Note- this instruction manual is an excerpt from a clean version of the final modified version of Attachment C: CA-GREET3.0 Technical Support Documentation, posted on August 13, 2018 as part of the rulemaking process supporting the LCFS amendments in effect from Q1 2019.

Tier 1 Simplified CI Calculator Instruction Manual

Sugarcane-derived Ethanol

A. Introduction

This document provides detailed instructions for the use of the Simplified CI Calculator for Tier 1 Sugarcane-derived Ethanol pathway applications. This Calculator is to be used to calculate a composite carbon intensity (CI) for Sugarcane-derived Ethanol from sugarcane-based juice and/or molasses feedstocks in Brazil. Each required specific input in the Calculator has been numerically labeled (i.e., 1.1, 1.2 etc.) so that users can follow the sequence and enter information as required.

Download the Simplified CI Calculator here:
https://www.arb.ca.gov/fuels/lcfs/ca-greet/ca-greet.htm

The Calculator has been automated to perform CI calculations using factors from the CA-GREET3.0 model. The Calculator replaces the existing Tier 1 Calculator and the operational data template in pathway application packages. Applicants are required to add facility information and verifiable monthly feedstock, operational energy use, fuel production and co-product data, and transport distances used in calculating the CI of Sugarcane-derived Ethanol. The Calculator is designed to work independently of the CA-GREET3.0 model, but will still require operational and production data from the mill to be entered for the previous 24-months which includes at a minimum, two sugarcane harvest cycles of at least 9-month duration each. **All inputs selected and input by the applicant must meet the requirements of the monitoring plan for entities required to validate or verify pursuant to sections 95491.1(c) and are subject to verification unless specifically exempted.**

B. Color Legend Used in the Calculator

The Calculator uses the following color legend to differentiate required inputs, calculated values, etc., described below:

Yellow Cells require user input
Light Blue cells show CI results
Green Cells show the calculation button
Gray Cells are calculated values

C. Calculator Overview

The following table provides an overview of the main tabs used in the calculator.

Table C.1. Overview of tabs used in the Simplified CI Calculator

Tab Name	Description
Summary	Summary worksheet. Contains an overall summary of the information entered in the "Calculator" tab of the Calculator and the calculated CI for Sugarcane-derived Ethanol. If desired, a **conservative margin of safety** may be added to the calculated CI in this tab in order to establish the final CI, pursuant to section 95488.4(a) of the regulation.
Calculator	Main calculation worksheet that contains fields requiring user input, as well as some parameters calculated by the worksheet. The end product of this worksheet is a calculation of a composite CI for a sugarcane-based ethanol pathway. Calculations in light gray and light blue cells are automatically calculated but dependent on user input provided in the yellow cells. This tab also includes a detailed sample CI calculation illustrating the aggregation of impacts. Some input fields have a drop down list of options for the user to select.
EF Tables	Reference worksheet. Contains greenhouse gas emissions factors (EF) from the CA-GREET3.0 model used in calculation of carbon intensities. No user interface is necessary in this tab.
EF General	Generalized worksheet for the development of the EF's for GHG impact assessments, and aggregation of well-to-wheels impacts. The factors are developed from CA-GREET3.0 or other equivalent models. No user interface is necessary in this tab.
Fuel_Specs	Reference worksheet for CI Calculations. Includes emissions factors derived from CA-GREET3.0 model, standard values, and assumptions related to the Calculator. No user interface is necessary in this tab.

D. Calculator tab

The "Calculator" tab includes pathway inputs used to calculate the CI for sugarcane-derived ethanol. Site-specific parameters must be input/selected by the applicant for all applicable fields in the worksheet. The Calculator tab requires that the applicant provide facility information, feedstock information, operational energy use data, fuel and co-product production data, feedstock and finished fuel transport distances for each mode of transport offered, and other pertinent information such as the level of mechanized harvesting implemented over the harvest cycle, and the amount of surplus cogenerated electricity exported to the grid. The Calculator tab consists of the following major components:

