

DRAFT USER GUIDE FOR LCFS SIMPLIFIED CI CALCULATOR

Biodiesel and Renewable Diesel

A. Introduction

This document provides detailed instructions for the use of the Simplified CI Calculator for Tier 1 biodiesel (BD) and renewable diesel (RD) pathway applications. This calculator is to be used to determine the carbon intensity (CI) for either BD or RD produced from multiple feedstocks including Soy Oil, canola, corn oil, used cooking oil, and tallow/animal fat. Specific inputs to this Calculator are subject to periodic verification. Each specific input requirement 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 draft Simplified CI Calculator here:

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The draft calculator has been automated to perform CI calculations using factors from the draft CA-GREET 3.0 model. The calculator is expected to replace the existing Tier 1 calculator and the operational data template in pathway application packages. The calculator requires the applicant to add facility information and verifiable monthly feedstock, operational energy use, fuel and co-product data, and transport distances used in calculating the CI of either BD or RD pathways. **All inputs selected and input by the applicant are subject to verification unless specifically exempted.**

This calculator also includes additional reference material such as greenhouse gas emissions factors used in CA-GREET 3.0 and reference fuel specifications. Also included with the calculator is a detailed breakdown of the calculations used to determine the final CIs of the various feedstock-finished fuel combinations.

B. Definition

Below is a list of definitions for the input data values used in the calculator:

Site Specific - An input value, or the raw operational data used to calculate an input value, which is required to be unique to the facility, pathway, and feedstock. All site-specific inputs that appear in the operational data summary form must be measured, metered or otherwise documented, and verifiable, e.g., consumption of utility natural gas or grid electricity at a fuel-production facility must be documented by invoices from the utility. Under this potential framework, an application might be rejected as incomplete if a site-specific input value cannot be determined.

Conditional Default - A conservative input value established by ARB staff, which may be used under specified conditions that is not subject to further conformance review. In a situation in which an applicant cannot provide the necessary information to determine and validate site-specific values, a conditional default may be used as a necessary substitute for the site-specific value. The conditions under which this value must be used are specific to each situation and would be defined by ARB staff accordingly. Conditional default values would be subject to validation that the specified conditions are met, but would not be subject to further verification, with the rationale that the value is based on reasonable assumptions and is sufficiently conservative to encourage use of site-specific values when feasible.

Standard Value - An input value that would not appear in the CI application operational data summary form and could not be modified to a site-specific value unless the applicant receives permission from the Executive Officer. These values are intended to be the same for all applicants of a given fuel type, and therefore would not be subject to CI conformance evaluation by ARB or third-party verifiers, e.g., the pipeline transmission distance for fossil natural gas; much of the background data used in CA-GREET 3.0 model, including emission factors, truck capacities, and farming inputs.

C. Color Legend Used in the Calculator

Yellow Cells require user input
Light Blue Cells show CI results
Green Cells show the calculation button
Gray Cells are Calculated Values

D. Calculator Overview

The following table provides an overview of the tabs used in the Simplified CI Calculator.

Table D.1. Overview of Tabs used in the Simplified CI Calculator.

Tab Name	Description
BD RD Summary	Summary worksheet. Contains an overall summary of the information entered in the “Soy Oil”, “Canola”, “Corn Oil”, “UCO”, “Tallow” tabs for feedstock production along with “BD-Production” and “RD-Production” tabs for fuel production of the calculator and calculated CIs and corresponding fuel volumes. The tab includes a ‘toggle’ for user to select either biodiesel or renewable diesel. This tab uses information from the feedstock and “BD-Production: or “RD-Production” tabs to provide a summary of pathway inputs, carbon intensities and corresponding BD or RD volumes for the various streams from a BD or RD production facility.
Soy Oil, Canola, Tallow, Corn Oil, UCO	Contains fields requiring user inputs for feedstocks (used in biofuel production), fields with grayed out cells (which are automatically calculated but dependent on input to yellow cells in the corresponding sections of the calculator) and other information from CA-GREET 3.0 required in calculating pathway CIs for BD or RD production. These tabs also includes details of CI calculations for the corresponding feedstock in each tab.
BD-Production, RD-Production	Contain a components of the calculator with fields requiring user inputs and those calculated by the sheet. Calculations in grayed out cells are automatically calculated but dependent on input to yellow cells in the feedstock and fuel production tabs of the Calculator. Additional information in these tabs are from CA-GREET 3.0 required in calculating pathway CIs for BD or RD. These tabs also include CI calculations.
EF Table	Contains greenhouse gas emissions factors from the CA-GREET 3.0 model used in calculation of carbon intensities.
References	Contains specifications of fuels and unit conversions. It also contains loss factors for Soy Oil, canola oil, tallow, corn oil and UCO.
Fuel_Specs	Contains specifications of fuels, global warming potentials of greenhouse gases, carbon and sulfur ratios of pollutants and other information used in calculation of CIs for BD or RD.
Misc.	Contains other information used in the calculation such as indirect land use and loss factors.

