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# Market-Based Accounting for Clean Fuels

APRIL 2025

CEAP | CLEAN ENERGY ACCOUNTING PROJECT

CRS

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# 1. Executive Summary

The clean fuels market is rapidly evolving to meet the growing demand for biogenic and lower-emission alternatives to conventional fossil fuels, demand largely intended to support fossil-derived greenhouse gas (GHG) emission reduction goals. However, existing guidance from the Greenhouse Gas Protocol (GHG Protocol) does not fully address how the procurement and use of contractual instruments for clean fuels should be reflected in corporate GHG inventories.

This CEAP guidance presents a framework for market-based accounting of direct emissions from clean fuel use and/or delivery consistent with the GHG Protocol Corporate Standard and its supplemental Scope 2 Guidance. By following this framework, organizations that use clean fuels can generate more accurate GHG emissions reports and make more credible claims to the emissions benefits of these fuels. This framework includes the application of nine consensus-based quality criteria for contractual instruments used in clean fuels markets, summarized here:

1. **Conveyance**: Issued instruments are the sole method of establishing ownership of the attributes of clean fuel and must provide the owner with clear documentation of those attributes, including details about the fuel's production and emissions.

2. **Aggregation**: All attributes of clean fuels should be conveyed by a single instrument or linked instruments retired together to ensure that all attributes of a unit of clean fuel correspond to a single use of that unit.

3. **Market Boundaries**: Instruments may support claims for fuels that are delivered through distribution systems where physical tracking of attributes is impossible or impractical and validate use claims where there is no physical chain of custody disputing the claim.

4. **Vintage**: To ensure that conveyed data and production audit trails are indelible, instruments must record a vintage date and expire within a period that reasonably ensures data integrity.

5. **Equivalency**: A fuel, its precursor chemicals, or its derivative compounds must be fit for the specific use being claimed and must wholly contain the attributes conveyed by the instrument supporting the use claim.

6. **Attribute Allocation**: Attributes may be freely allocated to volumes of produced fuel and/or co-products so long as the contractual instrument supporting the use claim does not convey more attributes than associated with the volume of fuel it represents.

7. **Input Instrument Retirement**: Contractual instruments issued for any production inputs must be retired or canceled prior to creating a new instrument conveying the attributes of the produced fuel.

8. **Default Attributes**: When attributes of a unit of produced fuel are sold separately from the fuel from which they derived, the volume of remaining, separated fuel must be assigned the most accurate attributes reasonably ascertained from available data.

9. **Tracking & Retirement**: To prevent double-counting, and secure the credibility of emissions reporting, contractual instruments must be tracked and retired.

These recommended criteria are intended to provide interim guidance for organizations to credibly calculate and report direct GHG emissions from the use of procured clean fuels while the GHG Protocol considers updates to its market-based accounting rules.

# 2. Introduction

Markets for clean fuels[1] are rapidly evolving, with many sectors working to scale production of biogenic and lower emissions fuels to replace conventional fossil fuels. In most cases, demand for clean fuels is driven by a desire by policy makers and market participants to reduce fossil-derived greenhouse gas (GHG) emissions. However, current guidance from the GHG Protocol and others does not fully describe how procurement and use of contractual instruments[2] for clean fuels should be reflected in corporate carbon inventories.

The GHG Protocol's Corporate Standard Scope 2 Guidance provides rules for applying market-based accounting[3] to calculate indirect GHG emissions associated with purchased electricity. These rules recognize the use of contractual instruments to transact and track exclusive delivery of specified emissions attributes associated with the generation of clean electricity. Within an organization's GHG inventory, the Scope 2 guidance only recognizes contractual instruments that meet certain quality criteria.

This CEAP guidance presents similar consensus recommendations for quality criteria for contractual instruments representing clean fuels that support credible use claims and accurate calculation of direct emissions[4] in a corporate carbon inventory. These recommendations apply to all contractual purchasing approaches that use market-based accounting and are consistent with the current version of the GHG Protocol's "Corporate Accounting and Reporting Standard Calculation" (the Corporate Standard).

This guidance is intended as an interim resource to support reporting to the GHG Protocol Corporate Standard and to inform the update of the standard that is currently underway.[5]

1 Clean fuels may possess low carbon intensity (CI) scores (due to biogenic/non-emitting inputs or lower life-cycle emissions than fossil equivalents), however, the recommendations in this guidance apply to all fuels. Programs that employ the guidance are encouraged to create definitions of clean that meet their own program objectives.

2 A contractual instrument is a record which conveys to its owner the unique right to claim consumption or use of the attributes of the material, product or project for which it was issued. Some contractual instruments may be transferred or transacted separately or "unbundled" from the material, product or project they represent. Contractual instruments relevant to fuels markets generally take the form of energy attribute certificates (EACs)– including Guarantees of Origin (GO), Renewable Fuel Certificates (RFCs), Renewable Thermal Certificates (RTCs), and Proofs of Sustainability (PoS). Bilateral contracts for attributes associated with particular types of fuel are also considered contractual instruments even though no certificates are issued.

3 In the context of fuels, market-based accounting reflects emissions from fuel that reporting entities have intentionally purchased (or not purchased) to support a credible use claim based on specified attributes of the fuel. Typically, market-based accounting is employed where companies wish to purchase materials or products from common pools or distribution systems where precise traceability to individual points of origin may not be feasible or practical. In these circumstances, attributes like emission factors are derived from contractual instruments rather than the emissions of the fuel used.

4 Direct emissions include "Scope 1" emissions and are GHG emissions released directly to the atmosphere from sources owned, produced, or controlled by the reporting entity.

5 GHGP's release of its final *Land Sector and Removals Guidance* also may eventually inform the update to the current GHG Protocol Corporate Standard accounting and reporting practices and alter the framework presented here.

# 3. Background

In August of 2023, the GHG Protocol published an *Interim Update on Accounting for Biomethane Certificates* noting how the history of biomethane accounting speaks to accounting for clean fuels generally.[6] This update found that "there is no definitive guidance on [the question of market-based accounting for clean fuels] under the GHG Protocol" and suggested that market participants "...consult with their auditors and consider rules provided by relevant target-setting programs or applicable regulatory schemes in their jurisdiction(s)" for guidance on how to report the purchase of clean fuel certificates in a manner consistent with the GHG Protocol's accounting and reporting principles.

Since publishing the Interim Update, there has been little comprehensive guidance for applying market-based accounting to the voluntary market for clean fuels. Acknowledging the need for accounting rules to be driven by stakeholder consensus, CEAP launched an initiative intended to gather stakeholders from multiple sectors to answer the following question:

**What are credible market-based rules to account for the direct emissions associated with the use of clean fuels?[7]**

Between April and August 2024, CRS convened a series of meetings with a broad diversity of stakeholders from fuel producing and consuming sectors. Starting with the Scope 2 Guidance and applying best practices for using contractual instruments in the clean power sector, attendees were challenged with defining a series of globally applicable quality criteria for contractual instruments that would be sufficiently rigorous to support credible use claims for clean fuels and accurate calculations of direct emissions.

This document is the product of those efforts and is intended to serve as interim guidance while the GHG Protocol issues new rules for market-based accounting with its update of the Corporate Standard.

6 Greenhouse Gas Protocol, "Interim Update on Accounting for Biomethane Certificates," GHG Protocol Blog, August 21, 2023. https://ghgprotocol.org/blog/interim-update-accounting-biomethane-certificates.

7 The scope of CEAP's Market-based Accounting for Clean Fuels initiative was limited to the direct emissions associated with the use of a fuel, therefore omitting indirect or induced emissions created in the production of the fuel.

# 4. Quality Criteria

The following quality criteria were identified as necessary for contractual instruments to support credible use claims for specified fuels and direct emissions calculations consistent with the Corporate Standard. In all cases, documentation of conformance with quality criteria should be precise, accurate, transparent, and verified.

## Criterion 1: Conveyance

***Contractual instruments must be the only method of conveying exclusive ownership of the chemical properties of a unit of produced fuel and any production attributes characterizing the direct GHG emissions associated with that unit. The date and location where the fuel was produced, and the origin, mass fraction[8], and any other specified attributes of each input in the production of the unit of produced fuel must be disclosed to the owner of the contractual instrument.***

Procurement of a contractual instrument entitles the purchaser to the exclusive right to claim use of the produced fuel and the emissions attributes of the specified unit of produced fuel when calculating direct emissions in a corporate GHG inventory. Both the use claim and the associated emissions attributes are conveyed exclusively by the instrument and are not included in nor conveyed using any other instrument or method.[9]

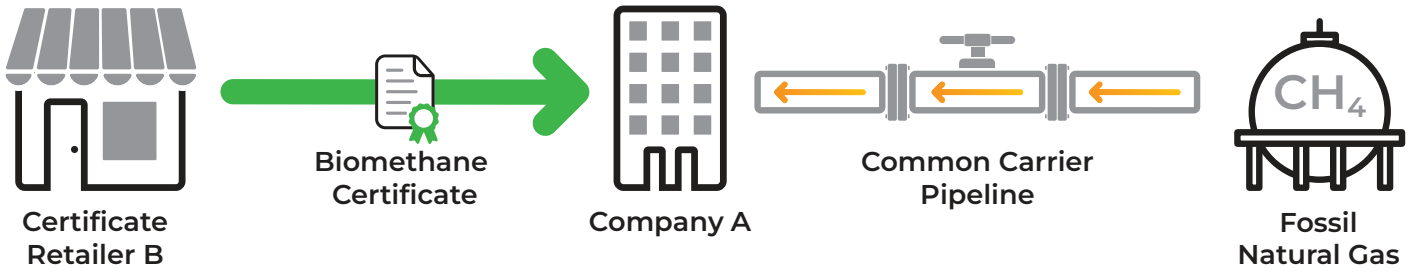
The conveyed attributes of a clean fuel generally derive from the fuel's chemical properties, emissions associated with the fuel's production, and the fuel's production vintage. However, attributes of feedstocks or other inputs to a fuel's production pathway can be partially or wholly allocated using contractual instruments associated with the feedstock or input. The biogenic or carbon-free attributes of a fuel's production inputs are, thus, crucial for characterizing emissions from a fuel's use as "biogenic" or "carbon-free" and must be disclosed through the contractual instrument.

The contractual instrument entitles the owner to specific information related to the source of the fuel and its production inputs that is essential for calculating accurate direct GHG emissions.[10] Disclosing this information also enhances transparency in the fuel procurement process and supports more credible use claims.

### Example 1.1: Biomethane Certificates

Company A has a goal to run its operations on 100% renewable energy but does not have a locally available supply of biomethane (also known as renewable natural gas or RNG). Company A purchases sufficient

**Figure 1.1.** Biomethane Certificates




8 Mass fraction measures the concentration of a constituent in a mixture or of a component in a compound and typically is expressed as the product of dividing the mass of the constituent or component by the mass of the mixture or compound.

9 When attributes of a procured and used fuel are bundled with the physical fuel, a credible use claim still requires that the attributes be conveyed exclusively through a contractual instrument.

10 Detailed information characterizing the attributes conveyed need not be disclosed with the contractual instrument itself but may be disclosed through a product content label or in another appropriate form.

**Table 1.** Company A's Emissions Reporting Under the 2015 Corporate Standard (by Gas and Scope)

| EMISSIONS | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|
| SCOPE 1 | | X | X |
| SCOPE 2 | | | |
| SCOPE 3 | | | |

| DIRECT $CO_2$ EMISSIONS FROM BIOGENIC COMBUSTION |
|---|
| X |

biomethane certificates from Certificate Retailer B to cover the company's annual consumption of fossil natural gas (which it receives via a regional common carrier pipeline) for heating its owned and operated buildings. Certificate Retailer B also provides Company A with default emissions factors for GHGs released when using the biomethane for which the certificates were issued.

