

State of California
Air Resources Board

Staff Discussion Paper

Natural Gas as a Transportation Fuel

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PURPOSE

This discussion paper provides an overview of how natural gas used as a transportation fuel is currently treated in the Low Carbon Fuel Standard (LCFS)¹ program and opens the dialogue with stakeholders about initiatives to improve administration of current program requirements, as well as potential future regulatory changes for this fuel type. It is a working document and is expected to evolve over time based on input from stakeholders.

INTRODUCTION AND GENERAL PROGRAM BACKGROUND

The LCFS is a performance standard that requires reductions in the carbon intensity of California's transportation fuels over time. Each fuel's carbon intensity (CI) is calculated based on greenhouse gas (GHG) emissions per unit of fuel energy over the fuel's lifecycle—from raw material or feedstock production through end use.² Lower-CI fuels produce fewer GHGs per energy unit. Higher-CI fuels, such as traditional petroleum-based fossil fuels, produce more GHGs per energy unit.

In order to reduce GHG emissions, LCFS requires a yearly declining average CI for the pool of California's transportation fuels. Fuels that exceed the mandated average CI generate deficits and those that have CIs below the mandated average CI generate credits. The quantity of credits or deficits generated by each fuel is determined by its fuel-specific CI score relative to the declining CI standard and the quantity of the fuel used for transportation in California. Deficits created by fuels that exceed the mandated CI must be offset with credits generated by lower-CI fuels.

Terms and acronyms used in this discussion paper are described here for reference.

- **Biogas** is a raw gaseous mixture composed primarily of methane and carbon dioxide and derived from the anaerobic decomposition of organic matter in a landfill, lagoon, or digester.³ Biogas has the environmental attributes⁴ of biomethane but not the physical properties of pipeline quality natural gas. In addition to its use in transportation, biogas can be used as a fuel in boilers and engines to produce electrical power.

¹ California Code of Regulations, title 17, section 95480 et seq. Available at: <https://www.arb.ca.gov/regact/2015/lcfs2015/lcfsfinalregorder.pdf>.

² A fuel's lifecycle emissions intensity is also referred to as its "pathway" or "carbon intensity score" in LCFS documentation. These values are usually expressed in units of grams carbon dioxide equivalent per megajoule (gCO₂e/MJ).

³ LCFS regulation section 95841.

⁴ See definition below. The terms "renewable attribute" and "environmental attribute" are used interchangeably in this discussion paper.

- **Biomethane** is also referred to as renewable natural gas (RNG). Biomethane is biogas that has been upgraded to meet pipeline quality natural gas standards⁵ and contains all the renewable attributes associated with the use of a pipeline quality biogas-derived fuel as a vehicle fuel.
- **Natural Gas (NG)** is a mixture of gaseous hydrocarbons, primarily composed of methane. This term is principally used to refer to natural gas derived from non-renewable (fossil) sources, but can also be used to describe the gas physically derived from renewable sources after it is stripped of renewable attributes.
- Fossil NG and RNG have very similar physical properties and can both be compressed or liquefied, then dispensed and used in vehicles as:
 - **Compressed natural gas** (CNG or bio-CNG),⁶
 - **Liquefied natural gas** (LNG or bio-LNG), and
 - Liquefied for transport and/or storage, re-gasified, compressed and dispensed to CNG vehicles (L-CNG or bio-L-CNG).
- **Renewable Attributes** means any environmental claim that is derived from the production or use of biogas. This includes any renewable, biological, or low CI characteristic of the biogas, whether or not the attribute has any economic value. Multiple claims on any biogas, biomethane, or associated environmental attributes would constitute double-counting prohibited by the LCFS regulation.⁷

NG transportation fuels that meet the CI target through 2020 are currently credit generating fuels in the LCFS. These include fossil CNG derived from North American sources, bio-CNG, bio-LNG, and bio-L-CNG. LCFS allows providers of these fuels to “opt in” to the program, and generate credits that can be sold in the California LCFS market. Fossil LNG and fossil L-CNG are not opt-in fuels, in that they must participate in the LCFS program; however, they may still be credit generators if their CI is below the compliance standard CI for a given year.

This paper currently focuses on NG and RNG from Tier 1 North American fossil NG and landfill gas pathways. Subsequent releases will focus on other NG pathways, including biogas from anaerobic digesters, livestock waste treatment, and wastewater treatment plants.

⁵ In LCFS regulation and U.S. EPA’s RFS, the commercial pipeline specifications applicable at the point of injection apply.

⁶ When used as CNG natural gas (including RNG) must meet the fuel specifications found in sections 2292.5 of the California Code of Regulations.

⁷ LCFS regulation section 95488(e)(2): “Initial demonstrations covering biomethane conveyed to California by pipeline for the purpose of earning credits under the LCFS shall include statements from the biomethane suppliers and marketers attesting to the fact that that biomethane is not being used to earn credits under any other state or federal program, with the sole exception of the federal Renewable Fuel Standard program (RFS2).” Available at:

<https://www.arb.ca.gov/regact/2015/lcfs2015/lcfsfinalregorder.pdf>.

Current Parties Eligible to Generate Credits for Natural Gas

The Reporting Party is the initial regulated party as defined in section 95483(d) (“Regulated Parties for Natural Gas”) of the current LCFS regulation. Appendix A of this discussion paper contains a graphic that illustrates LCFS reporting requirements for parties in the supply chain for fossil-based and biomethane-based CNG, LNG, and L-CNG. Note that the eligibility to generate credits can be transferred to downstream parties in the fuel supply chain if both the upstream and downstream parties agree by written contract and if the downstream party also takes ownership of fuel. The graphic shows the default scenario and how the LCFS obligation is transferred for each fuel. The exception to this arrangement is fossil CNG, where the designated credit generator (and Regulated Party) is the fueling station owner—the final downstream entity in the fuel supply chain.

For natural gas used as a transportation fuel, the following table lists the categories of entities eligible to generate LCFS credits and shows the number of such entities currently participating in the LCFS.

Table 1. Eligible Parties for Natural Gas and Biomethane

Eligible Party⁸	Number of Participating Entities
CNG Fueling Facilities including Public Transit Agencies	48
Bio-CNG Producers	28
LNG Producers	2
Importer/Marketers	2

1. LCFS FUEL PATHWAY EVALUATION PROCESS FOR NATURAL GAS

Current Pathway Application Process

When an eligible party listed above wishes to generate LCFS credits for NG, the first step they must take is to apply for the use of the appropriate carbon intensity score (or “pathway”).

ARB staff currently evaluates the fuel pathway application, which includes review of submitted information and review of the third-party engineering report required under U.S. EPA’s Renewable Fuel Standards (RFS) program, when available. The staff

⁸ LCFS regulation section 95483(d).

review can range from cursory, for “Lookup Table pathways” to extensive for the most complex “Tier 2” pathways.⁹

NG pathways vary significantly based on the source (fossil or biological), fuel form (CNG, LNG, L-CNG), transportation distances, and type of vehicle fueled (e.g., heavy duty or light duty vehicle; fuel, spark- or compression-ignition engine). The CI of these fuels also varies significantly; current approved pathway CI values for this category of fuels range from -276 gCO₂e/MJ to 90 gCO₂e/MJ.¹⁰

The pathway for fossil natural gas to California for use as a transportation fuel typically involves the following steps: the gas is extracted from wells (production), the gas is upgraded to pipeline quality (purification), injected into a commercial pipeline (transport), and withdrawn from the pipeline at a fueling facility or a liquefaction facility. At a fueling facility, NG is compressed for use in CNG vehicles. At a liquefaction facility, NG is liquefied and typically distributed by truck to fueling facilities, and then dispensed to LNG vehicles. In the case of L-CNG, LNG is distributed by truck and re-gasified and compressed at a fueling facility for use in CNG vehicles.

Landfill gas is the most common source of RNG for transportation in the LCFS. Typical landfill gas pathways involve the following steps: collection (extraction) using a system of perforated wells under negative pressure, clean up to remove water and contaminants, purification to remove CO₂ and meet pipeline quality specifications, and injection into the commercial pipeline. After that step, the pathway steps are identical to that of fossil natural gas vehicle fuels.

The current pathway CI certification process requires applicants to register their facilities in the Alternative Fuels Portal (AFP). Once registered, applicants select the appropriate pathway application type (Tier 1 or 2; Method 2A/2B/Lookup) and upload a completed version of the CA-GREET 2.0 workbook and a data sheet summarizing commercial operational data for 24 months¹¹ along with supporting documentation including invoices and receipts – see Table 2 for an example of the current operational data requirements for a Tier 1 natural gas pathway: landfill gas to bio-CNG.

