PETERSON

Sustainability Framework for Bio-Based Materials in the Netherlands

Review of Ecological and Management indicators and Chain of Custody requirements for scheme assessment in the chemical and construction sectors

Version 1 / 14.1.2025

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Assignment part 1

Introduction

The European Renewable Energy Directive (RED II) sets requirements for biomass used in energy applications. In the Netherlands, the Netherlands Enterprise Agency (RVO) seeks to extend the sustainability framework for biofuels and bioenergy established by the European Commission (EC) by also imposing parallel requirements on bio-based raw materials used in construction and chemical production. The RVO envisions that organizations operating in the Netherlands will be able to use Dutch approved certification schemes to demonstrate the sustainability of bio-based raw materials for applications beyond fuel and energy. For fuel and energy applications, the certification schemes approved or recognized by the EC under the RED II will be used. For other applications, including construction and chemical production, the Netherlands will recognize certification schemes based on a defined set of ecological and management requirements for schemes, which have yet to be established.

A legal framework is currently being developed to govern the entire assurance of sustainability of bio-based materials in the Netherlands, consisting of a Decree and a Regulation. The Decree specifies that the sustainability of bio-based raw materials can be demonstrated using Dutch approved certification schemes. The Regulation includes the ecological criteria (i.e., the RED II requirements) that sustainable bio-based raw materials must meet, as well as the criteria that bio-based certification schemes must meet in terms of how they are managed (i.e., good scheme management and auditing practices).

Ecological requirements

As defined by the RVO, the goal of Assignment 1 was to create a set of indicators to accompany the ecological (articles 29.2 to 29.7 of the RED II) and management (Table 10 of the "NL Sustainability Framework Advice" by Guidehouse and a Dutch iteration of the RED II Article 30.3 including group certification) requirements for the purpose of scheme assessment in the chemical and construction sectors in the Netherlands. A central aspect of this task was to determine if deviations would be needed from the way this is done in the assessment protocol of the EU for the ecological and/or management indicators under RED II for bio-based industries outside of fuel and energy.

Peterson Solutions approached this assignment by first devising a robust and clear structure for assessing the applicability of existing ecological and management requirements and indicators adapted from RED II for the chemical and construction industries. The first step in this process was the creation of two spreadsheets, which contained the existing ecological requirements (adapted from articles 29.2 to 29.7 of the RED II) and management requirements (RED II and IR 2022/996) respectively. Subsequently, the requirements were grouped into representative topics, and indicators were added to each requirement to provide a standardized level of detail, progressing from topic to related requirements and then to specific indicators.

In the context of this assignment, a **topic** refers to a broad category or subject area that organizes various related requirements, making it easier to address specific aspects of the sustainability of bio-based materials. A **requirement** is a specific ecological or management-related condition or criterion within a topic that must be met. An **indicator** is a measurable element or metric used to assess whether a requirement has been met, offering a way to quantify and evaluate compliance. For the sake of completeness, the review of the ecological requirements includes references to the corresponding REDII/ILUC **article**, and the article **description**. This structured approach ensures a standardized level of detail, progressing from broad topics to specific requirements and then to precise indicators, facilitating the assessment of relevant sustainability schemes for bio-based raw materials.

For the ecological requirements, the topics, requirements, and indicators are directly adapted from articles 29.2 to 29.7 of the RED II, with articles corresponding to topics, and requirements and indicators reworded for clarity.

Management requirements

This second part of assignment part 1 will focus on management requirements for schemes. The goal of this section is to provide practical guidance on scheme requirements, based on Guidehouse's reasoning in their report (table 10 on page 42). Expert experience from the project team and Peterson's network of experienced authors was also used.

Based on the reviewed table "Assignment Part 1_Review Management Requirements", indicators from the assessment protocol were reviewed in order to determine if adaptations are needed. Common practice and certification schemes in bio-based chemistry and bio-based construction were taken into consideration.

Additional requirements from Annex 3 of the request for proposal were additionally included in order to assess whether adaptations were needed. Here, the wording of the requirements was also considered in order to ensure that the translation was fit for use. The requirements for RED were used as the starting point.

For the management requirements, topics, requirements, and indicators were determined based on Table 10 of the "NL Sustainability Framework Advice" by Guidehouse and a Dutch iteration of RED II article 30.3.

Results

Using this structure, relevant and widely used schemes in the bio-based chemical and construction sectors were identified and paired with relevant ecological and management-related topics in the two spreadsheets. The identified schemes were further categorized based on whether they were RED II recognized, in the process of becoming RED II recognized, or not recognized by RED II. Following that categorization, it was decided that the ecological and management-related requirements of the specific non-RED II recognized schemes have to be reviewed to determine if

these schemes are able to comply fully, partially, or not at all to the various requirements. This was done in assignment part 2. In order to test our approach, an assessment was already done for the Nordic Swan scheme during assignment part 1. This assessment utilized findings from SustCert4BioBased, an ongoing 3-year Horizon Europe project (2022-2025), to which the authors of this report contribute. The project aims to assess and promote bio-based certification schemes and labels in Europe. This was done in parallel with having experienced internal scheme experts and auditors (FSC and ISCC) within the Peterson Control Union Group review the existing requirements and determine their applicability outside of certification schemes specifically for biofuels and biomass. Based on the findings from these two parallel processes, it was determined if deviations from existing ecological and management requirements for schemes would be needed for the chemical and construction sectors.

The results are laid down in two Excel files attached to this report, and are summarized in the conclusion of this report:

1) Assignment Part 1_Review Ecological Requirements
2) Assignment Part 1_Review Management Requirements

Results on Low ILUC-Risk

This chapter presents a review on the low ILUC-Risk certification requirements and guidance, which is required by the EC (Implementing Regulation 996) for high ILUC-Risk rated commodities. Currently this only includes oil palm, but this could become the case for other commodities in the future as well.

