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

Biomethane from Anaerobic Digestion of Dairy and Swine Manure

A. Introduction

This document provides detailed instructions for the use of the Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Dairy and Swine Manure pathway applications. This Calculator is to be used to calculate the carbon intensity (CI) for Compressed Natural Gas, Liquefied Natural Gas (LNG) and Liquefied and subsequently Compressed Natural Gas (L-CNG) from dairy cattle and swine manure anaerobic digesters. In this Calculator, only dairy cattle and swine manure is eligible for the offset credits for greenhouse gas (GHG) emission reductions. Pathways for biomethane from other types of manure or organic wastes (such as animal bedding, post-consumer food waste and green waste) should use the "Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Food, Green, and Other Organic Wastes." 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. 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 biomethane from dairy and swine manure digesters. **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.**

This Calculator also includes additional reference material such as greenhouse gas emissions factors and reference fuel specifications used in CA-GREET3.0, and certain emission factors from the Compliance Offset Protocol Livestock Projects (November 2014). The Calculator provides a detailed breakdown of the calculations used to determine the CI of each fuel pathway. The CI is not final until certified by the Executive Officer of the California Air Resources Board.

The applicant may only enter values or make selections in input fields designated by CARB for user input/selection, and may not change any other values or fields in the Calculator.

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 tabs used in the Simplified CI Calculator.

Table C.1. Overview of Tabs Used in the Simplified CI Calculator

Tab Name	Description
RNG Summary	Summary worksheet. Contains an overall summary of the information entered in the "Biogas-to-RNG" tab of the calculator and calculated CIs for livestock manure digester biogas to CNG, LNG, and L-CNG. 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.
Manure-to-Biogas (LOP Inputs)	Calculation worksheet that is based on selected equations from the "Compliance Offset Protocol Livestock Projects"[1] ("LOP" hereafter). The user inputs related to baseline and project methane emissions are indicated in yellow cells, automatically calculated values are in gray cells.
Avoided Emissions	Avoided methane calculation worksheet. Contains the values related to baseline and project methane emissions and the quantification of avoided methane and diverted CO_2 from land application.
Biogas-to-RNG	Calculation worksheet that contains the user inputs related to fuel production (biogas to biomethane) indicated in yellow, automatically calculated values in gray cells, and estimated CI results in blue.
EF Table	Reference worksheet. Contains greenhouse gas emissions factors from the CA-GREET3.0 model and the LOP used in calculation of carbon intensities.
Reference	Reference worksheet. Contains specifications of fuels (i.e., HHV, LHV, density, carbon ratio), global warming potentials of greenhouse gases, unit conversions, tailpipe emissions, LNG boil-off emissions and other information used in calculating CIs. The relevant tables in the LOP appendix are also listed in this tab.

[1] California Air Resources Board. Compliance Offset Protocol Livestock Projects – Capturing and Destroying Methane from Manure Management Systems. Adopted on Nov. 14, 2014. https://www.arb.ca.gov/regact/2014/capandtrade14/ctlivestockprotocol.pdf

D. Manure-to-Biogas (LOP Inputs) tab

The "Manure-to-Biogas (LOP Inputs)" tab contains the calculation sheet for selected parameters of the baseline and the project methane emissions ("LOP" is the acronym for ARB's "Compliance Offset Protocol Livestock Projects" in this document). This tab consists of the following major sections:

- Section L1: [Equation 5.3 in LOP] Baseline Methane Emissions from Anaerobic Storage/Treatment Systems ($BE_{CH4,AS}$)
- Section L2: [Equation 5.4 in LOP] Baseline Methane Emissions from Non-Anaerobic Storage/Treatment Systems ($BE_{CH4,nAS}$)
- Section L3: [Equation 5.6-Venting in LOP] Project Methane Emissions from Venting Events ($CH_{4\ vent}$) in the Biogas Control System (BCS)
- Section L4: [Equation 5.8 in LOP] Project Methane Emissions from the BCS Effluent Pond(s) ($PE_{CH4,EP}$)
- Section L5: [Equation 5.9 in LOP] Project Methane Emissions from *Non*-BCS Related Sources ($PE_{CH4,nBCS}$)

Section L1: [Equation 5.3 in LOP] Baseline Methane Emissions from Anaerobic Storage/Treatment Systems ($BE_{CH4,AS}$)

This section quantifies the modeled baseline methane emissions from the anaerobic storage/treatment system. Up to six livestock categories that deposit manure to the same baseline system can be modeled in this section. The following table lists the fields for Section L1.