⁹ For more information on application requirements and pathway classifications, see *Draft guidance Document for LCFS New Pathway Applications*. Nov. 5, 2015. Available at: <https://www.arb.ca.gov/fuels/lcfs/fuelpathways/newpathway-11052015.pdf>.

¹⁰ See table of all certified pathways. Available at: <https://www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm> Also note that a change has been implemented in 2016 in the system of fuel pathway codes (FPC). Historically, FPCs indicated the fuel using a prefix (CNG- for example) but did not provide any information about the feedstock. New FPCs that have been issued in 2016 and going forward indicate the fuel and feedstock. For example, a FPC for CNG derived from North American Fossil NG will now be assigned a FPC beginning with “CNGF-,” where the “-F” indicates that the feedstock is fossil NG. Pathways for RNG made from landfill gas will be assigned an FPC with prefix “CNGLF-.”

¹¹ For pathways with less than 24 months of operational data, a provisional CI may be considered.

Table 2. Current operational data requirements for Tier 1 NG pathway applications

A Tier 1 pathway application for Landfill Gas includes 24 months of the following monthly operational data:	Metered quantity of biogas captured and withdrawn from the landfill (typically measured in cubic feet per minute, logged over a time period in SCF at 60°F, and converted to MMBtu)
	Methane content of biogas (in percent)
	All process energy used in biogas cleanup operations including: <ul style="list-style-type: none"> - Electricity (in kwh) - Fossil NG (in MMBtu) - Raw biogas or biomethane (MMBtu) - Propane or LPG (in MMBtu) - Diesel (in gallons)
	Pipeline transmission distance (miles)— maximum distance from source to fueling station
	Methane content (%) biomethane after upgrading
	Metered quantity of biomethane produced for pipeline injection (in MMBtu)
A Tier 1 pathway application for CNG includes 24 months of the following monthly operational data:	<i>If Bio-CNG, these requirements are in addition to data for landfill gas pathways above</i>
	Either <ul style="list-style-type: none"> - Electricity (kwh) used for compression at the dispensing station, and <ul style="list-style-type: none"> - Metered quantity of CNG (in MMBtu) dispensed Or <ul style="list-style-type: none"> - CA-GREET default compression efficiency (in kWh/MMBtu)
	Pipeline transmission distance (in miles) <ul style="list-style-type: none"> - A default pipeline transmission distance of 1,000 miles is used for all fossil-based CNG pathways
	<i>If Bio-LNG or Bio-L-CNG, these requirements are in addition to data for landfill gas pathways above</i>
A Tier 1 pathway application for LNG or L-CNG includes 24 months of the following monthly operational data:	All process energy inputs to liquefaction including: <ul style="list-style-type: none"> - Electricity (in kWh) - Fossil NG (in MMBtu)
	Quantity of LNG (in gallons of LNG) produced
	Transport mode (Heavy Duty Diesel Truck or Heavy Duty LNG Truck)
	Maximum distance LNG is transported to farthest station (in miles)
	L-CNG pathways use CA-GREET default efficiency for regasification and compression (in kWh/MMBtu)

Once the pathway has been certified, the applicant may begin reporting transportation fuel transactions in the LRT-CBTS. In order to access any credits accumulated, the applicant must also currently complete a fuel transport mode (FTM) demonstration verifying that fuel is actually being transported by the modes claimed in the pathway. The following section explores potential changes to the LCFS fuel pathway application and evaluation processes.

Potential Changes for Consideration

Addition of Fossil CNG to the Lookup Table

Staff is considering including the Tier 1 fuel pathway “North American NG to CNG (delivered via pipeline, compressed in CA)” in the Tier 2 Lookup Table. Since Lookup Table pathways would no longer be confined to Tier 2 fuel pathways, the Tier 2 Lookup Table would be referred to simply as the “Lookup Table.”

Most inputs to modeling the CI of North American Fossil NG to CNG use regional average or default values from CA-GREET 2.0. The only user-specific inputs for this pathway in the Tier 1 calculator are (1) the transmission distance from origin to the fueling facilities, and (2) energy use for compression at the fueling facility. Based on applications processed in 2016, fueling facilities consistently use electricity for compression with efficiencies greater than 96 percent. To expedite review and certification of fossil CNG applications and limit verification checks for compression efficiency at dispensing stations, staff is considering the use of default values for transmission distance (e.g. 1000 miles) and compression efficiency (i.e., 96 percent). This would require only verification of gas quantity dispensed for transportation use (therms), providing both expediency and cost savings related to verification.

Potential Simplification of the Tier 1 Calculator for Landfill Gas Pathways

To facilitate pathway CI application, evaluation, and verification for landfill gas to CNG/LNG/L-CNG, staff is considering further simplification to the Tier 1 pathway application forms (as a replacement for the CA-GREET 2.0 Tier 1 Calculator). Similar to the current Tier 1 Calculator, these fillable forms would provide automated calculations using factors from the Board-adopted version of CA-GREET, but increase simplicity and transparency of these calculations.

Images of the draft form are shown in Appendix C, and a version with working automated calculations is posted for stakeholder review and feedback.¹² The form collects summarized operational data; this operational data is automatically translated to the user-defined inputs needed for the CI calculation. Using life cycle inventory data and emission factors from CA-GREET, the sheet will perform the needed CI calculations.

¹² Available at: https://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/lfg-pods.xlsm.

This will allow staff to automate any unit conversions that are currently performed by applicants, in order to simplify the application process and facilitate a direct comparison of the inputs to meter readings, data loggers, invoices, and other types of records. This form will offer a simplified, transparent and standardized method of demonstrating how operational data impacts CI, and may be useful to producers on an ongoing basis to monitor variations and mitigate risk of exceeding their certified CI.

- Staff is seeking input on development of the simplified CI application form. Please review the inputs section of the draft shown in Appendix C and provide feedback to identify raw, verifiable data that is metered or otherwise measured.
- Staff is working with U.S. EPA RFS program staff on developing requirements to ensure that reported quantities of RNG reflect only the renewable portion of the fuel. We are seeking stakeholder input specifically on how the blending of NG or additions of other fossil-based additives such as propane to increase the heat content of RNG is accounted in the quantities of biomethane reported (therms). LCFS program credits can be generated only for biomethane injected into the pipeline.
- Staff is seeking stakeholder feedback on the units of measurement at each data collection point. Consider providing feedback if, for example, your operation uses meters which record gas throughput and quality in units other than those shown. Are there variations in the types of meters used, calibration requirements, or other potential sources of inconsistency across producers that staff should be aware of?

Other Potential Changes to Pathway Application Requirements

Staff is considering removing the requirement to submit supporting documentation. Instead, the documentation supporting the operational data must be maintained according to recordkeeping requirements and will be reviewed and validated by an independent third-party verifier before a pathway can be certified. Staff is also considering including the FTM Pathway Demonstration in the initial validation prior to CI certification.

No changes are being suggested for the staff evaluation process; however, once the Tier 1 application data is submitted as part of a complete pathway application, staff will review the simplified form and application for completeness. If the application is complete, applicants will be advised to proceed with the validation step. Validation should occur after staff reviews the application for completeness and before it can be certified by the Executive Officer. If the application package is deficient, the application would be rejected and deleted from the AFP, requiring the applicant to re-apply with complete and updated information.

2. REPORTING REQUIREMENTS

After an entity has been approved to use an LCFS pathway to generate credits for natural gas as a transportation fuel, they must report the quantity of fuel dispensed to begin to receive credits.

Existing Reporting Requirements¹³

As described in the introduction, opting into the LCFS program involves registering with ARB in the LCFS Reporting and Credit Bank & Transfer System (LRT-CBTS) to establish a reporting account. This process is simple and primarily includes providing the organization name, organization address, organization federal employer identification number (FEIN), and account administrator information.

Prior to reporting for credits, the fuel production facility and relevant fuel pathways need to be registered in the Alternative Fuel Portal (AFP).¹⁴ For bio-CNG, bio-LNG, and bio-L-CNG pathways, the production facility location is where the biomethane is produced, (e.g., the landfill gas upgrading facility or dairy digester). For fossil LNG and L-CNG pathways, the production facility is the liquefaction plant. For fossil CNG pathways, there is no production facility to be registered in the AFP; but fossil CNG station owners register their fueling facilities in the AFP.