The implementation of low ILUC-Risk certification has been supported by a three-year project led by Guidehouse, with the aim to check the achievability of the requirements set in IR 996, as well as giving guidance for the low ILUC-risk certification. The final report of this project was published in January 2024 and can be found here Low ILUC Phase 2 - Final report (guidehouse.com). As per the executive summary of this report, various conclusions are taken, two of which are highlighted here:

1) An important ILUC risk mitigation measure is **"yield increase"**. In the pilot, various yield increase measures have been tested. Measuring this has turned out to be challenging, as there are **various reasons that may cause yield variation**, caused by external factors including weather. When measuring yield increase, it is important to link this to measures that are **"additional"**, e.g. have been implemented for the purpose of low ILUC-Risk compliance. Combined with yield variance due to weather, it becomes very **difficult to determine the amount of yield increase achieved.**
2) As only the achieved yield increase is subject to the low ILUC-Risk certification, the Guidehouse project reviewed the **attractiveness for companies** to achieve this certification. Compared to the normal RED II certification requirements, which result in the full yield achieving compliance, a successful low ILUC-Risk certification would only be possible for a limited number of farms where measures can still be enforced to significantly increase the yield (e.g. measures that can pass the "additionality test") to comply. It is therefore **not likely that the significant extra effort for the significant lower output will be attractive for a large number of companies**, as per the Guidehouse report.

Considering the above output of the report, it is expected that there will not be a lot of low ILUC-Risk certified material on the market. This indirectly means that products classified as high ILUC-Risk (currently oil palm) will no longer be attractive to use as biobased material under the REDII. Peterson advises taking this into account in the final considerations of enforcing a low-ILUC risk requirement and indicator.

Option to use EUDR

Oil palm and its derivatives are also subject to the EUDR, which is planned to get enforced as per 1st of January 2025. The following has to be considered to assess the effect of EUDR and if that could cover the low ILUC-Risk aspects:

- EUDR has a no-deforestation cut-off date of December 31st, 2020, which is considerably later as the REDII cut of date (December 31st, 2007)
- EUDR is not allowing any mass-balance of compliant and non-compliant materials, but requires traceability back to the field polygon
- Whilst EUDR is considerably stricter in the chain of custody requirements, it is **not considering indirect land use change**

The above differences between the REDII and EUDR requirements on land use and chain of custody show different approaches are taken to tackle this. The fact that EUDR is not considering indirect land use change may look weaker from an initial perspective, but based on the fact that it covers all major commodities with significant land use coverage and pressure on protected areas, and that the EUDR is relevant for all sectors, it can be concluded that it covers land use change more generic than REDII which only secures protected areas for bioenergy supply to Europe. The rising complexity in existing supply chains due to EUDR, as well as the low attractiveness on the low-ILUC risk module, requires in the view of Peterson a balanced approach where both the RVO requirement to be complied with by the schemes, as well as the complexity to comply with by the certified companies in the supply chain, shall be kept reasonable. Regarding the EUDR implementation, significant industry feedback came out in the last months, addressing that EUDR makes the import of raw materials and intermediate products significantly more difficult due to the administrative burden and the need to separate the products in smaller batches. This indirectly incentivizes global supply chains to process final products outside the EU, and therewith making it more attractive to outsource such economic activity. as The statement of Cepi.org is an example of that (20240925_Final-joint-statement-EUDR.pdf (cepi.org)). Following such statements, a formal proposal for a 12 month postponement of the EUDR is on the table whilst this project report is written: EU proposes to delay landmark anti-deforestation law by 12 months | Reuters. Considering the current amount of uncertainty on the EUDR, the pushback from the industry related to its strict chain of custody, and the fact that on single batch level, EUDR compliance is not indicating any risk reduction on indirect land use change, it is advised not to consider EUDR compliance within the framework to comply with articles 4 and 5 of Directive 2019/807.

Applicability of articles 4 and 5 of Directive 2019/807 in construction and chemical sector

There is a very significant overlap in the biobased raw materials certifiable under the REDII as well as under the non-RED approved schemes. Various scheme owner organizations have for this purpose divided their scheme requirements in REDII compliant ones (formally approved under REDII), and their "sister schemes" without such compliance, which includes among others ISCC Plus, REDcert2, RSB Global, et cetera. The full list of REDII compliant schemes, and those in the process of recognition (either in full or for specific scope extensions) can be found at the Voluntary schemes website of the European Commission. It is not mandatory for all the schemes to cover low iluc risk certification, since this is only subject to raw materials classified as high iluc risk. If they do not offer it, they cannot support their certified economic operators to use high iluc risk classified raw materials in their supply chain. All these schemes, however, require the same sustainability requirements for the initial raw materials. The main elements where these schemes differ are:

- Further raw materials are allowed (that are not covered by REDII)
- The non-REDII approved schemes allow a broader range of chain of custody options (more flexible rules than under REDII)
- They do not cross-recognize each other (as they only are obliged to do that under the REDII).

Taking all the above into account, the low-ILUC risk certification (currently relevant for Palm as a high ILUC risk classified product) is the only relevant mechanism to compliment sustainability criteria, similar as under REDII. In Assignment part 2, we will review the implications on the chain of custody related to these additional certification requirements.

The following ILUC-indicators could be formulated to confirm compliance with the given requirement "Biomass production has a low risk of indirect land use change (ILUC) and complies with Articles 4 and 5 of Regulation 2019/807".

Because high iluc risk certification is only offered in the certification market as a voluntary module and is not applied very much yet, is preferred to rephrase this requirement to a scheme requirement only to be applied when relevant in future policies.

Scheme Requirement

Schemes shall assure that in case of the use of high iluc risk feedstock, the biomass production has a low risk of indirect land use change (ILUC)' and complies with Articles 4 and 5 of Regulation 2019/807.

