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Chain of custody options for sustainable biofuels

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Contents

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Executive summary

Promotion and certification of sustainable biofuels is complex and requires a well-coordinated, multi-faceted and credible approach. While governmental mandates, international standards and certification programmes are instrumental in promoting the responsible production of sustainable biofuels, they are susceptible to fraud if not managed correctly, and can disrupt the supply chain, increase costs and inflate bureaucracy.

Fuels are a fungible commodity and are freely exchanged or swapped. Biofuels can be produced from numerous feedstocks from various regions around the world and can involve the mixing of different feedstocks to produce a batch of biofuel. Each economic operator of the supply chain, from buying agent to fuel supplier, has an interest in creating the best quality product at the lowest cost, which involves the purchase of feedstock, bio-oils or biofuels from a number of undisclosed suppliers. The fungible nature of biofuels, the complexity of the supply chain, the volatility of the market and the commercial nature of the business transactions involved, necessitate a credible accounting system.

A Chain-of-Custody (CoC) system is the chronological physical or electronic documentation—and/or paper trail—showing the acceptance/purchase, custody, control, transfer and disposition of a product or associated sustainable attributes. An effective CoC system should minimize costs, limit distraction from each economic operator's core business, and ensure a high level of credibility and integrity, as well as preserve the flow of fuel trade and infrastructure. It is also widely accepted that any benefits or burdens associated with a CoC system or the certified product it is tracking should be shared equally among all supply chain actors and should not disadvantage small-scale economic operators.

Leading sustainable agriculture initiatives use, or intend to use, one or more of the following three CoC systems:

1. **Physical segregation:** Certified products are physically segregated from non-certified products at every facility along the supply chain.

2. **Mass balance:** The amount of certified product sourced and sold by each supply chain actor is tracked. However, the certified product and associated documentation do not need to be sold together. The certified product can either be segregated (site level or tank level mass balance) or not (company level mass balance).

3. **Book-and-claim:** The certified product is completely decoupled from sustainability certificates, and both certified and non-certified products flow freely through the supply chain. Sustainability certificates would be issued by an independent issuing body.

A successful CoC system should be cost-effective, provide minimal disruption to fuel supply, and provide a robust system for managing transactions and verifying compliance. In a practical sense, it should be:

- simple and practical, with minimum complexity;

Table 1: Evaluation of CoC systems by relative level of success for four key factors

CoC system	Fungibility	Disruption	Complexity	Auditability
Physical segregation				
Tank level mass balance				
Site level mass balance				
Company level mass balance				
Book-and-claim				

- accountable, resistant to fraud, and provide a market driven, level playing field for all relevant parties;
- fungible and managed effectively, allowing flexibility, and limiting supply and trading disruptions;
- enforceable by regulatory authorities;
- managed effectively, by a professional, auditable and financially robust institution;
- modified to take account of existing conditions and realities.

These factors can be grouped into the following four overall success factors which help define the criteria for successful system implementation:

a) **Maintains fungibility:** The system works within the existing petroleum supply chain's transport, storage, trade and marketing systems without impacting on the degree to which biofuels can be freely interchanged within those systems.

b) **Limits disruption:** The system works within the existing petroleum supply chain's transport, storage and delivery systems without negatively impacting the industry's ability to provide consistent sources of fuel to the general public, even in the face of fuel shortages, natural disasters or supply chain failure.

c) **Is of limited complexity:** The system is designed to ensure compliance with standards and regulations, but limits steps to those that are absolutely necessary. Each step must be documented, certified, and auditable, but administration and costs are kept to the minimum necessary to ensure compliance.

d) **Is auditable and enforceable:** The system provides the ability to systematically check and verify all certified biofuel-related 'claims' to sustainability status from every participant throughout the entire supply chain. This is typically done by an accredited independent auditor. The regulatory authorities or a qualified third-party administer the accreditation and enforcement.

Any disruptions to the biofuels supply chain will discourage industry engagement while encouraging non-compliant behaviour (especially from smaller actors who are not commonly the focus of enforcement or public scrutiny) and/or increase costs of the final product. It could prove beneficial if the supply chain system builds onto existing systems, information and relationships whenever possible. Companies will be in a better position to meet and support the intent of government mandates if they are able to efficiently integrate requirements and processes into their business operations.

The integrity and credibility of the chosen CoC system is inevitably strengthened when governments enforce compliance with the CoC system and governmental regulations, so a system therefore needs to be auditable and enforceable. The CoC systems should also be coordinated with other sustainable agriculture and biofuel systems (e.g. RSPO) to prevent the possibility of intentional or unintentional double-counting of a certified product.

All three CoC systems described support the overarching intention of existing government mandates, however the chosen CoC system must enable the industry to maintain the fungible nature of global commodity trade while ensuring a level playing field for all economic operators. The physical segregation system would require establishing a parallel and dedicated supply chain for sustainable fuels. Book and claim systems can be applied in current fungible supply chains, however, a mass balance system will only be fungible and reduce administrative burden at the company level, or when applied to large consignments at the site level.

Introduction

Sustainably-produced biofuels have the potential to reduce environmental impacts, lessen the world's dependence on fossil fuels, provide local sources of fuel and income, and contribute to a healthy agriculture industry within rural communities in developing countries. The global agricultural sector employs half the world's labour force, with an estimated 1.3 billion workers active at the farm level[1]. The majority of the world's agricultural workers are located in developing countries and work as small-scale farmers, yet commodities are often cultivated on large-scale farms with fewer workers. International efforts are under way to define, certify and promote 'sustainable biofuels' with the aim of preventing any negative greenhouse gas (GHG) and general sustainability effects of specific biofuels production. The definition of 'sustainable biofuels' varies, and may encompass social standards, as well as the reductions in GHG emissions generated over their life cycle when compared to fossil fuels.

Depending upon the definition, the promotion and certification of sustainable biofuels may be complex and requires a well-coordinated, multi-faceted and credible approach. While governmental mandates, international standards and certification programmes are instrumental in promoting the responsible production of sustainable biofuels, they are susceptible to fraud if not managed correctly, and can disrupt the supply chain, increase costs and inflate bureaucracy. These distractions or disruptions from the normal course of business—along with the associated higher costs—create a challenge for the industry to meet government mandates, and inhibit future potential for the development of an unsubsidized market.

In order to participate in this debate, it is necessary to understand how the commodity supply chain operates today, and how proposed CoC systems would work within them. This document provides an insight into how fuel/biofuel supply chains are structured and operated, as well as information regarding common agriculture CoC systems, with a brief discussion on how these relate to the requirements of European and US biofuel mandates. In addition, the document presents findings from sustainable agriculture initiatives with the intent of spurring discussions among stakeholders interested in developing CoC systems that can support the expansion of sustainable biofuels in a scalable, credible and efficient manner, while also facilitating compliance with government mandates. The document also provides a brief overview of the US EPA's Moderated Transaction System (EMTS) (see Appendix 1).

Most parties agree that a CoC system should be cost-effective, limit distraction from each economic operator's core business, and ensure a high level of integrity as well as preserve the flow of fuel trade and infrastructure. It is also widely accepted that any benefits or burdens associated with a CoC or the certified product it is tracking should be shared equally among all supply chain actors, and should open the market rather than restrict it.

[1] International Labour Organization. *Occupational Safety and Health in Agriculture*, Programme on Safety and Health at Work and the Environment (Safe Work), March 26, 2009. www.ilo.org/public/english/protection/safework/agriculture/intro.htm

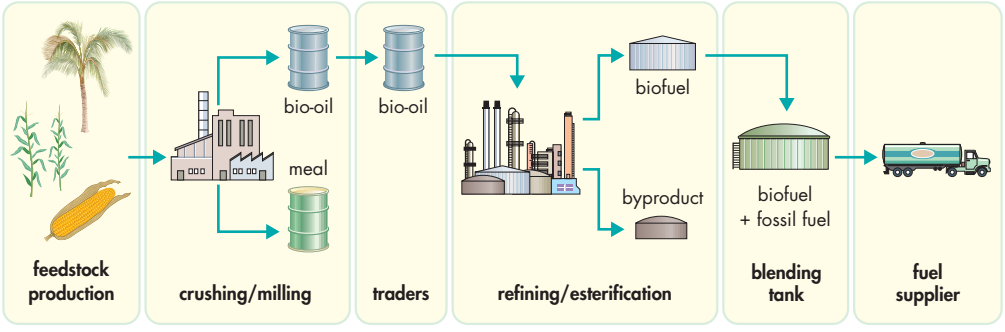
Understanding fuel supply chains and trade

In order to promote sustainability in agricultural supply chains, one must first understand the basic biomass feedstock and biofuel supply chain (Figure 1), as well as existing conventional fuel infrastructure and processes. Fuels are a fungible commodity and are freely exchanged. Biofuels can be produced from numerous feedstocks (sugarcane, corn, wheat, sorghum, rapeseed, palm oil, etc.) from various regions around the world and, at times, can involve the mixing of different feedstocks to produce a batch of biofuel (e.g. ethanol from wheat and ethanol from corn).