- Pathway Summary and Calculated CI (gCO_2e/MJ)
- Section 1: Applicant & Mill Specific Information
- Section 2: Finished Fuel Transport Information
- Section 3: Monthly Feedstock, Fuel, and Co-Product Production Data
- Section 4: Calculation of Production Yields and Mass Allocation Ratio
- Section 5: Verify Fuel and Co-Product Production Information
- Emissions Factor- based Aggregated CI Impact Determination for Sugarcane Juice Feedstock
- Emissions Factor- based Aggregated CI Impact Determination for Sugarcane Molasses Feedstock
- Aggregated CI Calculations

Pathway Summary and Calculated CI (gCO_2e/MJ)

A summary of CIs for juice and molasses-derived ethanol, average yields and volumes of ethanol produced from each of the two feedstocks and a composite CI is provided in this section. Although CIs are disaggregated between juice and molasses derived ethanol streams, for certification, only a composite CI will be available for a given plant for all sugarcane-derived ethanol. No user interface is required for this section.

Section 1: Enter Applicant & Mill Specific Information

In this section, input applicant and mill specific information. Details are provided in Table D.1.

Table D.1. List of input fields for Section 1 of the Simplified CI Calculator

Field Description	Value
1.1 Company Name	Registered name of the company. Example "ABC Company, LLC" or "ABC Company, Ltda."
1.2 Company or Facility ID	Input U.S. EPA Company and Facility ID's. If not available, contact CARB for LCFS Company and Facility ID's.
1.3 Application Number	Enter the application number provided by the AFP.
1.4 Mill Location, including State/Country	Input mill address, including State and Country (e.g., Sao Paulo, Brazil)
1.5 Harvest Cycle(s)	Input period for which harvest data is valid (e.g., January 2015 to December 2017)
1.6 Provisional Application?	Select "Yes" if Provisional, or "No" if not "Provisional". Click the "SELECT" button after filling out Field 1.6.
1.7 Credit for Export of Net Surplus Cogenerated Electricity	Select "Yes" if surplus cogenerated electricity is exported to the grid or "No" if no electricity is exported from the production facility. Click the "SELECT" button after filling out Field 1.6.
1.8 Electric Transmission and Distribution Loss	Standard value and fixed at 8.1% for Brazil. No input required.
1.9 Regional Electric Mix (Feedstock/Fuel)	29-Brazilian Mix (Standard for Brazil). No input required.
1.10 Choose Applicable Burn Area Evaluation for Cane Farms, then Click "SELECT" button	Choose from drop-down menu based on location; Standard for Sao Paulo State, or Standard for Non-Sao Paulo States. Additional details are provided below Table D.1. Click the "SELECT" button after making a selection.
1.11 Reference Year for Burn Area Evaluation (Calculated)	Cell shows the harvest year for which the Burn Area Evaluation was based upon. No input required.
1.12 Applicable Mechanized Harvesting Credit (Calculated)	Field 1.12 will appear gray with standard mechanized harvesting credits if either of the standard options are selected in Field 1.10. No input required.

Additional Details for Section 1:

Fields 1.10 and 1.11

The choice of mechanized harvesting is used to proportionally offset the impact from straw burning emissions, and is based on the percentage of mechanized harvesting on applicant owned, leased, and/or partnership sugarcane farms. The applicant may select one of two options for mechanized harvesting for sugarcane sourced for their facility:

a) Standard for Sao Paulo State, or
b) Standard for Non-Sao Paulo States

In the Field 1.10 drop-down menu selection, select “Standard for Sao Paulo State” if the ethanol plant/sugar mill sources all of its sugarcane from the State of Sao Paulo, for which a standard mechanized harvesting level of 80 percent is applied.
Select “Standard for Non-Sao Paulo States” if the ethanol plant/sugar mill sources all of its feedstock from non-Sao Paulo States, for which a standard mechanized harvesting level of 65 percent is applied. Click the “SELECT” button after making the selection to clear the previous value. Selecting either of these options exempts verification of mechanized harvesting levels implemented at applicant-sourced sugarcane farms during initial validation, and on-going periodic verification reviews of this parameter.

Section 2: Enter Fuel Transport Information

This section requires only input of fuel transport modes and distance. Many of the parameters in this section are derived from input data in Section 3. These are calculated parameters based on user-provided specific information in Section 3. Details are included in Table D.2 below.