NG providers that opt into the LCFS are subject to the reporting requirements set forth in section 95491(a) and the recordkeeping requirements set forth in section 95491(b) through (e) of the LCFS regulation.

The primary parameters reported quarterly are the amount of natural gas dispensed, CI value (fuel pathway), and the vehicle type (e.g. light duty/medium duty, heavy duty) that determines the energy efficiency rating (EER) used for credit calculation. The Reporting Party must report the amount of fuel dispensed at each individual fueling facility for each applicable FPC on a quarterly basis.

Because tracking the physical molecules of biomethane through the commercial pipeline distribution system is not possible, an energy balance system is used to track the ownership of the renewable attributes of the fuel. The renewable nature of the gas is considered by ARB to be separable from the physical gas at the injection point (and the injected gas is then considered to be indistinguishable from fossil gas). When fossil gas is withdrawn from the pipeline for final use in California, the renewable attribute is “reattached” on an energy-equivalent basis. The Reporting Party retains its own purchase invoices and contracts, and the contracts and invoices documenting the terms of the sale from the biogas producer to the marketer or other purchasing entity. This

¹³ Refer to the LCFS Regulatory Guidance16-05 document for more information on how to opt in, register and generate credits. Available at: https://www.arb.ca.gov/fuels/lcfs/guidance/regguidance_16-05.pdf

¹⁴ Entities may not report and generate credits based on transactions that precede the quarter in which they opt in.

gas is now recognized in the LCFS program as RNG. Distribution channels are identical to those described above for NG to CNG, LNG or L-CNG.

The final quarterly reports must be submitted in the LRT-CBTS by the deadlines specified in section 95491(a)(1)(A). An annual compliance report for the prior calendar year must be also submitted in the LRT-CBTS. In order to generate credits, the fuel provider must submit quarterly and annual reports.¹⁵

Reporting units for CNG and L-CNG are currently standard cubic feet (scf) – though staff is considering changing these reporting units (see below) – and for LNG the reporting units are gallons. Reporting Parties that use their utility bills for reporting of fossil CNG are reminded that the amount of the fuel on the utility bill is reported as a higher heating value (HHV) and must be converted to lower heating value (LHV) using the following equation:

$$\text{LHV} = \text{HHV} \times 0.903$$

Potential Implementation Improvements Regarding Enhanced Reporting

Staff is considering implementing the following administrative improvements for the Q1 2017 reporting cycle.

Registration for NG Reporting Parties in the LRT-CBTS

With increased interest in participation from natural gas providers and fleets, it has become important to enhance the registration requirements for fueling facilities to improve the data quality and prevent potential double counting. Further, the clarification about the point of crediting discussed above encourages reporting at the station level.

To facilitate this process, the registration of fueling facilities will be provided in the LRT-CBTS, instead of AFP, as staff is working on adding this functionality to LRT-CBTS. Reporting Parties will be required to register all their fueling facilities in LRT-CBTS using a template shown in Appendix B. The list of fueling facilities would need to be updated quarterly, if there are any changes. Upon the fueling facility registration, the system will generate a unique LCFS fueling facility ID that will have to be used by Reporting Parties when reporting fuel transactions in LRT-CBTS. An updated template for quarterly reporting of the fuel dispensed at individual fueling facilities for the upload to LRT will be provided in Q1 2017.

CNG Fueling Facility IDs

It is important to have a unique identifier for each CNG fueling facility.

¹⁵ Note that even if no fuel was provided, a quarterly report with zero amounts must be submitted to remain in good standing in the system.

This unique fueling facility ID could facilitate validation of each new registered fueling facility in the LRT-CBTS and would allow staff or verification bodies to match utility records to specific fueling facilities. Staff believes that providing fueling facility specific information will improve data accuracy and prevent double-counting of fuel dispensed at individual stations, and ensure that the fuel for which credits were claimed is used for transportation in California.

Because the double counting is less likely for LNG and L-CNG, as the station owners are not the credit generators as in the case of CNG, no unique ID is suggested for those fueling facilities at this time. However, staff is open to considering a unique ID for LNG and L-CNG fueling facilities, if considered desirable by stakeholders.

Reporting Limited to Dispensed Amounts at Fueling Facilities

There are a number of transaction types (e.g., production, import, purchased with obligation, etc.) that are currently used to report the amount of fuel transacted in LRT-CBTS. However, these transactions represent upstream activities and do not necessarily show how much fuel was actually dispensed at the fueling facility as required to be reported per section 95491(a)(3)(C)1.

Staff proposes to eliminate all upstream transaction types for NG (such as Production in California, Import, Purchased/Sold with Obligation, etc.) in the LRT-CBTS and, instead, have only one transaction type – “Natural Gas Vehicle (NGV) Fueling”. “NGV Fueling” would apply to the quantity of fuel dispensed for transportation use. This adjustment would not affect who is eligible to report or generate credits for a specific quantity of fuel, but would ensure that reporting of upstream production is linked to actual fuel amount dispensed at a fueling facility. In other words, it would require the credit generating party to track transfers through the supply chain, and ultimately attest that accurate fuel volumes with the appropriate FPCs are reported at the fueling facility level. Staff believes this would streamline reporting and verification and ensure that the fuel for which credits were claimed was used for transportation in California.

Potential Regulatory Amendments to Reporting Requirements

Staff is considering the following natural gas quantity reporting amendments.

Fuel Reporting Units for CNG & L-CNG Reporting

Currently, reporting units for CNG and L-CNG are standard cubic feet (scf); however, the volumes of CNG and L-CNG used for transportation at fueling facilities are metered by utilities in units of therms based on Higher Heating Value (HHV), which requires reporting parties to convert to scf using standard conversion factors in CA-GREET and identified in the LCFS regulation.

In order to simplify the reporting process, staff is considering requiring the amount of fuel dispensed at all fueling facilities to be reported in therms based on HHV as shown

on utility bills. The amount of fuel reported in therms would then be converted in the LRT-CBTS from therms (HHV) to mega joules (MJ) on a LHV basis.

Staff believes that this change would reduce potential errors and inconsistencies in reporting due to conversions, improve accuracy of fuel quantities reported, and make fuel quantities reported easily verifiable.

Reporting Total Fuel Amount Dispensed

Currently, the amount of CNG fuel reported quarterly is the amount dispensed at the fueling facility per FPC. Staff is suggesting that the total amount of CNG dispensed (fossil NG and RNG) at the fueling facility per quarter also be reported, as measured by the utility meter and reported on the utility bills. Staff believes that this requirement will facilitate energy balance accounting and will improve data accuracy. At this time, this change is suggested only for CNG providers; however, staff is open to consider the same requirement for LNG and L-CNG providers, if deemed useful.

Potential New Requirements for Tracking the Renewable Attributes of RNG

Allowing biomethane to generate LCFS credits by demonstrating an energy balance for the RNG injected into the pipeline system has proven challenging for ARB staff to verify without additional regulatory clarity to ensure consistency.

Renewable gas accounting has been demonstrated in most cases by contracts and invoices of both gas and renewable attribute sales throughout the supply chain. When gas or attributes change hands multiple times, the traceability may be compromised, and the risk that one or more entities in the supply chain are unaware of LCFS compliance requirements increases. The following suggestions could help ensure that each entity in the supply chain understands and clearly accepts responsibility for accurate accounting. For a detailed explanation of the role each entity plays in the supply chain, and their applicable verification requirements, please refer to Table 3 of this discussion paper.

To mitigate the risk of double counting biomethane renewable attributes, staff is considering proposing the following regulatory requirements:

- The biomethane importer or other party reporting and generating credits for biomethane would be required to maintain records of annual attestations of no double counting of either biogas or biomethane renewable attributes by all entities in the renewable attribute chain-of-custody.
- The biomethane importer would be required to maintain agreements with all entities in the renewable attribute chain-of-custody for access by ARB and its third-party verifier to records, facilities, and personnel for purposes of reviewing conformance with LCFS.

- In cases where the Producer sells biomethane to more than one entity, recordkeeping requirements would include a monthly energy balance and sales accounting by the Producer at the upgrade facility. These records—covering total quantities of gas whether or not they are used for transportation in California—would be subject to review by third-party verifiers and ARB.
- Consistent with the energy/mass balance demonstration requirements for other fuels, renewable attributes associated with biomethane injected into the common carrier pipeline in a given calendar month could only be carried over to the following calendar month to be reported as dispensed bio-CNG, bio-LNG, or bio-L-CNG.

➤ Staff seeks feedback on whether the requirements described above would sufficiently limit the risk of double counting.