EF Table Tab

This tab includes CI factors used in calculating CIs in the Calculator. All factors are expressed in gCO₂e/MJ of either BD or RD produced from soy oil, canola, tallow/animal fat, corn oil and used cooking oil. These are calculated using CA-GREET 3.0.

References Tab

This sheet details standard inputs in the Calculator for both soybean and canola farming for BD and RD. These inputs are not subject to change by the applicant. Most of these inputs are from CA-GREET 3.0. The standard inputs include farming energy, farming fertilizer and other chemical inputs, nitrous oxide production rate in soil based on nitrogen content of fertilizer used, CI for chemical used, co-product yield, and fuel transport distance from blending terminals to retail fueling stations.

Fuel_Specs Tab

This sheet includes fuel specifications (i.e., HHV, LHV, density, carbon ratio) for various process fuels, Global Warming Potentials of various greenhouse gases, carbon and sulfur ratios of greenhouse gas species, sulfur content in gasoline and diesel, unit conversions.

Misc. Tab

This tab includes loss factors from soybean, canola, corn oil, UCO, and tallow pathways and are directly incorporated from CA-GREET 3.0.

E. Calculator Details– Feedstock Tabs: Soy Oil, Canola, Tallow, UCO, and Corn Oil

The feedstock tabs contain the input worksheets for all the feedstocks listed above. This section provides details for the Soy Oil tab only. The other feedstock tabs are similar. The Soy Oil tab consists of the following major components (applies to **ALL** feedstock categories above):

- Section 1. Applicant Information
- Section 2. Feedstock Source
- Section 3. Feedstock Inputs

Section 1: Applicant Information

Begin by selecting the appropriate feedstock tab and entering the company name, city and state where the biodiesel or renewable diesel production facility is located. All CI values are calculated based on relevant site-specific inputs which have to be entered in the respective input fields. Details for entering data in all required fields is provided below.

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

Field Name	Description
1.1. Company Name	Registered name of the company. Example “ABC Company, LLC” or “ABC Company, Inc.”
1.2. Company ID	Enter U.S. EPA Company ID. If not available, contact CARB for LCFS Company ID.
1.3. Facility ID	Enter the Company’s Facility ID. If not available, contact CARB for LCFS Facility ID.
1.4. Soy Oil Production Location	Enter City, State, and Country where soy oil is sourced.

Section 2: Feedstock Source

Table E.2 lists the details of fields in Section 2 of the Soy Oil tab.

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

Field Name	Description
2.1. Select Source of Feedstock	Field 2.1 (for soybean production) includes two choices in a pulldown menu: U.S. or User-defined. If U.S. sourced soybean is selected, it is a standard input and no additional inputs are required for soybean farming.
2.2. If User-Defined selected, specify source of Soybean	If user-defined is selected in field 2.1, input source of soybeans in field 2.2. Input additional information if any in field 2.5. Click on “CI Calculation” in cell E12.
2.3. Specify GHG Emission Factor of Soybean Farming, gCO₂e/ton	If user-defined is selected in field 2.1, consult CARB staff to develop emission factors for soybean farming in gCO ₂ e/ton for the specific region and input in cell G10. This field is highlighted only if “user-defined” is selected in field 2.1.
2.4. Select Oil Extraction	Provides option for standard or site-specific for oil extraction from soybean. If standard is selected, no additional input is required for Section 2. Standard applies for all U. S. facilities which extract oil from soybeans. For oil extraction sites outside the U. S., select site-specific and click on “CI Calculation” in cell E12. Input additional information in field 2.5. For facilities in the U.S. who elect to use the site-specific option, use the same process detailed for fields 2.4 and 2.5.
2.5. Enter Oil Extraction GHG Emission Factor, gCO₂e/lb. oil	If user-defined is selected in field 2.4, consult CARB staff to develop emission factors for oil extraction in gCO ₂ e/lb. oil for the specific region and input in cell G11. This field is highlighted only if “site-specific” is selected in field 2.1.