Table D.1. List of Input Fields for Section L1 of the Simplified CI Calculator

Field Name	Description
L1.(1-6).1 Livestock Category (L)	Select a livestock category for each sub-section; each sub-section represents one specific livestock, and users can enter information for up to six livestock categories in six corresponding sub-sections.
L1.(1-6).2 Livestock Average Mass	The typical average mass of the livestock selected in L1.(1-6).1. See Table A.1 in the LOP.
L1.(1-6).3 Maximum CH_4 Potential	The maximum methane potential of the livestock selected in L1.(1-6).1. See Table A.2 in the LOP.
L1.(1-6).4 Livestock Excretion Rate	The daily manure excretion by the livestock selected in L1.(1-6).1, measured in volatile solids. See Table A.2 and A.4 in the LOP.
L1.(1-6).5 Monthly Data	Input the months and year(s) corresponding to the operational data provided.

L1.(1-6).6 Livestock Population	Monthly average population of the livestock selected in L1.(1-6).1
L1.(1-6).7 Calendar Days of the Month	Total calendar days of the reporting month.
L1.(1-6).8 Number of Reporting Days	Number of reporting days in the reporting month.
L1.(1-6).9 Average Temperature	Monthly average ambient temperature in degree Celsius.
L1.(1-6).10 Van't Hoff-Arrhenius factor	Factor associated with chemical reaction.
L1.(1-6).11 Fraction of Volatile Solids Sent to Anaerobic Storage/Treatment System	The fraction of manure (volatile solids) that would be sent to the anaerobic storage/treatment system for each livestock category, taking into account any volatile solids removed by solid separation equipment in the baseline case, as if the project BCS was never installed. Site-specific data must be used if available. If site-specific data is unavailable, values from Table A.9 of the LOP can be used. This table can also be found in the "Reference" tab.
L1.(1-6).12 Volatile Solids Available for Degradation	Monthly volatile solids available for degradation from anaerobic manure storage/treatment system 'AS' by the livestock selected in L1.(1-6).1.
L1.(1-6).13 Retention Time and Drainage	Select the options that is applicable. If the volatile solids retention time in the anaerobic storage/treatment system is less than or equal to 30 days, or if the month following the complete drainage and cleaning of solid buildup from the anaerobic storage/treatment system, the volatile solids retained in the system from the previous month must be set to zero.
L1.(1-6).14 Carryover from Previous Month	The difference between the VS available for degradation and the VS degraded from previous month. If this is the first year of the project, enter zero in the first month; otherwise, enter the VS carried over from December of the previous year.
L1.(1-6).15 Volatile Solids Degraded	Monthly volatile solids degraded by anaerobic manure storage/treatment system 'AS' by the livestock selected in L1.(1-6).1.
L1.(1-6).16 Baseline Methane Emissions, AS	The modeled baseline methane emissions from anaerobic manure storage/treatment systems.

Section L2: [Equation 5.4 in LOP] Baseline Methane Emissions from Non-Anaerobic Storage/Treatment Systems ($BE_{CH4,nAS}$)

This section quantifies the baseline methane emissions from non-anaerobic storage/treatment systems. The following table lists the fields for Section L2.