Table D.2. List of input fields for Section 2 of the Simplified CI Calculator

Field Description	Value
2.1 Anhydrous Ethanol Volume Transported by Truck (dry gal) (Calculated)	This field lists the ethanol volume transported by HDD Truck direct to Port. It is derived from Section 3, Field 3.18, Cell S59, and does not require a user input here.
2.2 Anhydrous Ethanol Transport Distance (km) by Truck to Port	Transport distance of ethanol from production facility to port by HDD truck.
2.3 Anhydrous Ethanol Ocean Transport Route to California	Select an intended shipping route for ethanol transport by Ocean Tanker from a port in Brazil to California. Three choices are offered in a pull-down menu: “Via Panama Canal”; “Via Strait of Magellan”; or “Via Cape Horn.”
2.4 Anhydrous Ethanol Transport Distance by Ocean Tanker to California (km)	Input transport distance to California Port from Brazilian Port (km).
2.5 Ethanol Transport Distance by Truck from California Port to Terminal (miles)	Standard distance of 40 miles and does not require user input.
2.6 Ethanol Transport Distance by Truck from California Terminal to Refueling Station (miles)	Standard distance of 50 miles and does not require user input.

Section 3: Enter Monthly Feedstock, Fuel, and Co-Product Production Data

Section 3 requires the applicant to enter inputs related to monthly feedstock inventory and transport, ethanol and sugar production, and electricity cogenerated or procured from the grid. The input data must span 24 months inclusive of two sugarcane harvest cycles of at least 9-month duration each. For provisional pathway applications, a minimum of 3-months data will be considered. An explanation of the fields in this section is described in Table D.3.

Table D.3. List of input fields for Section 3 of the Simplified CI Calculator

Field Description	Value
3.1 Reporting Month (MM/YYYY)	Input the months and year(s) corresponding to the operational data provided.
3.2 Cane Sourced from Applicant-owned Farms (Propria Farms)	Input monthly total quantity of sugarcane sourced from applicant-owned (Propria) sugarcane farms (metric tonnes).
3.3 Transport Distance of Cane Sourced from Applicant-Owned Farms (weighted average)	Enter monthly weighted average sugarcane transport distance by HDD Truck to mill from applicant-owned farms (km).
3.4 Cane Purchased from Partnership Farms (Terceiros Farms)	Enter monthly total quantity of sugarcane sourced from partnership (Terceiros) sugarcane farms (metric tonnes).
3.5 Transport Distance of Cane Sourced from Partnership Farms (weighted average)	Enter monthly weighted average sugarcane transport distance by HDD Truck to mill from partnership farms (km)
3.6 Total Sugarcane Procured (Calculated)	Total sugarcane sourced by the mill from applicant-owned and partnership farms (metric tonnes). This is a calculated value and does not require an input.
3.7 Filter Cake Transport & Distribution Distance (Calculated)	This field includes filter cake transport distance to the fields and is a calculated standard value (cane transport plus two miles). No user input necessary.
3.8 Amount of Externally Acquired or Purchased Bagasse[1]	Input monthly total quantity of additional sugarcane bagasse sourced from external sources for cogeneration (metric tonnes). Input required only if additional bagasse is sourced from external sources or intra-mill transfer.

[1] Includes externally acquired biomass (cane straw, wood chips, etc.) for use in the biomass boilers.