Biofuel precursors are mixed and transformed when processed through a multi-stage supply chain to produce finished quality biofuel. Each economic operator of the supply chain, from buying agent to fuel supplier, has an interest in creating the best overall product at the lowest cost, which may include the purchase of feedstock, bio-oils or biofuels from a number of undisclosed suppliers. Each operator along the supply chain will mix different feedstocks—which may vary in quality—to meet their customers' requests in the most cost-effective manner. For example, a number of producers may sell their feedstock to a buyer who will aggregate this with other sources. This mix will then be sent to a first processor (e.g. a mill) who will mix and process it with additional sources. It is also worth noting that the bio-oil or biofuel can be bought and sold while in transit and some owners (e.g. traders) may not physically take possession of the product.

Unless obligated by government mandates, buyers of feedstock, bio-oils or biofuel may not know where their products come from, nor have any relationship with producers or even initial processors such as the mills. The fungible nature of biofuels, the complexity of the supply chain, the volatility of the market and the limited transparency throughout the supply chain all create conditions that enable fraud and the manipulation of transactions. This is illustrated in a recent report by the European Anti-Fraud Office (OLAF), which identified 67 million Euros-worth of sugar subsidies tainted by irregularities and fraud between 2005 and 2008[2].

Figure 1: The biofuel supply chain



[2] New York Times, 27 October 2009. *Subsidies spur fraud in European sugar*. Stephen Castle and Doreen Carvajal.

Farm to crusher/mill stage of the supply chain

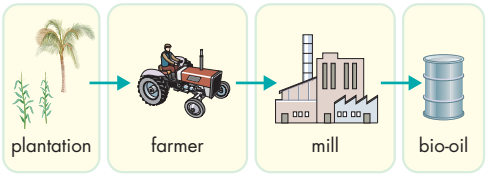
Before discussing the processing segment of the biofuel production chain, it is important to recognize the intersection of the farm and first processor. At this point there can be a range of scenarios, some of which pose significant challenges to segregating certified feedstock from non-certified feedstock, which in turn poses a risk to the integrity of the entire CoC system. The farm-to-initial processor segments of most commodity supply chains, including biofuels, can be placed in one of three categories:

1. segregated;
2. coordinated; or
3. aggregated.

Segregated supply chain (see Figure 2)

Segregated supply chains are most common in large-scale settings. Feedstock is segregated and its origin can be traced. An example of this system is an estate that either processes or mills its own feedstock or has a custom operator that processes/mills it on their behalf. In these situations the farmer retains ownership of the bio-oil, which is not aggregated with any other feedstock/oil at this stage.

Figure 2: Segregated supply chain



Coordinated supply chain (see Figure 3)

Coordinated supply chains can be found in small-, medium- and large-scale production settings. A central entity provides inputs, credit and transportation support, and/or purchases the feedstock from several producers. Feedstock is, or can still be, segregated and the origin of the feedstock can be traced with some effort. The central entity may hold exclusive purchasing rights for the feedstock.

Figure 3: Coordinated supply chain

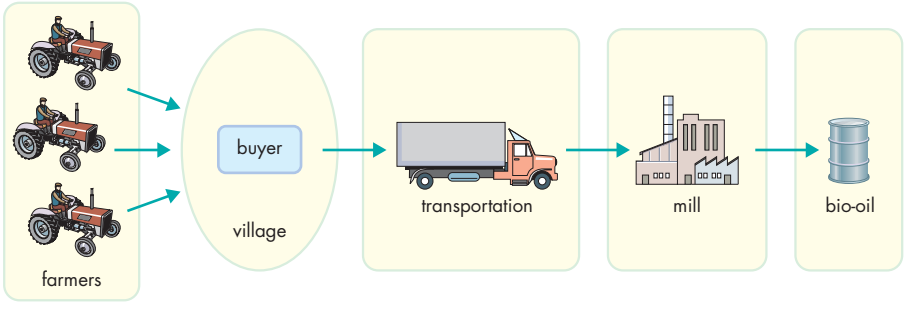
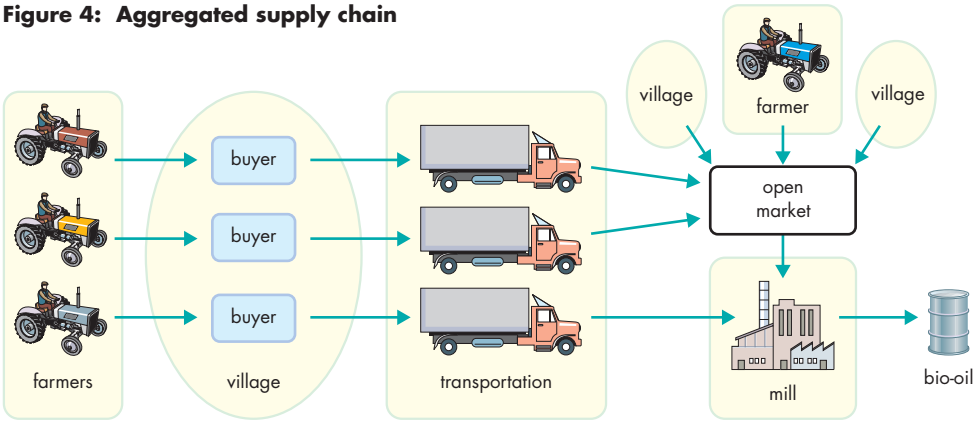


Figure 4: Aggregated supply chain



Aggregated supply chain (see Figure 4)

Aggregated supply chains are more common in small-scale settings. Farmers sell feedstock to one of many village merchants, and/or at local markets. Feedstock may be mixed at multiple stages and traceability is limited in some locations. Farmers usually place feedstock in bags or trucks and transport it to the buying station or to processors/mills in any way possible.

Crusher/mill to fuel blender segment of the supply chain

Under each of the above scenarios, the resultant bio-oil may be stored, transported and aggregated with other bio-oil as it is transferred to a second processor (refiner) where it is converted into biofuel. The exact source and percentage of various inputs is considered proprietary information to most actors. There is often a trader and/or transporter involved in this stage.

A fuel supplier or blender buys biofuel from a domestic producer or an importer. The biofuel producer or the biofuel importer must provide the government with proper documentation indicating the type of fuel, quantity and country of origin. It should be noted that the country of origin may, at times, differ from the country in which the feedstock was originally produced.

Multiple fuel suppliers use the same pipelines operated by independent companies. All fuels of the same type are co-mingled in the pipelines, with the quantity of fuel owned by each party tracked and reconciled with the use of meters. The fuel is then delivered to a depot. In most cases, fuels from different refiners/fuel suppliers are pooled at depots.

The practice of pooling various companies' fuel in pipelines and at depots allows the industry to share the extensive and expensive infrastructure required to get the product to market safely and efficiently. For example, this avoids the need for

individual oil companies to build and operate their own pipelines and tanks. This not only provides the cost-efficiency benefits associated with shared resources, but also limits disruptions in trade, delivery or processing. For example, if one producer has an unplanned shutdown, the other fuel suppliers from the same area can fill the gap and prevent shortages at the retail site.

When designing a CoC system for, and increasing the level of transparency within, the biofuel supply chain, it should be recognized that many members of the supply chain, from first processor to blender, treat their relationship with suppliers and buyers—along with details of transactions with these parties—as proprietary information. A successful CoC system will enable economic operators to maintain an appropriate level of confidentiality while providing a sufficient level of assurance to other industry members, regulators and society that they are operating with integrity and are able to substantiate all claims related to the handling and processing of certified products and/or provide the relevant documentation.

