

Benefits of a BEI for a Generic Corn Ethanol Facility

The overall success of the California Low Carbon Fuel Standards (LCFS) has driven many other markets, such as the Midwest, to start the process of adopting standards based upon the CA LCFS. This creates an economic opportunity for corn ethanol production facilities. Reaching these markets and receiving the premium pricing is based upon the carbon intensity (CI) and the carbon savings the ethanol facility creates. There are economic benefits to selling into these markets without taking any action; however, it is important to understand the business case for the potential replacement of the ethanol plant's existing heat and power production.

When you install a BioPro Power (BPP) Energy Island at an existing ethanol production facility there are significant benefits to the carbon intensity (CI). Since the BEI is fueled by corn stover, it represents renewable and sustainably produces heat and power for the facility. These benefits potentially increase the price premium based upon carbon emissions saved when ethanol is sold into a low-carbon fuel market such as the one that exists in California. To quantify these benefits, BPP USA, LLC commissioned the below modeling results, using the Argonne National Lab's GREET (Greenhouse gas, Regulated emissions, and Energy use in Transportation) model. Assumptions for a generic corn ethanol facility are modeled versus the same facility using a BEI for all its heat and power needs.

Inputs

Baseline generic plant: 26800 Btu/gal NG HHV, 1 kWh/gal

Stover system: 0 NG or grid power, 2.55-ton stover/1000 gal

Stover parameters: as provided by BPP.

Stover collection assumptions and CA_GREET3 upstream data in

Stover_Data_CI_Study_v3_combined.xls

Results

Base case, BEI system with BPP stover assumptions, and GREET stover assumptions are shown below for anhydrous ethanol.

Corn Ethanol CI	Generic Plant		GREET
	Base Case	Stover	Stover
(g CO ₂ e/MJ)			
Corn	28.57	28.57	28.57
DGS Credit	-11.9	-11.9	-11.9
Chemicals	2.11	2.11	2.11
Natural Gas	24.4	0	0
Power	8.5	0	0
Stover	0	2.72	2.93
Transport	2.6	2.6	2.6
ILUC	19.8	19.8	19.8
Total	74.08	43.90	44.11

The below explains what the results mean

1 This is the fuel we are replacing and will be compared to generate carbon savings

Reference Fuel
Gasoline

2 These are the assumptions for gasoline if we are selling in 2022

1. Select Compliance Year: 2022
 Gasoline CI Standard (gCO_{2e}/MJ): 89.50
 2. Select Vehicle-Fuel EER: 1
 Gasoline Energy Density (MJ/gal): 119.53

Fuel Equivalency \$/gal ethanol-equivalent

4 Various market prices for carbon savings in \$/ton, estimate is for \$205 in 2022

Alternative Fuel Premiums at Sample LCFS Credit Prices
 (\$/gal ethanol-equivalent for fuels used as gasoline substitutes)

CI Score (gCO _{2e} /MJ)	\$205	\$80	\$100	\$120	\$160	\$200
74	\$0.26	\$0.10	\$0.13	\$0.15	\$0.20	\$0.25
44	\$0.76	\$0.30	\$0.37	\$0.45	\$0.59	\$0.74

3 CI Scores from GREET Model

6 Score of 74 gets a \$.26 premium

6 Score of 44 gets a \$.76 premium or an additional \$.50

5 These are the premiums for the carbon savings expressed in \$/gal of ethanol based upon the carbon in \$/ton pricing for each CI score