3.9 Amount of Electricity Generated from Externally Acquired or Purchased Bagasse (Calculated)	This is a calculated parameter and is dependent upon the physical properties of steam exiting the generator (kWh). Input is not required for this field.
3.10 Amount of Externally Acquired or Purchased Molasses	Input monthly total quantity of sugarcane molasses sourced (or purchased) from external mills for ethanol production purposes (metric tonnes).
3.11 Amount of Ethanol Produced from Externally Acquired or Purchased Molasses	Input monthly total quanties of ethanol produced from externally purchased or acquired molasses (m^3). This volume shall be estimated based upon the quality and quantity of every batch of external molasses acquired for the production of ethanol. See Additional Details for Section 3 below.
3.12 Amount of Purchased Electricity from the Grid	Input monthly total electricity purchased from the public grid (kWh).
3.13 Surplus Electricity Cogenerated and Exported	Input monthly total surplus, cogenerated electricity exported from the mill (kWh).
3.14 Juice Allocated to Sugar Production (weighted average)	Input monthly weighted average share (%) of sugarcane juice allocated to finished sugar production. This number must be verifiable by enterprise production / data collection systems.
3.15 Fraction Sucrose Entering Sugar Production (monthly weighted average)	Input monthly weighted fraction of sucrose (fermentable or crystalline sugars) in juice that enters the sugar production process (tonne per metric tonne cane). Values must be verifiable from batch laboratory samples, and values recorded in enterprise production systems (ATR or TRS). See additional details below Table D.3.
3.16 Anhydrous Ethanol Production (Reported at 20 C / 68 F)	Input monthly total volume of anhydrous ethanol produced (m^3).
3.17 Moisture Content (Anhydrous Ethanol)	Input monthly weighted average moisture content (%) in anhydrous ethanol produced.
3.18 Adjusted Anhydrous Ethanol Production (Calculated)	Anhydrous ethanol produced less calculated ethanol from externally acquired molasses (m^3). Additional details are provided below Table D.3.
3.19 Hydrous Ethanol Production (Reported at 20 C / 68 F)	Input monthly total volume of hydrous ethanol produced (m^3).
3.20 Moisture Content (Hydrous Ethanol)	Input monthly weighted average moisture content (%) in hydrous ethanol produced. Must specify frequency of sampling for continuous production (batch, daily, or random).
3.21 Adjusted Hydrous Ethanol Production (Calculated)	Hydrous ethanol produced less calculated ethanol from externally acquired molasses (m^3). No user input necessary. Additional details are provided below Table D.3.

3.22 Amount of Finished/Table Sugar Produced	Input monthly total quantity of finished or table sugar produced (metric tonnes).
3.23 Total Ethanol Production (Reported at 20 C / 68 F) (Calculated)	Monthly total volume of anhydrous and hydrous ethanol produced (m^3). This is a calculated value and does not require user input.

Additional Details for Section 3:

Field 3.11

The volume of ethanol produced from externally purchased or sourced molasses ("external molasses") shall be determined for every batch of external molasses used in the production of ethanol. This volume can be estimated from the quality and quantity of every batch of externally acquired molasses.[2] The amount of fermentable sugars in the external molasses per metric tonne of standard molasses must be determined (batch specific value). The overall sugars-to-ethanol conversion efficiency must also be known. Commonly called "eta_e or ηe," the sugar-to-ethanol conversion factor is empirically determined in the Simplified CI Calculator, and is mill or site specific. This empirically determined value is depicted in Cell O75 of the Calculator! Tab, and is a site-specific value. The volume of ethanol derived from external molasses is then calculated as follows:

Sample Calculation for Determining the Volume of Ethanol Produced from External Molasses:

Quality of external molasses acquired = metric tonnes of fermentable sugars in external molasses / metric tonne of standard molasses

Quality of External Molasses Acquired:	=	0.50 (1)
Metric tonnes of external molasses acquired:	=	995.40 tonnes (2)
Therefore, amount of fermentable sugars:	=	0.50 x 995.4 (1 x 2)
Amount of fermentable sugars:	=	497.70 metric tonnes (3)
Sugar-to-ethanol conversion factor:	=	0.42 (Eta _e or ηe) (4)
Dry tonne of ethanol produced:	=	207.04 metric tonnes (3 x 4)
Dry tonne of ethanol produced:	=	207,043.20 kg ethanol
Dry Volume of ethanol produced:	=	69,291.57 gal ethanol (2,988 g/gal)
Dry Volume of ethanol produced:	=	**262.31 m^3 ethanol**

[2] Records shall be made available to the Third-party Verifier upon request.

