STAFF SUMMARY
Method 2B Application for California Energy Beets-to-Ethanol
PROSPECTIVE LCFS Pathway

Tracy Renewable Energy, LLC
Tracy Facility, Tracy, California
(ETHBE001)

Date Deemed Complete: November 10, 2015
Date Posted for Comment: December 18, 2015
Certified Date: December 30, 2015

Pathway Summary

This staff summary describes the prospective fuel pathway California Energy Beet Ethanol produced by Tracy Renewable Energy (TRE) at the Tracy Ethanol Plant under construction in Tracy, California. The facility is expected to produce over 20 million gallons per year of ethanol using energy beet as feedstock. Steam for the facility is produced by a dedicated anaerobic digester. Electricity is provided by a co-located desalination plant which produces steam from natural gas.

TRE requires a Method 2B application to model its feedstock and biogas process fuel. Beet feedstock has not previously been modeled in CA-GREET1.8b. Biogas was modeled based on parameters in the "Pathway for the Production of Biomethane from High Solids Anaerobic Digestion (HSAD) of Organic (Food and Green) Wastes.[1]"

The Roundup Ready® energy beet feedstock is provided by TRE's supplier, Delta Distiller Beets (DDB), from agricultural lands located within 50 miles of the fuel plant. Energy beets are similar to sugar beets but have higher fermentable sugar content. At the ethanol plant, the beets are sliced into small pieces called cossettes and the sucrose is then extracted with water, yielding raw juice and beet pulp. The beet pulp is pressed to extract as much sucrose as possible and the press water produced from pressing is recycled back to the extraction step and combines with the raw juice produced during extraction. The raw juice is then filtered to remove impurities and concentrated prior to fermentation. The sucrose is fermented to hydrous ethanol with yeast and centrifuged to remove the yeast and other solids. Finally, distillation and dehydration are used to remove remaining water from the ethanol, yielding anhydrous fuel (< 1% moisture content). The ethanol plant processes dried beet pulp which is sold to the local dairy industry as animal feed displacing feed corn.

The anaerobic digester produces digester gas (biogas or DG) from green waste, dairy manure and crude glycerin. The digester gas is processed minimally and combusted in a biogas boiler to provide process steam with a negative carbon intensity to the ethanol plant. The digestate is composted and the pathway receives credit for fertilizer displacement, similar to the HSAD pathway.

[1] ARB 2015. LCFS Pathway for the Production of Biomethane from High Solids Anaerobic Digestion (HSAD) of Organic (Food and Green) Wastes. December 15, 2014.

The fuel pathway includes all emissions associated with beet cultivation, beet transport, beet processing, digester feedstock production, digester feedstock transport, digester operation, ethanol and co-product production, ethanol transport and distribution, and fuel combustion.

Facility Location and Coordinates

The Tracy Renewable Energy ethanol facility is located in Tracy, California. The geographic coordinates are 37.769739 (latitude) and -121.425067 (longitude).

Satellite View of Tracy Renewable Energy Ethanol Production Facility
Tracy, California

Carbon Intensity of the TRE Pathway

The energy beet feedstock in this pathway has not previously been modeled in CA-GREET1.8b. The required parameter values were taken from a variety of data sources provided in Table 1. Full references for each source listed in Table 1 are provided in the References section of the TRE Pathway Document.

Table 1: California Energy Beet Production Data

Parameter	Value	Units	Source
Diesel tractor use	4.5	gal/acre	DDB Trial Plot
Energy beet yield	37.8	ton/acre	Kaffka (2013)
Nitrogen (applied as urea)	160	lb N/acre	Mayberry (2000)
Phosphorus (P_2O_5)	15	lb P_2O_5/acre	Purdue Recommendation[a]
Potassium (K_2O)	25	lb K_2O/acre	Purdue Recommendation[a]
Herbicide	1.625	lb/acre	DDB Trial Plot
Insecticide	1.55	lb/acre	DDB Trial Plot
Residue left on field	0.026	dry lb/lb beets	Frissel (2012)
N content of residue	0.03	lb N/dry lb residue	Frissel (2012)
Irrigation electricity rate	0.86	MJ_e/m^3 water	Klein (2005)

Irrigation requirement	102.05	m^3/tonne beets	Long (1994)
Fraction needing irrigation	50%	%	Conservative Estimate

[a] Cattanach, A., Dexter, A., Oplinger, E., "Sugar Beets", Alternative Fuel Crops Manual, available at http://www.hort.purdue.edu/newcrop/afcm/sugarbeet.html.