Certificate Retailer B's certificates convey the right for Company A to claim the use of biomethane and is substantiated by a detailed description of the chemical properties of the associated biomethane, the biomethane certificate issuance date, and the specified attributes characterizing emissions from the use of the fuel.

Categorization of direct emissions associated with Company A's use of the biomethane is provided in Table 1.

## Example 1.2: Renewable $H_2$ Fuel Cell

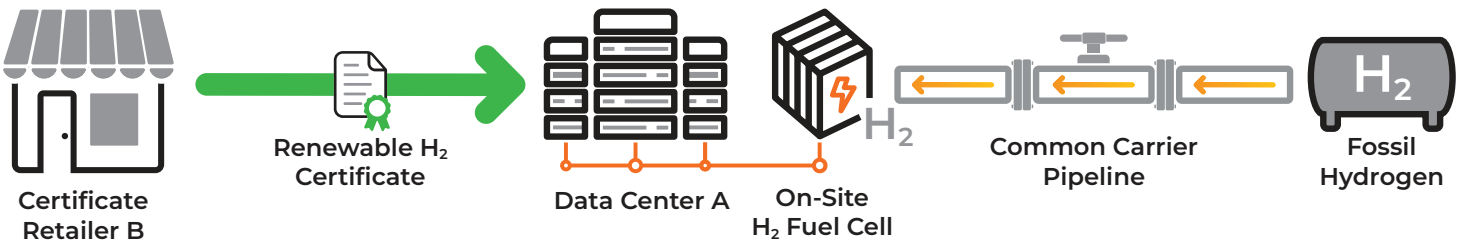
Data Center A uses pipeline-delivered fossil hydrogen (derived from natural gas) to operate a fuel cell it owns that generates power needed to cool the data center's servers. Data Center A wants its operations to run on 100% clean energy generated on-site but does not have an available supply of renewable hydrogen ($H_2$) where the data center is located.

Data Center A purchases from Certificate Retailer B sufficient renewable hydrogen certificates associated with renewable hydrogen injected into the common carrier pipeline to cover the annual consumption of fossil hydrogen its fuel cell consumes over the reporting period.

Ownership of renewable hydrogen certificates provided by Certificate Retailer B permits Data Center A to claim it is using renewable energy to power its operations and the claim is supported by the detailed information of the production process—including attributes associated with production inputs—contained in the product content label provided by Certificate Retailer B.

Data Center A would not report any non-energy associated emissions for this facility when reporting emissions to the GHG Protocol under the 2015 Corporate Standard.

**Figure 1.2.** Renewable $H_2$ Fuel Cell



## Calculating and Reporting Emissions

Reported emissions from the use of clean fuels must reflect the attributes conveyed by any retired contractual instruments applied to the fuels.

Certificate providers should disclose emissions data[1] and other relevant details which the reporting entity can use, alongside fuel use data (like engine performance and combustion technology), to determine the appropriate emissions factors and reporting categories for direct GHG emissions.

When no contractual instruments are issued and clean fuels are delivered through a dedicated system, emissions can be measured directly, derived from fuel characteristics, or calculated using fuel data and standard default emission factors.

Key accounting characteristic relevant to non-emitting fuels, biogenic emissions and avoided emissions are described below:

A. **Non-Emitting Fuels**: Users of non-emitting fuels, such as hydrogen or those with installed carbon capture and storage (CCS), will report zero direct emissions, regardless of fuel/energy input characteristics, because no gasses are being released to the atmosphere at the point of use.

B. **Biogenic Emissions**: Direct biogenic $CO_2$ emissions associated with the combustion of biomass are currently required to be reported outside of the scopes. This information is not typically reported as separate stationary and mobile combustion totals. Non-$CO_2$ emissions from clean fuel use (e.g., methane, nitrous oxide) must be reported within the appropriate scope subcategories. For fuels with traded attributes, reporting entities must calculate direct emissions using the residual mix or default conventional fuel factors and report them within the scopes. Reporting direct non-combustion biogenic $CO_2$ emissions is optional, as are indirect biogenic $CO_2$ emissions from electricity or the value chain. Organizations are encouraged to disclose these emissions when they are relevant to the inventory.

C. **Avoided Emissions**: The GHG Protocol's Interim Update on Accounting for Biomethane Certificates confirmed that the use of biomethane can result in avoided emissions. However, it suggested that companies must quantify these avoided emissions using a project-based accounting methodology and report them separately from the scopes. This principle can also apply to other clean fuels. In all cases, avoided emissions should not be included in emissions reported under the scopes.The same accounting update also discussed carbon intensity scores, which typically reflect how direct and indirect emissions of a clean fuel compare to another fuel or scenario. The update clarified that, where it was possible to disaggregate CI scores, the direct and indirect emissions could be included in gross inventory totals while project accounting elements could be reported separately. Where contractual instruments convey avoided emissions attributes, companies can report direct emissions in the gross inventory total (e.g., Scope 1 and/or direct biogenic), and separately disclose the avoided emissions attributes conveyed in the contractual instrument as supplemental information. Companies that report avoided emissions should provide data to support the claim that emissions are avoided and report the methodology, data sources, system boundary, time, and other assumptions used to calculate the emissions avoided.[2]

1 Certificate providers may choose to disclose emissions data converted to CO2e, buts gas-specific emissions accounting is mandated by the GHG Protocol and, for biogenic emissions, individual gasses must be categorized separately in an inventory report. Therefore, gas-specific information is preferred.

2 For more information on avoided emissions, see Greenhouse Gas Protocol, Corporate Value Chain (Scope 3) Accounting and Reporting Standard: Supplement to the GHG Protocol Corporate Accounting and Reporting Standard, section 9.5 "Accounting for Avoided Emissions," September, 2011, p.106. https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf and Russell, Stephen. "Estimating and reporting the comparative emissions impact of products, World Resources Institute Working Paper", January 2019. https://ghgprotocol.org/sites/default/files/2023-03/18_WP_Comparative-Emissions_final.pdf.

## Criterion 2: Aggregation

***All production attributes must be conveyed by a single instrument, or by multiple instruments transacted and retired together for parties associated with the same activity.***[11]

To prevent both the purchaser of the instrument and the consumer of the fuel from claiming the same attributes, proper market-based accounting requires that all specified attributes deriving from fuel delivered via a shared distribution system adhere to a single instrument and that the single instrument supports the only direct claim to those attributes.

Absent an instrument, neither a product label, declaration of the fuel seller, or measured direct emissions support a legitimate claim to attributes that have already been conveyed. Fuel producers must not characterize any fuel as "clean" or "biogenic" unless it is accompanied by an instrument that verifies and conveys the required specified attributes.[12]

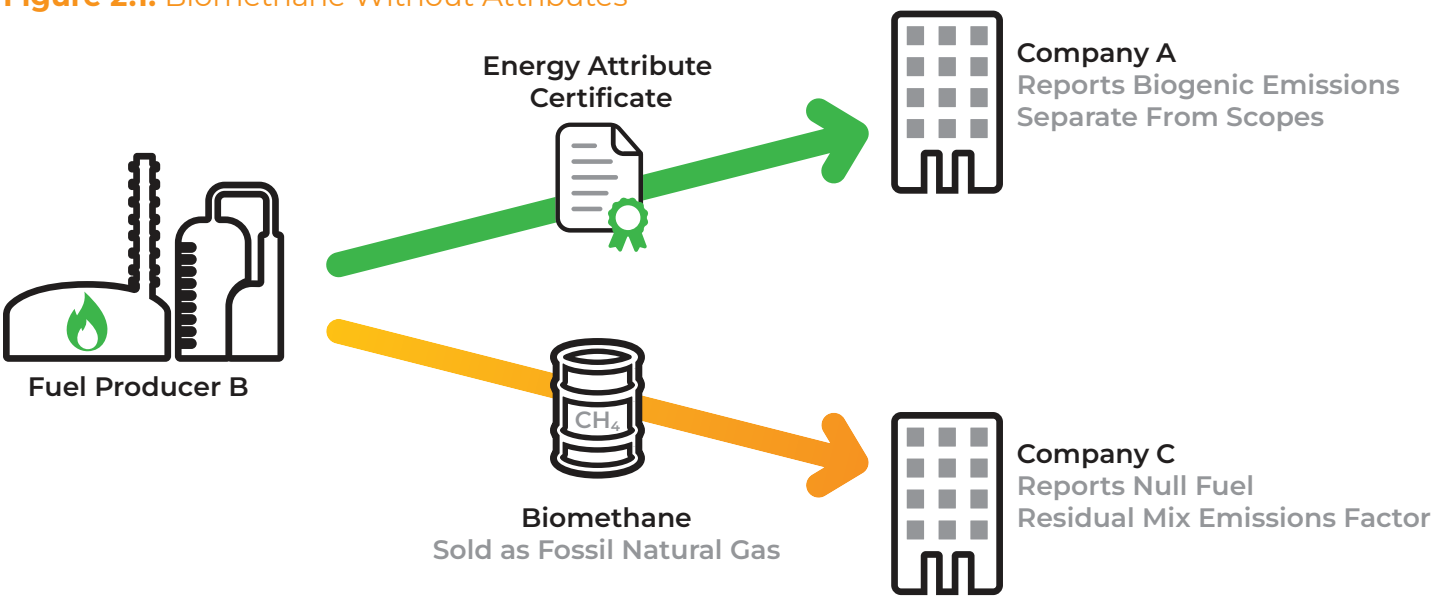
Proper market-based accounting requires that entities using any fuel without corresponding contractual instruments conveying specified attributes of the fuel must treat the fuel as "null fuel"[13] and calculate the direct emissions using either the system-wide residual fuel mix or the default emissions factor for the conventional fossil fuel commonly used for the same purpose (see Criterion 8: Default Attributes).

### Example 2.1: Biomethane without Attributes

Company A purchases energy attribute certificates (EACs) issued for biomethane produced by Fuel Producer B, a well-known distributor of biofuels. Fuel Producer B sells the physical fuel associated with the EACs to a different entity, Company C.

Fuel Producer B may not characterize the fuel sold to Company C as biogenic, but instead must either designate it as the conventional fossil fuel that would otherwise be supplied to Company C for the intended

**Figure 2.1.** Biomethane Without Attributes




11 For biomethane-derived electricity distributed through the EU's bulk power grid, for example, Guarantees of Origin (GOs) are considered complementary to Proof of Sustainability (PoS) certificates and provide evidence of the information claimed on the PoS document. To discourage double counting of attributes, both instruments are retired simultaneously with the consumption of the electricity.

12 Where fuels are delivered to a single end-user bundled with their attributes, no tradeable certificate must be issued, and the sales contract is the contractual instrument conveying ownership of the attributes.

13 The term "null fuel" aligns with market-based accounting for bulk electricity, which refers to grid-delivered electricity whose specified attributes have been sold or transferred as "null power."

use or as reflecting the attributes of the residual mix of fuels present in the common carrier pipeline or shared distribution system used to distribute the fuel.

Categorization of direct emissions associated with Company A's use of biomethane certificates is provided in Table 2.

**Table 2.** Company A's Emissions Reporting Under the 2015 GHG Protocol Corporate Standard (by Gas and Scope)

**COMPANY A**

| EMISSIONS | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|
| SCOPE 1 | | X | X |
| SCOPE 2 | | | |
| SCOPE 3 | | | |

| DIRECT $CO_2$ EMISSIONS FROM BIOGENIC COMBUSTION |
|---|
| X |

Even though Company C purchased the fuel from a well-known biofuels producer, Company C must be told it is purchasing "null fuel." To prevent double counting of the fuel's biogenic attributes, Company C must calculate direct emissions from the use of the purchased fuel using either the emissions factor associated with conventional pipeline quality natural gas, or the factor associated with the residual mix of fuels in the gas pipeline serving the company.