Section 3: Feedstock Inputs

Table E.3 lists the fields used in Section 3 of the Soy Oil tab in the Calculator.

Table E.3. List of input fields for Section 3 in the Soy Oil Tab of the Simplified CI Calculator

Field Name	Description
3.1. Monthly Data	Label for all 24 months for which data inputs are required. No inputs are required for field 3.1.
3.2. Beginning	Input beginning feedstock inventory data (in lbs.) for the first month

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Feedstock Inventory	in field 3.2. No inputs are required for the remaining months since these are calculated using inputs in fields 3.2 to 3.5.
3.3. Oil Received	Input monthly total feedstock (in lbs.) purchased in this field for all 24 months of operation.
3.4. Oil Used (Calculated)	Monthly feedstock (in lbs.) used is automatically calculated in field 3.4. No inputs are required for this Field.
3.5. Ending Feedstock Inventory	Input monthly total feedstock inventory (in lbs.) in this field for all 24 months of operation.
3.6. Moisture Content	Input monthly weighted average moisture content (in percentage) for feedstock in this field for all 24 months of operation. Utilize an industry standard moisture measurement protocol.
3.7. Feedstock Transport (weighted average)	Field 3.7 is a label for feedstock transportation to the biodiesel or renewable diesel production plant. No inputs are required for this section.
3.8. Weighted average of oil transported by HDD Truck	Input monthly total feedstock transported by HDD truck and monthly weighted average transport distance by this mode in field 3.8.
3.9. Weighted average of oil transported by Ocean Tanker	Input monthly total feedstock transported by Ocean Tanker and monthly weighted average transport distance by this mode in field 3.9.
3.10. Weighted average of oil transported by Rail	Input monthly total feedstock transported by rail and monthly weighted average transport distance by this mode in field 3.10.
3.11. Weighted average of oil transported by Barge	Input monthly total feedstock transported by barge and monthly weighted average transport distance by this mode in field 3.11.

Section 3.0 Additional details for Feedstock Inputs Section

For feedstock production, enter data for site-specific inputs for feedstock inventory to enable calculation of quantity of feedstock used in biofuel production. Cells which

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are grayed out are calculated values and do not require applicant input. The first input is the beginning inventory of feedstock (in pounds) and all calculations for beginning inventory for subsequent months are automatically calculated from the inputs to other cells in this section of the sheet. Input monthly totals for feedstock received (as purchased) in pounds and total monthly ending feedstock inventory in pounds. The monthly total quantities must be inclusive of moisture (and not to be reported on a dry basis). The inventory data is used to determine the total feedstock used as feedstock for biofuel production.

To facilitate calculation of weighted transport distance, staff is suggesting a calculation methodology detailed below. The monthly weighted average for each mode (feedstock transport in a given month may include more than one mode of transport) is included in the cell, for instance, soy oil transport for a given month. This methodology is suggested be used to report monthly weighted average transport distance in the Calculator sheet.

Actual soyoil (lbs.) transported by corresponding mode of transport and miles transported						
Modes of Transport						
	Truck	Miles	Rail	Miles	Barge	Miles
1	100,000	50	100,000	1,200		
2	200,000	150				
3			200,000	800		
4			100,000	200	100,000	250
5			50,000	1,000		
6						
7						
8						
Weighted average distance and corresponding quantities to be used for monthly reporting of feedstock						
	300,000	117	450,000	778	100,000	250
Example in sheet above:						
Entry 1	For the month, the facility received 100,000 lbs. by a mode which included 50 miles by truck followed by 1200 miles by rail					
Entry 2	For the month, the facility also received 200,000 lbs. by truck only with a transport distance of 150 miles					
Entry 3	For the month, the facility also received 200,000 lbs. by rail only with a transport distance of 800 miles					
Entry 4	For the month, the facility also received 100,000 lbs. which included 200 miles by rail followed by 250 miles by barge					
Entry 5	For the month, the facility also received 50,000 lbs. using only rail transport for a distance of 1000 miles					

For these scenarios, the facility shall report 300,000 lbs. with a weighted average distance of 117 miles by HDD truck, 450,000 lbs. with a weighted average distance of 778 miles by rail and 100,000 lbs. with a weighted average distance of 250 miles by barge.