The assurance of this requirement can be proven by:

1) Proof that the feedstock is **not** determined as high indirect land-use change-risk feedstock for which a significant expansion of the production area into land with high carbon stock is observed, OR

2) In case the feedstock is determined as high indirect land-use change-risk feedstock for which a significant expansion of the production area into land with high carbon stock is observed, this feedstock shall be certified against the low-ILUC risk certification module, as per implementing regulation 996 articles 24-27.

The following indicators are proposed for both above options:

Indicator to apply option 1: the sustainability declaration shall confirm that the original raw material. The sustainability declaration requirements of the scheme provide an option to correctly claim that the biomass does not contain feedstock that can be classified as high iluc-risk.

Indicator to apply option 2: when a high iluc-risk classification feedstock is certified, the scheme provides an EC recognized additional low iluc-risk certification module. Evidence of this requirement shall be found by confirming low-iluc-risk compliance on the sustainability declaration and is required when the raw material has been classified high iluc-risk. Schemes that do not have such a module approved as part of their REDII approval can only ask their economic operators to apply option 1.

The above two-fold requirement has been added to the list of ecological requirements.

Conclusion and outcomes of the review

This section describes our (preliminary) conclusion on the ecological and management requirements.

Ecological Requirements

The review resulted in a list of certification schemes, categorized in those with an existing REDII recognition, those under an application process, and those that are not recognized by the REDII. During our review, all our experts agreed that most of the biobased raw materials that can be used in the chemical and construction sector can be used in the bioenergy sector, most of the supply chains would face a lot of additional complexity if ecological sustainability requirements would be different for different purposes. The following explanations further justify this:

- In case differentiation of requirements would be needed, the existing base of certified supply chain would need to go through significant extra effort, to get an additional compliance certificate, in most cases even without knowing if “the buyers of the buyer” of their material is actually requiring this.
- The existing REDII certification systems (as well as local legislation and subsidy schemes such as SDE++) are known in the market and proven to work. Our assessment has not come across any requirements that are bioenergy-sector related, so we conclude they are non-sector specific, but are determining the sustainable sourcing of raw materials in general.

Following these justifications, only the below changes have been proposed:

- The description of the REDII indicators refer to "biofuels, bioliquids and biomass fuels", it is recommended to change this into "bio-based products"
- The addition of the two-fold Iluc indicators to the low ILUC-risk requirement

Both additions are included in bold in the excel file “Assignment Part 1_Review Ecological Requirements”.

On top of the above, first indications show that the REDII cut-off date to convert land with high-conservation values is differently implemented in forestry schemes. In part 2 of this report, it will be further investigated to propose a potential solution.

Management Requirements

The review of the management requirements resulted in the following changes:

- Table 10 of the Guidehouse report and the requirements of Annex III of RVO were combined in the spreadsheet. The color-coding (yellow, green blue) rows on the table cross refers to the bullets in RVO Annex III. Most of these are grouped under a new topic “reliability and accessibility of information”, while some others were included under the topic “management of audit” already present in Guidehouse report table 10.

- Under the topic “transparency of scheme operation”, an extra requirement on activity reports from the scheme was added, in line with Articles 5(2,4), 6, 17(7), Annex III of the REDII Implementing Regulation (EU) 2022/996. This report is set to be needed for initial and re-recognition cycles, to avoid the need for annual reporting, especially in the early years of the framework’s existence. Upon review of the results of this report, a more frequent reporting cycle may be required by the regulator. Schemes with annual activity reports made for REDII can use these reports to fulfill this requirement.
- Under the topic “Accreditation of certification bodies” a change is made to avoid that every certification body is required to have an ISO 14065 accreditation. This is a deviation from IR Article 11(1), proposed since this requirement is already not realistic for the CBs of REDII voluntary schemes, and will go way beyond what is required for non-REDII approved schemes. Alternatively, the CBs “shall comply to the GHG verification requirements of ISO 14065 where it performs audits on actual GHG values.”
- Under the topic “Supervision of the certification bodies and economic operators for voluntary schemes” the indicator is simplified, by taking the reference to “granting access” to the facility out. Experience under the REDII and the national authorities that want to get granted access to facilities all over the world shows clear indications that this is not enforceable in practice and could hamper the recognition process.

All above changes are marked in bold in the file “Assignment Part 1_Review Management Requirements”.

Assignment part 2

The objective of assignment part 2 was to create requirements for supply chain management in the “chain of custody”, in line with the model of the RED (article 30 and elaborations in the IR 996) as the RVO aims to develop a similar system with recognized certification schemes and those recognized under the RED may qualify for this as well. This included assessing the CoC requirements, planning and conducting stakeholder engagement in order to align the results with common practices, as well as an analysis of key certification schemes and supply chains. A table specifying the properties of different types of COC models is also provided. The table is in line with ISO/CD 13662:2024 (Annex C, standard in development) and ISO 22095 (on topics relevant for the scope of the Dutch duurzaamheidskader), and can be found in Table “CoC overview ISO norm v.Peterson” attached to this report.

As described in ISO 22095, mass balance refers to a CoC model in which materials or products with specific characteristics are mixed with materials or products without some or all of these characteristics. As a result of applying the mass balance model, a claim can be made on a part of the output, corresponding to a proportion of the input. ISO 22095 describes the key properties of the chain of custody models: identity preserved, segregated, controlled blending, mass balance, and book and claim. These commonly used chain of custody options are described below.

Identity preserved

In this CoC model, materials or products originate from a single source, and their specified characteristics are maintained throughout the supply chain.

Segregated

In the segregated CoC model, specified characteristics of a material or product are maintained from the initial input to the final output.