Categorization of direct emissions associated with Company C's use of the gas provided by Fuel Producer B is provided in Table 3.

**Table 3.** Company C's Emissions Reporting Under the 2015 GHG Protocol Corporate Standard (by Gas and Scope)

**COMPANY C**

| EMISSIONS | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|
| SCOPE 1 | X* | X* | X* |
| SCOPE 2 | | | |
| SCOPE 3 | | | |

| DIRECT $CO_2$ EMISSIONS FROM BIOGENIC COMBUSTION |
|---|
| |

*Quantified using conventional natural gas emissions factor or the residual mix

## Criterion 3: Market Boundaries

***Contractual instruments must be sourced from shared distribution systems,[14] which comprise a single market when the following conditions are met:***

A. ***the fuel represented by the instrument and the fuel used derive from shared distribution systems wherein different fuels and/or fuels from different sources are mixed;***

B. ***fuel with the same physical properties is present within the distribution system to which the producer of the fuel is connected and the distribution system where the fuel-consuming activity is located;***

C. ***the specified attributes claimed do not exceed the sum of those specified attributes associated with the volume of fuel present within both distribution systems;***

D. ***the instrument is contractually enforceable both where the fuel is introduced and where the fuel-consuming activity occurs; and***

E. ***the entity making the use claim either has operations physically connected to the distribution system where the fuel with the conveyed attributes was injected, or there is a physical connection by which fuel from the distribution system to which the fuel producer is connected can enter the distribution system where the fuel-consuming activity is located.***

Where there is no plausible physical chain of custody that contradicts the use claim supported by contractual instruments, the instruments enable the most accurate tracking of attributes associated with the produced fuel. Shared distribution systems that mix different fuels or fuels from multiple sources make physical tracking of the attributes of fuels impossible or impractical. As a result, under the following conditions contractual instruments are required to track attributes of specified clean fuels within and across these systems.

A. **Mixed Distribution**: The fuel whose use is being claimed and the fuel that is actually used must be connected to shared distribution systems where different fuels and/or fuels from different sources are mixed so that it becomes impossible or impractical to track any particular molecule of fuel from where it was injected to where it was used. Under these circumstances, contractual instruments are the best means of tracking conveyed attributes and provide the strongest evidence supporting the chain of custody asserted by the use claim.

B. **Equivalent Fuel**: Equivalent fuel is present both in the distribution system where the fuel from which the attributes derived was injected and the distribution system where the fuel-using activity is located. This ensures that no practical distinction can be made between fuels in either distribution system.

C. **Limited Attributes**: Contractual instruments may not convey more than the sum of attributes associated with the total volume of the claimed fuel injected into all distribution systems comprising the market. This restriction is facilitated through Criterion 6 (Equivalency) and Criterion 9 (Tracking & Retirement) and precludes use claims that assert a technically infeasible chain of custody, which would undermine the credibility of the claim.

D. **Mutual Recognition**: The contractual instrument supporting the use claim must be enforceable both in the jurisdiction where the fuel from which the attributes derived is injected and the jurisdiction

14 The term "shared distribution system" does not refer to any term of art used within the fuels sector but is used here to connote any mechanism by which fuel from multiple sources is mixed and delivered to end-users. Examples of shared distribution systems include common carrier gas pipelines and mixed fuel bunkering, as well as fuel storage farms and tanker trucks, where mixed fuels or fuels from different sources are mixed and transported from producer to end-user. The physical boundaries of shared distribution systems, including any interactions with other distribution systems and the operational boundaries of consumers, are what determines a consumer's geographic market boundary. These market boundaries need not correspond to otherwise defined subnational or national boundaries.

where the fuel-using activity is located. Mutual recognition of the legitimacy of the contractual instrument is necessary to effectuate transactions based on the instrument within or across distribution systems serving different jurisdictions.

E. **Physical Connection**: There is no requirement that fuel associated with the attributes be directly injected into the same distribution system where the fuel-consuming activity is located. A credible use claim can be supported where the claimant has operations that physically connect to the shared distribution system where the fuel with the associated attributes was injected.[15] Alternatively, contractual instruments can support a credible use claim where there is any physical connection between the distribution systems allowing fuel from the system to which the producer is connected to be introduced to the system where the fuel-consuming activity occurs.[16]

Where physical tracking of attributes between injection and a specific fuel-using activity is impossible or impractical, contractual instruments transacted under the above conditions support credible use claims. These conditions ensure there is no competing chain of custody that can be asserted with greater legitimacy than the chain of custody supported by the contractual instrument. This criterion facilitates broader market access to nascent clean fuels and to fuels with limited supply or restrictive distribution without subverting the credibility of the use claim or the accuracy of direct emissions calculated from data conveyed by the instrument.

## The Sustainable Aviation Fuel Certificate (SAFc) Registry

Rocky Mountain Institute (RMI) and the Environmental Defense Fund (EDF) have organized a registry for Sustainable Aviation Fuel certificates (SAFc), which recognizes two separate but linked certificates (SAFcA and SAFcE) characterizing two different claims on the emissions attributes of the same volume of produced Sustainable Aviation Fuel (SAF).

SAFcA certificates are retired by the airline operator to support a credible claim to the emissions benefit, including any direct avoided emissions associated with one metric ton of neat SAF. Where a SAFcE certificate has not also been issued for the same metric ton of neat SAF, a SAFcA certificate will also include any discreet indirect emissions attributes.

SAFcE certificates can be issued to unbundle indirect emissions benefits from the direct emissions benefits contained within a SAFcA. By separating indirect emissions attributes from direct emissions attributes, SAFcE certificates may be purchased by airline passengers to claim emissions from their travel.

Although designed as instruments to support avoided emissions calculations, SAFcA certificates convey the direct emissions factor associated with the combustion of SAF. As a result, in an attributional inventory, these certificates can be used to substantiate calculations of direct emissions based on the direct emissions associated with using the fuel.

15 An airline, for example, may claim use of sustainable aviation fuel (SAF) if one of its aircraft has a route that includes airports where SAF is distributed.

16 The connection between distribution systems may not be direct, may involve infrastructure typically used to deliver dedicated supply, and may include intervening segments where different fuel or fuels from different sources are not mixed. For example, U.S. biomethane blended with liquid natural gas (LNG) that is transported in a dedicated LNG tanker ship across the Atlantic Ocean and injected into the European integrated infrastructure would sufficiently connect two shared distribution systems.

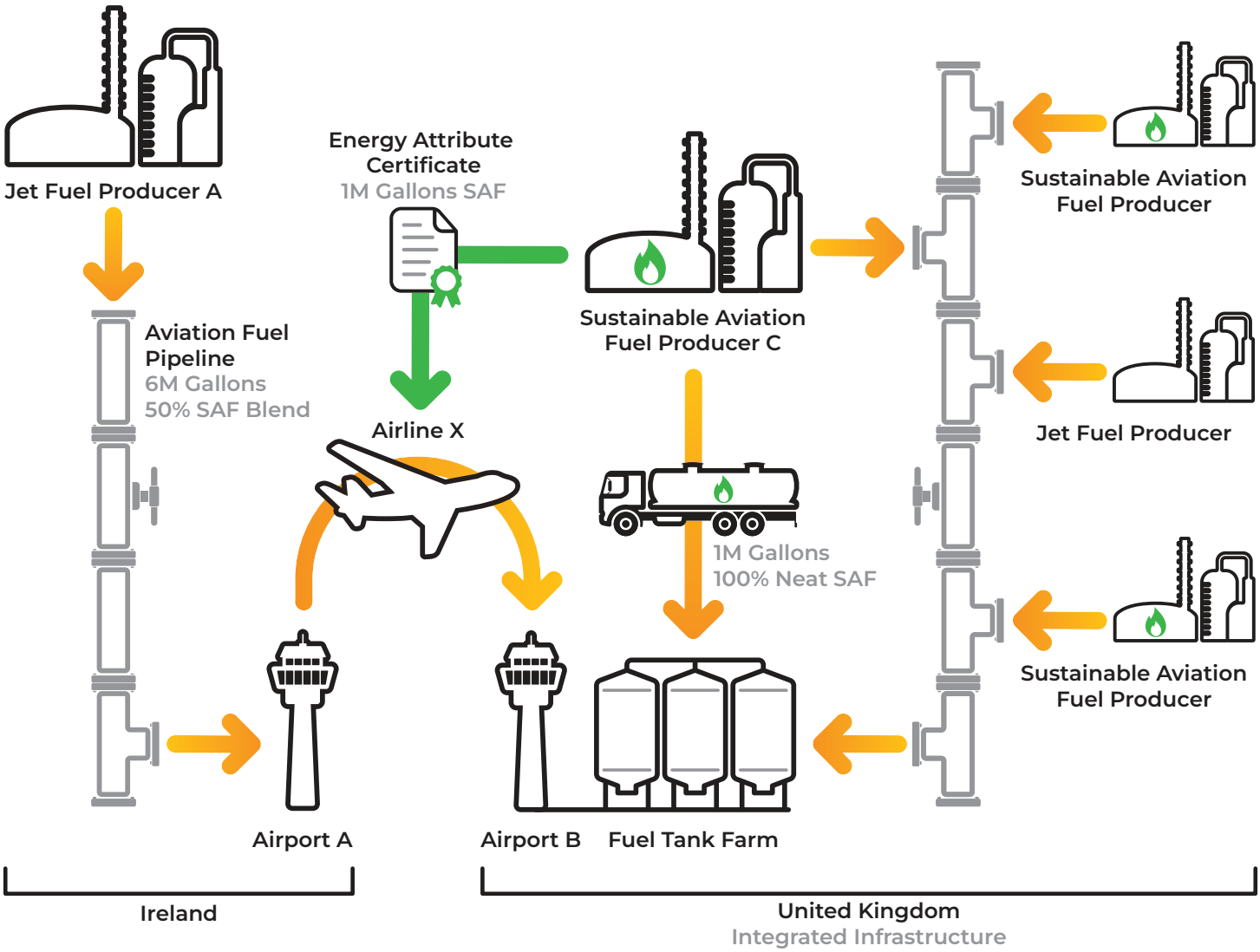
## Example 3.1: SAF Market Boundaries

Jet Fuel Producer A has operations in Ireland where the company produces both biogenic sustainable aviation fuel (SAF) and conventional fossil jet fuel. Jet Fuel Producer A currently distributes 6 million gallons of a 50% SAF blend (50% SAF + 50% fossil jet fuel) annually via a shared aviation fuel pipeline to Airport A, a regional transport hub.

Several different SAF and fossil jet fuel producers deliver their products via pipelines and tanker trucks to a mixed fuel storage farm at Airport B, located in the UK. In 2024, SAF Producer C trucked 1 million gallons of neat SAF (100% pure, unblended) to the storage farm, where it was blended with all other stored fuel and delivered to all aircraft fueled at Airport B.

Airline X, a regional carrier with flights to both Airport A and Airport B, wants to procure enough SAF to claim that the 8 million gallons its fleet consumed in 2024 was 50% SAF. Airline X purchases 6 million gallons of 50% SAF-blended fuel (bundled with certificates verifying the attributes of the fuel) from Jet Fuel Producer A. From SAF Producer C, it purchases certificates representing the attributes of 1 million gallons of pure SAF trucked to Airport B's fuel storage farm.