Field 3.15

The amount of sucrose (which is a proxy for crystalline and fermentable sugars in sugarcane juice) in the juice entering the sugar production process is not the same as the amount of sucrose in the juice measured after the sugarcane crush (ART). This is because some process losses associated with pre-treatment, and dilution of the juice may occur prior to the juice entering the sugar production process. These losses have been estimated to be approximately one percent of the total amount of sucrose. Therefore, if the amount of sucrose measured at the crush is 0.15 or 15 percent, the mill can expect the amount of sucrose at sugar production to be approximately 0.14 or 14 percent in enterprise production systems as ATR or TRS (or total reduced sugars after losses). The monthly weighted average value is referred in the Calculator as the "eta_j" parameter.

Field 3.18 and 3.21

If ethanol is produced from externally-sourced molasses, the quantity of ethanol produced is split equally between adjusted ethanol production calculated in fields 3.18 and 3.21. The adjustment subtracts half of the ethanol produced from externally-sourced molasses from the anhydrous ethanol produced, and the other half from hydrous ethanol produced.

Section 4: Calculation of Production Yields and Mass Allocation Ratio

Section 4 in the Calculator worksheet uses the fuel ethanol production yields from juice and molasses and calculates the mass allocation ratio (used to attribute upstream GHG impacts from sugarcane farming and transport to molasses derived ethanol). To calculate yields, mill-specific parameters need to be input. These parameters are called the Gopal-Kammen Model Parameters and are illustrated and discussed in Table D.4 below. Once these parameters are input, the CI Calculator uses an iterative process to calculate yields of ethanol from each feedstock using total production quantities of ethanol and finished sugar, as well as the mass allocation ratio. Details of the inputs required are described in Table D.4. Other calculated parameters and outputs are discussed in Table D.5.

The Simplified CI Calculator requires that the "Solver" Add-in functionality be installed into the version of Microsoft Excel run by the applicant. Instructions to install the Add-in function are provided below.

INSTRUCTIONS TO INSTALL "SOLVER" ADD-IN FUNCTIONALITY

1. Click or go to "File" in the Header Menu
2. Click or Select "Options" on the far Left Side Menu
3. A new window "Excel Options" opens up. Select "Add-ins" on the Left Side Menu.

4. In the Dialogue Box Select "Solver Add-in" either in the "Active Application," or "Inactive Application Add-ins." Click OK.
5. If you don't see the "Solver Add-in," do the following:
6. At the Bottom of the Dialogue Box, Select or Manage "Excel Add-Ins" from the Drop-down Menu. Then Select "Go."
7. An "Add-Ins" Window will Open. In the Window, Select or Check the Box for "Solver Add-in," and the Box for "Analysis ToolPak." Then Click OK.
8. Go to the Excel Header Menu and select "Data." The "Solver" function is located at the far right in the "Analyze" box.

Table D.4. Description of Calculator Worksheet Inputs for Section 4

G-K Model Parameter	Description
4.1 ηj (tonnes of fermentable sugars in juice/tonne of cane) (Calculated)	eta_j is a monthly weighted average parameter assigned to the fraction of sucrose in the juice that enters the finished sugar or ethanol production process. Due to some process losses associated with pre-treatment and pH adjustment, eta_j is not the same as the amount of sucrose measured after the cane crush, or at the gate. No user input is necessary.
4.2 ηs (tonnes of sucrose in final sugar/tonne of sucrose into sugar factory) (Calculated)	eta_s, this is the fraction of sucrose that enters sugar production and is converted into finished sugar. It is a calculated parameter, and no user input is necessary.
4.3 Sucrose in molasses (tonnes sucrose in molasses/tonne of sugarcane) (Calculated)	This is the ratio of the amount of sucrose in molasses per tonne of sugarcane that is available for conversion (fermentation) to ethanol. It is a calculated parameter and no user input is necessary.
4.4 ηe (dry tonnes of EtOH/tonne of fermentable sugars into distillery) (Calculated)	eta_e represents the conversion efficiency of a sugar molecule into ethanol. Assuming "sucrose" is a simple C6 sugar, the theoretical conversion efficiency of sugar is 0.51. In reality, this efficiency is in the range 0.43-0.48. It is a calculated parameter, and no user input is necessary.
4.5 LHV of anhydrous Ethanol (MMBtu/dry ton EtOH)	LHV of ethanol (MMBtu/dry ton). This is a standard value and no user input is necessary.
4.6 Choose ms (tonnes of sucrose in final sugar/tonne of final sugar product)	ms represents the purity of the finished sugar product. Input value for facility weighted average over 24 months of production. The user may choose the "User Defined" option in Cell E77 and then input a Site Specific value in Cell F77, or choose Standard Value in Cell E77. After choosing either option (and entering a user-defined value if the User-Defined option was selected), click F9 to update the sheet. The User-Defined input must be described in the Supplementary Documentation attached with the Simplified CI Calculator.
4.7 Choose mm (tonnes of fermentable sugars in standard molasses/tonne of standard molasses)	mm represents the amount of fermentable sugars in standard molasses per tonne of standard molasses. Input value for facility weighted average over 24 months of production. The user may choose the