Controlled blending

In controlled blending, materials or products with a set of specified characteristics are mixed according to certain criteria with materials or products without that set of characteristics. This results in a known proportion of the specified characteristics in the final output,

Mass balance

In the mass balance model, materials or products with a set of specified characteristics are mixed or co-processed with materials or products without that set of characteristics, according to defined criteria. In this CoC model, the proportion of the input with specified characteristics will typically vary across different outputs.

Book and claim

In this model, the administrative record flow is not necessarily connected to the physical flow of the material or product in the supply chain. This type of CoC option is typically used when the certified material cannot, or only with difficulty, be kept separate from the non-certified material, such as renewable power in an electricity grid which also has power from non- renewable sources.

As the above definitions highlight, the chain of custody models have varying levels of strictness when it comes to what is allowed. The supply chain in question and market requirements can determine which CoC is most applicable. For example, the mass balance approach is often applied in supply chains where materials are combined to make new products and as a result of the process, materials become indistinguishable. If it is known that a certain amount of input with specific characteristics is in the system, it is nevertheless appropriate to pass forward those characteristics through this chain of custody model. This option is widely used across various industries, including among others the construction, chemicals, energy and plastics sectors.

In addition to market preferences, the selection of the most appropriate CoC model can also be done based on system requirements or regulatory requirements. For example, while the book and claim model is widely used in e.g. the aviation and energy industries due to its high flexibility and low barriers to entry, it is not considered an acceptable chain of custody method under RED II and various certification schemes, such as ISCC. It is therefore important to consider the characteristics and different requirements related to each chain of custody model.

The “CoC overview ISO norm v.Peterson” summarises the properties and quality criteria of the different COC options, in line with ISO/CD 13662:2024 (Annex C) and ISO 22095 (on topics relevant for the scope of the Dutch duurzaamheidskader).

Stakeholder Engagement

As part of the second part of the assignment, stakeholders were invited to contribute to the project by providing their feedback via expert interviews. This stakeholder engagement was conducted jointly with the RVO, utilising the networks of both Peterson and RVO. The expert interviews were all conducted by Peterson. Relevant companies from the chemical and construction sector were invited to contribute by giving their feedback. Annex I includes the Interview Protocol with the questions that have been asked. A summary of the replies is also included in the Annex. The goal was to ensure that the key aspects were being considered, and the findings would incorporate common industry practices. The outcome of the interviews was used as input and cross-check on the COC methodology reflection, as well as for the ten the supply chains descriptions and our analysis of the certification schemes. As such, the expert inputs formed the “reality check” for the assignment.

After aligning with RVO on the shortlist of experts to contact, company representatives were contacted via email in order to set up a one-hour online interview. If an expert was not available for an interview but still wanted to contribute to the project, they were also offered the option to provide their feedback in a written format. In total nine interviews with ten experts were

conducted, with six further experts providing their input in writing. The table below summarises whether the companies involved were active in the chemicals sector, construction sector, or both.

Table 1: Summary of Sectors of Companies involved in the Stakeholder Engagement

Company	Sector	
	Chemicals	Construction
Company 1		x
Company 2	x	
Company 3	x	
Company 4	x	x
Company 5		x
Company 6	x	x
Company 7	x	x
Company 8	x	x
Company 9	x	x
Company 10	x	
Company 11	x	
Company 12	x	
Company 13	x	x
Company 14	x	
Company 15	x	x

Summary of findings from stakeholder engagement

The stakeholder engagement offered some interesting insights into the current market practises. Firstly, as can be seen from Table 1, the majority of companies were active in both the chemicals and construction sectors. Indeed, even in cases where a company was primarily active in the chemicals sector, they indicated that the end products would often end up in the construction

sector. This was an interesting finding, as it highlighted the interconnective nature of the two sectors. The supply chain examples show the interconnection in both sectors, here we highlight the most relevant examples:

- Refined biobased oils, as well as biodiesel can be further processed in the chemical sector towards hard plastics for construction elements and roofing materials
- Aniline oil can be chemically processed to produce aramid, which can be used in reinforcement materials for the building sector.
- Companies producing renewable diesel/(bio)naphta can produce co-products, such as olefins that produce various hard plastics, foams and polystyrene, which can all be used in the construction sector as building or insulation material.

As part of the interviews, the companies were asked to review ten supply chains prepared as part of the assignment by Peterson, based on the initial suggestions from RVO which were adapted by Peterson with the industry practises in mind. The findings indicate that the majority of companies could relate to at least one of the chains; however, at times minor adaptations were needed to account for company or sector specifics. As part of the revision of the ten chains, the experts were moreover asked whether any further important chains should be added to the list. The majority of companies did not specify an additional chain which should be added. The answers to this question for those who specified that another chain should be included have been summarised below.

- There are two value chains missing: A chain where you have wood from secondary / not from primary forests, e.g. from landscape activities (pruning, trees chopped from highways et cetera, and a value chain for waste/recycled wood streams

- Used cooking oil could be included into a specific chain. It is very important for companies like ours that it is a part of it; we don't want to end up doing greenwashing if something is considered to be wrong with UCO. Also, vegetable oil or rapeseed oil could be added.

- The chains could be made broader. The option with paint would suit us, but paint is just one of the possible end products.

Overall, we have used the insights of the interviews to adapt the supply chains into a total set of 13 supply chains, which can be found below.