A disaggregated table of total emissions of the system including emissions from Farming Energy, Agricultural Chemicals production impacts and soil emissions, Feedstock Transport, Digester Feedstocks, Plant Operation, Ethanol Transport & Distribution, and the addition of Denaturant are shown in **Table 10 of the TRE Pathway LCA Report**.

The proposed TRE fuel pathway code, description and CI results for the TRE prospective pathway are shown in Table 2.

Table 2: Proposed Lookup Table Entry for Fuel/Feedstock

Fuel	Pathway Identifier	Pathway Description	Carbon Intensity Values ($g\ CO_2e/MJ$)		
			Direct Emissions	Land Use or Other Indirect Effects	Total
Ethanol	ETHBE001	2B Application*: Ethanol Produced from California Energy Beets using biogas derived from anaerobic digestion of green wastes, manure and glycerin; with credit for avoided waste management and co-products (compost and animal feed).	-16.36	30	13.64

*****Specific Conditions Apply.

Operating Conditions

Operations at the TRE plant will be subject to the following conditions designed to ensure that the CI of the energy beet ethanol sold under the pathway described in this Staff Summary will remain at or below the value appearing in Table 2. The conditions must be met for every gallon of ethanol produced by TRE. Once the facility has commenced commercial production, the applicant must provide one quarter of operational data and request a provisional CI. This provisional CI is subject to adjustment on the basis of quarterly operational data. The pathway CI will remain provisional until two years of operational data reflecting steady-state operation has been received and verified by staff.

The CI may not be used to generate provisional credits until an initial demonstration satisfying conditions 1-3 are met:

1. Evidence of the digester operation. At minimum, such evidence includes but is not limited to air permits covering the digester itself, any associated clean up and processing equipment, and its combustion for use in the ethanol process.
2. TRE must obtain CARB Livestock Offset Protocol Verification.
3. Physical demonstration of digester feedstock handling and transport. At the time of approval of this prospective application, the exact process by which manure will be collected from supplying dairies is uncertain. Once digester operation has commenced, TRE must submit a report describing the exact origin and handling methods for collection of manure and green wastes. TRE application materials imply that the manure will be extracted from an anaerobic lagoon, requiring equipment that is not modeled in this pathway, and implying that the moisture content as received by TRE may be higher than modeled in this pathway.

In addition, the prospective pathway CI is subject to the following conditions:

4. Annual glycerin inputs to the digester are **limited to the value submitted in the TRE application, in bone dry tonnes per year (or equivalent tonnes volatile solids[2] (VS))**. Exceedance of the application's value could result in an actual CI which is higher than the prospective certified CI and may constitute a violation.
5. Annual manure inputs to the digester must be **greater than or equal to the VS per year value submitted in the TRE application, in tonnes of volatile solids** based on design parameters. Manure use less than the application's value could result in an actual CI which is higher than the provisionally certified CI and may constitute a violation.
6. Annual green waste inputs to the digester must be **greater than or equal to the value submitted in the TRE application, in bone dry tonnes per year (or equivalent tonnes VS)** based on design parameters. Green waste consumption of less than the application's value could result in an actual CI which is higher than the provisionally certified CI and may constitute a violation.
7. The magnitude of the credit for avoided methane from diversion of manure from anaerobic lagoon management is limited to existing (2015) permitted head at all supplying animal facilities.
8. Digester gas generated from manure and used in the ethanol plant to receive LCFS credit for ethanol produced by this pathway is not used to generate Offset credits under the Livestock Offset Protocol or any other carbon credit system.
9. The CI value determined for this pathway is applicable only for beets grown in California's San Joaquin Valley. Use of beets grown outside of the San Joaquin Valley could result in an actual CI which is higher than the provisionally certified CI and may constitute a violation.
10. Any new or additional processing of solid or liquid effluent from the digester which is not modeled in this pathway must be reported to ARB, whether it is onsite or occurs elsewhere, is performed by TRE or any other entity using the by-product.

[2] VS – Volatile Solid content of the material. VS is a measure of the organic matter which is available to be converted to methane and carbon dioxide.

