	4%	
Dry Matter Loss from corn stover road transport	EtOH!E64	2%	
HDPE Inputs for corn stover	EtOH!O45	0 kg/dry tonne	
Ethanol Production			
Corn Stover Ethanol Production Fuel Combustion Shares			
NG engine	EtOH!L320	0%	
NG large industrial boiler	EtOH!L322	50%	
NG small industrial boiler	EtOH!L323	50%	
Fuel Production			
Yield	EtOH!G140	80.0 gal/dry ton	
Energy Inputs			
Biomass Co-gen Fuel source	Fuel_Specs!A139:E148	N/A	
Energy Mix	T1Calculator!E9	U.S. Average (#1)	
Biomass boiler emission factors	EF!BV6:BV16	N/A	
Natural Gas Energy Use for corn stover ethanol	ETOH!CR351	0 Btu/gal, LHV	
Grid Electricity Consumption for corn stover ethanol	ETOH!CR355	0 kWh/gal	
Share of Biomass for corn stover ethanol production	ETOH!CR354	60%	
Corn Stover Chemical and Enzymes inputs	ETOH!CR357:CR362	N/A	
Calculation array for corn stover ethanol fermentation	ETOH!CR365:CR379	See array	
Corn stover ethanol production Non-combustion Emissions calculation array	ETOH!CT371:CT375	N/A	
Share of biomass for ethanol	EtOH!BK164	60%	
Denaturant	Petroleum!B279	95%	
Net Electricity Export	EtOH!G140	-2.56 kWh/gal	
Ethanol Transport			
Rail Transport	T&D!HR105	1,400 miles	
Ethanol truck to rail yard transport distance	T&D!HS105	50 miles	

Input Changes Table 2

ABBK Hugoton Wheat Straw Pathway
(Locations of cells containing Confidential Business Information are shown, but the actual values of such confidential information are not disclosed)

Parameters	Draft CA-GREETv2.0, or ecoInvent	Draft CA-GREETv2.0, or ecoInvent	ABBK Hugoton
	Worksheet Location	Default Cell Value	Wheat Straw Pathway Values
Biomass Feedstock			[redacted]
Farming Collection Energy	Inputs!J279	131,500 Btu/dry ton	
Diesel Fuel Shares for Wheat straw collection	EtOHBS338	93%	
Electricity Fuel shares for wheat straw collection	EtOHBS344	7%	
Pesticide use for wheat straw	EtOHBX334	30.1 g/dry ton	
NO from N fertilizer and above/below ground Wheat Straw biomass	EtOHBT381	64.93 g/dry ton	
N2O from N fertilizer and above/below ground wheat straw biomass biomass	EtOHBT382	97.07g/dry ton	
Fertilizer Inputs			
- Total N	Inputs!J281	3,517 g/dry ton	
- P2O5	Inputs!J282	1,228 g/dry ton	
- K2O	Inputs!J283	5,008 g/dry ton	
N content in Wheat Straw Residue	EtOH!D50	0.6%	
N Fertilizer Mix			
N Fertilizer mix: Urea (NH2CONH2)	Ag_Inputs!X76	31%	
N Fertilizer mix: Ammonium Nitrate (NH4NO3)	Ag_Inputs!Y76	23%	
N Fertilizer mix: Urea-Ammonium Nitrate Solution	Ag_Inputs!Z76	29%	
N Fertilizer mix: Monoammonium Phosphate	Ag_Inputs!AA76	32%	
N Fertilizer mix: Diammonium Phosphate	Ag_Inputs!AB76	4%	
Dry Matter Loss from Wheat Straw road transport	EtOH!E64	2%	
Wheat Straw Field Treatment Dry Matter Loss	EtOH!l39	2%	
Wheat Straw Field Drying Loss	EtOH!l40	5%	
Wheat Straw Collection Loss	EtOH!l41	3%	
HDPE Inputs for Wheat Straw	EtOH!L45	0 kg/dry tonne	
Ethanol Production			
Corn Stover Ethanol Production Fuel Combustion Shares			
NG engine	EtOH!S320	0%	
NG large industrial boiler	EtOH!S322	50%	
NG small industrial boiler	EtOH!S323	50%	
Fuel Production			
Yield	EtOH!GF141	80.0 gal/dry ton	
Energy Inputs			
Biomass Co-gen Fuel source	Fuel_Specs!A139:E148	N/A	
Energy Mix	T1Calculator!E9	U.S. Average (#1)	

Input Changes Table 2 Continued

ABBK Hugoton Wheat Straw Pathway
(Locations of cells containing Confidential Business Information are shown, but the actual values of such confidential information are not disclosed)

Parameters	Draft CA-GREETv2.0, or ecoInvent Worksheet Location	Draft CA-GREETv2.0, or ecoInvent Default Cell Value	ABBK Hugoton Wheat Straw Pathway Values
Biomass boiler emission factors	EF!BV6:BV16	N/A	[redacted]
Natural Gas Energy Use for wheat straw ethanol	ETOH!CC351	0 Btu/gal, LHV	
Grid Electricity Consumption for wheat straw ethanol	ETOH!CC355	0 kWh/gal	
Share of Biomass for wheat straw ethanol production	ETOH!CD354	60%	
Wheat Straw Chemical and Enzymes inputs	ETOH!CC357:CC362	N/A	
Calculation array for wheat straw ethanol fermentation	ETOH!CC365:CC379	See array	
Wheat straw ethanol production Non-combustion Emissions calculation array	ETOH!CE371:CE375	N/A	
Share of biomass for ethanol	EtOH!BK164	60%	
Denaturant	Petroleum!B279	95%	
Net Electricity Export	EtOH!F140	-2.56 kWh/gal	
Ethanol Transport			
Rail Transport	T&D!HR105	1,400 miles	
Ethanol truck to rail yard transport distance	T&D!HS105	50 miles	