Certifying, segregating and tracking feedstock/biofuels into unique channels would most likely require completely new systems, processes and possibly infrastructure. This would impose unreasonable costs on the system, which would ultimately be borne by the consumer and would limit the scalability of biofuels production.

Overview of sustainable biofuels policies and mandates

The European Union's Renewable Energy Directive

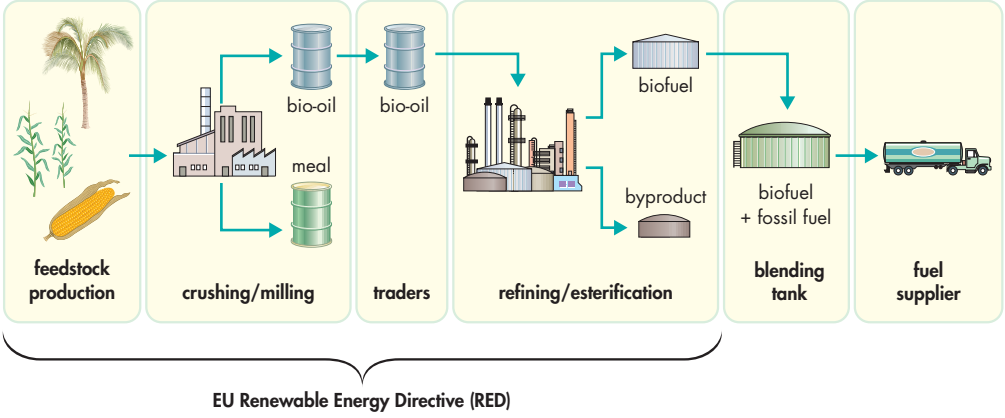
The European Union's (EU's) Renewable Energy Directive (RED), expected to be implemented in 2010, mandates the use of 10% renewable fuels (by energy content) in transport in every Member State by 2020. The Directive also aims to ensure that only biofuels generating net GHG savings of at least 35% will count toward the target. This will increase to 50% in 2017, with 60% expected for new installations. Approved biofuels must also have no negative impact on biodiversity and land use. This requires that feedstock be certified against these criteria, and GHG emissions be calculated along the supply chain.

The EU recognizes that policies which promote the development of sustainable biofuels should not lead to prohibition of the free movement of fuels that meet the harmonized environmental specifications. Proposed CoC systems would extend from the farm or mill to the biofuel producer. Specific types of CoC systems that will be accepted under the RED are being proposed. At this time, 'book-and-claim' systems are not being proposed under the RED but this will be re-evaluated at the next review.

US Renewable Fuels Standard

The 2005 Energy Policy Act established a Renewable Fuels Standard (RFS) requiring the use of 7.5 billion gallons per year of renewable fuels by 2012. The Energy Independence and Security Act (EISA) increased the requirement of renewable fuel use to 36 billion gallons per year by 2022. The RFS also requires refiners and importers to purchase certificates for each category of renewable fuels. Biofuels in general must have a minimum of 20% reduction in life cycle GHG emissions against a 2005 fossil fuel baseline (except for corn facilities built prior to December 19, 2007).

Figure 5: The CoC supply chain boundary proposed by the EU Renewable Energy Directive



So-called advanced biofuels and bio-based diesel require at least a 50% reduction, and cellulosic biofuels will require a 60% reduction. GHG savings are determined using default values based on feedstock and processing pathways. In addition to GHG reduction requirements, all feedstock must meet a definition of 'renewable biomass'. Most refiners, blenders and importers are required to use a minimum volume of renewable fuel each year. Alternatively, these 'obligated parties' must buy credits to meet their required minimum volume. This minimum volume is determined as a percentage of the total volume of motor-vehicle fuel a company produces or imports.

The RFS is being rolled out in two phases, with phase 1 (RFS1) currently in place, and phase 2 (RFS2) in effect from 2010 to 2022. RFS2 established four categories of renewable fuels: total renewables; advanced biofuels; biomass-based diesel; and cellulosic biofuels. Under the RFS, each US biofuel producer or importer must generate a 38-digit Renewable Identification Number (RIN) for every gallon of biofuel produced or imported into the USA. The RIN is the basic tracking device used in all RFS transactions and is attached to the purchase or import of qualifying renewable fuel. In RFS2, a RIN is proposed to identify which category the fuel fits into, but not the specific feedstock, its origin or processing methodology.

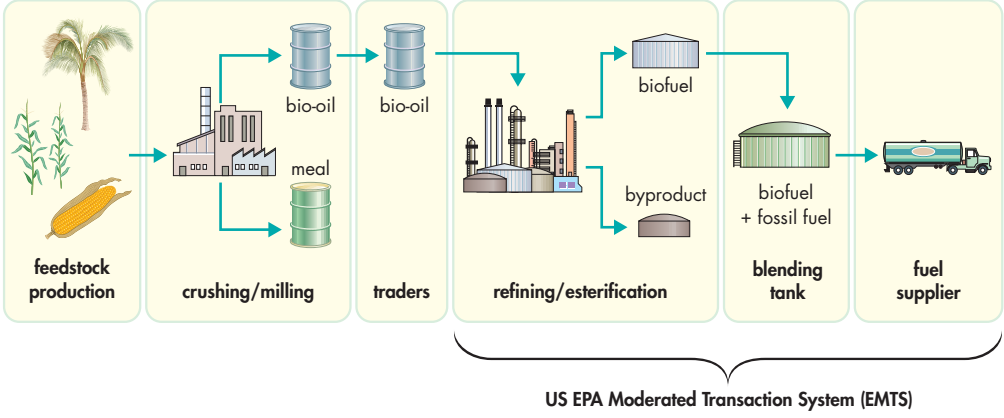
It is the biofuel producer's/importer's responsibility to maintain separate documentation demonstrating that the biofuel associated with a RIN meets the definition of renewable feedstock, and otherwise meets the category definition assigned by the producer/importer. Currently, there is no specific guidance as to the types of documents or administrative controls required, and/or auditing standards that a biofuel producer/importer must meet; however, these aspects are currently under development.

The RFS1 programme relies on the manual submission of data to the EPA for credit towards the RFS obligation, and is not intended or required to provide the buyer, government or the public with information on the source of the biofuel. To make the system more effective and secure, under RFS2, more information will need to be recorded to justify renewable fuel type categorization.

In part to solve the problems associated with the RFS1 system, and in anticipation of more complexity in RFS2, the US EPA proposes to operate a Moderated Transaction System (EMTS) that will provide the industry with one central clearinghouse to report and track transactions from fuel producer to fuel supplier using RINs in a structured, uniform environment. EMTS does not extend across the entire production chain, nor does it function as a CoC system. Figure 6 illustrates the segment of the biofuel supply chain applicable to EMTS. Because EMTS would be operated by the EPA, it is hoped that it will be transparent, better enabling auditing and enforcement.

Currently, the RFS and the supporting EMTS do not capture or track the GHG data or renewable status of a biofuel back to the farm level. Thus, no CoC system is required nor does EMTS act as one. However, the possibility of such requirements and questions about how the US system can align with feedstock, bio-oils or biofuels from sources certified under emerging sustainable agriculture initiatives (e.g. RSPO, RTRS, BSI) still exist. For additional information on how the proposed EMTS will function, see Appendix 1.

Figure 6: The segment of the biofuel supply chain addressed by the US EPA Moderated Transaction System



Chain of custody systems

A CoC is the chronological physical or electronic documentation—and/or paper trail—showing the acceptance/purchase, custody, control, transfer and disposition of a product or associated sustainable attributes. This publication outlines the information that should be included in sustainable biofuel documentation under a CoC, i.e. volume, source of feedstock, type of feedstock and applicable certification number, together with GHG emissions and sustainability data.

Most CoC systems focus on the sustainability of feedstock production. For biofuels, all GHG emissions along the entire production chain must be included. Both the EU's RED and EPA's RFS establish default GHG values for feedstock and production processes, however, there is as yet no global consensus on the methodology used to calculate GHG emissions, or how best to incorporate these data into a CoC system. Hence, most economic operators opt to use default values rather than attempt to calculate actual GHG emission values. For most situations, the method used to integrate process-related GHG emissions will depend largely on the CoC system being used. These methods discussed below as each type of CoC system is presented.