	"User Defined" option in Cell E78 and then input a Site Specific value in Cell F78, or choose Standard Value in Cell E78. After choosing either option (and entering a user-defined value if the User-Defined option was selected), click F9 to update the sheet. The User-Defined input must be described in the Supplementary Documentation attached with the Simplified CI Calculator.
4.8 Modeled ethanol production (dry gal) (Calculated)	This is a calculated value, and is used as a check between reported and modeled values. It is based upon the yield of ethanol determined in the G-K table (Cells F85 and G85). Additional details are provided below Table D.4. No user input is necessary.
4.9 Adjusted reported ethanol production number (dry gal) (Calculated)	This is a calculated value and is used to compare modeled ethanol production quantities with input data provided by the applicant. Additional details are provided below Table D.4. No user input is necessary.
4.10 Differences between modeled and adjusted reported ethanol production numbers (dry gal) (Calculated)	This is a calculated value, and is based upon the difference of the modeled and adjusted reported ethanol production numbers. The objective is for this value to be zero. This cell will report an imbalance when a "Solver" solution cannot be found. Additional details are provided below Table D.4. No user input is necessary.
4.11 Modeled finished sugar production (metric tonnes) (Calculated)	This cell is a calculated value based upon the yield of finished sugar predicted in the G-K parameters table (Cell F81).
4.12 Reported finished sugar production (metric tonnes) (Calculated)	This cell is a calculated value based upon the monthly weighted average finished sugar production numbers reported by the applicant.
4.13 Differences between modeled and reported finished sugar production (metric tonnes) (Calculated)	This is a calculated value based on the differences between the modeled and reported production values of finished sugar production. The objective is set for this value to be near zero. This cell will report an imbalance when a "Solver" solution cannot be found. No user input is necessary.
4.14 Mass Allocation Ratio (Calculated)	Ratio used to apportion upstream GHG emissions associated with sugarcane production, harvest, transport, filter cake transport, and sugar production to molasses-based ethanol. This is a calculated value, and no user input is necessary.

Once the G-K parameters are input in Section 4, the sugarcane juice-to sugar share (Field 3.14) and the reported 24-month finished sugar and ethanol production data are utilized to compare modeled production quantities of finished sugar and ethanol, and to calculate fuel yields and the mass allocation ratio. This is accomplished as detailed below:

1. Select "Data" from the spreadsheet header menu above. Then Click the "Solver" icon menu above to the far right of the Header. A “Solver Parameters” window opens up. Ensure that the "Set Objective" refers to **cell E88**, and is set to a value of 0.0.

2. The variable cells “eta_s” and “eta_e” must be specified (separated by a comma) in the next sub-window entitled “By Changing Variable Cells.” Do not change any of the constraints defined in the “Subject to the Constraints” window (0.38 > eta_e < 0.48, and eta_s < = 0.99). Cell F90 must include an input with a constraint less than or equal to 1.0.

3. Check box “Make Unconstrained Variables Non-Negative.” Choose “GRG Nonlinear” for the Solving Method. Then Click the "Solve" button at the bottom.

4. The Solver will go through several iterations to find a solution. A new window "Solver Results" will open up. Solver will display the message that a solution has been found, and all constraints and optimality conditions have been satisfied. Choose to keep the Solver Solution.