**Figure 3.1.** SAF Market Boundaries



SAF Producer C conveys certificates to Airline X representing 1 million gallons of SAF attributes, and injects 1 million gallons of pure (100%) SAF into the fuel storage farm at Airport B. The SAF, however, is assigned a conventional fossil jet fuel emissions rate. Other airlines purchasing fuel from Airport B's fuel storage farm calculate and report their emissions inventories using the emissions factor for conventional fossil jet fuel.

The certificates, which are legally enforceable in both Ireland and the U.K., are retired on behalf of Airline X. Airline X is then able to claim that it has met its goal and reports carbon dioxide emissions associated with the purchased SAF as biogenic direct emissions, separate from Scope 1.

Categorization of direct emissions associated with Airline X's use of SAF certificates is provided in Table 4.

**Table 4.** Airline X's Emissions Reporting Under the 2015 GHG Protocol Corporate Standard (by Gas and Scope)

**AIRLINE X**

| EMISSIONS | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|
| SCOPE 1 | | X* | X* |
| SCOPE 2 | | | |
| SCOPE 3 | | | |

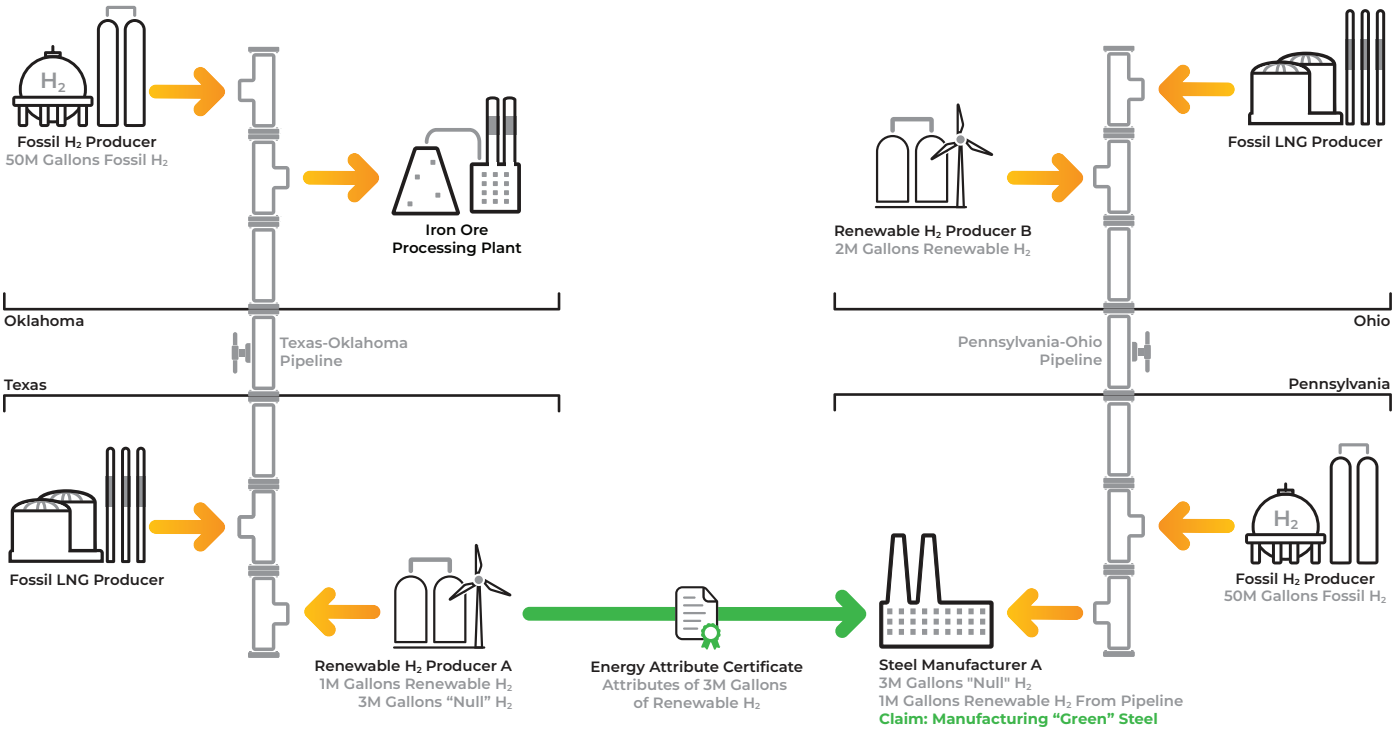
| DIRECT $CO_2$ EMISSIONS FROM BIOGENIC COMBUSTION |
|---|
| X |

*Quantified using conventional jet fuel emissions factor or the residual mix

## Example 3.2: Renewable $H_2$ Market Boundaries

Steel Manufacturer A has a steel production plant located in Pennsylvania that uses 3 million gallons of fossil natural gas to produce steel from iron ore that the company mines and processes in a facility outside of Davis, Oklahoma. Steel Manufacturer A's iron processing

**Figure 3.2.** Renewable $H_2$ Market Boundaries



facility in Davis is supplied continuously with fossil natural gas from the Texas-Oklahoma common carrier pipeline serving parts of Northern Texas and Southern Oklahoma.

Steel Manufacturer A wants to begin manufacturing and marketing "green" steel, which will be produced in the smelter at the company's Pennsylvania plant using only renewable or carbon-free energy. The Pennsylvania plant currently receives natural gas from the Pennsylvania-Ohio common carrier pipeline serving Western Pennsylvania and all of Ohio. The pipeline is also connected to Green Hydrogen Producer B with operations just outside Cleveland, Ohio. The company produces renewable hydrogen using electricity generated from an on-site solar PV farm. In 2024, Green Hydrogen Producer B injected 2 million gallons of renewable hydrogen into the Pennsylvania-Ohio pipeline. The pipeline also connects to a conventional fossil hydrogen producer near Scranton, Pennsylvania that injected 50 million gallons of fossil hydrogen into it in 2024.

Hydrogen Producer A operates a facility in Texas producing electrolytic hydrogen from excess wind power generated in West Texas. The energy attribute certificates (EACs) produced by Hydrogen Producer A are legally recognized across the U.S. In 2024, Hydrogen Producer A injected 1 million gallons of renewable hydrogen, and 3 million gallons of hydrogen stripped of its production attributes into the Texas-Oklahoma pipeline. Hydrogen Producer A sells to Steel Manufacturer A EACs conveying the unbundled attributes of 3 million gallons of green hydrogen stripped of its attributes that it injected into the Texas-Oklahoma pipeline. Steel Manufacturer A offtakes 3 million gallons of hydrogen from the Pennsylvania-Ohio pipeline and retires the EACs purchased from Hydrogen Producer A, allocating it to the 3 million gallons it withdrew from the Pennsylvania-Ohio pipeline to fuel the smelter at its Pennsylvania plant.

Steel Producer A reports no direct emissions from its smelter and may credibly market the steel produced by the smelter as "Green Steel" made with carbon-free energy.

## Example 3.3: Global Biomethane Shipment

Fuel Producer A, a UK natural gas exporter, recently started producing and distributing biomethane, including at a facility in Bacton, UK near the company's export terminal on the North Sea. The terminal is used to supply liquefied natural gas (LNG) tankers that deliver the gas across the North Sea to a terminal in Belgium connected to the European integrated infrastructure.

To fuel its gas-fired power plants in Belgium, Utility B annually purchases 20 million gallons of fossil LNG supplied by Fuel Producer A.

A new regulation requires all utilities in Belgium to generate 25% of their power from carbon-free sources. To comply with the regulation, Utility B contracts with Fuel Producer A to replace 5 of the 20 million gallons of LNG it normally imports with biomethane.

Fuel Producer A liquefies the biomethane and injects it into the same common carrier pipeline that supplies its North Sea export terminal. When the fuel is injected, Fuel Producer A is issued renewable thermal certificates (RTCs) for the biomethane's specified attributes—including its biogenic emissions profile—by an international attribute tracking system. Fuel Producer A transfers the RTCs (along with ownership of the attributes) to Utility B's account with the tracking system.

Just as it does every year, Ocean Tanker X withdraws 20 million gallons of LNG from Fuel Producer A's export terminal and carries it across the North Sea to an import terminal on the Belgian coast, where it is injected into the EU's integrated pipeline infrastructure. All of Utility B's power plants in Belgium are supplied with LNG from this infrastructure.

To prove compliance with the 25% carbon-free regulation, Utility B fuels its fleet of gas-fired power plants with 20 million gallons of LNG from the EU integrated pipeline and retires RTCs corresponding to 5 million gallons of biomethane.

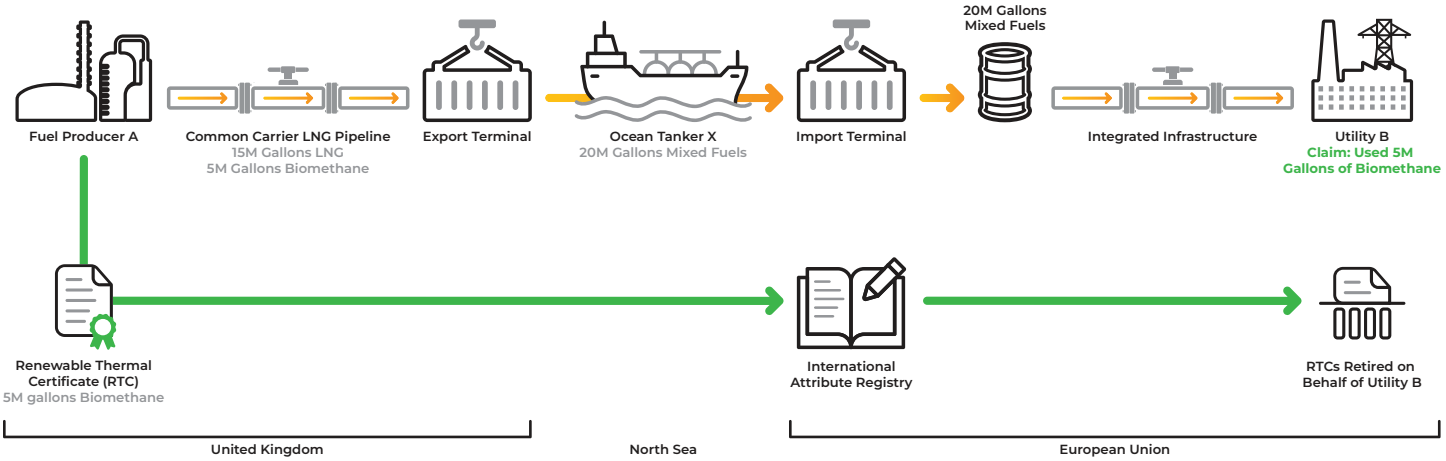


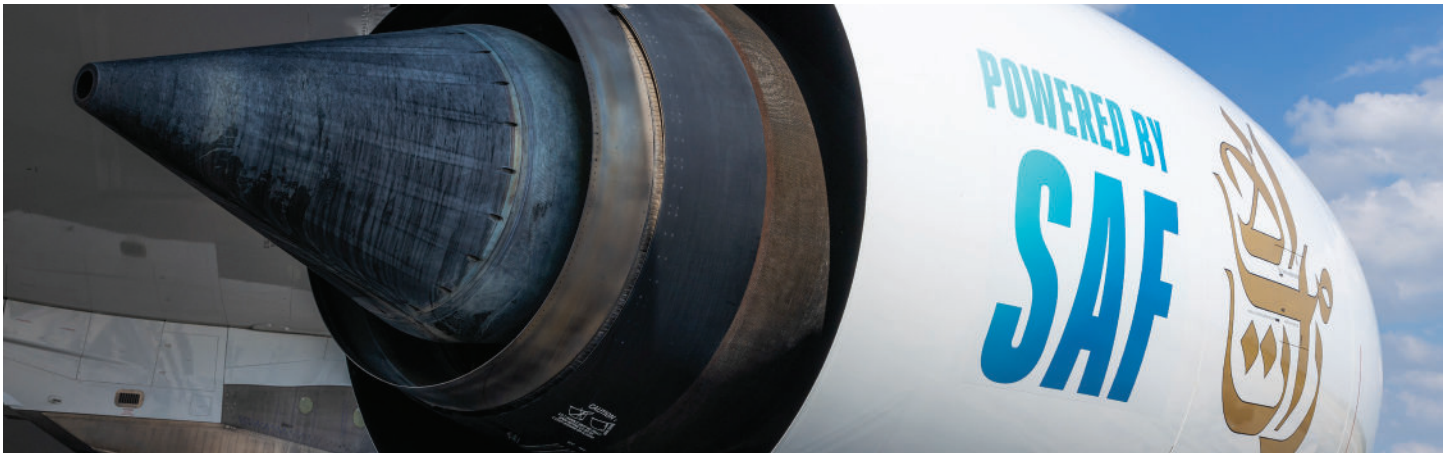

**Figure 3.3.** Global Biomethane Shipment

## Market Boundary Limitations for Nascent Markets

Several clean fuels are in a nascent phase of development. Although there may be broad demand, limited access to production and distribution can make it difficult to prove the path delivered fuel takes through dedicated infrastructure to where the fuel-consuming activity of an instrument owner is located. In some cases, this may restrict the development of clean fuels markets even when there is sufficient demand for the fuels and their development is environmentally sound.