Review of example supply chains

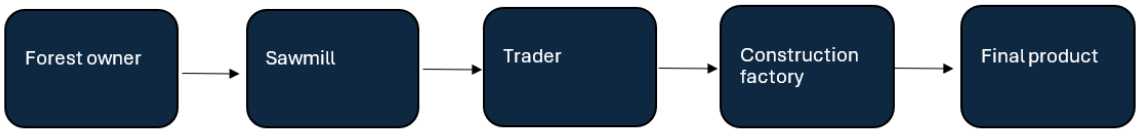
This section will present 13 supply chains relevant for the context of this project. These include the following chains:

1. A chain from wood from primary forests to timber frame construction or other innovative building elements

2. A chain of agricultural raw material such as hemp or flax to be used into building products, especially insulation materials
3. A chain of maize/sugarcane processed outside the EU into liquid chemicals from which paint is produced (in NL)
4. Supply chain example 4: A chain of ethylene or ethanol from Brazil that is made into a bioplastic
5. A chain mixing bio feedstock and fossil feedstock. E.g. fossil/bio blend ethylene pipeline.
6. A chain of palm oil from Malaysia, ending up in shampoo/cosmetics.
7. A chain in which bio feedstock and fossil feedstock enter into a chemical reaction to produce a new material
8. A biodiesel plant producing refined oils and biodiesel used for further processing in the chemical sector for applications such as roofing materials in the construction sector.
9. Co-products from a bioenergy refinery that are used by the chemical sector to produce hard plastics, foams, insulation materials
10. A chain in which bio feedstock is partly or fully replacing fossil feedstock to produce products of similar, high quality compared to products made of virgin fossil feedstock
11. An energy utility producing heat and electricity with up to 100% biobased materials, producing fly ash and bottom ash for the construction sector
12. The production of steel where the use of coal shall be phased out, resulting in steel with only biobased carbon
13. Using grass to produce biocoal for various applications in the chemical and construction sector.

For every supply chain above, we have described the different steps, chain of custody options, and common certifications, including a typical supply chain flowchart. This is summarized with a table at the end of each section, which also confirms the first and last company in the certified supply chain.

Supply chain example 1: A chain from wood from primary forests to timber frame construction or other innovative building elements



For this supply chain type it is clear that sustainable forest management certification such as FSC and PEFC are key to assure sustainability criteria. These schemes are recognised by the market already in the construction sector, and its forest management criteria are endorsed by other schemes:

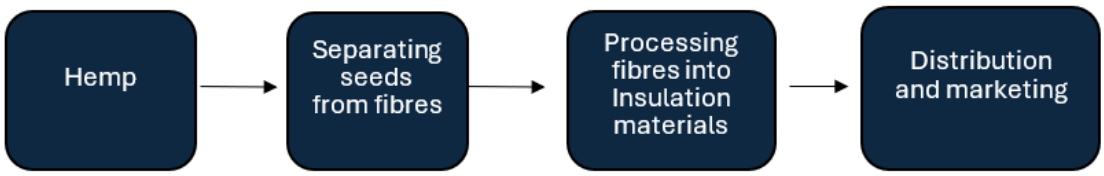
1) Sustainable Biomass Program has adopted FSC/PEFC criteria and applied these in a bridging document for the material to become RED compliant for the bioenergy sector
2) Nordic Swan, EU Ecolabel, Blue Angel for the use of FSC/PEFC certified input material in their ecolabelling

Looking at the ecological requirements from the REDII, compatibility can be expected with PEFC, since that scheme is in the process to get a REDII approval. Since that is not the case, a detailed assessment has been done to compare FSC's sustainable forest management requirements with those of the REDII. Considering the presence of the FSC scheme, it is recommended to take that outcome into account in the final definition of ecological requirements for the biobased product framework in the Netherlands. In line with this, also the chain of custody methodology of FSC is relevant to take into account.

Supply chain example 1			
Typical certification schemes	COC-options	First certified scope	Last certified scope
FSC	Segregation and a mixed percentage claim with controlled wood	Forest management certification, group of landowners under one certificate	Company distributing the final product on the market
PEFC	Segregation and a mixed percentage claim with controlled wood	Forest management certification, group of landowners under one certificate	Company distributing the final product on the market

Supply chain example 2: A chain of agricultural raw material such as hemp or flax to be used into building products, especially insulation materials

This is a clear example where traditional insulation materials such as polystyrene can be produced by fibre coming directly from agricultural raw materials. The supply chain roughly looks as follows:



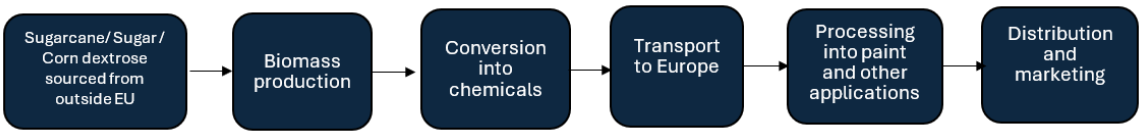
Among the stakeholders that responded to our engagement process, there was unfortunately nobody who was active in this supply chain. Based on our own experience and research, we found that such supply chains can also make a claim under the "Stichting Nationale

Koolstofmarkt" (SNK) where the lower CO2 footprint of this material is recognised and upon application of the material, carbon credits can be issued. More information regarding the hemp methodology of SNK can be found on their website Hennep voor langdurige koolstofopslag – Stichting Nationale Koolstofmarkt. Although this is a carbon credit compensation scheme, it shows that for these products other incentives than biobased certification schemes are already in place, which is relevant to consider as market incentives. These insights gained on this type of supply chain need further investigation, it is clear that also other initiatives work towards incentives for the use of alternative raw materials.

Supply chain example 2			
Typical certification schemes	COC options	First certified scope	Last certified scope
These products are eligible under ISCC	Segregation possible	Farm/Group of Farms /First gathering point	Company that installs the material in the building (where the proof of material replacement is made)

Supply chain example 3: A chain of maize/sugarcane processed outside the EU into liquid chemicals from which paint is produced (in NL).

One example of such a supply chain would include the following steps: Sugarcane from outside of Europe, e.g. from Thailand or Brazil, or corn dextrose from the US is sourced. Biomass is produced outside of Europe, converted to a chemical outside of Europe, transported to Europe where it is processed and included in final products. The final application could be paints but also agrochemicals, homecare (furniture), personal care, food, feed, pharmaceuticals, or bio-based polymers.