Table D.2. List of Input Fields for Section L2 of the Simplified CI Calculator

Field Name	Description
L2.1 Non-anaerobic Storage/Treatment Systems	Select the non-anaerobic storage/treatment systems that are applicable.
L2.2 Methane Conversion Factor	Methane conversion factor for non-anaerobic storage/treatment system. See Table A.5 in the LOP. This factor is determined by the selection in L2.1.
L2.3 Manure Managed in Non-Anaerobic Storage/Treatment Systems	The fraction of manure (volatile solids) that would be sent to the non-anaerobic storage/treatment system for each livestock category, taking into account any volatile solids removed by solid separation equipment in the baseline case, as if the project BCS was never installed. Site-specific data must be used if available. If site-specific data is unavailable, values from Table A.9 of the LOP can be used to calculate the fraction sent to non-anaerobic systems. This table can also be found in the "Reference" tab.
L2.4 Baseline Methane Emissions, non-AS	The modeled baseline methane emissions from non-anaerobic manure storage/treatment systems.

Section L3: [Equation 5.6-Venting in LOP] Project Methane Emissions from Venting Events ($CH_{4\ vent}$) in the Biogas Control System (BCS)

This section quantifies the BCS system project methane emissions from venting events only. Other emissions directly associated with the biomethane production in the BCS project this Simplified CI Calculator evaluates in the "Biogas-to-RNG" tab. The following table lists the fields for Section L3.

Table D.3. List of Input Fields for Section L3 of the Simplified CI Calculator

Field Name	Description
L3.1 Monthly Data	Input the months and year(s) corresponding to the operational data provided.
L3.2 Maximum Biogas Storage of the BCS System	The maximum biogas storage of the BCS system must be calculated using project-specific information and design documentation.
L3.3 Average Daily Biogas Production for the 7 Days Preceding the Venting	This volume flow must come from the monitored project-specific flow data corrected to standard conditions. See Equation 5.7 in the LOP for the biogas volume correction for temperature and pressure.
L3.4 Number of Days for the Uncontrolled Venting	This must be monitored and recorded at least daily from the time of discovery; it must date back to the last field check date without any uncontrolled venting events.
L3.5 Quarterly Methane Concentration	The quarterly methane concentration is used for the entire month in which it is taken and for all subsequent months until a new methane concentration is taken. A weighted average of more frequent samples may also be used.

L3.6 Project Methane Emissions from Venting	Results of the monthly quantity of methane that is vented to the atmosphere due to BCS venting events.

Section L4: [Equation 5.8 in LOP] Project Methane Emissions from the BCS Effluent Pond(s) ($PE_{CH4,EP}$)

This section quantifies the methane emissions from the BCS pond where the effluent from the BCS project is held. The following table lists the fields for Section L4.

Table D.4. List of Input Fields for Section L4 of the Simplified CI Calculator

Field Name	Description
L4.1 Livestock Category	These are the same livestock categories selected in Section L1.
L4.2 Average Population	Average population of each livestock category based on monthly population data for a given reporting period.
L4.3 Livestock Excretion Rate	The daily manure excretion by the livestock category, measured in volatile solids. See Table A.2 and A.4 in the LOP. These are the same values entered in fields L1.(1-6).4.
L4.4 Maximum CH_4 Potential	The maximum methane potential of each livestock category. See Table A.2 in the LOP. These are the same values entered in fields L1.(1-6).3.
L4.5 Fraction of Volatile Solids Sent to BCS System	The fraction of manure (volatile solids) that would be sent to the BCS system for each livestock category, taking into account any volatile solids removed by solid separation equipment. Site-specific data must be used if available. If site-specific data is unavailable, values from Table A.9 of the LOP can be used. This table can also be found in the "Reference" tab.
L4.6 Volatile Solids to Effluent Ponds	Results of the amount of manure (volatile solids) that is sent to the effluent ponds daily by the livestock category.
L4.7 Number of Reporting Days	Total number of reporting days in the reporting period.
L4.8 Methane Conversion Factor	Methane conversion factor for the effluent pond (liquid/slurry uncovered). See Table A.5 in the LOP.
L4.9 Project Methane Emission from Effluent Ponds	Results of the total methane emissions from the project BCS effluent ponds.

Section L5: [Equation 5.9 in LOP] Project Methane Emissions from Non-BCS Related Sources ($PE_{CH4,nBCS}$)

This section quantifies the project methane emissions from sources in the waste treatment and storage category other than the BCS and associated effluent pond. The following table lists the fields for Section L5.