Chain of custody standards

Specific requirements will vary for different CoC systems. Common standards, however, outline specific guidelines or requirements for each type of CoC system, which may include certified product segregation. Some CoC programmes outline temporal requirements that must be met as the product and/or certificates are processed, traded or allocated—e.g. it may be a requirement that the final feedstock sustainability and GHG data certificates are redeemed (e.g. registered by fuel suppliers under RED or RFS). Under most standards, each participating economic operator must be certified by a regularly accredited Certifying Body, and must be subject to an annual audit by an independent third party. Audits are conducted by Certifying Bodies accredited under the applicable programme (e.g. RSPO, FSC).

There are two types of CoC certifications for economic operators: broker and processor. The broker certification programme covers businesses that may own the product on paper but do not store, handle or process the product. The certification and annual audits for these businesses are limited to administrative systems and processes. In some cases these can be conducted remotely (e.g. the Smartwood programme, which provides a diverse set of certification and verification services for the forest industry). The processor certification programme includes an audit of the administrative systems and processes, but also a physical audit of facility processes and facilities, from receiving, through processing, shipping and selling.

Specific requirements for CoCs under different programmes (e.g. RED, RFS, RSPO) may vary and will be set out in applicable guidance documents. For general reference, information regarding the American Society for Testing and Materials' (ASTM's) generic Chain of Custody standards is provided in Appendix 2. It is anticipated that ISO 248 (currently under development) will also include requirements for CoC systems.

Table 2: Description and basic requirements for chain-of-custody systems

CoC system	Description	Requirements
Physical segregation	Certified products are physically segregated from non-certified products at every facility along the supply chain. Processing GHG data can be incorporated into documentation at each stage of the supply chain.	• Documentation must accompany the certified product at all times. • Facilities are usually certified to manage certified products. • It is advisable that all facilities trading sustainable certificates and/or products are audited, certified and registered. • May require cleaning of equipment between the processing of non-certified and certified products.
Mass balance	The amount of certified product sourced and sold by each actor in the supply chain is tracked. However, the certified product and sustainable certificates (e.g. documentation that represents the sustainable attributes embedded in the certified product) do not need to be sold together. The certified product does not need to be segregated from non-certified products (except for site level and tank level mass balance that *do* require segregation during some stages). Processing GHG data can be incorporated into documentation at each stage of the supply chain, or documented and managed separately.	• Each sustainable certificate must match the quantity of certified product it represents. • It is advisable that all facilities trading sustainable certificates and/or products are audited, certified and registered. • Verification is carried out at multiple stages. • Site level and tank level mass balance requires the certificate to be coupled with the certified product up to the blending stage.
Book-and-claim	The certified product is completely decoupled from sustainability certificates. The certified product flows freely through the supply chain, just as a non-certified product does. Sustainability certificates are traded by an independent issuing body. GHG data can be collected, documented and managed separately.	• The establishment of an independent issuing body is required to ensure credibility of the system. • Auditing of the issuing body and/or any other traders of sustainable certificates is recommended.

Types of CoC systems

Most leading sustainable agriculture initiatives use, or intend to use, one or more of three general CoC systems, i.e. the physical segregation system, mass balance system, and the book-and-claim system. A description of, and the requirements for, each system are provided in Table 2.

Physical segregation CoC systems

In a physical segregation CoC, certified products are physically segregated from non-certified products at all stages of the supply chain, as illustrated in Figure 7. The main goal is to ensure that certified and non-certified products are not mixed in the supply chain. In a sub-category—*identity preservation*—the source of the certified product is also tracked as it travels through the production chain, thus providing traceability back to the origin of the product's feedstock.

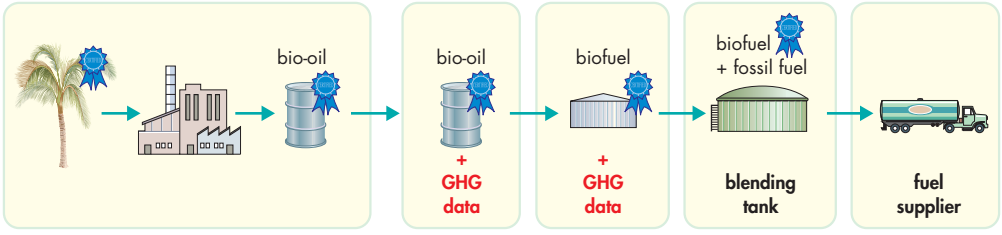
Under the physical segregation model, all economic operators who participate in the trading and processing of a certified product under the CoC system should be certified based on their ability to manage data, accounting, documentation and other processes involved in the buying and selling of certified feedstock/biofuel or associated certificates.

Economic operators can integrate required GHG data into the documents they provide to their customers. Under these circumstances, and using actual or default values, the GHG savings would be aggregated as the bio-oil/fuel moves up the supply chain, resulting in accurate final GHG emissions data for the certified product that could be integrated into one sustainability certificate for feedstock and processing/transportation.

Advantages of a physical segregation system

- It enables GHG savings/data from all processors and transporters along the supply chain to be easily and accurately incorporated into one document.
- It is preferred by many non-governmental organizations because the sustainable attributes are linked with the biofuel throughout the chain.
- It is the only system that can provide a documented guarantee to the final consumer that the biofuel component of the actual product they purchase is sustainable.

Figure 7: Example of a physical segregation CoC system



- Identity preservation is the only CoC system that traces the final product to a certified sustainable source.

Disadvantages of a physical segregation system

- It is incompatible with existing trade and processes, as well as with the fungible nature of biofuels.
- The need to segregate and aggregate certified products can cause delays in processing, and may give rise to additional costs of storing and transporting segregated products. This is also likely to delay payment to suppliers and/or delivery to buyers.
- It requires significant investment and may take considerable time to set up.
- The extensive processing, segregation, storage and documentation requirements create a distraction from each supply chain actor's core business.
- It often requires businesses to source qualified product from outside their approved sourcing networks.
- Falsification of documentation and claims can occur at every stage in the supply chain, increasing the need, cost and resources required to validate claims and enforce the system.
- The creation of a premium product can encourage fraud by unscrupulous actors.

Example of a physical segregation system

- Genetically modified and non-genetically modified food products are kept physically separated throughout the supply chain.

Mass balance CoC systems

In a mass balance system, each company keeps track of the amount of sustainable product it sources and the amount of sustainable product it sells over a specific period, i.e. each company can never claim to sell more sustainable product than it was able to source. Although there is no *physical* segregation of sustainable product from non-sustainable product, there is *administrative* segregation of sustainable product from non-sustainable product. In most supply chains using a mass balance system, each supply chain actor handling the certified product should be certified and registered with the trading system. This certification should focus on administrative and documentation systems and processes to ensure proper accounting of the certificates.

Economic operators could integrate required GHG data into the documents they provide to their customers. Under these circumstances, the GHG data could be aggregated as the bio-oil/fuel or its representative documentation moves up the supply chain, resulting in accurate final GHG data for the certified product that could be integrated into one sustainability certificate for feedstock and processing/transportation.

Company, site and tank level mass balance

There are three general types of mass balance systems relating to the flow of product:

1) company level;
2) site level or production unit level; and
3) tank level.

A *company level* mass balance system (Figure 8) enables decoupling of the sustainable feedstock certificate from the product when it first enters the company. The company can then

allocate the certificate to its customers along with different products from the same feedstock. For example, a large ethanol producer could purchase certified feedstock in one country for use in their ethanol plant, but allocate the certificate to the customer of a different plant (owned by the same producer), possibly in another country.

The *site level* system (Figure 9) requires the documentation to accompany the certified product until it enters the site (yet to be defined under the RED). For example, a site could be a group of ethanol-containing tanks at an export facility. No notice would be paid as to the actual tank used for holding the certified or uncertified product.