Third-party Aggregator

The current LCFS regulation designates certain entities to be eligible to generate credits under NG categories. Historically, some of these entities have not opted in to the LCFS program to generate credits due to limited resources and low financial incentive for the small amount of NG provided.

To enhance participation and provide flexibility, staff is considering providing greater clarity about how credit generators can, at their option, contractually designate a third-party to manage LCFS credit generation for them. These third parties would be referred to as “aggregators.”

An entity that chooses to act as an aggregator would become a Regulated Party and could act on behalf of parties that are not yet registered in LCFS as well as entities that are already Reporting Parties in LRT-CBTS. In either case, the aggregator would likely need to have a written contract with the owners of each reported fueling facility, and these agreements would likely need to be provided to ARB and the verifier. The enhanced registration requirement for individual facilities would also apply to aggregators.

Staff believes that providing flexibility – by allowing other entities that may be interested in reporting and aggregating credits on behalf of CNG transportation fuel providers – would encourage participation in LCFS program, including transit agencies and small fleet owners.

At this point, staff is considering this option only for fossil CNG Regulated Parties (as well as electricity fuel providers and hydrogen providers), however, staff is open to considering a third-party aggregator for additional fuels, if deemed desirable by stakeholders.

- Staff is seeking stakeholder feedback on the suggestion to allow aggregators to assume responsibility for reporting and the right to generate credits on behalf of the designated Regulated Parties for fossil CNG and other fuels. The Reporting Party would accept verification responsibility and would arrange through its contracts for ARB and verifier access to records, facilities, and personnel.

3. VERIFICATION

A successful GHG reduction program requires a system to monitor, report, and verify GHG emissions to aid implementation and tracking of the effectiveness of emission reduction strategies. Historically the LCFS has relied upon a robust reporting program built around ARB staff evaluation fuel CI through the fuel pathway application process and conducting spot-checks on the reporting of quarterly fuel volumes.^{16,17}

ARB is now considering supplementing the work of ARB staff with a verification system conducted by independent third-parties engaged by entities reporting to ARB under the LCFS. Conceptually, these verifiers would perform GHG accounting checks in a role similar to the independent, objective evaluations of organizations' financial reports by financial auditors. ARB has extensive experience with an analogous system under the regulation for the Mandatory Reporting of Greenhouse Gas Emissions (MRR) pursuant to the California Global Warming Solutions Act of 2006 (AB 32) and through the verification of GHG compliance offset projects under ARB's Cap-and-Trade Program.^{18,19}

Existing Verification Provisions

Existing verification provisions were added in the 2015 LCFS readoption. These provisions are currently being used to support ARB compliance audits and enforcement activities.

Section 95491(d) Verification of Pathway, CI, Report

¹⁶ LCFS Fuel Pathways. Available at: <https://www.arb.ca.gov/fuels/lcfs/fuelpathways/fuelpathways.htm>.

¹⁷ LCFS Data Management System. Available at:
<https://www.arb.ca.gov/fuels/lcfs/reporting%20tool/datamanagementsystem.htm%23lrt-cbts>.

¹⁸ AB 32 explicitly supported verification calling for ARB to "adopt regulations to require the reporting and verification of statewide greenhouse gas emissions and to monitor and enforce compliance..." Health and Safety Code (H&SC) section 38530(a). Program information on MRR verification is available at:
<https://www.arb.ca.gov/cc/reporting/ghg-ver/ghg-ver.htm>.

¹⁹ Offset Verification Program. Available at:
<https://www.arb.ca.gov/cc/capandtrade/offsets/verification/verification.htm>.

“All data and calculations submitted by a Regulated Party for demonstrating compliance or claiming credit are subject to verification by the Executive Officer or a third party approved by the Executive Officer.”

Section 95491(e) Access to Records

“Pursuant to H&S section 41510²⁰, the Executive Officer has the right of entry to any premises used, leased, or controlled by a Regulated Party, a Reporting Party, a verifier, or an applicant, in order to inspect and copy records relevant to the determination of compliance. Scheduling of access shall be arranged in advance where feasible and must not unreasonably disturb normal operations, provided, however, that access shall not be unreasonably delayed.”

Potential Amendments to Verification

Staff’s verification white paper²¹ provides the framework for the development of an LCFS verification program and overarching considerations that will inform potential amendments to the LCFS regulation.

ARB staff is considering mandatory verification of various program aspects including, but not limited to:

- fuel pathway carbon intensities,
- reported fuel quantities (for both high and low carbon fuels), and
- chain-of-custody information (for some feedstocks and finished products).

The objective of such a verification program is to ensure integrity in the LCFS credit market through assurance of GHG reduction claims in the LCFS. In pursuit of this objective, the guiding principles when designing a verification program must include:

- (1) ARB retention of sole authority over the LCFS program, including verification requirements, as bestowed through the State’s legislative and regulatory process;
- (2) Continual improvement in the detection, prevention, and correction of errors or fraud;
- (3) Identification and implementation of cost reducing strategies, while maintaining verification rigor;
- (4) Policy consistency with other ARB verification programs; and

²⁰ California Code of Regulations, Health and Safety Code 41510: <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=hsc&group=41001-42000&file=41500-41514.10>.

²¹ Staff White Paper: Framework for Development of a Low Carbon Fuel Standard Verification Program. Available at: https://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/verification_whitepaper_102116.pdf

(5) Consideration of the unique attributes of fuel carbon intensities and fuels marketing structure.

The degree of ARB oversight, verifier competency and training, and conflict of interest requirements are expected to be consistent with ARB's Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (MRR) and Compliance Offset verification programs, while seeking to harmonize, where possible, with existing verification and certification programs, most notably U.S. EPA's RFS Quality Assurance Program (QAP).

Staff is continuing to coordinate with U.S. EPA to harmonize with the RFS and QAP requirements. Under RFS, biomethane meets the requirements to generate D3 RINs for cellulosic biofuels. The majority of cellulosic biofuels comes from landfill biogas upgraded to biomethane,²² and approximately 60 percent of D3 fuels are QAP program-approved biofuels as of September 2015.²³

Verification requirements and the Regulated Party for natural gas will depend on the supply chain that generates credits or deficits. Natural gas comes from multiple sources (fossil and biological); originates both inside and outside California; can be transported by a variety of modes over user-defined or default distances; is ultimately dispensed and used in the form of CNG, LNG, or L-CNG; and is used in various types of vehicles (e.g., heavy duty or light duty vehicle; fuel, spark- or compression-ignition engines). Verification sampling requirements will be based on risk of error, risk of fraud, risk of inappropriately double counting renewable attributes, and the CI sensitivity of user-defined inputs.

Under the potential changes to the reporting requirements, where only one transaction type would be reported in the LRT-CBTS – Natural Gas Vehicle (NGV) Fueling, the credit-generating party would be subject to verification and need to monitor transfers through the supply chain and ultimately attest that accurate fuel quantities with the appropriate FPC codes are reported.

Meter accuracy will be reviewed during validation and verification to assure that calibration is carried out by a qualified technician using appropriate protocols at the frequency required by meter manufacturer or that meters used in third-party financial transactions are consistent with MRR section 95103(k).

²² RNG: rising to the challenge, from Renewable Energy from Waste Magazine, February 22, 2016, <http://www.rewmag.com/article/rng-rising-to-the-challenge-february-2016/>.

²³ RIN Fraud & Compliance Presentation, Byron Bunker, Director, Compliance Division, Office of Transportation and Air Quality, U.S. EPA, Sept. 22, 2015. Available at: https://www.epa.gov/sites/production/files/2015-11/documents/bunkerenergyconferenceslidedeck_09212015_final.pdf.

Considerations for the Verification of Natural Gas

Figure 1 and Table 3 present an example pathway to help provide clarity on potential verification requirements for landfill gas to bio-CNG fuel pathways. Table 4 describes verification points for fossil CNG, LNG, and L-CNG. When the simplified CI application form as shown in Appendix C is finalized, staff will request feedback on considerations for monitoring plans to be developed and maintained by Reporting Parties and to ensure any additional verification points are considered.

Verification requirements for a Tier 1 landfill biogas to bio-CNG pathway would generally consist of four main components to assure accurate accounting of generated LCFS credits:

- (1) Validate initial 24 months of operational data required for fuel pathway application.²⁴
- (2) Verify on an on-going basis that average CI over 12 month compliance period does not exceed the certified value by reviewing monthly operational data and transactions.
- (3) Verify production and sales of biogas and biomethane to ensure proper energy accounting and that environmental attributes are not double counted or assigned to any use of the biogas separate from that claimed in the LCFS.
- (4) Verify CNG quantities dispensed for transportation use at the fueling stations.