Table D.5. List of Input Fields for Section L5 of the Simplified CI Calculator

Field Name	Description
L5.1.a Other Anaerobic Storage/Treatment Systems	Select other non-BCS anaerobic storage/treatment systems that are applicable.
L5.1.b Non-anaerobic Storage/Treatment Systems	Select the non-anaerobic storage/treatment systems that are applicable.
L5.2 Methane Conversion Factor	Methane conversion factor for non-anaerobic storage/treatment system. See Table A.5 in the LOP. This factor is determined by the selection in L5.1.a and L5.1.b.
L5.3 Manure Managed in Non-BCS (Other) Systems	The fraction of manure (volatile solids) that would be sent to the anaerobic storage/treatment system for each livestock category, taking into account any volatile solids removed by solid separation equipment in the baseline case, as if the project BCS was never installed. Site-specific data must be used if available. If site-specific data is unavailable, values from Table A.9 of the LOP can be used. This table can also be found in the "Reference" tab.
L5.4 CH_4 Emission Factor, non-BCS	Methane emission factor for the livestock population from non-BCS related sources.
L5.5 Project Methane Emissions, non-BCS	The modeled project methane emissions from sources in the waste treatment and storage category other than the BCS and associated effluent pond.

E. Avoided Emissions tab

The “Avoided Emissions” tab contains the additional calculation worksheet for avoided methane and CO_2 credits, and consists of the following major sections:

- Section P1. Results from the "Manure-to-Biogas (LOP Inputs)" tab
- Section P2. Avoided CH_4 Emissions Calculation Details
- Section P3. Avoided CO_2 Emissions Calculation Details

Section P1. Results from the "Manure-to-Biogas (LOP Inputs)" tab

All the values in this section are calculated values based on the quantification methodology by ARB’s “Compliance Offset Protocol Livestock Projects” (detailed calculation can be found in the "Manure-to-Biogas (LOP Inputs)" tab). The following table lists the fields for Section P1 of the “Avoided Emissions” tab.

Table E.1. List of Input Fields for Section P1 of the Simplified CI Calculator

Field Name	Description
P1.1 Select Digester Type	Select either “Covered Lagoon” or “Enclosed Vessel” as the type of livestock manure digester operated.
P1.2 Monthly Data	Input the months and year(s) corresponding to the operational data provided.
P1.3 Baseline methane emissions ($BE_{CH4\ Mod}$)	Results of monthly baseline methane emissions calculated using the Equation 5.2 from the LOP.
P1.4 Project methane emissions	This field includes a label for project methane emissions and does not require an input
P1.4.a Venting methane ($CH_{4\ vent}$)	Results of monthly quantity of methane that is vented to the atmosphere due to the digester venting events. These are calculated values based on the $CH_{4\ vent,i}$ formula provided in the “Equation 5.6” section from the LOP.
P1.4.b Effluent ponds methane ($PE_{CH4,EP}$)	Result of monthly methane emissions from the digester effluent pond. This is calculated value based on the Equation 5.8 from the LOP.
P1.4.c Storage/Treatment methane ($PE_{CH4,nBCS}$)	Result of monthly methane emissions from the non-digester sources (waste treatment and storage). This is calculated value based on the Equation 5.9 from the LOP.

P1.4.d Digester leakage	Results of monthly quantity of methane leakage from the digester.

Section P2. Avoided CH_4 Emissions Calculation Details

This section contains an example calculating the avoided methane emissions from land application.

Section P3. Avoided CO_2 Emissions Calculation Details

This section contains an example calculating the avoided CO_2 emissions diverted from land application.

F. Biogas-to-RNG tab

The "Biogas-to-RNG" tab contains the main CI calculation worksheet and consists of the following major sections:

- Section 1. Applicant Information
- Section 2. Biomethane Production Data
- Section 3. CNG, LNG, and L-CNG Production and Transport Data
- Section 4. CI Calculation Details

Section 1. Applicant Information for Biomethane Production

The following table lists the fields used in Section 1 of the Biogas-to-RNG tab.