Figure 8: Example of a mass balance system at the company level

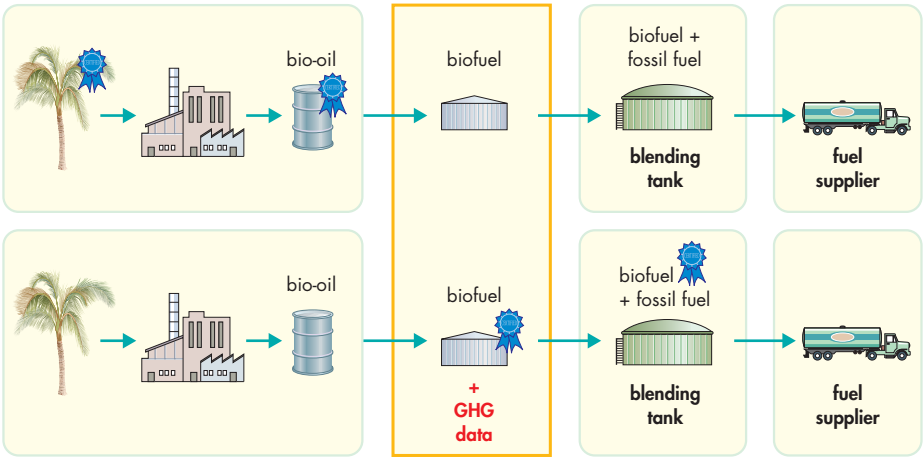


Figure 9: Example of a mass balance system at the site level

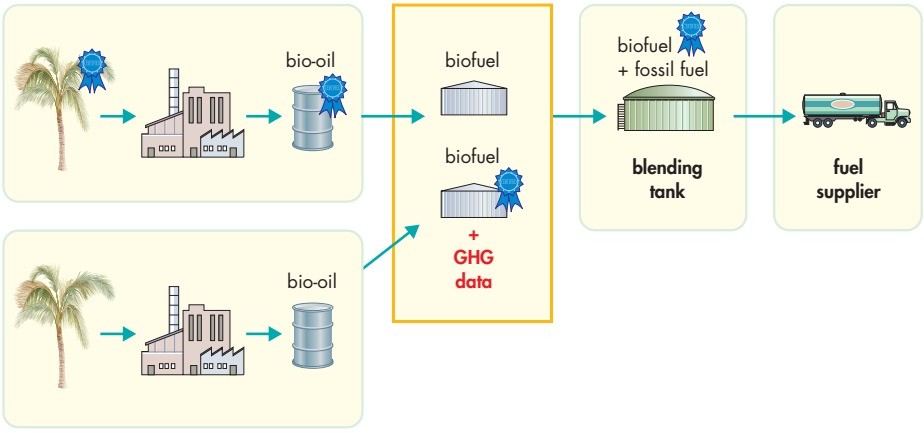
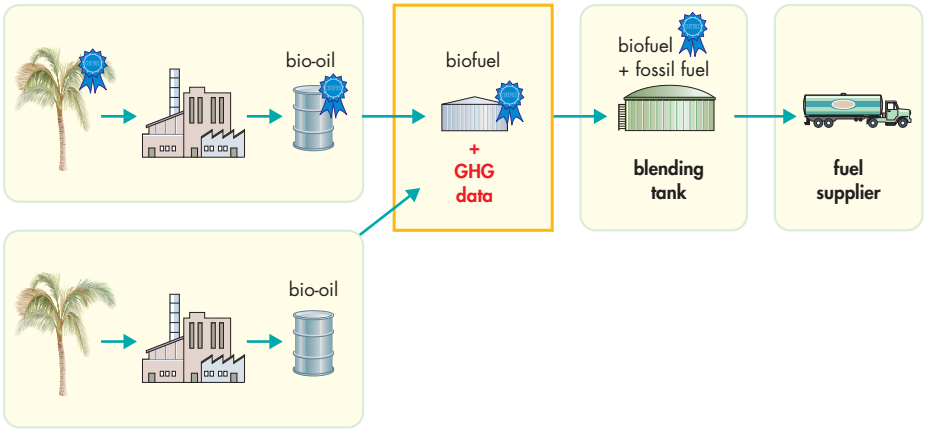


Figure 10: Example of a mass balance system at the tank level

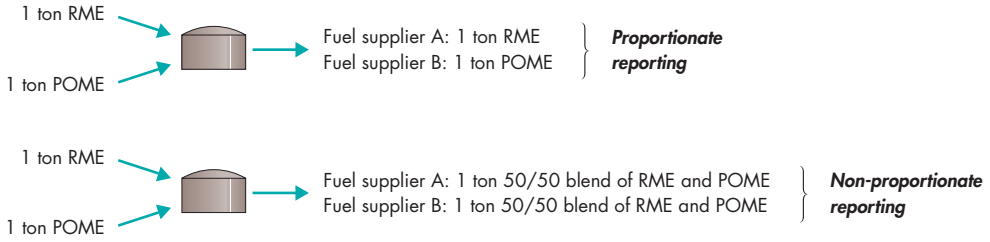


The *tank level* system (Figure 10) requires segregation of the certified product, together with its documentation at the tank level, i.e. it cannot be merged with multiple tanks at the site.

In addition to product flow mass balance systems, there are two different ways of reporting feedstock claims through the mass balance systems depicted in Figure 11:

- Non-proportionate mass balance reporting allows a company to report its mass balance claims across different feedstocks. For example, a company can balance the sustainability and GHG data across products produced from, or containing, a mix of different feedstocks (e.g. rapeseed and palm oil).
- Proportionate mass balance reporting requires a company to segregate its mass balance claims within a specific feedstock. For example, a company can balance the sustainability and GHG data across all palm oil—whether sourced from Indonesia or Malaysia—but cannot apply this data to product made from other feedstocks, e.g. rapeseed.

Figure 11: Proportionate and non-proportionate reporting under mass balance systems



Advantages of a mass balance system

- The credibility of a mass balance system may be perceived to be higher than a book-and-claim system as there is a closer physical connection between the certified product and the company from which the actual product is purchased.
- Incorporation of GHG savings/data from all processors and transporters along the supply chain is possible.
- Company level system: no physical infrastructure investments are required.
- Site level and tank level systems: at least a portion of the resultant biofuels can be linked to a sustainable source of feedstock.
- Only the tank level system retains a physical link between the resultant biofuel and the sustainable source of feedstock (but even this depends on rules regarding timing of allocation of data).

Disadvantages of a mass balance system

- The extra processing, segregation, storage and documentation create a distraction from each supply chain actor's core business, and may lead to higher administrative costs.
- It requires administrative tracking at each stage of the supply chain, and is therefore more cumbersome than a book-and-claim system.
- Certification, registration and auditing of each supply chain actor is recommended, which increases costs as well as administrative and resource burden.
- It may lead to double counting, e.g. several parties making claims on a batch of sustainable product. Rigorous control with unique certificates must therefore exist.
- Falsification of documentation and claims can occur at every stage in the supply chain, increasing the need, cost and resources required to properly validate claims and enforce the system.
- Certified processors of both certified and non-certified material are able to more easily misrepresent non-certified product (e.g. processors can present their 'facility' certificate as proper 'product-level' certification).
- Data verification will be more cumbersome in non-segregated portions of the supply chain.
- Site and tank level systems: all of the disadvantages identified for physical segregation apply to the segregated portions of the supply chain under these systems.

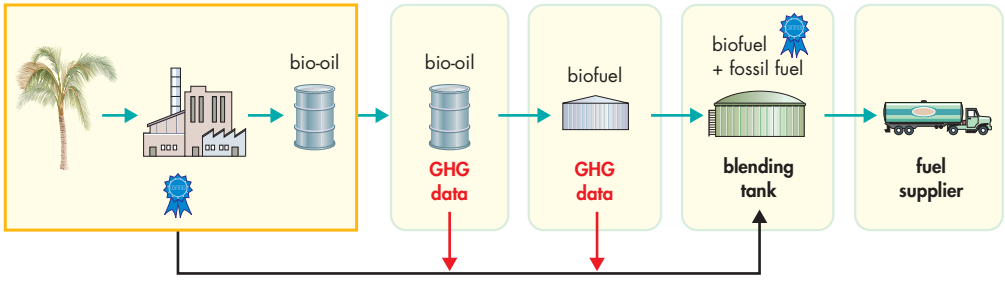
Example of a mass balance system

- Forest Stewardship Council (FSC) credit system, wherein a sawmill processes both FSC and non-FSC wood. The sawdust resulting from the process can be sold as 'FSC-mixed' within a mass balance system.

Book-and-claim CoC systems

The central characteristic of a book-and-claim system is that trade in physical products is completely decoupled from trade in sustainability certificates (Figure 12). For example, sustainable product certificates are traded between farms/mills and fuel suppliers/others. The farm/mill receives a unique certificate for each unit of sustainable product it adds to the market. The certificate

Figure 12: Example of a book-and-claim system



holds information on the sustainability of the farm (e.g. that it is certified by a certain standard) and may also contain GHG data. A centralized issuing body usually issues this certificate. The farm or mill can sell this certificate to a fuel supplier or any other party through the issuing body or trading system. When the fuel supplier brings a certain amount of sustainable product onto the market and claims their product originates from a sustainable farm, the fuel supplier needs to submit the certificates to the issuing body. The certificates are said to be 'redeemed' and cannot be claimed again.