Operational Data Requirements

Operational data must be submitted quarterly until two years of data reflecting steady state operation has been received by ARB Staff. Additional requirements for this pathway include the following:

1. Regular (monthly) results of laboratory analyses of VS content of manure samples from well-mixed, representative batches as agreed upon in TRE's "Plan for Manure Data Tracking and Reporting under LCFS." Include a written description of the source of each sample and how it was obtained, adhering to the appropriate test methods identified and proposed by the applicant (University of Wisconsin-Madison, "Recommended Methods of Manure Analysis").
2. Records (such as receipts, invoices, or bills of lading) identifying the quantity of manure, green waste and glycerin utilized in the digester. Any purchase contracts for feedstock entered into by the applicant.
3. Any additional digester feedstocks not modeled, such as beet processing residue or the thin stillage from fermentation should be summarized and submitted quarterly.
4. As required under the San Joaquin Valley Air Pollution Control District, Authority to Construct PERMIT NO: N-8887-1-0 and N-8887-2-0 (natural gas boilers), the applicant shall maintain records of the cumulative annual use of the fuel combusted in these units. As under PERMIT NO: N-8887-3-0, the applicant shall keep records of the feedstock [beets] material received (tons), and PERMIT NO: N-8887-4-0, shall maintain monthly records of the quantity of ethanol (gallons) produced at this facility.
5. Natural gas consumed by Regenerative Thermal Oxidizer, as measured by flow meter described in Permit No. N-8887-16-0.

LCFS Recertification:

All fuel pathway codes issued prior to January 1, 2016 will expire on December 31, 2016. Fuels with <u>prospective</u> CIs are not eligible to claim credits under the LCFS under the readopted LCFS regulation, effective January 1, 2016. To claim provisional credits the applicant must provide one quarter of operational data once commercial production has commenced. ARB will then complete an updated lifecycle analysis and make necessary adjustments to the originally certified <u>prospective</u> CI if warranted and approve a provisional CI for each of the pathways being considered in this application. To confirm compliance with updated operating conditions, the Executive Officer may reevaluate any aspect of the review at any time and revise the certification to reflect new information. At any time after certification, the Executive Officer may increase the CI values upon a determination that the provisional CIs underestimate fuel life carbon intensity. (Cal. Code Regs. tit. 17, § 95486, subd. (e)(3)(K) (original LCFS); Cal. Code Regs. tit. 17, § 95488, subd. (c)(5)(L) (beginning January 1, 2016).)

Staff Analysis and Recommendations

Staff has reviewed Tracy Renewable Energy's application for certification of a California energy beet ethanol pathway for its Tracy, CA facility and finds the following:

- Staff has replicated the CI value calculated by the applicant using CA-GREETv1.8b GHG lifecycle emissions model and other supporting calculations furnished by TRE.

- Staff finds that the inputs proposed by TRE for energy beet farming in TRE are representative of energy beets grown in California and recommends that the input parameters and associated CI for this feedstock will be available to future LCFS applicants using beets cultivated in California's San Joaquin Valley.

- Staff notes that TRE has not provided documentation verifying the plant's thermal and electrical energy use. The plant process heat consumption values reported for TRE's process reflect anticipated digester gas use based on engineering design. The digester gas is expected to be produced in an anaerobic digester from green waste, dairy cow manure and crude glycerin from biodiesel plants and combusted in a boiler. This pathway is prospective until such operating data is available to validate the certified CI value.

- Staff recognizes that the electricity is generated onsite using steam from the adjacent natural gas-based desalination plant; Staff and TRE have agreed to model the electricity as natural gas-derived electricity based on the default CA-GREET efficiency for a natural gas utility using a boiler.

- Staff proposes to estimate the impact of indirect land use change (ILUC) emissions for this pathway based upon the ILUC value for corn ethanol (30 g CO_2e/MJ). If an updated ILUC value for sugar beets is unavailable when TRE reapplies for certification under the readopted program, Staff recommends that TRE may use the new ILUC value for corn ethanol under the readopted LCFS (19.8 g CO_2e/MJ).

On the basis of this evaluation, staff recommends that Tracy Renewable Energy's Prospective application for a Method 2B LCFS pathway be approved, subject to the operating conditions established in this Staff summary.