When it comes to sugarcane, Bonsucro is the most widely used certification scheme. The end products can typically also be e.g. ISCC Plus certified.

Bonsucro follows a mass balance approach for tracing Bonsucro certified claims in the supply chain.

The chain of custody options accepted under ISCC Plus include physical segregation, mass balance, and controlled blending.

Two types of physical segregation are possible: identity preservation or Hard IP, as well as physical segregation or Soft IP. Under identity preservation or Hard IP, the physical mix of non-sustainable and sustainable material is not allowed. Moreover, sustainable materials with different sustainability characteristics (e.g. origin of raw material, GHG emissions et cetera must be kept physically separate throughout the supply chain. Physical segregation or soft IP is also not allowing the physical mix of non-sustainable and sustainable material, but the physical mix of sustainable materials with different sustainability characteristics (such as different GHG values) is allowed.

ISCC Plus distinguishes between four types of mass balancing options, namely attribution determined by mass, attribution determined by energy, trace-the-atom, and 12C/ 14C isotope measurement.

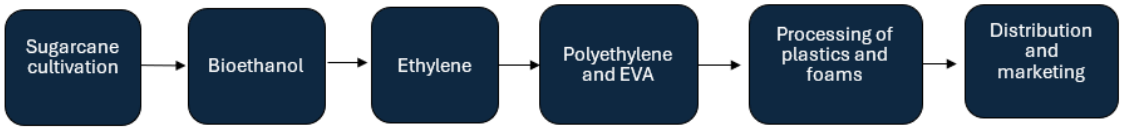
Besides physical segregation and mass balance, controlled blending is the third Chain of Custody option available under ISCC PLUS. Controlled blending refers to a planned blending regime resulting in constant and verifiable content of bio, circular and renewable feedstock in the final product. Blending is obtained by mixing the feedstocks or products without a chemical or biological reaction.

The first certified party for such an agricultural value chain will typically be the first gathering point, and the last one the trader/storage. Conversely, for any supply chain using waste or residue, the first certified scope would be the collecting point.

Supply chain example 3			
Typical certification schemes	COC options	First certified scope	Last certified scope
ISCC Plus/Bonsucro	Mass Balance (with different allocation models that can be equal to controlled blending), Physical Segregation	First gathering point	Trader/ Storage, entity that brings the product on the market

Supply chain example 4: A chain of ethylene or ethanol from Brazil that is made into a bioplastic.

In this supply chain example, bioethanol made from sugarcane is purchased and converted into ethylene. This bio-based ethylene can then be used to produce polyethylene and EVA. Through processing, the material can be converted into products used in a wide range of applications, including packaging and foams for the construction sector.



For this type of supply chain, Bonsucro is by far the largest for sugarcane and ISCC+ is the largest for other materials. RSB is another a relevant certification scheme.

Bonsucro accepts mass balance as a chain of custody option. The chain of custody options accepted under ISCC Plus include physical segregation, mass balance, and controlled blending. Finally, under RSB the following mass balance options are accepted: Identity Preserved, Product Segregation, Mass Balance, Content Ratio Accounting and Book & Claim.

RSB provides five different options for the chain of custody system that shall be put in place: Identity Preserved, Product Segregation, Mass Balance, Content Ratio Accounting and Book & Claim.

Supply chain example 4			
Typical certification schemes	COC options	First certified scope	Last certified scope
ISCC EU/Plus / Bonsucro	Mass Balance (with different allocation models that can be equal to controlled blending), Physical Segregation	First gathering point	Trader/ Storage, entity that brings the product on the market
RSB	Identity Preserved, Product Segregation, Mass Balance, Content Ratio Accounting and Book & Claim.	First gathering point	Trader/ Storage, entity that brings the product on the market

Supply chain example 5: A chain mixing bio feedstock and fossil feedstock. E.g. fossil/bio blend ethylene pipeline.

Multiple companies expressed that they mix/blend products, but in most cases, this also involves chemical processing. Therefore, we have no specified flowcharts listed under this chain. The chain of custody options for blending products are however not different from those where fossil and bio are chemically reacting. When it comes to making a claim on only the bio content, there are a few challenges relevant here that is also known from the bioenergy sector:

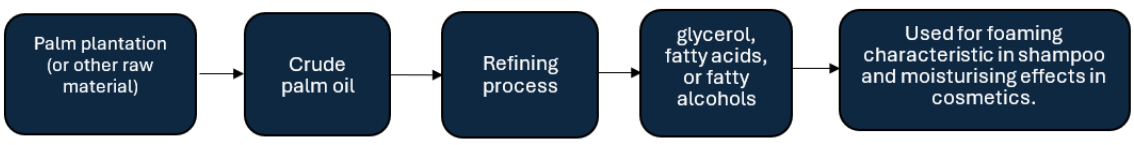
- Blending mostly happens on large terminals with pipeline networks to distribute product from the jetty (where the vessel barges (off)load). Pipelines connect tanks, but always keep left-over product. This means that with every pump-over activity, the ratio of fossil-bio that has been measured in a batch, can change.
- blending does not automatically result in a homogeneous mix, which means that companies that only blend may need an extra proof that their mix was homogeneous, or a C12/C14 analysis may need to prove this.

Both above challenges show that handling of the product may change the ratio of fossil and bio in the mix. Assuming that free allocation of characteristics is rather only applied within the bio component of the mix, it has to be taken into account that this brings uncertainties in the supply chain when this bio component may vary over various unavoidable handling activities, such as pump overs. Since most certification schemes do currently not demand to do an analysis of the fossil-bio ratio, this may not even be known in every different step.

Supply chain example 5			
Typical certification schemes	COC options	First certified scope	Last certified scope
ISCC EU/Plus	EU: Mass Balance, (Physical Segregation) Plus: Mass Balance (with different allocation models that can be equal to controlled blending), Physical Segregation	First gathering point or collecting point	Trader/ Storage, entity that brings the product on the market

Supply chain example 6: A chain of palm oil from Malaysia, ending up in shampoo/cosmetics.