5. Click OK. The mass allocation ratio has been calculated to determine upstream impacts.

6. If a solution has not been found, then check the data in Section 3 and Section 4 for accuracy until a solution has been found, and all constraints and optimality conditions have been satisfied. Use the imbalance between modeled and reported production quantities of ethanol and finished sugar to refine the parameters.

7. If a solution has not still been found, then check the juice shares in Field 3.14 (fraction juice allocated to sugar production), and the amount of sucrose in Field 3.15 that enters sugar production (fraction of sucrose in the cane juice that enters sugar production). The level of sucrose (eta_j), input 4.1, could be lower due to process losses even if measured higher at the gate or after the cane crush. Process losses must be empirically determined. Additionally, the juice shares allocate the juice between finished sugar and ethanol production. Therefore if the output cannot be matched, the juice shares may be checked to boost the output of finished sugar or ethanol.

Additional details for Table D.4 calculated parameters.

Field 4.10 “Difference between reported and modeled” should be a calculated value of zero (0.0). If a non-zero number exists in this cell, the Solver is alerting the applicant to a constraint in output that cannot be increased or decreased as a result of the G-K parameters and production data entered. For example, Cell E88 may indicate that a difference of 100,000 gallons of ethanol exists between the reported production quantities and the modeled quantity from each feedstock.

Field 4.11 “Modeled finished sugar production (metric tonnes)” shows the modeled quantity of finished sugar based on the G-K parameters and the data entered in Section 3. If this quantity does not match the reported finished sugar production number (Section 3, Field 3.22), then it is an indication that some of the parameters could be incorrect leading to an imbalance in the modeled quantities obtained from the material balance.

Field 4.14. “Mass Allocation Ratio” is used to apportion upstream GHG emissions associated with sugarcane production, harvest, transport, filter cake transport, and sugar production to the molasses-based ethanol pathway. A well-to-tank CI for each feedstock is calculated, but the composite CI is the CI that will be used for reporting fuel volumes and periodic verification. This CI is depicted in the value for field “Composite CI, gCO_2e/MJ” shown in the block “Pathway Summary and Calculated CI” at the top of the Calculator worksheet. The Composite CI can also be calculated or updated by clicking on the “Calculate CI” button (green) in Section 4 of the Calculator worksheet. Clicking or selecting this button has the same effect as launching the Data Solver function in the worksheet.

General Note- The applicant should note that if information in the Section 3 table is changed (for example, if the monthly sugarcane throughput, or the measured sucrose level entering the sugar production process was to be lowered) after a “Solver” solution has been found, it will likely result in an imbalance in ethanol volume produced being reported in **Cell E88** of the Calculator worksheet. In this case, the applicant must repeat the steps in Section 4, and find a new solution utilizing the “Solver” function. If any other non-production information is changed that warrants a new calculation of the CI value (for example, if the transport distance parameters were to be changed), then the CI value will be updated automatically, or may be updated by pressing the F9 function key.

The next block in the Calculator worksheet (Section 5) presents a summary of fuel yields from each feedstock, as well as a summary of modeled finished sugar, ethanol production from each quantity of feedstock, and surplus cogenerated electricity exported to the public grid (Table D.6) for the 24-month or 3+ month (provisional pathway) periods. While the parameters in this block are calculated parameters, the applicant should verify the accuracy of the model with actual production data (see Section 3).

Section 5: Verify Fuel and Co-Product Production Information

Section 5 does not require any user input, but presents the intermediate results of the Simplified CI calculator if the monthly production data has been entered correctly and the model has been executed without error. A discussion of each calculated parameter is provided in Table D.5.