For transport of feedstock, applicants must calculate the appropriate mileage for each mode of transport as described below. For rail transport, mileage must be based on the rail network maps from either BNSF Railway¹ or Union Pacific.² For facilities which are not on the BNSF or Union Pacific rail network, applicants may use

¹ BNSF railway system: <http://www.bnsf.com/customers/where-can-i-ship/>

² Union Pacific system: <https://www.up.com/aboutup/usguide/index.htm>

a publicly available web-based driving distance estimator for the distance between the facility and the nearest rail depot. Truck transport distance between two points may be determined using a publicly available web-based driving distance estimator. Barge transport distance must be calculated using a reputable online mapping system, reported in miles.³ Nautical miles calculated by the online mapping system must be converted to miles using the conversion factor of 1 nautical mile/1.152 miles.⁴

F. Calculator Details – BD Production Tab

The “BD-Production” tab contain the CI calculation worksheet consisting of the following major components:

- Section 1. Pathway Summary and Estimated CI (g/MJ)
- Section 2. Fuel Production Data Summary
- CI Calculation Details

All CI values are calculated based on relevant site-specific inputs entered in the respective input fields. Only after all site-specific inputs for a given facility have been entered, the calculated CIs will represent the pathway CIs for the various streams as detailed in this tab and the “BD RD Summary” tab. Details for entering data in all required fields is detailed below.

Section 1: Applicant Information

Table F.1 includes fields requiring inputs related to applicant, facility location. This section also provides a summary of pathway CIs corresponding to inputs in the feedstock tabs and the BD-Production tab. All CI values are calculated based on relevant site-specific inputs which have to be entered in the respective input fields. Only after all site-specific inputs for a given facility have been entered, the calculated CIs shall represent the pathway CIs for the various streams as detailed in this tab.

³ Example of an online nautical distance mapping system: <https://www.marinetraffic.com/en/voyage-planner>

⁴ Nautical miles to miles conversion factor source: <http://www.metric-conversions.org/length/uk-nautical-miles-to-miles.htm>

Table F.1. List of input fields for Section 1.0 of the Simplified CI Calculator.

Field Name	Description
1.1. Applicant	Registered name of the company. Example “ABC Company, LLC” or “ABC Company, Inc.”
1.2. Facility Location	Enter City, State, and Country of BD production facility.
1.3. Pathway Summary	Field to include a summary of the BD pathways such as “soy oil and tallow to BD”.

This section of the calculator contains the calculated CI results for a BD pathways. The final results are displayed here after the data are entered and user clicks the “Calculate CI” button.

Section 2: Enter BD Production Energy Consumption, Chemicals, Co-products, and Fuel Transport Data

The following table lists the fields used in Section 2 of the calculator.

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

Field Name	Description
2.1. Regional Electricity Mix for Fuel	Field 2.1 contains 30 regional electricity mixes. Applicant must select a regional mix from the dropdown menu based on the facility location.
2.2 Enter GHG EF of Electricity Mix, gCO₂e/kWh	This field is highlighted only if “User-Defined Mix” is selected in field 2.1. This field requires input of emission factor for electricity mix corresponding to the location of the RD production facility. Consult with CARB staff to develop a site-specific emission factor for crude. Input emission factor in this field (cell N22).
2.3. Regional Crude Mix	Choose the source of crude mix from the pulldown menu based on location of BD production facility. If selection is “U. S. Average Crude”, no additional input is required but requires clicking on the “Calculate CI” button. If selection is “User-Defined Crude”, consult with CARB staff to develop emission factor for crude. After selection, click on “Calculate CI” button.