This supply chain example is solely connected to the chemical sector. In our interview respondents we had no palm oil processor or shampoo producer. Based on our own expertise, a simplified flowchart is shown below. Our responses from interviewed experts, is that most of them try to avoid palm oil due to the challenges around its perception and the risk on (indirect) land-use change, already addressed in the REDII for the energy sector. Those companies active in multiple sectors (plan to) avoid the raw material completely. Therefore, emphasis was given that palm oil is not the only raw material that can be used, despite the fact that due to high yields it has good availability, and it is chemically ideal and easier to refine.

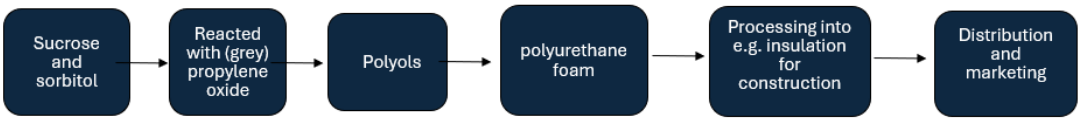


The low iluc-risk certification setup from the REDII is most relevant for this supply chain example. As mentioned previously, the experience in practices with companies achieving this certification is still limited. For all other REDII related requirements, this supply chain is used to the requirements from the REDII, so no other challenges in the adoption to expect. Mass balance will be the primary way to get this material certified, and under RSPO the book and claim method is often used.

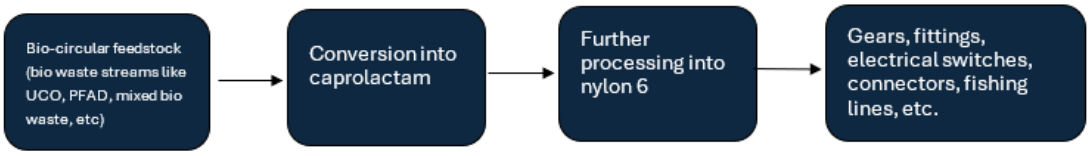
Supply chain example 6			
Typical certification schemes	COC options	First certified scope	Last certified scope
ISCC EU/Plus	EU: Mass Balance, (Physical Segregation) Plus: Mass Balance (with different allocation models that can be equal to controlled blending), Physical Segregation	Plantation / First gathering point	Trader/ Storage, entity that brings the product on the market
RSPO	Typically mass balance, or book and claim	Plantation	Trader/ Storage, entity that brings the product on the market

Supply chain example 7: A chain in which bio feedstock and fossil feedstock enter into a chemical reaction to produce a new material.

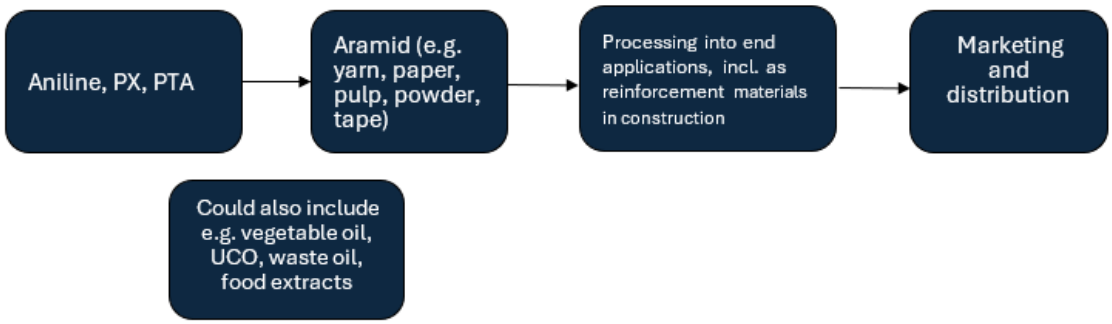
This supply chain example is relatively broad and based on our expert interviews various flowcharts have been created. The first flowchart shows sucrose and sorbitol are used as initiators in polyols. This means they are then reacted with (grey) propylene oxide (PO) to form polyols which in the next step is used to make polyurethane foam, often for insulation for construction. Some oils can be used directly as polyols or blended with other (grey) components to make formulations. UCO based aromatics can replace fossil aromatics, on a mass balance basis. A typical certification that could be applied to such a chain would be ISCC Plus. These chemical reactions between fossil and bio inputs are normally referred to as “co-processing”. In such cases free attribution of characteristics would not be allowed, as the attribution shall happen based on the chemical reaction. After comparing the requirements of this attribution method under ISCC Plus, Peterson comes to the conclusion it is the same as referred to as “controlled blending” in ISO22095:2020.



Below, another example is given where mass balanced bio-circular material is used. This can be bio waste streams such as used cooking oils, PFAD, mixes bio waste-based feedstock. These are converted into caprolactam, which is the main building block to produce nylon 6. Nylon 6 can, among other applications be used in gears, fittings, electrical switches, connectors, all relevant in the construction sector. ISCC Plus is again a typical certification scheme to be applied for such a chain.



Another example is given below, coming from a supply chain that is producing aramid for the spinning of yarns that can be used in various applications such as the reinforcement materials in the construction sectors. As input materials, Aniline, PX and PTA are often used, but the oil-based materials could be fossil, circular, but also include vegetable oils, UCO or other waste oils. ISCC Plus is a common scheme here as well, typically on a mass balance basis.