The feedstock sustainability certificate would most likely include GHG data attributed to feedstock production only. Therefore, the remaining GHG data requirements would be limited to the processing/transportation segment of the supply chain, i.e. after it leaves the first processor through to the biofuel producer. Given the two separate sources of GHG data—production and processing/transportation—the GHG data would be calculated and aggregated independently from the bio-oil/fuel (i.e. decoupled from the processes and product). This may lead to a second certificate that is traded in a similar fashion—potentially alongside—the feedstock sustainability certificate, as depicted in Figure 12.

Advantages of a book-and-claim system

- The trade of sustainability certificates does not affect the trade of the physical product. In other words, trade in the sustainable product can continue unchanged, which has clear benefits to market players and may enable greater market penetration.
- An increase in demand for sustainability certificates leads to an increase in sustainable production. Therefore, a book-and-claim system serves the purpose of increasing sustainable production.
- With sustainability certificates bought directly from growers and decoupled from the physical product, there are fewer actors in the certification chain, hence the chances are better that the added value inherent in sustainable production will end up with the grower rather than the intermediaries
- Any interested stakeholder can purchase certificates.

- A government 'owned' book and claim system offers many benefits, including an independent accounting and verification body, a high level of credibility, and a direct link to enforcement of regulations.
- The credibility of claims depends on the credibility of the independent issuing body, which should remain high because it will be motivated to maintain a high level of credibility.
- Auditing and data verification would be easier and more reliable than that required under a mass balance system which could involve multiple sites.
- It provides access to the certificate market for small farmers who may not have any local demand for sustainable product or logistics for export (e.g. soy farmers in India).

Disadvantages of a book-and-claim system

- There are no guarantees that the sustainable material used for products actually originates from a sustainable farm.
- It may lead to double counting, e.g. several parties making claims on a batch of sustainable product. Therefore, rigorous control with unique certificates must exist.
- Because of the need for a comprehensive design with a credible issuing body, setting up a book-and-claim system will require both time and high start-up costs. It is not considered a particularly economic system for small-volume production.

Example of a book-and-claim system

- It is used in the electricity sector for the trade in electricity from renewable energy (renewable energy certificates).

Other biofuel CoC systems

UK Renewable Transport Fuel Obligation Programme

The Renewable Transport Fuel Obligation (RTFO) Programme, an obligation on fuel suppliers to ensure that a certain percentage of their aggregate sales are made up of biofuels, has been in place since April 2008. The effect will be to require 5% of all UK fuel sold on UK forecourts to come from a renewable source by 2010. RTFO is currently in operation, but will eventually be replaced with the EU's RED. The UK currently recognizes book-and-claim, mass balance and physical segregation CoC systems.

Each retailer must report the quantity of fuel purchased on a monthly basis. The information required for biofuels includes: country of origin of the feedstock, recognized sustainability standard (e.g. Roundtable for Sustainable Palm Oil—RSPO), proof of compliance with deforestation prohibition, and GHG savings. The retailer can report 'unknown' for any of these criteria. The monthly reports are aggregated and independently verified at the end of the year, when a tax is assessed. Verification is conducted by a third party on a limited liability basis (i.e. only a certain percentage of data is audited along the supply chain). There is currently no central information system where all obligated parties register and submit their mandatory reports. A retailer can use default GHG emissions/emission savings that are conservative estimates based on the feedstock and processing method. In general, because of the conservative nature of the default values, GHG savings will be greater if actual data is used.

Roundtable for Sustainable Palm Oil's track and/or trade systems

RSPO has been operating a CoC system that consists of segregation, mass balance and book-and-claim systems for approximately 18 months. A brief introduction into how the CoC systems link with the feedstock certification system is provided below.

Under RSPO, the pressing mill is certified by a third-party Certifying Body. The Certifying Body certifies a certain number of tonnes of crude palm oil (CPO). The Certifying Body also certifies the suppliers that sell to the RSPO-certified mill to ensure that they are compliant with RSPO principles and criteria. Some mills may only process palm oil from RSPO-certified suppliers; under these circumstances, 100% of that mill's CPO will be RSPO certified. The mill that processes only certified palm oil can easily feed into any of the three CoC systems discussed in this publication. For mills that receive both RSPO-certified and non-RSPO-

certified suppliers, only the CPO generated by the certified suppliers can feed into a segregation system, and only the equivalent amount of CPO generated from certified suppliers will feed into the mass balance or book-and-claim CoC systems. As described below, these CoC systems are operated by one of two service providers who have automated systems in place that can track transactions and enable accurate accounting of certified tonnes registered and redeemed.

RSPO is currently developing a central database through which all certified mills will register as members, as well as announce their certified product. This registered CPO will then be directed to one of the two service providers, as determined by the mill. The RSPO database will ensure that the same batch of RSPO-certified CPO is not potentially traded through both systems, i.e. circumstances such as double counting are avoided.

Although the systems are in operation, a task group within RSPO is evaluating the current systems and exploring ways to address the different forms of product that result when the same feedstock is used for different products and/or co-products (e.g. glycerin, ethanol and sugar produced from the same batch of certified feedstock). This task group is also defining whether processors include blenders, and whether or not traders should be required to register on trading platforms, among other considerations.

Commodity Trading Systems

RSPO has contracted UTZ CERTIFIED (UTZ) to implement its traceability system for RSPO-certified sustainable palm oil for the models' mass balance and physical segregation, and for GreenPalm to implement its book-and-claim model. The RSPO also requires that the supply chain meets certain criteria (e.g. is RSPO certified) to permit UTZ trading of mass balance certificates. Sellers must also be registered to use the UTZ system. A brief summary of each of these two systems is provided below.

UTZ

The UTZ system facilitates the trading of sustainable palm oil through its unique platform that enables growers/producers to enter their volumes of certified product (i.e. 'announce' their palm oil). Each entry is given a unique number that is visible to others, who then have the ability to purchase that lot of palm oil. The buyer receives a unique number that is entered into the system and verified. UTZ accounts for all volumes and can, therefore, facilitate mass balance as well as identity preservation models.

The UTZ system limits the mark-up of premiums by allowing buyers to identify and separate them

from product cost at the first transaction. This allows other supply chain actors to see premiums as separate charges, which can be backed out of any non-product charges they apply. The buyer also pays a US$3 fee, of which $1 goes to RSPO. Currently, RSPO uses these funds to support smallholder capacity building.

GreenPalm

The GreenPalm programme uses a book-and-claim model that allows buyers of palm oil to make and document contributions to sustainable palm oil without the administrative processes—physical or otherwise—necessary to track it through the physical supply chain. RSPO-certified palm oil producers register a quantity of their output with the GreenPalm programme. They are awarded one GreenPalm certificate for each tonne of palm oil that has been sustainably produced. Manufacturers or fuel suppliers can then bid for, and buy, those certificates online. The palm oil itself is sold, processed and purchased in the usual way.

Only producers certified by RSPO auditors are allowed to supply certificates for GreenPalm brokerage. GreenPalm has not had any audits of their system conducted to date. Subsequent audits will verify that certificate sales do not exceed total production including sales by other approved supply chains. End users who wish to make claims may also be audited. The buyer pays a US$4 fee, of which $1 goes to RSPO. Currently, RSPO uses these funds to support smallholder capacity building. GreenPalm hopes to reduce the US$3 brokerage fee as initial investments decline and use of the system increases. Any member of GreenPalm can buy certificates. GreenPalm waives the one-time membership fee of US$500 for RSPO members.

Emerging sustainable agriculture initiatives

Recent efforts to promote sustainable agriculture have the aim of making positive changes on a mainstream scale. Initiatives aimed at improving environmental and/or social conditions in agriculture supply chains that have already been established or are currently in development include: RSPO, Better Sugarcane Initiative (BSI), Round Table for Responsible Soy (RTRS), and Roundtable for Sustainable Biofuels (RSB). These initiatives have established requirements and mechanisms for certifying feedstock production against their principles and criteria in accordance with ISO 17011: *General requirements for bodies providing assessment and accreditation of conformity assessment bodies*. Existing government mandates accept certification under these standards as complying with their sustainability requirements for feedstock. None of these initiatives currently have a programme to measure or certify GHG emissions/savings, but efforts to incorporate GHG calculations are under way.