Figure 1 illustrates a common pathway in which biomethane is produced at a landfill and injected into the commercial pipeline. The renewable attributes are then assigned to an equivalent amount of gas extracted from the commercial pipeline, compressed at a station in California, dispensed to vehicles, and reported as bio-CNG.

- Staff is seeking stakeholder feedback on the potential verification points shown in Tables 3 and 4.
- Staff is seeking stakeholder feedback on whether written guidance or regulation text is needed to specify permitted biogas, biomethane, and renewable attribute contracting practices along the supply chain.
- Regarding site visits and frequencies for RNG verification, staff is seeking stakeholder feedback regarding which items required for compliance are more likely to change (e.g., meter readings, environmental attribute contracts) and which items are less likely to change (e.g., landfill production capacity, pipelines at biomethane injection point, fueling station locations).

²⁴ See the draft pathway form shown in Appendix C as it relates to potential CI verification points.

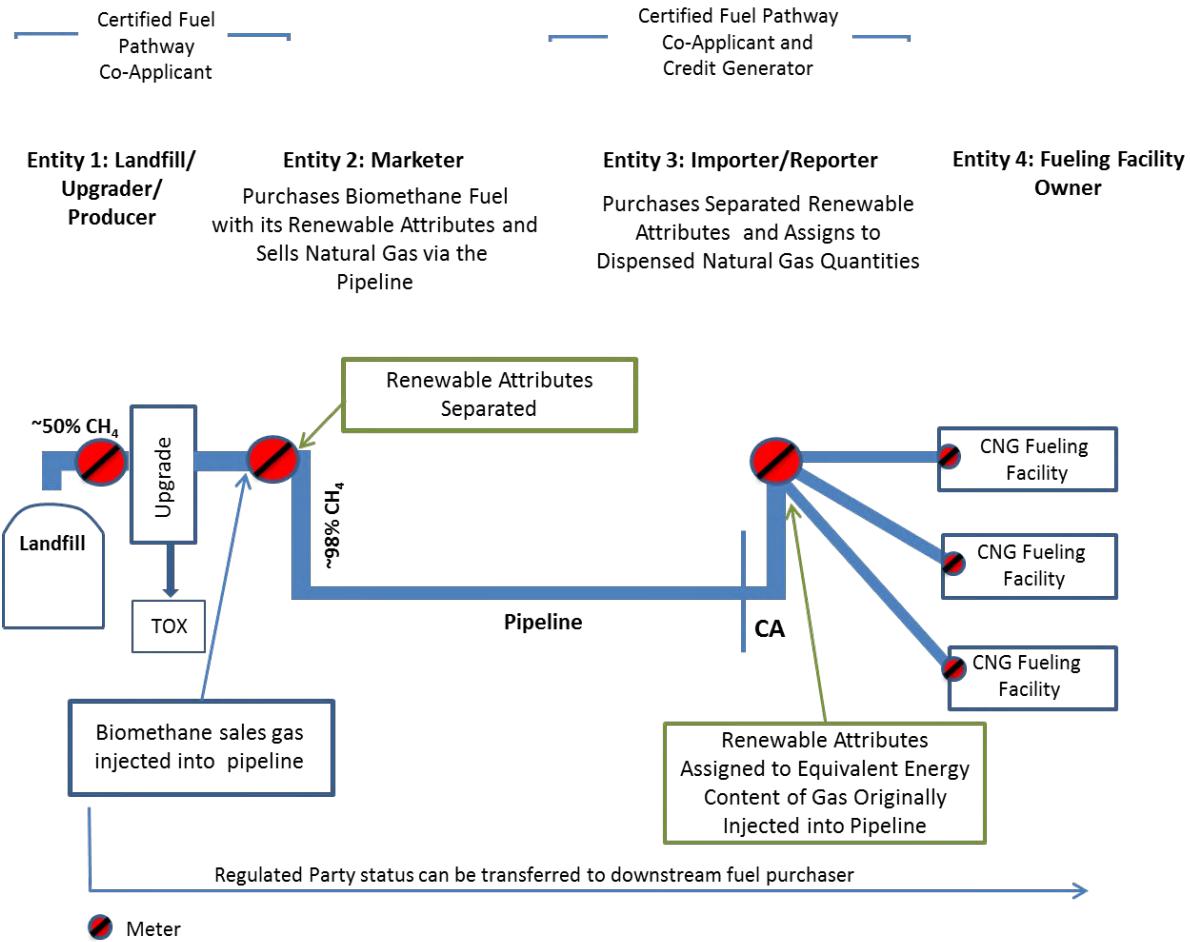


Figure 1. Example Pathway for Bio-CNG from a Landfill

Table 3. Verification Points for an Example Landfill Gas to Bio-CNG Supply Chain

<p>Entity 1: Landfill and Upgrading Facility Operator (common ownership in this example)</p> <ul style="list-style-type: none">As the Producer, the landfill/upgrader is eligible to generate credits, but in this example the obligation is transferred downstream to the Importer.Landfill/Upgrader injects into commercial pipeline. Provides product transfer documentation of biomethane injection to Entity 2—Biomethane Marketer.
<p>How Entity Fits into Supply Chain Verification:</p> <ul style="list-style-type: none">The majority of operations that contribute to CI occur in the upgrading stage; therefore, this entity must provide necessary operational data to ARB to support the fuel pathway application.Attests to no double-counting and cooperates with CI validation/verification and biomethane quantity verification.Must arrange for access to all relevant information, including facilities, records, and personnel, for verifier and ARB when requested.
<p>Verification Points:</p> <ol style="list-style-type: none">(1) Confirm geographic location.(2) Site visit to confirm that process flow diagram in CI pathway application accurately reflects landfill and upgrading operations and that the facility is properly configured for landfill biogas collection, upgrading, and biomethane injection into commercial pipeline.<ul style="list-style-type: none">Includes meter identification and locations.Includes all natural gas distribution lines and other energy sources that may be entering or leaving between the landfill and the commercial pipeline injection point.Includes all combustion equipment and reflects any on-site use of raw biogas or biomethane for thermal or electrical process energy.Indicates co-products, if any.(3) Check monthly energy balance on biomethane production.<ul style="list-style-type: none">Review Certificates of Analysis (COA) and commercial distribution pipeline specifications and waivers as described in U.S. EPA's RFS registration requirements.²⁵Confirm meter calibration practices and accurate unit conversions per ARB requirements.Cross check that metered biogas sent to upgrade facility does not exceed landfill biogas production capacity minus flared biogas. Review RFS third-party engineering report (if available) or calculate biogas production using tons of waste in place and EPA LandGEM Model²⁶ and compare to LMOP²⁷ database.Review types, quantities, and sources of all process energy used for upgrading biogas to biomethane. Assure correct accounting of biogas used for cleanup and thermal oxidation.Check sales gas energy content and volume at final metering point. Confirm reported biomethane energy content does not include any fossil fuel added prior to injection into commercial pipeline, or is properly accounted for.Review leak detection and repair practices.(4) Review contracts and sales invoices to ensure accurate accounting of renewable attributes and no double counting.

²⁵ U.S. EPA Guidance on Biogas Quality and RIN Generation when Biogas is Injected into a Commercial Pipeline for use in Producing Renewable CNG or LNG under the RFS Program. Available at: https://www.epa.gov/sites/production/files/2016-09/documents/420b16075_0.pdf.

²⁶ U.S. EPA Landfill Gas Emissions Model (LandGEM). Available at: <https://www.epa.gov/catc/clean-air-technology-center-products#software>.

²⁷ U.S. EPA Landfill Methane Outreach Program (LMOP). Available at: <https://www.epa.gov/lmop>.