Expansive market boundaries facilitate greater investment in emerging alternative fuels by allowing a larger pool of customers to exert their demand. Expanding consumer demand creates economic incentives that speed the scaling of production processes more quickly than would be possible in markets where the conveyance of attributes is limited by physical infrastructure.

Some suggest creating more flexible market boundary rules for nascent markets, which could be narrowed over time. While the market boundary definition provided in Criterion 3 may be more limited than some may propose, it is consistent with the GHG Protocol's Corporate Standard guidance on market-based accounting for Scope 2 and provides robust capacity to transition to clean fuels while still supporting credible use claims.



## Criterion 4: Vintage

***Contractual instruments must record a vintage date and be canceled or retired within a period that reasonably secures the integrity of the audit trail prior to use of the corresponding fuel.***

The vintage of a contractual instrument is the date when the fuel represented by the contractual instrument is produced. This is typically different from the date the instrument is issued, which varies by sector and can be based on processes like fuel production, pipeline injection, or safety testing and certification. In some instances, instruments may be issued when the producer understands how the purchaser intends to use the fuel, which then permits the producer to provide more customized emissions data.

Fuels can be stored almost indefinitely with little degradation. Consequently, there is no physical need to restrict the time between when a contractual instrument for a clean fuel is issued and when the instrument may substantiate a credible use claim.

However, the integrity of the contractual instrument does depend on how its data is stored. Data integrity rests on several factors, including storage type, environmental conditions, and protective protocols.[17]

Risks associated with data integrity increase the longer the data is stored. Therefore, it is prudent to retire certificates for use claims before risks to data integrity become unreasonable. What is reasonable may depend on the specific context in which contractual instruments are employed, including characteristics of the storage medium, protective protocols, and system redundancies.

This criterion precludes instruments from supporting credible use claims indefinitely and defines a period of time during which instruments can be applied without substantial risk to the integrity of the data comprising the instrument. However, the criterion provides sufficient flexibility to tailor vintage windows to specific contexts and to adjust expiration dates as data storage technology evolves and improves.

17 See Blum, R. and Singh, R., "Chapter 26, Data Integrity: What You Read is What You Wrote," in Sight Reliability Engineering: How Google Runs Production Systems, ed. Beyer, B., et. al., O'Reilly, April, 2016. https://www.oreilly.com/library/view/site-reliability-engineering/9781491929117/.

## Criterion 5: Equivalency

***Contractual instruments may support the credible use of a fuel, its precursors, or its derivatives with the same production attributes, accounting for any conversion loss factors.***[18]

To support a credible direct use claim, contractual instruments must represent the relevant attributes of a physically and chemically identical fuel to the produced fuel, a precursor containing the relevant attributes of the fuel, or a derivative with the same relevant attributes as the produced fuel.[19]

Where fuels are not physically and chemically identical, contractual instruments can support credible claims to the use of the fuel so long as the attributes conveyed by the instrument are fully contained within the material represented by the instrument. Accurate application of the instrument in these cases requires accounting for any conversion losses necessary to establish equivalence.

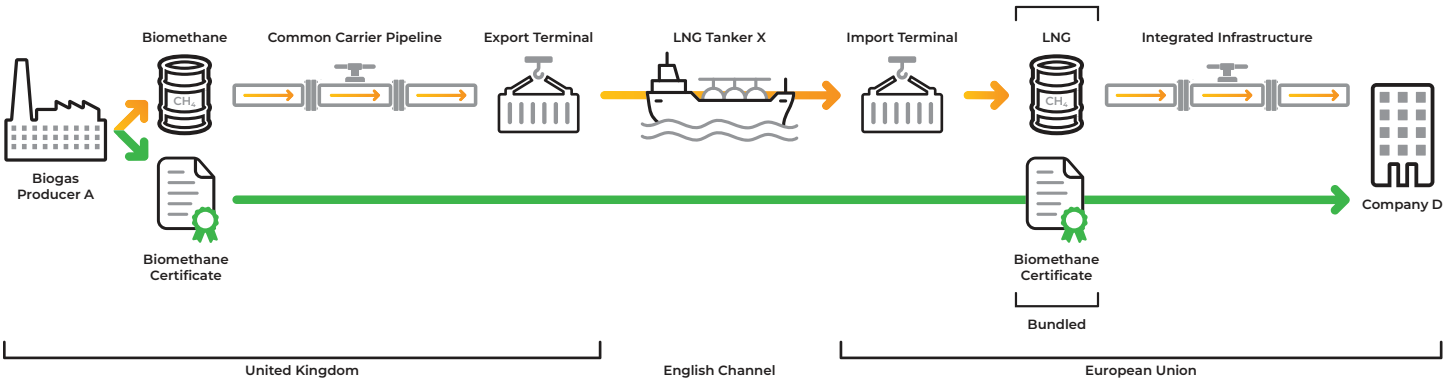
## Example 5.1: Converting Biomethane to Renewable $H_2$

Company D, a plastics manufacturer in Luxembourg, purchases biomethane from Biogas Producer A, a British fuel exporter permitted to supply natural gas to the EU under a bilateral agreement between the UK Government and the European Commission.

Biogas Producer A generates biomethane from animal fats collected from abattoirs located in Southern England and Wales. The biomethane is injected into a common carrier pipeline that supplies a liquid natural gas (LNG) export terminal on the North Sea coast. LNG Tanker X regularly offtakes millions of gallons of LNG from this terminal and transports them across the North Sea to an import terminal on the Belgian coast. The import terminal is connected to the European integrated infrastructure, which includes pipelines in Luxembourg that are the main source of the LNG that Company D typically uses to manufacture its plastics.

Because the biomethane Biogas Producer A injects into the UK common carrier pipeline is chemically identical to the LNG that is offloaded at the export terminal, and the LNG offloaded at the export terminal, transported,

**Figure 5.1.** Converting Biomethane to Renewable $H_2$




18 Conversion loss factors refer to variables impacting the quantity or characteristics of a substance as it is converted from one chemical to another. Inefficiencies in the conversion process or even the process itself may consume some of the volume or attributes associated with the fuel to which the precursor is converted or from which the derivative originated. To support a credible use claim, contractual instruments must account for the lost volume and attributes.

19 Biomethane, for example, may be converted into hydrogen and contains within its chemical structure all the relevant attributes of hydrogen fuel.

and injected into the EU integrated infrastructure is chemically identical to the biomethane offloaded from the infrastructure by Company D, Company D may apply the contractual instrument issued for the biomethane to the fuel it receives without requiring that those instruments be retired and the attributes transferred to a new LNG instrument when the fuel is converted to LNG at the export terminal on the UK coast (see Criterion 7: Input Instrument Retirement).

Categorization of direct emissions associated with Company D's use of the biomethane provided by Biogas Producer A is provided in Table 5.

**Table 5.** Company D's Emissions Reporting Under the 2015 Corporate Standard (by Gas and Scope)

**COMPANY D**

| EMISSIONS | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|
| SCOPE 1 | | X | |
| SCOPE 2 | | | |
| SCOPE 3 | | X* | |

| DIRECT $CO_2$ EMISSIONS FROM BIOGENIC COMBUSTION |
|---|
| X |

*Emissions associated with upstream product losses due to conversion and distribution

## Criterion 6: Attribute Allocation

***Contractual instruments may convey specified attributes allocated to any outputs of a production pathway provided the total attributes conveyed do not exceed the total attributes input to the production pathway.***

Fuel production processes can be complex, and there are often circumstances where, for example, biogenic and conventional fossil feedstocks both contribute attributes to a produced fuel and its co-products. In these cases, there can be free allocation of specified characteristics to fuel production outputs provided associated emissions claims are consistent with the total specified attributes associated with inputs to the fuel production pathway, accounting for any conversion losses.

Allocating specified attributes evenly across production outputs does not necessarily generate more accurate characterizations of the outputs, although producers are free to do so. Instead, by ensuring that outputs do not convey more of the specified attributes than contained in the inputs, this criterion facilitates pathways producing fuels, derivatives, co-products, and by-products, while accurately accounting for attributes allocated across all of them.

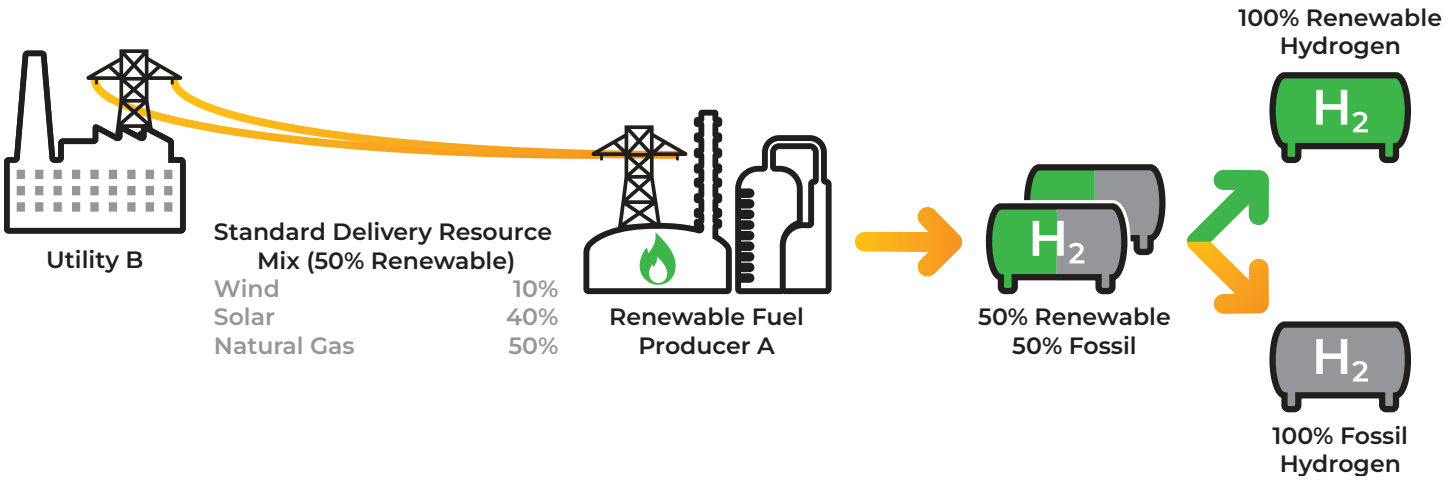
### Example 6.1: Converting Mixed $H_2$ to 100% Renewable $H_2$

Hydrogen Producer A uses the standard electricity product supplied by Utility B to generate an electrolytic reaction that separates ultrapure water into its component parts – oxygen and hydrogen. Utility B's resource mix is composed of 10% wind-generated power, 40% solar PV power, and 50% natural-gas fired generation.