Table D.5. List of calculated fields for Section 5 of the Calculator worksheet

Field Description	Value
5.1 Amount of Ethanol Produced from Sugarcane Juice (Calculated)	Ethanol produced from sugarcane juice feedstock (dry gal). No user input is necessary.
5.2 Sugarcane Juice-to-Ethanol Yield (Calculated)	Yield of ethanol from sugarcane processed at the mill (dry gal per wet metric tonne) from cane juice feedstock. No user input is necessary.
5.3 Amount of Ethanol Produced from Molasses (Calculated)	Ethanol produced from sugarcane molasses feedstock (dry gal). No user input is necessary.
5.4 Molasses-to-Ethanol Yield (Calculated)	Yield of ethanol from sugarcane processed at the mill (dry gal per wet metric tonne) from molasses feedstock. No user input is necessary.
5.5 Total Ethanol Volume Produced (Calculated)	Total ethanol produced from cane juice and molasses (dry gal). No user input is necessary.
5.6 Total Amount of Finished Sugar Produced (Calculated)	Calculated quantity of finished sugar produced at the mill; it should match the total production input based on 24-month data (metric tonnes). No user input is necessary.
5.7 Net Surplus Cogenerated Electricity Exported (Calculated)	Net (of purchases) amount of surplus cogenerated electricity exported, in kWh. No user input is necessary.
5.8 Net Electricity Credited to Pathway (Calculated)	Net amount of surplus cogenerated electricity credited to the pathway (kWh) after allocation between co-products. No user input is necessary.
5.9 Electricity Co-Product Credit (Molasses Feedstock) (Calculated)	Net amount of surplus cogenerated electricity credited to the pathway (kWh) per gallon of ethanol produced from Molasses feedstock. No user input is necessary.
5.10 Electricity Co-Product Credit (Cane Juice Feedstock) (Calculated)	Net amount of surplus cogenerated electricity credited to the pathway (kWh) per gal ethanol produced from Sugarcane juice feedstock. No user input is necessary.
5.11 Composite Electricity Co-Product Credit (kWh/gal) (Calculated)	Total electricity co-product credit calculated based on a weighted average of electricity generated from molasses and juice-based production processes. No user input is necessary.

A final composite fuel pathway CI is determined based upon the 24-month production parameters entered in Section 3 of the Calculator worksheet (see “Pathway Summary and Calculated CI (gCO_2e/MJ)” block at the top of the worksheet).

Emissions Factor (EF)-based Aggregated CI Impact Determination for Sugarcane Juice Feedstock

For each aggregated impact associated with the well-to-wheels assessment, emissions factors have been developed that enable the determination of the GHG impacts per metric tonne of feedstock, or per gallon of finished ethanol produced (macroscopic factors). The GHG impacts are then divided by the energy value of the finished fuel produced to give the CI impact of the aggregated component of each feedstock-based pathway. These factors were developed for each feedstock, and in this section the CI for the pathway based on sugarcane juice feedstock is determined. The CI of the sugarcane juice-based feedstock is combined with the CI of sugarcane molasses-based feedstock (see below) to determine a composite CI for all ethanol produced and reported in the section entitled "Pathway Summary and Calculated CI (gCO_2e/MJ)."

Emissions Factor (EF)-based Aggregated CI Impact Determination for Sugarcane Molasses Feedstock

For each aggregated impact associated with the well-to-wheels assessment, emissions factors have been developed that enable the determination of the GHG impacts per metric tonne of feedstock, or per gallon of finished ethanol produced (macroscopic factors). The GHG impacts are then divided by the energy value of the finished fuel produced to give the CI impact of the aggregated component of each feedstock-based pathway. These factors were developed for each feedstock, and in this section the CI for the pathway based on sugarcane molasses feedstock is determined. The CI of the sugarcane molasses-based feedstock is combined with the CI of sugarcane juice-based feedstock (see above) to determine a composite CI for all ethanol produced and reported in the section entitled "Pathway Summary and Calculated CI (gCO_2e/MJ)."

Aggregated CI Calculations (for each feedstock)

This section contains a detailed breakdown of the calculations used for the CI determination based on user inputs and applicable reference data in this calculator. Calculations are based upon emissions factors directly adopted from the draft CA-GREET3.0 model proposed for adoption. The CI Calculations provide an aggregation of each GHG impact that results from application of agricultural inputs, crop harvesting, transport to fuel production facility, fuel production, transport and distribution of the fuel, and assessments of co-product credits. The CI Calculations further provide an overview of the contribution to the composite CI, by feedstock.

Footnotes

Footnotes are included below the CI Calculations for user reference.