Table F.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 Digester Location (Street, City, State)	Location of the anaerobic digester. Example: "AAA Livestock Manure Digestion Facility in Sacramento". Select the state from the drop-down menu.
1.5 LNG Liquefaction Facility Location (Street, City, State)	Location of the liquefaction facility (Street, City, State).
1.6 CNG Dispensing Station(s) Location (Street, City, State)	Location of California CNG dispensing station (Street, City, State). For distribution to multiple California stations, use Bakersfield as the endpoint in determining the (the Standard Station Centroid location). See additional details below Table F.2.
1.7 LNG Dispensing Station(s) Location (Street, City, State)	Location of LNG dispensing station (Street, City, State). For multiple stations, calculate a centroid location based on a weighted average of fuel dispensing stations to which LNG is supplied. See additional details for Field 3.6.b. below Table F.3.
1.8 L-CNG Dispensing Station(s) Location (Street, City, State)	Location of L-CNG station (Street, City, State). For multiple stations, calculate a centroid based on a weighted average of fuel dispensing stations to which L-CNG is supplied. See additional details for Field 3.6.b. below Table F.3.
1.9 Digester Type	The digester type is the same selection appeared on the "Avoided Emissions" tab, section P1.1: either "Covered Lagoon" or "Enclosed Vessel".
1.10 Average Annual Temperature (°C)	Select the closest average annual temperature in °C.

Section 2. Biomethane Production Data

The following table lists the fields used in Section 2 of the Biogas-to-RNG tab. Additional details are included below Table F.2.

Table F.2. List of Input Fields for Biogas Processing

Field Name	Description
2.1 Select Regional Electricity Mix for Biomethane	Choose the electricity mix corresponding to the zip code for the region where the livestock manure digester biogas upgrading plant is located. The Calculator includes 26 eGRID zone mixes, Brazilian average mix, Canadian average mix and User Defined Mix included in the pull down menu. For facilities in the U. S., select one of 26 eGRID zones available for the U.S. If upgrading facility is located outside the U.S., select "User Defined Mix". For facilities which use biogas for electricity production, choose the user defined electricity option in field 2.1. After selecting an electricity mix option, click the "**Calculate**" button. If "User Defined Mix" is selected, consult with CARB staff to develop an emission factor for the user defined mix to be input as detailed in field 2.27. Data sources for User-Defined electricity mixes must be documented in the Supplemental Documentation attached with the Simplified CI Calculator.
2.2 Provisional Pathway?	If there is less than 24 months of available data, select "Yes", otherwise choose "No". If the application is for a provisional pathway, input available months of operational data, starting in Month 1 (minimum three months of operational data required to meet provisional requirements).
2.3 Monthly Data	Input the months and year(s) corresponding to the operational data provided.
2.4 Total Raw Biogas Flow (metered)	Input monthly total raw dry biogas flow (in Standard Cubic Feet at 60°F, 1 atm) data for 24 months (at least 3 months if provisional) of operation. Specific requirements detailed below Table F.2.
2.5 Biomethane Content (% Methane)	Input monthly weighted average methane concentration in raw dry biogas for 24 months (at least 3 months if provisional) of operation. Specific requirements detailed below Table F.2.
2.6 Raw Biogas Flow to Upgrading (metered)	Input monthly raw biogas use (in Standard Cubic Feet at 60°F, 1 atm) for producing transportation fuels. See additional details below Table F.2.
2.7 Biomethane Content (% Methane)	Input monthly weighted average methane concentration data (measured in raw dry biogas) for 24 months (at least 3 months if provisional) of operation. Specific requirements detailed below Table F.2.