Linking the certified feedstock and/or its sustainable attributes in order to meet government mandates, corporate goals, or consumer expectations requires a CoC system. The CoC system should account for and/or track the certified material in a cost-effective and resource-efficient manner with limited bureaucracy and administrative requirements.

RSB and BSI are in the initial stages of evaluating existing CoC systems, and have not yet designed a system for their programmes. It should be noted, however, that most of these programmes certify the product generated by the first processor (e.g. mill). This processor will likely receive and process both certified and non-certified product from numerous large and/or small-scale producers. In aggregated and coordinated supply chains, this is often the most difficult segment of the supply chain to segregate and track due to the lack of systems, documentation and policing capabilities, as well as the increased incentive for local actors to falsify claims of certified product. Proper segregation and tracking of the certified product, together with the keeping of appropriate documentation, are essential to ensure the integrity of not only the certified product, but also every claim from that point forward.

Considerations

Certification programmes play an important role in the advancement of sustainable biofuels. They can promote better farming practices, benefiting the environment and/or the community and industry as a whole. However, few certification programmes—if any—have reached a significant scale, largely due to costs, distractions to business operations, transportation costs associated with linking new supplier-buyer connections, and the reluctance of consumers to pay a higher price associated with non-food/premium products. It is especially difficult to apply CoC systems to commodities such as biofuels because they are liquid and often indistinguishable from other sources, and are processed through a multi-stage, co-mingled supply chain before finally being blended with fossil fuels. Because the identity of individual batches of the product is lost in commodity supply chains, it is inevitable that claims are susceptible to fraud.

Numerous challenges exist in addressing the direct and indirect impacts of an expansion in biofuels production (e.g. land-use change, food security) through a standards and CoC system alone. Research, technological advances, capacity building and policy, as well as monitoring and enforcement by governments in the producing regions, are just some of the other issues that need to be addressed. It is also important to ensure that the production of certified, responsible feedstock keeps pace with the increasing demand dictated by government mandates and/or society in general. If demand significantly outpaces supply, the resultant premiums may hinder adoption and overall progress.

All three CoC systems support the overarching intention of existing government mandates, i.e. to support the shift from unsustainable and GHG intensive practices resulting from biofuel production. They must enable the industry to maintain the fungible nature of the global commodity trade while ensuring a level playing field for all economic operators. However, given the complexities of each CoC system, having multiple systems in place simultaneously to manage the same biofuel market would be chaotic, and could hinder enforcement by the regulatory authorities.

It would be helpful if governments that establish the mandates facilitate the reporting of critical data. A system should minimize administrative tasks, bureaucracy and associated costs to consumers, industry members and governments, and should therefore be integrated into existing reporting requirements whenever possible. For example, it would be advantageous to submit the required documentation for sustainable biofuels through the same reporting process that fuel suppliers use to report the type, quantity and country of origin of their fuels. The system should respect the desire of economic operators to maintain the confidentiality of proprietary information (e.g. the identity of suppliers and transaction arrangements).

The integrity and credibility of the system and associated claims will inevitably be strengthened if governments also enforce compliance with systems and mandates. Systems should be auditable and, ideally, audited on a routine basis. A government owned, operated, and enforced system would control costs, streamline processes and

maximize the credibility of the certificate. It would create a level playing field for all industry members. A government operated clearinghouse, like the US EMTS, through which all certified product and claims would be registered, traded and redeemed (expired) would streamline data reporting and verification, as well as minimize the risk of 'double counting' or other forms of fraud. Without such a central clearinghouse, the potential for fraud is high.

Systems should be coordinated with other sustainable agriculture and biofuel systems (e.g. RSPO) to prevent the possibility of intentional or unintentional double counting of certified products. A system, or interfacing systems, to allow European and US reporting systems to share information and reconcile quantities of sustainable biofuels produced and claimed by either region would be helpful in ensuring that double-counting of the same certified product does not occur.

When designing a CoC system it is important to recognize that it is only one element of a larger system. The aim of such a system is to promote the expansion of sustainable and low-GHG biofuel production with a focus on feedstock production, which is where the majority of impacts and opportunities to support the growth of local communities occurs. Any disruptions to the biofuels supply chain will discourage industry engagement while encouraging non-compliant behaviour—especially from smaller actors who are not the focus of enforcement or public scrutiny—and/or increase the cost of the final product. Companies will be in a better position to meet and support the intent of government mandates if they are allowed to efficiently integrate requirements and processes into their business operations.

Additional considerations

It is important to remember that with sustainability, unlike with segregation of genetically modified (GM) and non-GM crops, the amount of certified and non-certified product in a mixture cannot be determined by laboratory analysis, as the molecules are chemically and physically identical. With no laboratory testing, the accuracy of reporting of operators relies on the quality of the documentation. A simple, easily understood CoC system provides the best possible safeguard against fraud.

Based on the experiences and/or research conducted for other sustainable commodity programmes (e.g. BCI, FSC), some issues that should be considered when designing certification programmes and CoC systems include:

- Governments and/or industry associations may not support a certification programme that infers that the rest of the subject crop is 'less good'.
- Certification and CoC systems are resource intensive and often force businesses to work outside existing sourcing networks.
- The costs of becoming certified can put small-scale economic operators at a disadvantage.
- Programmes that require additional documentation and/or processing add complexity and cost.
- Under mass balance and physical segregation, costs may become amplified as they are passed along the supply chain.
- Few certification systems have been able to demonstrate measurable improvements in key social or environmental indicators.
- Biofuel suppliers will most likely use the CoC system that meets mandated requirements using the most streamlined processes available (i.e. mass balance for RED, book-and-claim for RTFO).
- Premiums will motivate support, but may also provide an incentive for people to corrupt the system, therefore, controls that are challenging to implement and which will increase costs will be needed in some regions.
- Issues of complexity and bureaucracy in implementing the GHG portion of the system encourages the use of default values which, in turn, limits motivation to improve practices, processes or equipment that could enhance GHG performance.

There are many unresolved issues under the emerging sustainable agriculture and biofuel systems that should also be considered. Some of the most significant include:

- Should mass balance be applied at the company, site or tank level?
- How should environmental attributes, especially GHG savings, be best allocated between the biofuel portion versus non-fuel co-product (e.g. cosmetic ingredients or food)?
- What is the most effective way to address, document and account for indirect land-use changes?
- There is, as yet, no global consensus on methodology for calculating GHG emissions/savings.
- Should the sustainability of the feedstock be documented, traded and registered separately from the GHG calculation associated with processing and transportation?

Appendix 1: US EPA's Moderated Transaction System

The EPA's proposed Moderated Transaction System (EMTS) will provide a centrally-managed system that provides a mechanism for screening and tracking RIN credits with the aim of minimizing administrative, data entry or other potential errors in establishing and reporting RINs. The EMTS will not reconcile entries with market-based claims, but instead act as an accounting system, seeking to bring integrity to the market. Thus, it is not intended to facilitate, or act as a substitute for, any of the CoC systems discussed in this paper.

Under the EMTS, all other members of the supply chain (e.g. importers, blenders and refiners) will be considered obligated parties, and will be required to register with the EPA. Registration will be automatic for users/organizations registered under 40CFR Part 80; RIN generation qualification, however, will be determined through a new facility registration process. Every user will have specific and restricted rights on EMTS (e.g. submitter, editor or viewer). All users will be required to have a Corporate Officer's signature on file with the Office of Transportation and Air Quality before their data can be entered in EMTS.

RINs can be generated, separated, traded, stored and retired in EMTS. They may be kept in holding accounts until the seller wants to make them available; however, they will need to be used within two years from the date of manufacture. RINs can also be locked by the EPA, or by an individual submitter, rendering them unavailable for trade. All transactions can be made in two ways, either through a batch file or through the EMTS web application.

Industry participants will file submissions through an exchange network, and third-party submission will also be possible. The basic transaction types are: generate, separate, sell, buy, and retire.