Half of the hydrogen produced using Utility B's standard delivery electricity can be characterized as renewable hydrogen since 50% of the power required for the electrolytic reaction derived from renewable resources.

Hydrogen Producer A, however, combines the renewable half of one unit of produced fuel with the renewable half of another unit of produced fuel to create from two units of production output, a single unit of renewable hydrogen and a single unit of conventional fossil hydrogen. Hydrogen Producer A documents the calculation and discloses the production process when issuing any certificate representing the attributes of the renewable hydrogen it produces. The other half of the production output Hydrogen Producer A markets as conventional fossil hydrogen.

**Figure 6.1.** Converting Mixed $H_2$ to 100% Renewable $H_2$



## Criterion 7: Input Instrument Retirement

***Any contractual instruments conveying attributes of inputs to the production pathway of a fuel must be retired to substantiate a contractual instrument issued for the produced fuel.***[20]

Clean fuels may be produced with inputs that are considered clean fuel themselves. Renewable hydrogen, for example, is a fuel and a feedstock in ammonia, another low-emissions fuel. Biomethane is a feedstock in the production of methanol, a promising clean maritime shipping fuel.

Specified attributes of feedstock and other production inputs may themselves be transacted via contractual instruments. When attributes of a feedstock have been sold or transferred prior to entering a fuel's production pathway, the feedstock cannot be said to contribute those attributes to the produced fuel. The produced fuel must be characterized as either "null" fuel (see Criterion 8: Default Attributes) or have attached to it sufficient purchased attributes to replace the specified attributes conveyed prior to entering the production pathway.

To prevent double counting of attributes when producing clean fuel from other fuels, the fuel producer must retire the existing instruments conveying specified attributes input to the production pathway prior to issuing a new instrument corresponding to an output of the production pathway.

### Example 7.1: Biomethane Feedstock to Biomethanol Certificates

Fuel Producer A produces biomethanol from biomethane feedstock, which was produced using corn stover and delivered through a common carrier pipeline to Fuel Producer A's production facility in Denmark.

Prior to selling and delivering the biomethanol via common carrier pipeline to Ship Owner B (who combusts pure methanol as a low-carbon maritime shipping fuel), Fuel Producer A obtains and retires the Proof of Sustainability (PoS) associated with the biomethane and obtains a new PoS for the biomethanol from an official sustainability scheme. The PoS for the biomethanol effectively transfers exclusive ownership of the biomethane feedstock attributes to Ship Owner B (see Table 6).

**Table 6.** Ship Owner B's Emissions Reporting Under the 2015 Corporate Standard (by Gas and Scope)

**SHIP OWNER B**

| EMISSIONS | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|
| SCOPE 1 | | X | X |
| SCOPE 2 | | | |
| SCOPE 3 | | | |

| DIRECT $CO_2$ EMISSIONS FROM BIOGENIC COMBUSTION |
|---|
| X |

### Example 7.2: Biomethane to Renewable $H_2$

Fuel Producer A produces biomethane from wastewater (sludge), which it sells (bundled with RTCs characterizing the biogenic nature of the fuel) to Hydrogen Producer B, an established manufacturer of conventional fossil-based hydrogen generated through steam reformation of fossil natural gas.

Hydrogen Producer B uses the biomethane as a feedstock in a steam reformation process that uses natural gas to generate heat, converting the biomethane into hydrogen. Before issuing an RTC conveying the biogenic attributes of the renewable hydrogen, Hydrogen

20 This criterion applies when it is necessary to issue a new contractual instrument for a produced fuel either because the production attributes of the fuel differ from its inputs or because attributes of certain inputs have been sold or conveyed prior to entering the production pathway of the fuel. Where a produced fuel has an identical chemical structure to its production inputs (for example when biomethane is converted to liquid natural gas) and any conversion losses are accounted for when applying the produced fuel to the fuel-consuming activity, fuel producers have the option—but not the obligation—to cancel or retire instruments conveying the production attributes of the input fuel and have a new instrument issued for the produced fuel.

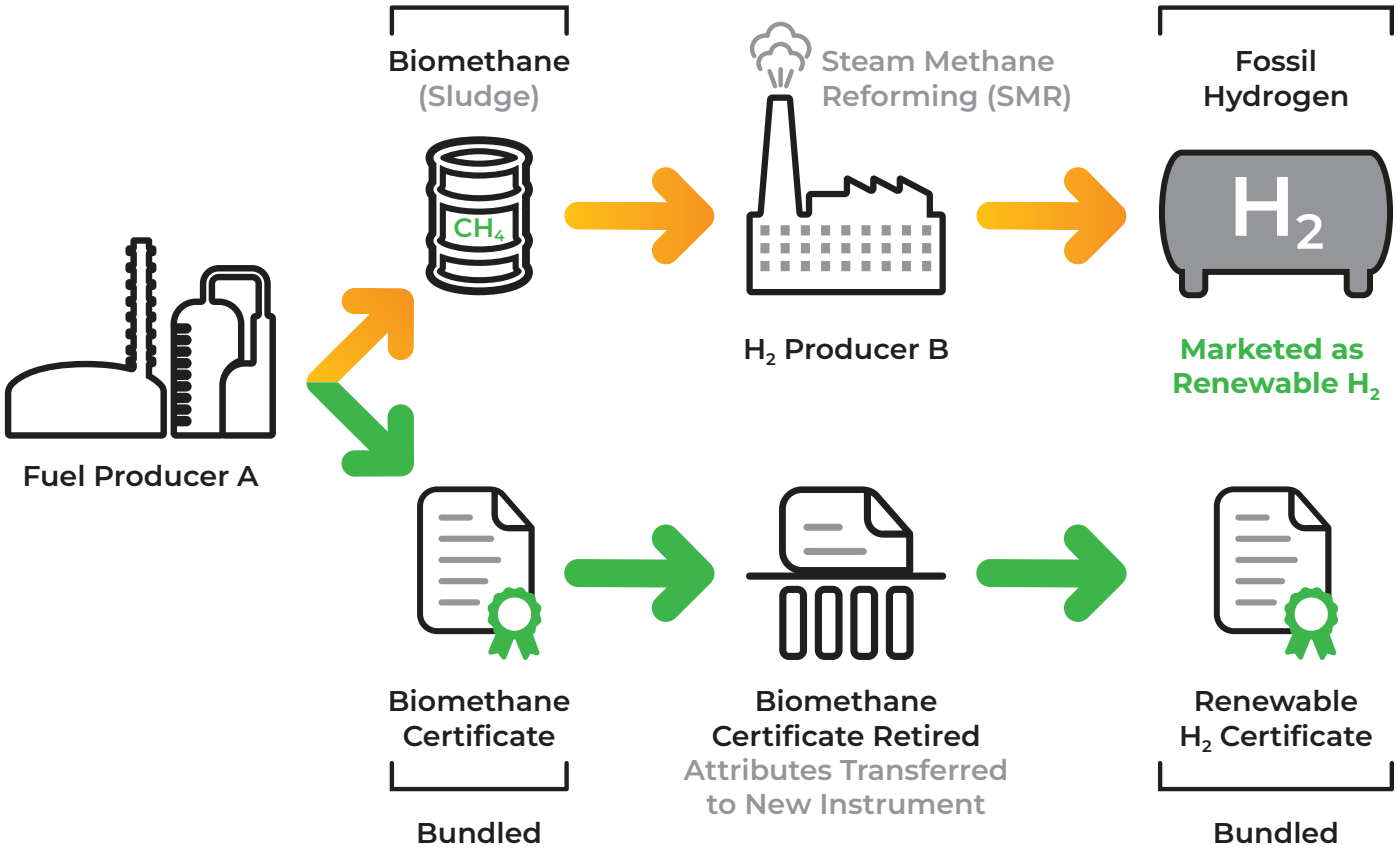



**Figure 7.2.** Biomethane to Renewable $H_2$

Producer B cancels the RTC associated with the purchased biomethane and transfers the attributes to the new RTC issued for the produced hydrogen, accounting for any conversion losses in its production (see Table 7).

**Table 7.** Hydrogen Producer B's Emissions Reporting Under the 2015 Corporate Standard (by Gas and Scope)

**HYDROGEN PRODUCER B**

| EMISSIONS | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|
| SCOPE 1 | X* | X* | X* |
| SCOPE 2 | | | |
| SCOPE 3 | | | |

| DIRECT $CO_2$ EMISSIONS FROM BIOGENIC COMBUSTION |
|---|
| |

*Emissions associated with the on-site heat generation resource
**Note: While steam reformation does not combust the feedstock, the process does emit $CO_2$. Any emissions of this $CO_2$ corresponding to the biomethane certificates may be disclosed at the option of the reporter, as only biogenic emissions resulting from combustion are required to be reported outside of the scopes.

## Criterion 8: Default Attributes

***Fuels for which the attributes have been sold or transacted shall be assigned the attributes of the most accurate residual mix that can be calculated from available data or the attributes of the fossil fuel typically used for the same purpose.***

Market-based accounting facilitates the "unbundling" of the attributes of a fuel from the physical fuel through contractual instruments that may be transacted separately from the fuel itself. As a result, market participants are challenged with characterizing fuel whose attributes have been separately conveyed, without double-counting them.

It is most accurate to characterize the remaining "null fuel" using the residual mix of resources distributed through the shared distribution system after all fuel whose attributes have been transacted and allocated to specific end-users has been subtracted from the mix.[21] Where there is little or no data to support a residual mix calculation, null fuel should be assigned attributes corresponding to the highest emitting fossil fuel typically employed for the same purpose. Both the residual mix calculation and assigning the attributes of the fossil equivalent avoids double-counting and supports exclusive ownership of transacted attributes.