2.8 Diesel (baseline manure transport and handling)	Input monthly total diesel use (in gallons at ambient temperature) to transport and handling manure in the baseline case for 24 months (at least 3 months if provisional) in this field.
2.9 Utility Sourced NG (baseline)	Input monthly total fossil natural gas use (baseline case) from a pipeline source (or other) in MMBtu from utility invoices (reported in HHV) for 24 months (at least 3 months if provisional) of operation.
2.10 Grid Electricity (baseline manure pumping and solids separation)	Input monthly total electricity use (baseline case) from the grid in kWh from utility invoices for 24 months (at least 3 months if provisional) in this field.
2.11 Grid Electricity (for digester heating)	Input monthly total electricity use (digestion process) from the grid in kWh from utility invoices for 24 months (at least 3 months if provisional) in this field.
2.12 Biomethane (for digester heating)	Input monthly biomethane use (in MMBtu in HHV) for heat generation in a small industrial boiler (10-100 MMBtu/hr input) during the digestion process.
2.13 Utility Sourced NG (digester project)	Input monthly total fossil natural gas use (digestion process) from a pipeline source (or other) in MMBtu from utility invoices (reported in HHV) for 24 months (at least 3 months if provisional) of operation.
2.14 Diesel (digester project manure transport and handling)	Input monthly total diesel use (in gallons at ambient temperature) in transporting and handling manure for the digestion process for 24 months (at least 3 months if provisional).
2.15 Utility Sourced NG (upgrading and compression)	Input monthly total fossil natural gas use (biomethane upgrading and compression) from a pipeline source (or other) in MMBtu from utility invoices (reported in HHV) for 24 months (at least 3 months if provisional) of operation.
2.16 Biomethane (as Process Fuel for upgrading and compression)	Input monthly biomethane use (in MMBtu in HHV) as process fuel in a small industrial boiler (10-100 MMBtu/hr input) for the biomethane upgrading and compression process.
2.17 On-Site Electricity from Biogas (upgrading and compression)	Input monthly total electricity use (biomethane upgrading and compression) from the electricity generated on-site from a biogas-fueled reciprocating engine (in kWh).
2.18 Grid Electricity (upgrading and compression)	Input monthly total electricity use (biomethane upgrading and compression) from the grid in kWh from utility invoices for 24 months (at least 3 months if provisional) in this field.

2.19 Buy Back fossil NG to boost Btu prior to pipeline injection	Input monthly total quantity of buyback fossil NG (in MMBtu, HHV) if NG is used to boost biomethane energy content to meet pipeline specification. This quantity is not used in CI calculations. Subtract this quantity of fossil NG when reporting pipeline injected biomethane in field 2.23. Additional details are included below Table F.2.
2.20 Propane used to boost Btu prior to pipeline injection	Input monthly total quantity of propane (in gallons at ambient temperature) if propane is used to boost biomethane energy content to meet pipeline specification. This quantity is not used in CI calculations. Subtract this quantity of propane when reporting pipeline injected biomethane in field 2.23. Additional details are included below Table F.2.
2.21 Flared gas including tailgas from upgrading, (metered biogas)	Input monthly total volume of biogas flared, which includes the upgrading tailgas.
2.22 Biomethane Content (% Methane in Flared Gas)	Input monthly weighted average methane concentration in flared gas for 24 months (at least 3 months if provisional) of operation.
2.23 Biomethane Injected into Pipeline for Transportation Fuel Production (metered), (subtract buyback NG and Propane if used to boost Btu)	Input monthly total biomethane injected into the pipeline (in MMBtu) for 24 months (at least 3 months if provisional). The quantity must be supported by the sales receipts. See additional details below Table F.2.
2.24 Biomethane to Electricity Production	Input monthly total biomethane (in MMBtu, HHV) used for electricity production on-site for 24 months (at least 3 months if provisional). Assuming 100% biomethane content.
2.25 On-site Electricity Production	Input monthly total electricity produced from the biomethane for 24 months (at least 3 months if provisional).
2.26 Export Electricity	Input monthly total electricity produced from the biomethane and exported for 24 months (at least 3 months if provisional).
2.27 NG pipeline Transmission	This field includes a label for NG pipeline transmission and does not require an input.
2.27.a From upgrading facility to CNG Station	Input distance from biogas processing facility to the intended CNG station in California. If fuel is sent to multiple stations, use the Standard Station Centroid of Bakersfield as the endpoint. Additional details below Table F.2.
2.27.b From upgrading facility to LNG plant	Input distance from biogas processing facility to the liquefaction facility. This is required only if the pathway application includes LNG and L-CNG pathways. Additional details below Table F.2.