<p>Entity 2: Biomethane Marketer (may be the same entity as the Importer; in this example biomethane, with its renewable attributes attached, is sold to an intermediate entity)</p> <ul style="list-style-type: none"> • Purchases biomethane from the landfill/upgrader, including renewable attributes. • Separates the renewable attributes; sells and delivers physical gas to a third party (such as local utility) as fossil NG via the commercial pipeline. Sells biomethane attributes downstream to Importer.
<p>How Entity Fits into Supply Chain Verification:</p> <ul style="list-style-type: none"> • Establishes a chain-of-custody for the renewable attributes from the landfill/upgrader through the Biomethane marketer to the Biomethane Importer, demonstrating ownership of renewable attributes is not transferred to other parties or otherwise double counted. • Must arrange for access to all relevant information, including Landfill/Upgrader facilities, records, and personnel, for verifier and ARB when requested.
<p>Verification Points:</p> <ol style="list-style-type: none"> (1) Review invoices, contracts, and other supporting documentation of transactions between landfill/upgrader, utilities, pipeline companies, or other physical gas purchasers, and Biomethane Importer to support energy balance and ensure proper accounting of renewable attributes. (2) Meter readings at injection into pipeline, if applicable.
<p>Entity 3: Biomethane Importer (may be same entity as the marketer)</p> <ul style="list-style-type: none"> • Purchases separated renewable attributes from the Biomethane marketer. • Assigns renewable attributes to physical quantities of NG dispensed at a fueling facility in California and ensures RNG and NG are accurately tracked with correct FPCs. • Reports quarterly quantities of bio-CNG dispensed in the LRT, per vehicle application type and fueling facility unique meter ID. • Generates bio-CNG credits based on quantities of bio-CNG reported in the LRT. • Demonstrates renewable attributes are not double counted and maintains chain-of-custody documentation for the renewable attributes.
<p>How Entity Fits into Supply Chain Verification:</p> <ul style="list-style-type: none"> • As the first to report quarterly transactions to the LCFS, the Biomethane Importer is the Regulated Party (the Credit Generator) and is responsible for validation/verification of bio-CNG credit generation. • Must arrange for access to all relevant information, including facilities, records, and personnel in the biomethane and the renewable attributes supply chain for verifier and ARB when requested. • Likely required to submit a monitoring plan describing data management systems and practices along the supply chain in its fuel pathway application, as described in the Verification White Paper²⁸ and the pathway application (see Appendix C).
<p>Verification Points:</p> <p>Review invoices, contracts, and other supporting documentation of transactions between Landfill/Upgrader, utilities, pipeline companies, or other physical gas purchasers, and Fueling Facility Owners to support energy balance and ensure proper accounting of renewable attributes.</p>

²⁸ Available at: https://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/verification_whitepaper_102116.pdf

Entity 4: CNG Fueling Facility Owner

- Establishes agreement with Biomethane Importer and reports total quantities of CNG dispensed per vehicle type to Biomethane Importer.
- May opt into LCFS and generate fossil CNG credits based on the difference between the total CNG dispensed less the bio-CNG reported by the Biomethane Importer.

How Entity Fits into Supply Chain Verification:

- Likely registers fueling facility with ARB and receives unique facility ID.
- Must arrange for access to all relevant information, including facilities, records, and personnel, for verifier and ARB when requested.
- If reporting remaining fossil CNG in LRT to generate credits, must arrange for verification of fossil CNG quantities. One option may include coordinating with Biomethane Importer to include verification of fossil CNG credits in the bio-CNG verification scope of work.

Verification Points:

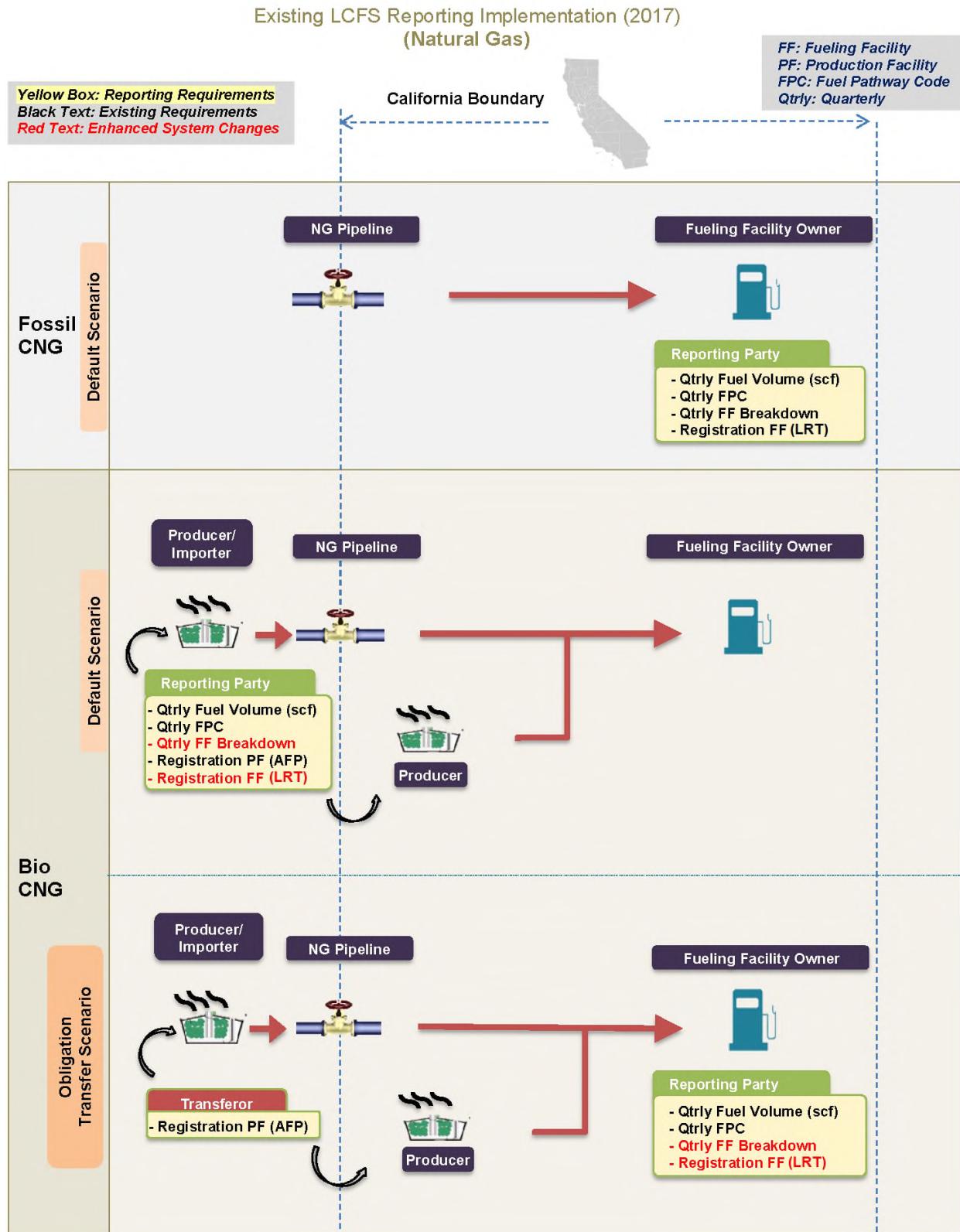
- (1) Direct data check: total metered therms from utility bills at each fueling facility.
- (2) Review allocation method per vehicle type and supporting data.
- (3) Cross check: CNG dispensed at each fueling facility.
- (4) Onsite energy use for compression, unless CA-GREET default is applied.
- (5) Review agreement with bio-CNG reporting entity.