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<p>2.4. Enter GHG EF of Crude Sources, gCO₂e/MMBtu of Crude</p>	<p>This field is highlighted only if “User-Defined Crude” is selected in field 2.3. This field requires input of emission factor for crude corresponding to the location of the BD production facility. Consult with CARB staff to develop a site-specific emission factor for crude. Input emission factor in this field (cell N23).</p>
<p>2.5. Regional Natural Gas (NG) Source</p>	<p>Choose the source of NG from the pulldown menu based on location of BD production facility. If selection is “U. S. NG”, no additional input is required but requires clicking on the “Calculate CI” button. If selection is “User-Defined NG”, consult with CARB staff to develop emission factor for crude. After selection, click on “Calculate CI” button.</p>
<p>2.6. Enter GHG EF of NG Sources, gCO₂e/MMBtu of NG</p>	<p>This field is highlighted only if “User-Defined NG” is selected in field 2.5. This field requires input of emission factor corresponding to the location of the BD production facility. Consult with CARB staff to develop a site-specific emission factor for crude. Input emission factor in this field (cell N24).</p>
<p>2.7. Monthly Data</p>	<p>Label for all 24 months for which data inputs are required. No inputs are required for field 2.7.</p>
<p>2.8. Beginning Biodiesel Inventory (60°F)</p>	<p>Input monthly inventory data for BD (gallons at 60°F) for the first month in field 2.8. No inputs are required for the other months since these are calculated from inputs in fields 2.9 through 2.11.</p>
<p>2.9. Biodiesel Produced (Calculated) (60°F)</p>	<p>Monthly fuel produced data (gallons at 60°F) in this field will be automatically calculated. No inputs are required for the other months since these are calculated from inputs in fields 2.8 through 2.11.</p>
<p>2.10. Ending Biodiesel Inventory (60°F)</p>	<p>Input monthly total ending inventory for BD (gallons at 60°F) in this field for all 24 months of operation.</p>
<p>2.11. Biodiesel Sales (60°F)</p>	<p>Input monthly total sales data of BD (gallons at 60°F) in this field for all 24 months of operation.</p>
<p>2.12. NG Use from Utility Invoices</p>	<p>Input monthly total NG consumption data (mmBtu, HHV) in this field for all 24 months of operation.</p>

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2.13. Electricity Use from Utility Invoices	Input monthly total electricity use (in kWh) in this field for all 24 months of operation.
2.14. Alternate Fuel Use	If another fuel source is used for fuel production, input monthly total use (lbs.) in field 2.14 for all 24 months of operation. Consult with CARB staff to develop appropriate emission factor for the alternate fuel.
2.15. Beginning Methanol Inventory	Input monthly inventory data for methanol (in lbs.) for the first month in field 2.15. No inputs are required for the other months since these are calculated from inputs in fields 2.16 through 2.18.
2.16. Methanol Used (Calculated)	Monthly methanol used data in this field will be automatically calculated. No inputs are required for this field.
2.17. Methanol Purchased	Input monthly total methanol purchased data in this field for all 24 months of operation.
2.18. Ending Methanol Inventory	Input monthly total methanol ending inventory in this field for all 24 months of operation.
2.19. Distillate Bottoms Production	Input monthly total distillate bottoms data (in lbs.) in this field for all 24 months of operation. Consult with CARB staff to develop appropriate emission factor for co-product credit. To ensure co-product credit, appropriate evidence of end-fate of all co-products need to be demonstrated. If part or all of the distillate bottoms are used as process fuel, co-product credit will not be offered.
2.20. Free Fatty Acids Production	Input monthly total free fatty acids data (in lbs.) in this field for all 24 months of operation. Consult with CARB staff to develop appropriate emission factor for co-product credit. To ensure co-product credit, appropriate evidence of end-fate of all co-products need to be demonstrated.
2.21. Glycerin Production (moisture corrected)	Monthly total glycerin data (in lbs.) must be input in this field for all 24 months of operation. To ensure co-product credit, appropriate evidence of end-fate of all co-products need to be demonstrated.

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2.22. Other Co-products (Specify here)	Monthly total other co-product data (in lbs.) must be input in this field for all 24 months of operation. Appropriate evidence to support “other” (must specify) production must be available. Consult with CARB staff to develop appropriate emission factor for co-product credit. To ensure co-product credit, appropriate evidence of end-fate of all co-products need to be demonstrated.
2.23. Biodiesel Transportation	No inputs are required for field 2.23.
2.23.a. By HDD Truck to port/yard	Input miles transported by HDD truck from BD production facility to either a port or rail yard for further transport.
2.23.b. By HDD Truck to blending terminal	Input miles transported by HDD truck to final blending terminal.
2.23.c. By Rail	Input miles transported by rail to blending terminal. The point of origin for rail transport is either from a loading dock at the BD production facility or a point where BD is transported from the production facility by HDD truck to a railyard (as described in field 2.23.a).
2.23.d. By Ocean Tanker	Input miles transported by Ocean Tanker to a blending terminal. The point of origin for ocean transport is either from a loading dock at the BD production facility or a point where BD is transported from the production facility by HDD truck to a port (as described in field 2.23.a).
2.23.e. By Barge	Input miles transported by barge to blending terminal. The point of origin for barge transport is either from a loading dock at the BD production facility or a point where BD is transported from the production facility by HDD truck to a port (as described in field 2.23.a).