2.28 Specify GHG Emission Factor for Electricity Mix	If "User Defined Mix" is selected in field 2.1, consult with CARB staff to develop a user defined GHG emissions factor and input in this field in cell AA28. Data sources for User-Defined electricity mixes must be documented in the Supplemental Documentation attached with the Simplified CI Calculator.
"Calculate" Button	After all data in Section 2 are entered, click the "Calculate" button (cell E24) in Section 2 to calculate CI for the CNG pathway.

Additional Details for Section 2 and Table F.2

Inlet raw biogas sourced from the digester (Field 2.4, and 2.6)

Requires a dedicated flow measurement system with temperature measurement to enable reporting of gas flow at 1 atm. pressure and 60°F (dry gas flow corrected for moisture) to account for monthly total raw biogas volume sourced from the digester (Field 2.4) and the raw biogas volume used for upgrading to transportation fuels (Field 2.6). The flow measurement system must be calibrated per manufacturer's requirement and scaled to measure the entire range of potential flow of biogas. Measurement must be continuous and all data must be electronically archived (manual recording is not acceptable). The direct metering of the quantity and percentage methane concentration of biogas captured from the digester are not used in CI calculations, but rather as a check to ensure that total biomethane sales do not exceed the biogas quantity sourced from the digester. If biomethane is used for electricity generation on-site, applicant must report the metered quantities of (1) biogas used for electricity generation, (2) electricity generated from biomethane, and (3) the exported electricity from biomethane.

Methane content (% Methane in Field 2.5 and 2.7)

Input monthly weighted average methane concentration (dry gas basis). Methane measurement must be recorded every 15 minutes (at a minimum) with instrumentation capable of electronic archival (manual recording will not be acceptable). The methane measurement system requires calibration per manufacturer's requirement and scaled to measure the entire potential range of methane concentration in the biogas.

Using biomethane to generate electricity for biogas upgrading (Field 2.16)

Although the Calculator can accommodate facilities which use biomethane to generate electricity for biogas upgrading, applicants must declare the use of on-site electricity generation and consult CARB staff prior to submission of a pathway application. A dedicated meter to quantify biomethane-derived electricity in kWh (Field 2.16) must be used to report use of this electricity in the Calculator sheet.

Dedicated metering of buyback NG and propane (Field 2.19 and 2.20)

For digester gas upgrading facilities which use buyback natural gas (NG) or propane to boost the Btu of biomethane prior to pipeline injection (to meet pipeline specifications), dedicated metering must be installed to substantiate quantities of NG or propane used for this purpose. If dedicated metering is not installed or not verifiable, all NG reported in field 2.19 will be added to NG and propane reported in field 2.15 (and considered used for upgrading biogas).

Net biomethane injected into pipeline (Field 2.23)

Because the monthly total quantity of the pipeline injection (in MMBtu) may include NG and/or propane blended with biomethane to meet pipeline specifications, the use of any non-renewable gas must be explicitly disclosed through invoices. The quantity entered in field 2.23 shall include only the net biomethane quantity; any fossil inputs must be subtracted from the actual quantity injected into the pipeline that was purchased by the local utility or other party. This is consistent with quantities reported for RIN generation under the RFS, which is based on the Btu of the pipeline quality biogas after treatment, and prior to any blending with non-renewable fuel or injection into a pipeline.

Note: CI calculations for biomethane are performed on a net MMBtu injected by subtracting all fossil NG and propane inputs (including quantities used in a flare, thermal oxidizer, or biogas processing) from renewable biomethane (in MMBtu) injected into the pipeline.