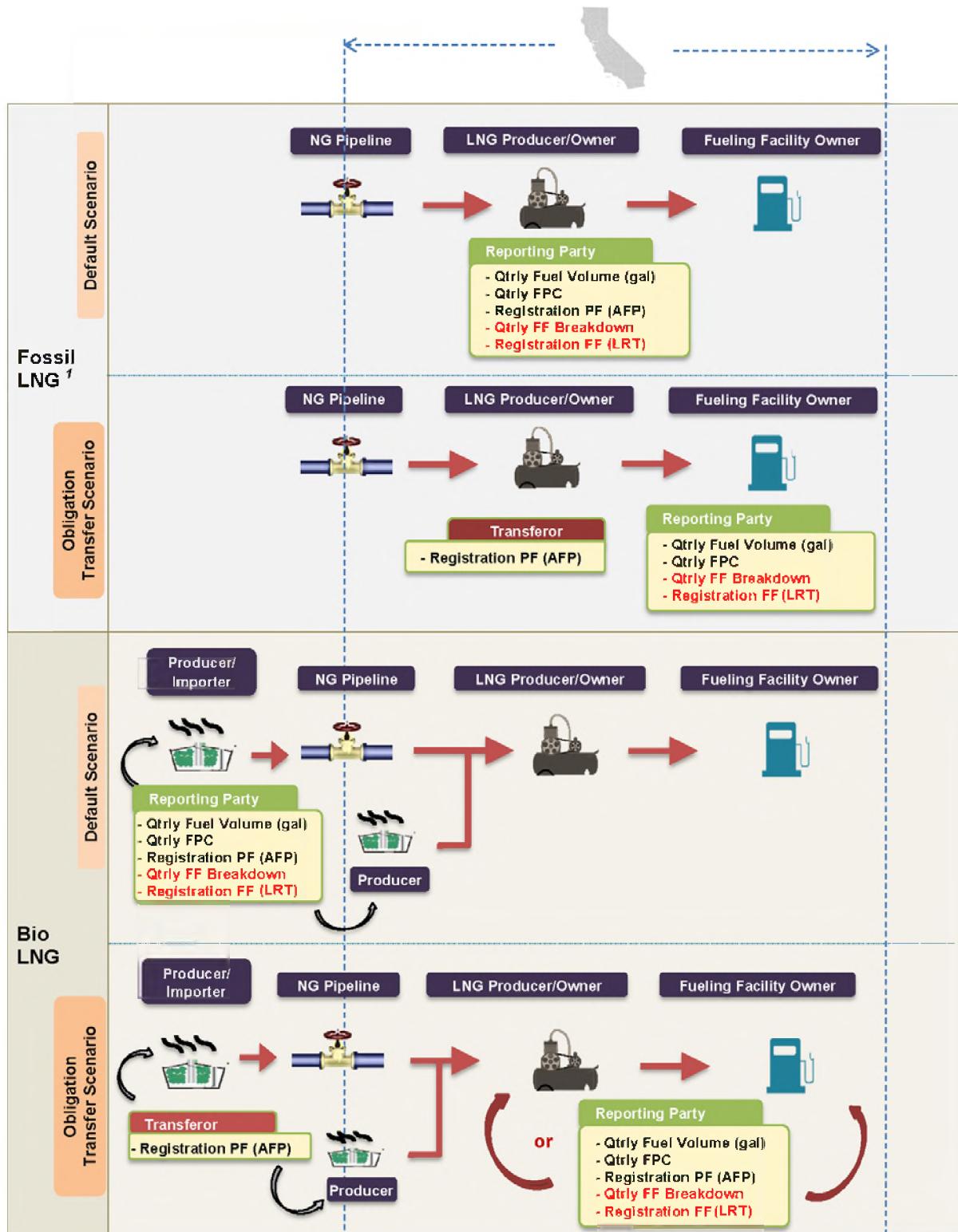
Table 4. Verification Points for North American Fossil NG to CNG, LNG or L-CNG

Data	Documents
Fossil CNG	
Quantity of NG extracted from pipeline at CNG fueling facility	Quarterly LRT reports, utility bills
Quantity of CNG dispensed	Meter readings as a cross check
Fossil LNG and Fossil L-CNG	
Quantity of NG extracted from pipeline at liquefaction facilities	Utility bills, liquefaction facility meter data
Quantity of LNG produced in liquefaction facilities	Monthly production report by liquefaction company, meter data
Quantity of LNG delivered to LNG fueling facilities in CA and distance	Truck delivery records (i.e. Bills of Lading), confirmation that LNG (not CNG) was dispensed, LNG dispensed meter data
Quantity of LNG delivered to CNG fueling facilities in CA and re-gasified and distance	Compare truck delivery records (i.e. Bills of Lading) to CNG dispensing meter data

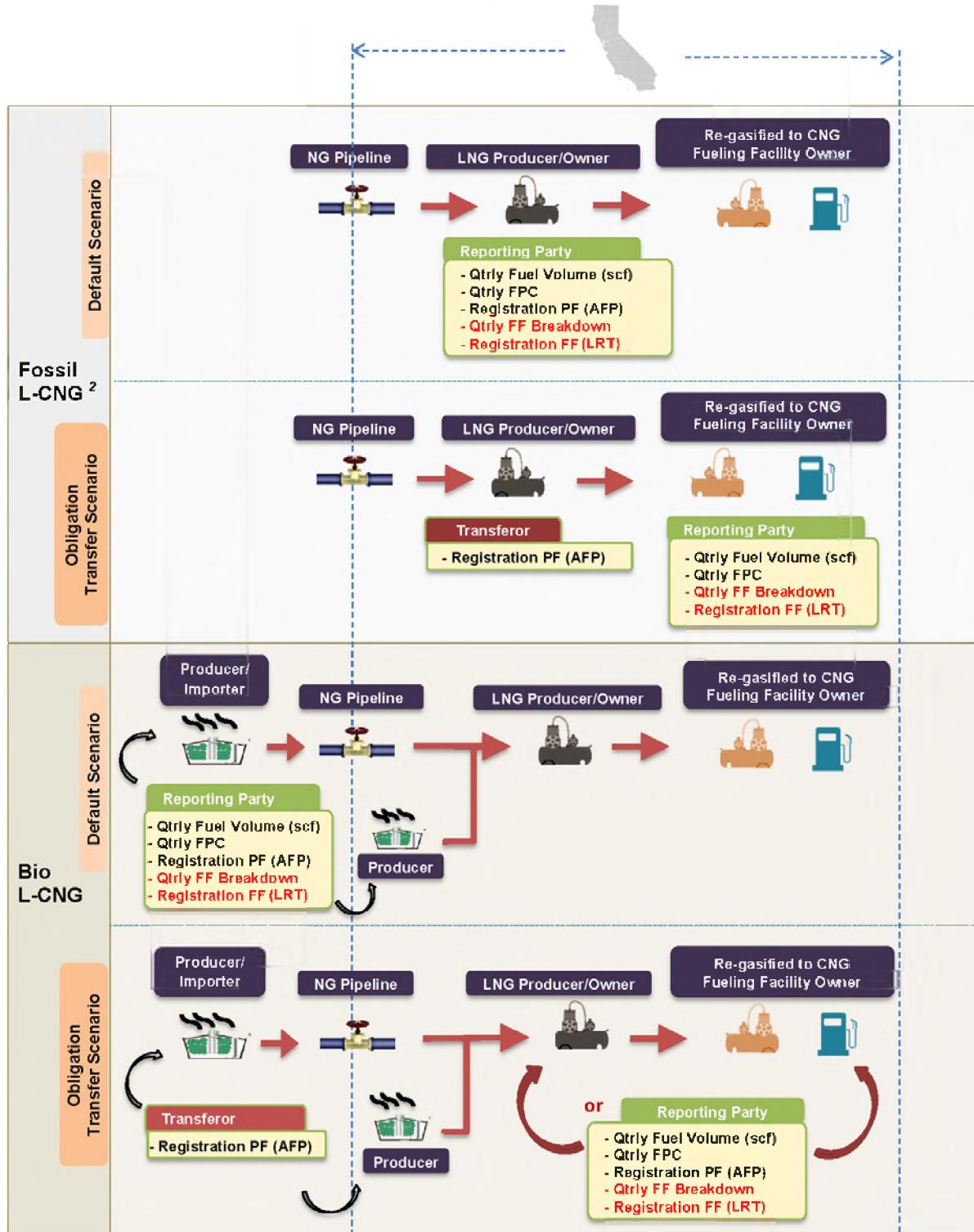
APPENDIX A

NATURAL GAS REPORTING PARTIES AND REPORTING REQUIREMENTS





¹ Initial regulated party for fossil LNG is the entity that owns the fossil LNG right before it is transferred to storage at the facility at which the liquefied blend is dispensed to motor vehicles for their transportation use. This will hold true even if that entity is an out-of-state entity. In that case, the out-of-state entity would be subject to reporting requirements as shown above.



² Where no Bio-LNG is added to Fossil LNG prior to compression to CNG, the regulated party is initially the entity that owns the fossil LNG right before it is transferred to the facility at which the fossil LNG is re-gasified and dispensed to motor vehicles for their transportation use. This will hold true even if that entity is an out-of-state entity. In that case, the out-of-state entity would be subject to reporting requirements as shown above.

APPENDIX B
LRT FORM FOR NG FUELING FACILITY REGISTRATION

Natural Gas-Based (CNG, LNG, L-CNG) Fueling Facility List

Company Name ⁽¹⁾	FEIN ⁽²⁾	Fueling Facility Name ⁽³⁾	Street Number & Name ⁽⁴⁾	City ⁽⁴⁾	Zip Code ⁽⁴⁾	Meter # ⁽⁵⁾	Fuel Type ⁽⁶⁾	FPC ⁽⁷⁾	Longitude ⁽⁸⁾	Latitude ⁽⁸⁾

NOTES:

- (1) The organization name of the reporting party registered in LCFS.
- (2) The Federal Employer Identification Number (FEIN) of the Reporting Party.
- (3) The name of the fueling facility.
- (4) The address of the fueling station, including street number and name, city, and zip code.
- (5) Meter number is the utility-meter number as it appears on the utility bill. It only applies to CNG (both fossil-based and bio-CNG).
- (6) The fuel type should be one of the following: CNG, LNG, L-CNG, bio CNG, bio-LNG, bio-L_CNG.
- (7) The Fuel Pathway Code (FPC) associated with this fueling facility.
- (8) Report Latitude and Longitude in units of Decimal Degrees, carried to a minimum of 6 decimal places after the decimal point. West Longitude and south Latitude should be written with a negative sign. Use either Google Earth or GPS meter.