Electricity Mix

The applicant must select a regional electricity mix for biofuel production from “Electricity Mix Region for Fuel”. The dropdown menu consists of 30 sub-regions (26 from the U.S based on eGRID 2014⁵, one from Brazil, one from Canada, one from U.S average, and one for User Defined region⁶).

⁵ “Emissions & Generation Resource Integrated Database (eGRID)” - U.S EPA, extracted 02-2017: <https://www.epa.gov/energy/emissions-generation-resource-integrated-database-eGRID>

⁶ Although Canada and Brazil are included in the drop down menu, the starch calculator is designed only for starch ethanol and corn fiber ethanol produced in the U. S.

CI Calculation Details

This section contains an example pathway CI calculation with a detailed breakdown of all calculations used for CI determination based on information entered by the user and applicable reference data. These calculations are included in cells 56 through 271 in the BD production tab. Calculations are based on representative inputs used in the input cells in this calculator. None of the user-defined options have been used in the sample calculations.

G. Calculator Details – RD Production Tab

The “RD-Production” tab contain the CI calculation worksheet consisting of the following major components:

- Section 1. Pathway Summary and Estimated CI (g/MJ)
- Section 2. Fuel Production Data Summary
- CI Calculation Details

All CI values are calculated based on relevant site-specific inputs entered in the respective input fields. Only after all site-specific inputs for a given facility have been entered, the calculated CIs will represent the pathway CIs for the various streams as detailed in this tab and the “BD RD Summary” tab. Details for entering data in all required fields is detailed below.

Table G.1. List of input fields for Section 1.0 of the Simplified CI Calculator.

Field Name	Description
1.1. Applicant	Registered name of the company. Example “ABC Company, LLC” or “ABC Company, Inc.”
1.2. Facility Location	Enter City, State, and Country of RD production facility.
1.3. Pathway Summary	Field to include a summary of the RD pathways such as “soy oil and tallow to RD”.

This section of the calculator contains the calculated CI results for a RD pathways. The final results are displayed here after the data are entered and user clicks the “Calculate CI” button.

Section 1: Applicant Information

Table F.1 includes fields requiring inputs related to applicant, facility location. This section also provides a summary of pathway CIs corresponding to inputs in the feedstock tabs and the RD-Production tab. All CI values are calculated based on

relevant site-specific inputs which have to be entered in the respective input fields. Only after all site-specific inputs for a given facility have been entered, the calculated CIs shall represent the pathway CIs for the various streams as detailed in this tab.

Section 2: Enter RD Production Energy Consumption, Co-products, and Fuel Transport Data

The following table lists the fields used in Section 2 of the calculator.

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

Field Name	Description
2.1. Regional Electricity Mix for Fuel	Field 2.1 contains 30 regional electricity mixes. Applicant must select a regional mix from the dropdown menu based on the facility location.
2.2. Enter GHG EF of Electricity Mix, gCO2e/kWh	This field is highlighted only if “User-Defined Mix” is selected in field 2.1. This field requires input of emission factor for electricity mix corresponding to the location of the RD production facility. Consult with CARB staff to develop a site-specific emission factor for crude. Input emission factor in this field (cell N22).
2.3. Regional Crude Mix	Choose the source of crude mix from the pulldown menu based on location of RD production facility. If selection is “U. S. Average Crude”, no additional input is required but requires clicking on the “Calculate CI” button. If selection is “User-Defined Crude”, consult with CARB staff to develop emission factor for crude. After selection, click on “Calculate CI” button.
2.4. Enter GHG EF of Crude Sources, gCO2e/MMBtu of Crude	This field is highlighted only if “User-Defined Crude” is selected in field 2.3. This field requires input of emission factor for crude corresponding to the location of the RD production facility. Consult with CARB staff to develop a site-specific emission factor for crude. Input emission factor in this field (cell N23).
2.5. Regional Natural Gas (NG) Source	Choose the source of NG from the pulldown menu based on location of RD production facility. If selection is “U. S. NG”, no additional input is required but requires clicking on the “Calculate CI” button. If selection is “User-Defined NG”, consult with CARB staff to develop emission factor for crude. After selection, click on “Calculate CI” button.
2.6. Enter GHG EF of NG Sources, gCO2e/MMBtu of NG	This field is highlighted only if “User-Defined NG” is selected in field 2.5. This field requires input of emission factor corresponding to the location of the RD production facility. Consult with CARB staff to develop a site-specific emission factor for crude. Input emission factor in this field (cell N24).