Information required for EMTS depends upon the submission type. For RIN generation the requirements are expected to include: feedstock details, renewable fuel volume, facility location, equivalence ratio, and either RIN pricing or renewable fuel pricing details. For RIN transfer the expected requirements include renewable fuel volume, RIN type, date, buyer, seller and RIN pricing or renewable fuel pricing. EMTS checks the content of each file submitted. RINs can be split and separated. The reasons for separating RINs must be documented (e.g. separation by obligated party due to fuel blending to 80% volume or less, fuel export, or use in neat form).

RIN information requirements

Information required for each RIN includes:

- *Production date:* the date on which the fuel was produced.
- *Batch volume:* the total volume in gallons of renewable fuel produced in the batch.
- *Denaturant volume:* the total volume in gallons of denaturant added to ethanol only (not required for biodiesel).
- *Production process:* the production process used to make the renewable fuel.
- *RIN quantity:* the number of RINs being generated.
- *Fuel:* the type of renewable fuel produced.
- *Equivalence Value:* the multiplier directly related to fuel type.

Additional information that should be in each batch file includes:

- Originating source of the fuel: identifier of the organization and facility that produced the renewable fuel, and batch number.
- Feedstocks: feedstock code, renewable biomass indicator, feedstock volume, feedstock unit of measure.
- Co-product codes: the type of material generated, volume and unit measure.

When a trade occurs, the seller must provide:

- Transaction date
- RIN(s) being sold
- Batch volume
- Trading partner (public identification number and name)
- Type of fuel
- Transaction price (RIN or gallon price)
- Reason for selling RINs
- Assignment—RINS are 'assigned' or 'separated'
- Year RIN was generated (RIN year)

Appendix 2: American Society for Testing and Materials' Chain of Custody Standards

The American Society for Testing and Materials (ASTM) is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems and services. The ASTM has drafted the following requirements for chain of custody procedures.

Identification

The certified product shall be marked or labelled to indicate its sourcing and/or feedstock such that all actors in each stage of the supply chain can distinguish it from uncertified product. The identification shall be indicated on the CoC form.

Storage

The certified product and documentation shall be stored in a secure, orderly, traceable, and retrievable fashion.

- The certified product shall be physically separated from similar uncertified products.
- The certified product shall be handled by as few people as necessary.

Transportation

- The certified product and documentation shall be transported in a secure, orderly, traceable and retrievable fashion.
- The certified product shall be physically separated from similar uncertified products.

- Shipping containers shall be marked or labelled to indicate their sourcing and/or feedstock in a manner consistent with product identification.

Documentation

- A standard CoC form used for each stage of the product's life shall include:
  - A description of the certified product:
    - Manufacturer name, product name and description.
    - Quantity of original product and percentage of original product in shipment.
  - Sourcing of product:
    - List and description of marketing claims related to source and/or feedstock materials.
    - Modifications and/or processing of product during custody.
    - Indication by mark or label to identify product and shipping container.
  - Seller's information:
    - Contact information: name, title, organization, address, telephone and email.
    - Date and time of shipment, method of transport, condition of product.
  - Buyer's information:
    - Contact information: name, title, organization, address, telephone and email.
    - Date and time of shipment, method of transport, condition of product.
- Throughout its life, the CoC shall include a log of custodians that includes, for each custodian, the name, department and organization, custodial period, sourcing of the product and modifications made to the product.
- The aggregate CoC shall comprise all CoC forms generated throughout all stages of the product's life:
- CoC forms shall be maintained by each facility for the anticipated life of the product.

Glossary of terms

Aggregated supply chain: Supply chain or portion (e.g. farm through crusher/mill) in which a product is mixed with other sources and its traceability is limited.

ASTM: American Society for Testing and Materials

Biofuels: Liquid fuels derived from plant materials.

Book-and-claim: Chain of custody system that decouples attributes from certified products that can flow through the supply chain without segregation or administrative tracking.

BSI: Better Sugarcane Initiative

Certified product: Biomass, bioliquid or biofuel that has been produced from farms and/or initial processors that have been certified under a credible and recognized standard.

Certifying body: Third-party organization that is accredited to certify economic operators on behalf of a standards organization.

Chain of custody: A system that tracks feedstock, biofuel and bioliquid—or their intermediary products or components—through two or more life-cycle stages, from origin to end user.

Conventional fuels: Petroleum-based fuels such as fossil fuels, hydrocarbons and mineral oils.

Coordinated supply chain: Supply chain or portion (e.g. farm through crusher/mill) in which a central entity provides input, credit and transportation support, and/or purchases most or all product that travels through this portion of the chain.

Economic operator: Organization responsible for one or more steps in the feedstock, bioliquid or biofuel chain of custody.

EMTS: US EPA Moderated Transaction System

Feedstock: Initial plant material used to produce biofuels.

FSC: Forest Stewardship Council

Fungibility: Interchangeability of fuels and/or the systems used to transport and administer them.

Greenhouse gas (GHG) emissions: Emissions of gases that trap heat in the atmosphere.

Identity preservation: A sub-category of *physical segregation* where the certified product is also tracked as it travels through the supply chain, thus providing traceability back to the origin of the product's feedstock.

ISO: International Organization for Standardization

Mass balance: Chain of custody system that tracks a certified product through administrative processes, but allows the actual product to mix with non-certified products as it moves through the supply chain or portion thereof. Different types of mass-balance systems include:

- *Company level*—enables decoupling of sustainable feedstock certificate from product when it first enters the company.
- *Site level*—requires documentation to accompany certified product until it enters the site (to be defined).
- *Tank level*—requires segregation of certified product and documentation at a tank level (i.e. it cannot be merged with multiple tanks at the site).
- *Proportionate mass balance reporting*—requires that a company segregate its mass balance claims by feedstock.
- *Non-proportionate mass balance reporting*—allows a company to report its mass balance claims across different feedstocks.

Office of Transportation and Air Quality: The department of the US Environmental Protection Agency (US EPA) that regulates air pollution from motor vehicles, engines and the fuels used to operate them.

Organization: Company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration.

Physical segregation: Chain of custody system that segregates certified product from non-certified product throughout the supply chain.

RED: European Union Renewable Energy Directive

Renewable Identification Number (RIN): Basic currency of the US EPA's Renewable Fuel Standard (RFS). It is a 38-character numeric code generated by the producer or importer of renewable fuel that represents gallons of renewable fuel produced/imported, and is assigned to gallons of renewable fuel exchanged between buyers and sellers. RINs are transferred along with the transfer of ownership (but not necessarily custody) of the fuel.

RFS: US Renewable Fuel Standard

RSPO: Roundtable on Sustainable Palm Oil

RTRS: Round Table on Responsible Soy

Segregated supply chain: Supply chain or portion (e.g. farm through crusher/mill) in which product is segregated from other product and through which its origin can be traced.

Sustainable feedstock: Plant material that will be used to produce biofuels and has met the definition of sustainability under the mandate and/or sustainable agriculture initiatives.

Traceability: Ability to track product through every step of the supply chain to its origin.

IPIECA

IPIECA is the global oil and gas industry association for environmental and social issues. It develops, shares and promotes good practices and knowledge to help the industry improve its environmental and social performance; and is the industry's principal channel of communication with the United Nations.

Through its member led working groups and executive leadership, IPIECA brings together the collective expertise of oil and gas companies and associations. Its unique position within the industry enables its members to respond effectively to key environmental and social issues.

Company members

BG Group
BP
Chevron
CNOOC
ConocoPhillips
Eni
ExxonMobil
Hess
Hunt Oil
KPC
Mærsk
Marathon
Nexen
NOC Libya
Occidental
OMV
Petrobras
Petronas
Petrotrin
PTT EP
Qatargas
RasGas
Repsol YPF
Saudi Aramco
Shell
SNH
Statoil
Talisman
Total
Woodside Energy

Association members

African Refiners Association (ARA)
American Petroleum Institute (API)
Australian Institute of Petroleum (AIP)
Canadian Association of Petroleum Producers (CAPP)
Canadian Petroleum Products Institute (CPPI)
The Oil Companies' European Association for Environment, Health and Safety in Refining and Distribution (CONCAWE)
European Petroleum Industry Association (EUROPIA)
International Association of Oil & Gas Producers (OGP)
Petroleum Association of Japan (PAJ)
Regional Association of Oil and Natural Gas Companies in Latin America and the Caribbean (ARPEL)
South African Petroleum Industry Association (SAPIA)
World Petroleum Council (WPC)

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