APPENDIX C

DRAFT SIMPLIFIED CI APPLICATION DATA SUMMARY FORM

Three screenshots of the draft reporting form for Tier 1 landfill gas pathway applications are shown below. This form would potentially replace the existing Tier 1 calculator in pathway application packages. The sheets highlight facility information and verifiable producer operational data used in calculating the CI of landfill gas-derived biomethane. The finalized sheet would be updated in 2017 to reflect any updates to the CA-GREET model.

The first screenshot shown below requires the firm name, location of landfill, location of CNG station in California (and if applicable, location of LNG production, and location of LNG/L-CNG stations in California).

Facility information:

Applicant: ABC Company	Landfill Location: XYZ Landfill in Any Town , Any State	CNG Production Location:	CNG Stations in California	LNG Production Location:	Any City, California	L-CNG Production Location:	LNG/CNG Stations in California
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Operational Data for Feedstock production (biogas to biomethane):

The second screenshot below shows the operational data required for the feedstock production phase, to be completed by the gas upgrading facility. All operational data entered in the form would be subject to verification.

Only biomethane injected into the pipeline would be included in the “biomethane product gas” column in the form. If fossil hydrocarbon gas is blended with the biomethane to enhance heat content prior to the metered injection point, this shall be disclosed and added to the inputs to biogas processing. Other pathway inputs which have an impact on CI but not included in the summary sheet would not require verification under the potential regulation. Values for any parameters not provided by the applicant in the form will instead use conservative default values, and as such are being considered to minimize verification burden.

Data Years	Step 1) Select Feedstock Production Region							
	Select Regional Electricity Mix for Biomethane	1-U.S Ave Mix	Enter Maximum Pipeline Transmission Distance in mile 1,925					
Process	Biogas Feedstock (at Inlet to Processing)		Inputs to Biogas Processing					
Monthly Data	Inlet Raw LFG Extraction, (metered)	Raw Biogas Quality (% Methane)	Facility Total NG from Utility Invoices	Facility Total Diesel from Invoices	Facility Total Propane (LPG) from Invoices	Other Fuel (note type and source documentation)	Facility Total Electricity from Utility Invoices	Biomethane Product Gas, (metered)
Unit	SCF at 60° F	%	MMBtu	Gallons	MMBtu	MMBtu	kWh	MMBtu
Month 1	37,376	54.0%	3155.4	0	280	0	4,032,210	999,256
Month 2	24,251	54.0%	2851.3	0	307	0	1,112,210	5,628,943
Month 3	54,251	54.0%	2851.3	0	307	0	1,112,210	46,895,123
Month 4	16,000	54.0%	2851.3	0	307	0	1,112,210	947,014
Month 5	4,251	54.0%	2851.3	0	307	0	1,112,210	580,000
Month 6	54,251	54.0%	2851.3	0	307	0	9,112,210	198,000
Month 7	1,000	54.0%	2851.3	0	307	0	1,112,210	107,014
Month 8	3,000	54.0%	2851.3	0	307	0	1,112,210	198,000
Month 9	2,000	54.0%	2851.3	0	307	0	1,112,210	1,989,555
Month 10	50,000	54.0%	2851.3	0	307	0	1,112,210	8,123,568
Month 11	60,000	54.0%	2851.3	0	307	0	1,112,210	1,900,000
Month 12	15,000	54.0%	2851.3	0	307	0	1,112,210	1,233,316
Month 13	12,000	54.0%	2851.3	0	307	0	1,112,210	5,615,301
Month 14	14,000	54.0%	2851.3	0	307	0	1,112,210	1,234,569
Month 15	9,000	54.0%	2851.3	0	307	0	5,000,000	5,980,562
Month 16	3,500	54.0%	2851.3	0	307	0	1,112,210	9,198,000
Month 17	1,000	54.0%	2851.3	0	307	0	1,112,210	5,510,000
Month 18	5,600	54.0%	2851.3	0	307	0	1,112,210	550,000
Month 19	1,200	54.0%	2851.3	0	307	0	1,112,210	89,565,662
Month 20	5,400	54.0%	2851.3	0	307	0	1,112,210	56,487,000
Month 21	1,900	54.0%	2851.3	0	307	0	1,112,210	12,356,895
Month 22	5,500	54.0%	2851.3	0	307	0	1,112,210	1,234,562
Month 23	5,000	54.0%	2851.3	0	307	0	1,112,210	980,000
Month 24	24,251	54.0%	2851.3	0	307	0	1,112,210	1,895,222
Total in HHV	409,729		68,735	0	7,346	0	41,500,841	259,407,562

Producer's Operational Data for Fuel Production:

The third screenshot includes inputs for bio-CNG, bio-LNG, and bio-L-CNG. This data is provided by the fueling facility that performs compression, or the liquefaction plant, as applicable.

For the bio-CNG pathways, staff is considering applying default parameters for all stages of final fuel production, eliminating the need for any verified CI inputs for this stage of the lifecycle. Staff suggests using a default value of 96% for compression efficiency. This value is based on the most conservative compression efficiency for all of the pathways certified in 2016. The use of this proposed value will eliminate the necessity for verification of electricity used for compression of bio-CNG at a dispensing station in California.

For bio-LNG, verified inputs that could be included are:

- Total monthly biomethane used in the production of LNG (in MMBtu)
- Total monthly LNG produced (in gallons)
- Total fossil NG used as process fuel if applicable (in MMBtu)
- Total monthly electricity used for liquefaction (in kWh)

- Transport mode (HD Diesel or HD LNG truck) and maximum LNG transport distance (in miles).

In addition, the producer is required to provide an affirmation that all delivery trucks and storage tanks are equipped with boil-off recovery; however, the amount of NG recovered is a default which would not be subject to verification.

Compression efficiency described above applies to both bio-CNG and bio-L-CNG.

Data Years	Step 2) Select Region for CNG, LNG, and L-CNG Production				
	Select Regional Electricity Mix for Fuel Production		3-CAMX Mix		
Process	Inputs for LNG				
Monthly Data	NG as feedstock	LNG Production	NG as process fuel	Electricity from Utility Invoices	LNG Transport and Distribution
Unit	MMBtu	Gallons	MMBtu	kWh	miles
Month 1	184,379	2,173,772	0	2,955,895	Select to affirm truck and storage tanks are equipped with Boil-Off Recovery
Month 2	184,379	10,173,772	0	3,055,895	No
Month 3	184,379	12,173,772	0	3,155,895	
Month 4	184,379	2,173,772	0	2,955,895	
Month 5	184,379	2,173,772	0	2,955,895	
Month 6	184,379	2,173,772	0	2,955,895	Enter Maximum LNG Transport Distance by Heavy Duty Diesel Truck
Month 7	184,379	2,173,772	0	2,955,895	5
Month 8	184,379	2,173,772	0	2,955,895	Enter Maximum LNG Transport Distance by Heavy Duty LNG Truck
Month 9	184,379	2,173,772	0	2,955,895	45
Month 10	184,379	2,173,772	0	2,955,895	
Month 11	184,379	2,173,772	0	2,955,895	
Month 12	184,379	2,173,772	0	2,955,895	
Month 13	184,379	2,173,772	0	2,955,895	
Month 14	184,379	2,173,772	0	2,955,895	
Month 15	184,379	2,173,772	0	2,955,895	
Month 16	184,379	2,173,772	0	2,955,895	
Month 17	184,379	2,173,772	0	2,955,895	
Month 18	184,379	2,173,772	0	2,955,895	
Month 19	184,379	2,173,772	0	2,955,895	
Month 20	184,379	2,173,772	0	2,955,895	
Month 21	184,379	2,173,772	0	2,955,895	
Month 22	184,379	2,173,772	0	2,955,895	
Month 23	184,379	2,173,772	0	2,955,895	
Month 24	184,379	2,173,772	0	2,955,895	
Total in HHV	4,425,104	70,170,528	0	71,241,480	