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2.7. Monthly Data	Label for all 24 months for which data inputs are required. No inputs are required for field 2.7.
2.8. Beginning RD Inventory (60°F)	Input monthly inventory data for RD (gallons at 60°F) for the first month in field 2.8. No inputs are required for the other months since these are calculated from inputs in fields 2.9 through 2.11.
2.9. RD Produced (Calculated) (60°F)	Monthly fuel produced data (gallons at 60°F) in this field will be automatically calculated. No inputs are required for the other months since these are calculated from inputs in fields 2.8 through 2.11.
2.10. Ending RD Inventory (60°F)	Input monthly total ending inventory for RD (gallons at 60°F) in this field for all 24 months of operation.
2.11. RD Sales (60°F)	Input monthly total sales data of RD (gallons at 60°F) in this field for all 24 months of operation.
2.12. NG Use from Utility Invoices	Input monthly total NG consumption data (mmBtu, HHV) in this field for all 24 months of operation.
2.13. Electricity Use from Utility Invoices	Input monthly total electricity use (in kWh) in this field for all 24 months of operation.
2.14. Hydrogen Used	Input monthly Hydrogen use (in lbs.) from grid data in this field for all 24 months of operation.
2.15. Light Hydrocarbon Production	Input monthly inventory data for light hydrocarbon production (in lbs.) in this field for all 24 months of operation.
2.16. Naphtha Production	Input monthly inventory data for naphtha production (in lbs.) in this field for all 24 months of operation.
2.17. Propane Production	Input monthly inventory data for propane production (in lbs.) in this field for all 24 months of operation.

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2.18. Other Co-products (Specify here)	Monthly total other co-product data (in lbs.) must be input in this field for all 24 months of operation. Appropriate evidence to support “other” (must specify) production must be available. Consult with CARB staff to develop appropriate emission factor for co-product credit. To ensure co-product credit, appropriate evidence of end-fate of all co-products need to be demonstrated.
2.19. RD Transportation	No inputs are required for field 2.19.
2.19.a. By HDD Truck to port/yard	Input miles transported by HDD truck from RD production facility to either a port or rail yard for further transport.
2.19.b. By HDD Truck to blending terminal	Input miles transported by HDD truck to final blending terminal.
2.19.c. By Rail	Input miles transported by rail to blending terminal. The point of origin for rail transport is either from a loading dock at the RD production facility or a point where RD is transported from the production facility by HDD truck to a railyard (as described in field 2.19.a).
2.19.d. By Ocean Tanker	Input miles transported by Ocean Tanker to a blending terminal. The point of origin for ocean transport is either from a loading dock at the RD production facility or a point where RD is transported from the production facility by HDD truck to a port (as described in field 2.19.a).
2.19.e. By Barge	Input miles transported by barge to blending terminal. The point of origin for barge transport is either from a loading dock at the RD production facility or a point where RD is transported from the production facility by HDD truck to a port (as described in field 2.19.a).

Electricity Mix

The applicant must select a regional electricity mix for biofuel production from “Electricity Mix Region for Fuel”. The dropdown menu consists of 30 sub-regions (26 from the U.S based on eGRID 2014⁷, one from Brazil, one from Canada, one from U.S average, and one for User Defined region⁸).

⁷ “Emissions & Generation Resource Integrated Database (eGRID)” - U.S EPA, extracted 02-2017: <https://www.epa.gov/energy/emissions-generation-resource-integrated-database-eGRID>

⁸ Although Canada and Brazil are included in the drop down menu, the starch calculator is designed only for starch ethanol and corn fiber ethanol produced in the U. S.

CI Calculation Details

This section contains an example pathway CI calculation with a detailed breakdown of all calculations used for CI determination based on information entered by the user and applicable reference data. These calculations are included in cells 56 through 260 in the RD production tab. Calculations are based on representative inputs used in the input cells in this calculator. None of the user-defined options have been used in the sample calculations.