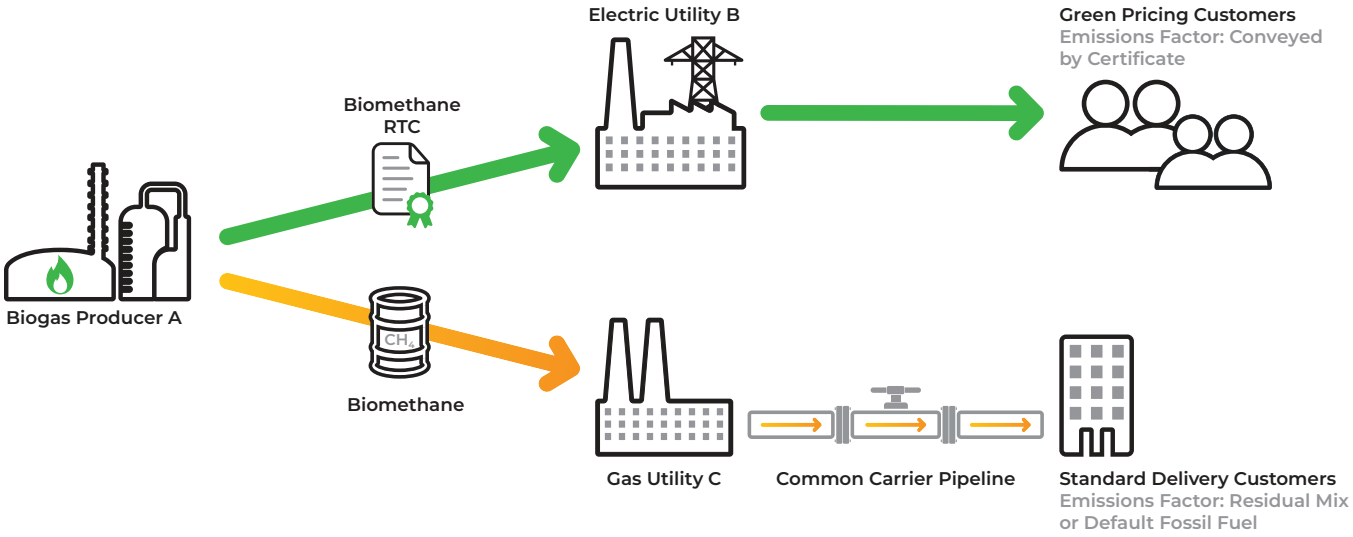
Attributes of a fuel that have been separately transacted may also be replaced by procuring and

**Table 8.** Assigning Fuel Attributes

| RANK | PROCESS TO CALCULATE ATTRIBUTES |
|---|---|
| 1 | Apply a regional residual mix calculation that excludes transacted specified fuels |
| 2 | Apply a regional "voluntary-only" residual mix calculation that excludes voluntary purchases certified by a recognized standard-setting organization* |
| 3 | Assign attributes of the conventional fossil fuel typically used for the same purpose |
| 4 | Apply a grid average fuel mix |

*For example, while none yet exists, CRS could develop a residual mix that excluded voluntary procurement of fuel certified under its Green-e© Renewable Fuels program.

**Figure 8.1.** "Null" Biomethane Emissions Factors




21 It is still uncommon for fuel producers or government agencies that regulate them to calculate and make public residual mix calculations. The European Commission (EC), however, has funded development of a draft methodology for calculating residual mixes for gases and others are developing similar guidance for liquid fuels to facilitate the calculation. See Association of Issuing Bodies (AIB), "Technical assistance to develop methodologies compliant with Disclosure obligations on RES gases," T3: Draft methodology for Disclosure supervision and Residual Mix calculation for gases, European Commission Report No ENER/2023/MVP/0010, 2023. https://www.aib-net.org/sites/default/files/assets/news-events/AIB%20Project-Consult/REGADISS/REGADISS_Task%203%20Draft%20methodology%20for%20disclosure%20supervision%20and%20residual%20mix%20calculation%20for%20gases_v1.pdf.

retiring contractual instruments conveying an equal or greater amount of the same specified attributes.

Reporting entities should not apply the attributes of an average mix of fuels present in a shared distribution system without removing transacted attributes. Relying on average fuel mixes double counts the attributes and mischaracterizes the null fuel by assigning it attributes that have been sold and are the exclusive property of the purchasers.

The best methods for applying default attributes to fuel whose attributes have been separately conveyed follow this hierarchy:

### Example 8.1: "Null" Biomethane Emissions Factors

Biogas Producer A sells unbundled biomethane certificates to Gas Utility B to supply its 100 percent green fuels program, while the underlying gas is sold to Gas Utility C and delivered to customers via a common carrier pipeline as the utility's standard fuel product.

## Land Use Change

Biofuels that use feedstocks derived from crops and cultivated plants risk adverse land use changes that may contribute to global climate change and undermine claims to avoided GHG emissions. For instance, some alternative jet fuel derived from Malaysian and Indonesian palm oil has a higher lifecycle carbon intensity even than conventional fossil jet fuel, where its cultivation coverts tropical rainforests and peat swamp to palm oil plantations. Draining peat swamps releases methane and nitrous oxides, and clearing rainforests destroys a potent carbon sink and replaces it with plants that store significantly less carbon.

In Q1 2025, the GHG Protocol is expected to publish Land Sector and Removals Guidance, which will provide guidance to companies for reporting GHG emissions, removals, and carbon storage from land-based activities and products. While the land use implications of biofuel production may not impact reporting of direct emissions, they are critical to an evaluation of the full lifecycle emissions of a fuel. Companies intending to procure biofuels or their attributes should get a more complete picture of the climate impact of their choices by considering the cultivation of fuel feedstocks.

Several certifications and standards have set eligibility rules or other requirements restricting fuels or feedstocks derived from certain land uses. It is best practice for contractual instruments to provide information related to crop-based feedstocks and to attest that the feedstock in question was not grown on high biodiversity value land that was fallow after 2008.[1] Recent proposed changes to California's Low-Carbon Fuels Standard (LCFS), as well as standards currently applied under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to account for emissions from bio-based sustainable aviation fuel (SAF), require an attestation by the producer that the feedstock for the relevant biofuel was not grown on land left fallow after 2008.[2] Companies and reporting programs can use this information to avoid fuels made with feedstocks grown on such land.

1 For example, the European Commission defines high biodiversity value land as land which, after January 2008, was primary forest or other wooded land where there was no clearly visible indication of human activity and areas designated for nature protection purposes; or for the protection of rare, threatened, or endangered ecosystems .See Navigant, Technical Assistance for the preparation of guidance for the implementation of the new bioenergy sustainability criteria set out in the revised Renewable Energy Directive – REDIIBIO, Final report, European Union, February, 2021. https://energy.ec.europa.eu/system/files/2021-04/rediibio_final_report_version_2_0.pdf.

2 This guidance does not make this attestation an explicit requirement of the listed quality criteria because the guidance is limited in scope to direct emissions. Moreover, including the attestation would introduce elements of consequential accounting into the attributional accounting framework adopted under the GHG Protocol for Scope 1 emissions. However, we note that the forthcoming land sector and removals guidance may require entities to report within the scopes emissions associated with land use changes induced from growing biofuel feedstocks.

Neither Biogas Producer A nor Gas Utility C can claim to be delivering fuel with the emissions attributes of biomethane since the certificates associated with those attributes were sold to Gas Utility B and subscribers to Gas Utility B's green fuels program have exclusive ownership of those attributes.

Gas Utility C does not characterize the biomethane it delivers as clean or carbon-free (or even biomethane). Instead, because no residual mix is available for the common carrier pipeline, it assigns to its standard delivered fuel an emissions factor associated with the fossil natural gas typically delivered to customers.

Categorization of direct emissions associated with the use of each utility's products is provided in Table 9.

**Table 9.** Emissions Reporting of Each Gas Utility Under the 2015 Corporate Standard (by Gas and Scope)

**GAS UTILITY B'S PRODUCT**

| EMISSIONS | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|
| SCOPE 1 | | X* | X* |
| SCOPE 2 | | | |
| SCOPE 3 | | | |

| DIRECT $CO_2$ EMISSIONS FROM BIOGENIC COMBUSTION |
|---|
| X |

*Non-$CO_2$ emissions from biofuel combustion are reported in the scopes.

**GAS UTILITY C'S PRODUCT**

| EMISSIONS | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|
| SCOPE 1 | X | X | X |
| SCOPE 2 | | | |
| SCOPE 3 | | | |

| DIRECT $CO_2$ EMISSIONS FROM BIOGENIC COMBUSTION |
|---|
| |

## Criterion 9: Tracking & Retirement

***Contractual instruments must be tracked and permanently redeemed, retired, or canceled by or on behalf of the reporting entity.***

Credible markets for contractual instruments must incorporate mechanisms that ensure to the consumer an exclusive direct claim on the emissions and other conveyed attributes of clean fuels. Credible claims thus require accurate tracking of attributes from issuance of the instrument to its retirement or cancellation.

Retiring, expiring, or canceling contractual instruments is essential to deterring double-claiming of attributes from the same volume of fuel. Tracking and retirement of instruments creates a complete and indelible chain-of-custody asserted by the owner of the instrument. Ownership of the instrument, moreover, renders the asserted chain of custody more legitimate than any competing chain of custody that could be asserted without the support of an associated contractual instrument.

Widespread use of electronic tracking systems has bolstered confidence in the security and veracity of transactions involving contractual instruments. Confidence in contractual instruments is also buttressed by independent audits of transactions by accredited providers, independent certifications from recognized organizations or agencies, and the increased use of disclosure registries. Evidence of relevant compliance program implementation, where it exists, also contributes to the credence of contractual instruments by reducing the risk that attributes may be double counted or double claimed.

### Example 9.1: M-RETS Tracking Renewable $H_2$

Gas Utility A, located in the U.S. state of Minnesota, injects renewable hydrogen from its green hydrogen electrolysis facility into the common carrier natural gas pipeline network serving most of the mid-western United States. When the hydrogen is injected into the pipeline, M-RETS, a U.S. certificate tracking system where Gas Utility A is registered, issues Renewable Thermal Certificates (RTCs) for the fuel and deposits them in Gas Utility A's account. Gas Utility A transfers the RTCs to a named account for its green hydrogen customers and then permanently retires them. Gas Utility A's green hydrogen customers can then claim to be using green hydrogen.

### Example 9.2: EU Certificate Tracking

Clean Fuel Producer X produces biomethane in Denmark for distribution to customers throughout Europe via the EU's integrated gas infrastructure. Its biomethane is certified by REDCert, one of the official EU voluntary sustainability schemes officially recognized by the European Commission. Clean Fuel Producer X converts each volume of biomethane consigned to a particular purchaser to Megawatt hour (MWh) equivalent and registers the consignment with the EU's Union Database for Biofuels (UDB).[22] REDCert issues a Proof of Sustainability (PoS) for the consignment and documents information about the feedstock used to produce the biomethane, data characterizing the fuel, and ownership transactions of the produced fuel and its corresponding specified attributes.

Each MWh of fuel can also generate a Guarantee of Origin (GO) issued by the Danish national GO registry. Moreover, a link is established between the GO and PoS requiring the instruments to be canceled or retired together on behalf of the same entity.

22 The UDB enables the tracing of liquid and gaseous transport fuels that are eligible to be counted toward a Member-State's renewable energy quota under Article 29(1) of the Renewable Energy Directive (EU) 2018/2001 (RED II). It is a mandatory database registering all sustainability certificates for biofuels in the transport sector as well as their corresponding feedstocks and it tracks every transaction involving the biofuels and their corresponding feedstocks. All Voluntary Schemes recognized by the European Commission and within the scope of RED II—including all recognized organizations tracking contractual instruments conveying the attributes of clean transportation fuels purchased within the EU—are required to provide information to the UDB. Due to technical challenges, full implementation of the UDB has been delayed until mid-2025. This example assumes the planned procedure for implementing the UDB in May, 2025 as it existed on the publication date of this document. Final UDB implementation procedures may vary.

Clean Fuel Producer X has the choice to request both a GO and PoS or only one of them. If only a PoS is issued, all transactions (including cross-border ones) must be registered with the UDB. If only a GO is issued, all transfers of ownership within Denmark are registered in the national registry and cross-border trading is facilitated through the European Renewable Gas Registry (ERGaR).