Pipeline transport distance for renewable natural gas (Fields 2.27.a and 2.27.b)

For pipeline transport distance from a biogas processing facility to a CNG dispensing station or to a liquefaction facility, driving distances between the two locations may be determined using a publicly available web-based mapping. For RNG to CNG pathways which use multiple dispensing stations, staff used fuel sales data for Q1 and Q2, 2017 and calculated a volume weighted Standard Station Centroid, which was found to be just below Bakersfield. Based on the centroid approach, applicants using multiple dispensing stations may use driving distance from a digester in the U.S. or Canada to Bakersfield, CA as the pipeline transmission distance in the Simplified CI Calculator (or Tier 2 if applicable). Alternatively, the applicant could choose to use a more conservative value, such as the distance to the farthest fueling facility, in order to minimize the risk of exceeding the certified CI as a result of changes in the supply chain.

Section 3. CNG, LNG and L-CNG Production and Transport Data

Table F.3. provides details of inputs for LNG and L-CNG pathways. Additional details are included below Table F.3.

Table F.3. List of Input Fields for Section 3 of the Simplified CI Calculator.

Field Name	Description
3.1 Select Regional Electricity Mix for LNG Production	Choose the electricity mix corresponding to the zip code for the region where the liquefaction plant is located. The Calculator includes 26 eGRID zone mixes, Brazilian average mix, Canadian average mix and User Defined Mix included in the pull down menu. For facilities in the U. S. select one of 26 eGRID zones available for the U. S. If the liquefaction facility is located outside the U. S., select the "User Defined Mix". After selecting an electricity mix option, click the "**Calculate**" button. If "User Defined Mix" is selected, consult with CARB staff to develop an emission factor for the user defined mix to be input in field 3.7. Data sources for User-Defined electricity mixes must be documented in the Supplemental Documentation attached with the Simplified CI Calculator.
3.2 NG from NG purchase invoices	Input monthly total fossil NG sourced from a pipeline source (or other) in MMBtu from utility invoices (reported in HHV) for 24 months (at least 3 months if provisional) of operation. The input includes fossil NG used as process fuel and liquefied to LNG. Renewable attributes to support renewable biomethane dispensed must be provided to verifier during on-site audit.
3.3 LNG Production from Production Log	Input monthly total LNG produced in gallons (reported at ambient temperature) for 24 months (at least 3 months if provisional).
3.4 NG as process fuel (Calculated)	This field calculates NG used as process fuel using inputs in fields 3.2 and 3.3. No user input is required for this field.
3.5 Electricity from Utility Invoices	Input monthly total electricity use from the grid in kWh for 24 months (at least 3 months if provisional).
3.6 LNG Transport and Distribution	This field serves as a label for LNG transport and distribution section. No input is required for this field.
3.6.a Select to affirm LNG delivery trucks are equipped with Boil-Off Recovery	If trucks transporting LNG are equipped to recover "Boil-Off", select "Yes" else "No" in field 3.6.a.
3.6.b Enter Transport Distance from Liquefaction Plant to station	Input distance from liquefaction facility to the intended LNG or L-CNG dispensing station in California. Additional details are included below Table F.3.

3.6.c Select to affirm the LNG storage system is equipped with Boil-Off Recovery	If the LNG storage system is equipped to recover “Boil-Off”, select “Yes” else “No” in field 3.6.c.
3.7. Specify GHG Emission Factor for Electricity Mix	If “User Defined Mix” is selected in field 3.1, consult with CARB staff to develop a user defined GHG emissions factor and input in this field in cell AI30. Data sources for User-Defined electricity mixes must be documented in the Supplemental Documentation attached with the Simplified CI Calculator.
“Calculate” Button	After all data are input in Section 3, click the “Calculate” button (cell AH24) to calculate pathway CIs for the LNG and L-CNG pathways.

Additional Details for Section 3

Transport of LNG to dispensing facility (Field 3.6.b)

Driving distance between any two locations may be determined using a publicly available web-based driving distance if fuel is dispensed at a single station. If multiple dispensing facilities are utilized, a volume weighted average transport distance based on 24 months (at least 3 months if provisional) of sales records must be used for LNG distribution to fueling facilities. Alternatively, the applicant could choose to use a more conservative value, such as the distance to the farthest fueling facility, in order to minimize the risk of exceeding the certified CI as a result of changes in the supply chain.

Section 4. 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.