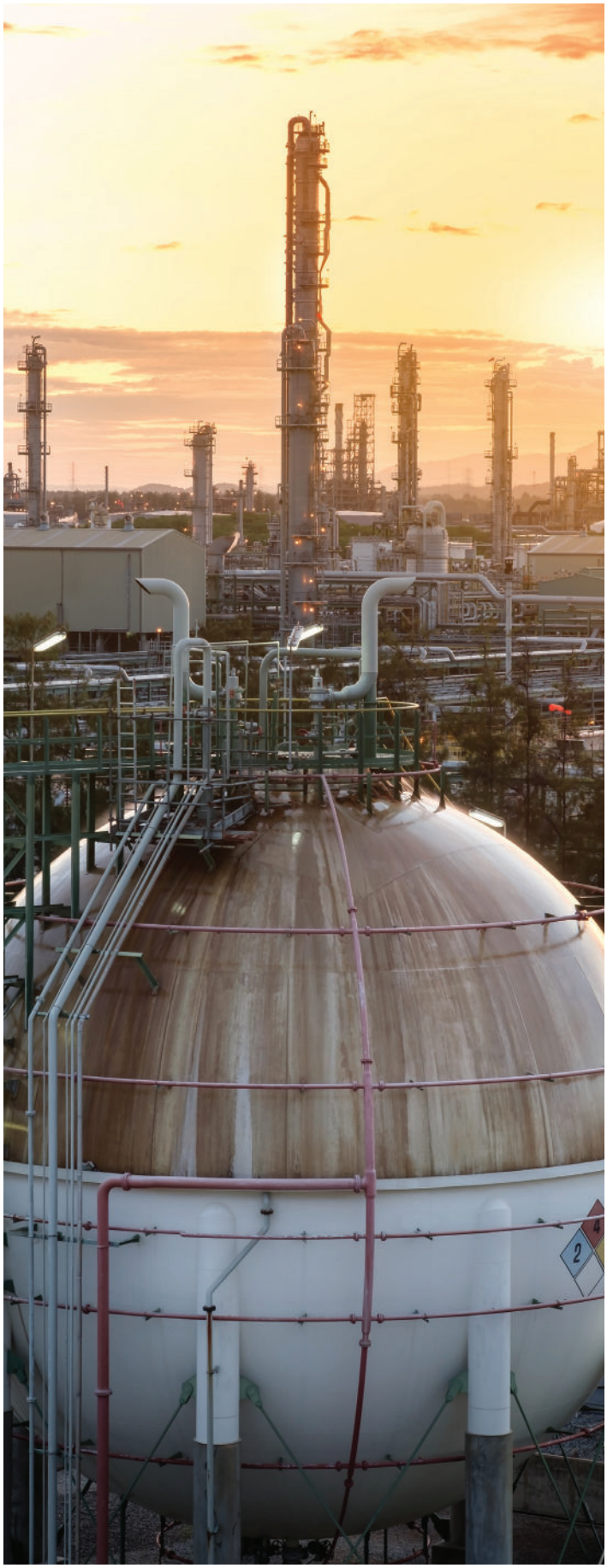
End User Y is in Spain and withdraws the consignment of biomethane from the integrated infrastructure and uses it to fuel a fleet of natural gas-powered cargo vans it operates near Seville. End User Y retires the corresponding GO and PoS within the UDB. If only a GO has been issued, it is retired in the Spanish national registry.[23]

By complying with mandated information uploads, Clean Fuel Producer X supports a central hub for tracking transport biofuels and corresponding contractual instruments throughout the EU. By retiring contractual instruments within the national registry or UDB, End User Y is permitted to make an exclusive use claim with confidence that no other entity will have a legitimate claim to the attributes it owns.

# 5. Conclusion

This guidance offers consensus-driven recommendations on key contractual instrument quality criteria to ensure accurate and credible use claims. These criteria are consistent with the current GHG Protocol Corporate Accounting and Reporting Standard and cover essential areas such as conveyance, aggregation, market boundaries, vintage, equivalency, and tracking and retirement. By adhering to these criteria, organizations can ensure that contractual instruments maintain the integrity of their emissions reporting when using market-based approaches to account for purchased clean fuel.

This document also provides relevant examples, references to broader issues in clean fuel markets and general accounting and reporting guidance for using contractual instruments when calculating direct emissions.



# Glossary of Terms

**Attributes**: In the context of clean fuels, the characteristics of products or services that impact the environment, human health, social equity, or any other matter of interest to a purchaser. Environmental attributes include, for example, biodegradability, recyclability, greenhouse gas emissions, energy efficiency, water efficiency, indoor air emissions, hazardous waste, and carcinogenicity.

**Attribute allocation**: The process of apportioning characteristics of fuel production or consumption using contractual instruments.

**Biogenic emissions**: $CO_2$ emissions from combustion, harvest, digestion, fermentation, decomposition, or processing of biological materials. Biogenic emissions are thought to not contribute to increased anthropomorphic $CO_2$ in the atmosphere because the growth and decomposition of biological material is part of the natural carbon cycle and would have occurred regardless of human intervention.

**Book-and-claim**: A chain of custody model in which specified attributes are represented by contractual instruments which are not necessarily connected to the flow of physical material or product through the supply chain.

**Certificate**: A contractual instrument that conveys information about a unit of energy, including the resource used to create the energy and the emissions associated with its production and use.

**Common carrier pipeline**: An open-access pipeline for the transmission of gas, gas derivatives, precursor chemicals and other compounds shared among several suppliers and delivered to multiple end-users.

**Contractual instruments**: A record which conveys to its owner (or the owner's assignee) the unique right to claim delivery and/or consumption or use of the attributes of a material, product, or project for which the record was issued. Some contractual instruments may be transferred or transacted separately or "unbundled" from the material, product, or project they represent. Contractual instruments relevant to fuels markets generally take the form of energy attribute certificates (EACs), including Guarantees of Origin (GO), Renewable Fuel Certificates (RFCs), Renewable Thermal Certificates (RTCs), and Proofs of Sustainability (PoS). Bilateral contracts for attributes associated with particular types of fuel are also considered contractual instruments.

**Emissions factor**: A representative value intended to describe the rate at which an activity releases greenhouse gases by relating the quantity of the gas released to the atmosphere with an activity associated with its release. These factors are usually expressed as the weight of the emission per unit (expressed as weight, volume, distance, or duration) of the activity causing the emission.

**Energy Attribute Certificate (EAC)**: A contractual instrument that conveys information (attributes) about a unit of energy, including the resource used to create it and the emissions associated with its production and use. An EAC may also convey the location of the facility that generated the unit of energy, when that facility began operations, and when the unit of energy was produced. The World Resources Institute coined the phrase "energy attribute certificate" as an inclusive term that covers tradable instruments used in the United States, Europe, and elsewhere.

**Feedstock**: Any raw or unprocessed material from which a fuel derives.

**Guarantee of Origin (GO)**: Guarantees of Origin (GOs) are energy attribute certificates (EACs) certifying the attributes of a produced fuel and issued pursuant to a directive of the European Commission. In the European Union, GOs are the only instruments evincing the origin of electricity generated from renewable resources. GOs are considered complementary to Proof of Sustainability (PoS) certificates and substantiate the information claimed by the PoS. Both instruments are retired simultaneously with the consumption of the associated energy.

**Market-based accounting**: Market-based accounting reflects emissions from fuel that reporting entities have intentionally purchased (or not purchased) to support a credible claim based on specified attributes of the fuel. Market-based accounting provides a mechanism to verify use claims and ensure that the same attributes are not claimed by more than one entity.

**Market boundary**: The specific parameters of interrelated practices which establish the physical and temporal limits and constraints of a market. Market boundaries delimit the number of sellers and buyers within a market and restrict the transaction of contractual instruments intended to support credible use claims.

**Null fuel**: Fuel delivered over a shared distribution system whose specified attributes have been sold or transferred.

**Production attribute**: Characteristics of a product that derive from its production pathway and may be conveyed separately from the physical output of the pathway (see Attributes).

**Production pathway**: The comprehensive process by which a fuel is produced, including cultivation and development of feedstocks and inclusive of any co-products or by-products.

**Production input**: The material or energy used to make a product; the production inputs for clean fuels include agricultural and forest biomass and waste materials, as well as the electricity or heat required for any chemical conversions within the production pathway.

**Proof of Sustainability (PoS)**: In the European Union, a PoS is the attestation of a fuel producer that a given batch of biofuel and/or bioliquid meets the standards for sustainability issued by a voluntary scheme. The voluntary scheme certifies the proof, and the certification supports any claim to the environmental benefits of consuming the fuel. PoS are retired with Guarantees of Origin (GOs) to ensure exclusive ownership of the attributes of biofuels and the right to make claims based on those attributes.

**Renewable Thermal Certificate (RTC)**: An energy attribute certificate specifically representing the attributes associated with a unit of thermal energy. Generally, RTCs represent the environmental attributes associated with the generation and consumption of one dekatherm (Dth) of thermal energy (heat) generated from renewable sources. In the U.S., GTCs have emerged as the primary contractual instrument for transacting the attributes of clean fuels.

**Residual mix**: The unallocated or unclaimed energy and emissions delivered to customers through a shared distribution system. Residual mix calculations characterize the mix of fuels that remain in a shared distribution system after all allocated, transacted, or claimed fuels have been subtracted.

**Shared distribution system**: Any mechanism by which different fuels and/or fuels from multiple sources may mix within the same infrastructure before being delivered to end-users. Examples of shared distribution systems include common carrier gas pipelines and mixed fuel bunkering, but may also include fuel storage farms and tanker trucks, where mixed fuels or fuels from different sources are conveyed.

**Scope 1 (direct) emissions:** Greenhouse gas emissions that are directly caused by a company's owned or controlled sources.

**Scope 2 (indirect/energy input) emissions:** Indirect greenhouse gas emissions that occur from purchasing energy from a utility provider and are created by the generation of electricity, heat, or steam.

**Scope 3 (induced/supply chain) emissions:** Indirect greenhouse gas emissions that occur in a company's value chain, are not owned or controlled by the company, but are induced through the company's operations or products

**Use claim**: An assertion that the claimant has used a particular material and may thereby benefit from environmental attributes associated with use of the

material. In market-based accounting, contractual instruments are evidence supporting use claims.

**Vintage:** The date a fuel is produced, which may differ from the date it is injected into a shared distribution system or the date a contractual instrument conveying its attributes is first issued.

# Acknowledgments


## CEAP Advisory Committee

CRS would like to thank the CEAP Advisory Committee for its support. Without it, CEAP's work—and this publication—would not be possible.

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Apple*
CDP
Clean Energy Buyers Institute
Constellation
Google
Priority Power
Steel Dynamics
U.S. EPA's Green Power Partnership
University of California Office of the President
WSP

**Denotes CEAP Founding Partner*

## Special Thank You To

Veronica Bradley, Clean Fuels Alliance America
Parikhit "Ricky" Sinha, Electric Hydrogen

## Market-based Accounting for Clean Fuels Initiative Working Group

CRS would also like to thank the Market-based Accounting for Clean Fuels Initiative Working Group. Their expertise and perspectives were critical to the initiative's objectives and outcomes. Participation in the Working Group does not imply that a participant or their organization endorses, recommends, warrants, or follows this guidance. Working Group participants make no claims, promises, or guarantees about the accuracy, completeness, or adequacy of the guidance.

3Degrees, Laura Vendetta
Aspen Institute, Selena Elmer
Center for Green Market Activation, Dan Smith, Sumedha Sharma
Clean Energy Fuels, Nicholas Yeh
EcoEngineers, Juliana Johnson
ERGaR, Tim Hamers
Generate Capital, Maya Kelty
Google, Jordan Chamberlain, Megan Sutter, Jenna Stauffer
M-RETS, Ben Gerber
Meta, Devon Lake
Molecule Group, Sam Lehr
Renewable Thermal Collaborative, Blaine Collison, Ruth Checknoff
RMI, Laura Hutchinson
RNG Coalition, Sam Wade
Southern Company, Mindy Pierette, Jennifer McCullars
TES Hydrogen, Tyler Cole
WWF, US, Hunter Hollander, Daniel Riley, Marty Spitzer


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v1.0, April 21, 2025