All the above flowcharts have in common that the fossil component from a practical perspective can be replaced, but in all cases this adds costs and the companies face a lack of interest so far in their customer base. Based on the expert interviews, mass balance was currently the preferred

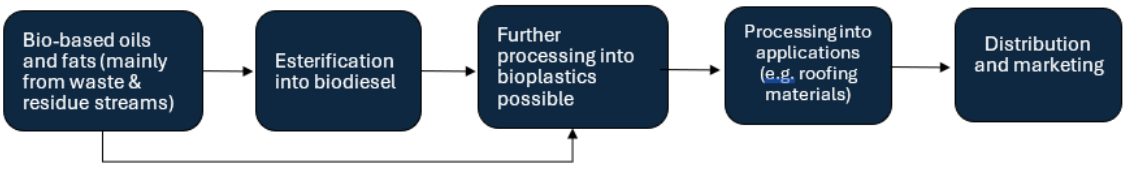
chain of custody option, although it was put forward by interviewees that adaptations can be made in the future towards stricter CoC methods, if the market demand is there.

Supply chain example 7			
Typical certification schemes	COC options	First certified scope	Last certified scope
ISCC Plus	Mass Balance (with different allocation models that can be equal to controlled blending), Physical Segregation	First gathering point or collecting point	Trader/ Storage, entity that brings the product on the market

Supply chain example 8: A biodiesel plant producing refined oils and biodiesel used for further processing in the chemical sector for applications such as roofing materials in the construction sector.

This supply chain has similarities to example 7, however it is worth mentioning that biodiesel plants have the option to either sell their refined biobased oils, as well as their biodiesel (this same oil with the esterification process. See the specific supply chain chart below. It has to be mentioned that this is a clear example where the applications in chemical and construction sectors will compete with the revenue model incentivized by the REDII directive. Potential certifications for biodiesel for the energy sector include ISCC EU.

Under ISCC EU, physical segregation and mass balancing are accepted as chain of custody options. Two types of physical segregation are possible: identity preservation or Hard IP, as well as Bulk commodity or Soft IP. Unlike ISCC Plus, ISCC EU does not allow for controlled blending as a chain of custody option.

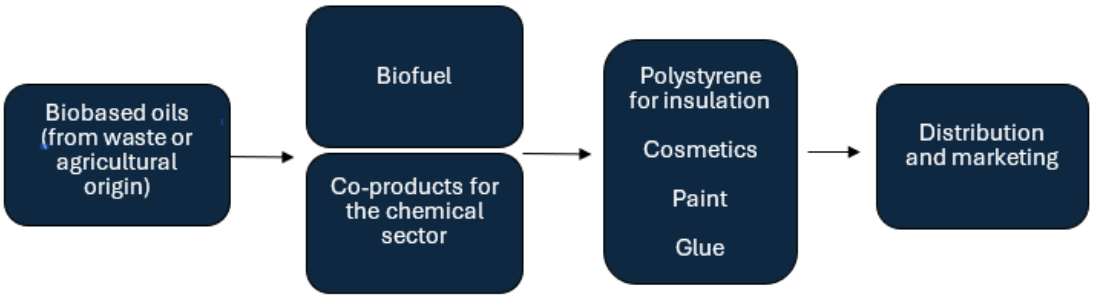


Supply chain example 8			
Typical certification schemes	COC options	First certified scope	Last certified scope

ISCC EU/Plus	EU: Mass Balance, Physical Segregation Plus: Mass Balance (with different allocation models that can be equal to controlled blending), Physical Segregation	Collecting point	Trader/ Storage, entity that brings the product on the market

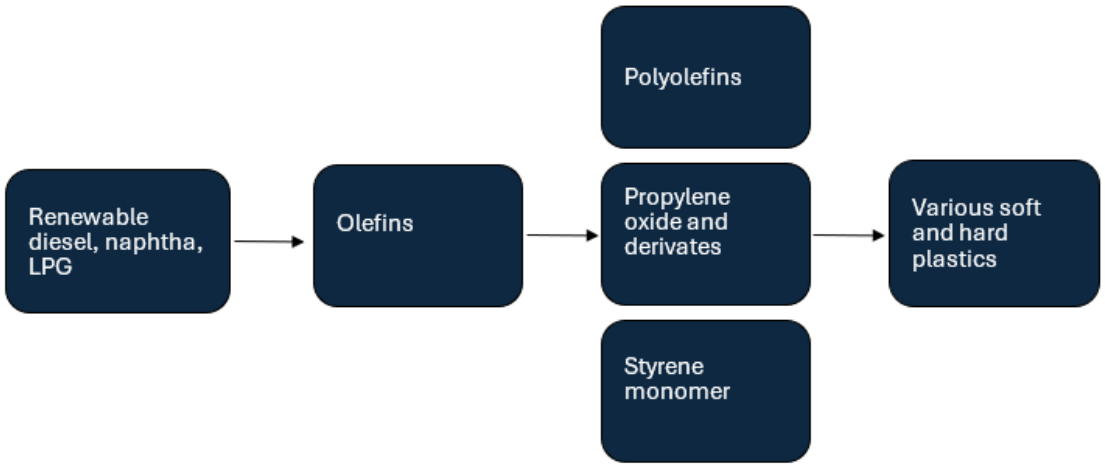
Supply chain example 9: Co-products from a bioenergy refinery that are used by the chemical sector to produce hard plastics, foams, insulation materials

In various expert interviews, a link with this supply chain came up. We have created two different flowcharts. The first one below indicates that the start of such a chain can come out of a biorefinery, where in a later step, biofuel is produced with co-products for the chemical sector. These can end up in insulation, cosmetics as well as paint or glue, i.e. various applications related to the construction and chemical sector. For such a chain, ISCC Plus would be a typically used certification scheme, with mass balance (free allocation) a typical CoC option.



The second flowchart below shows that this supply chain can also start at a later step, after the a final energy product is produced. The olefins coming out of this product can in multiple steps be converted into various soft and hard plastics. For polymers and chemicals, ISCC Plus would be a

typical scheme, whereas for fuels ISCC EU would be the most relevant option.



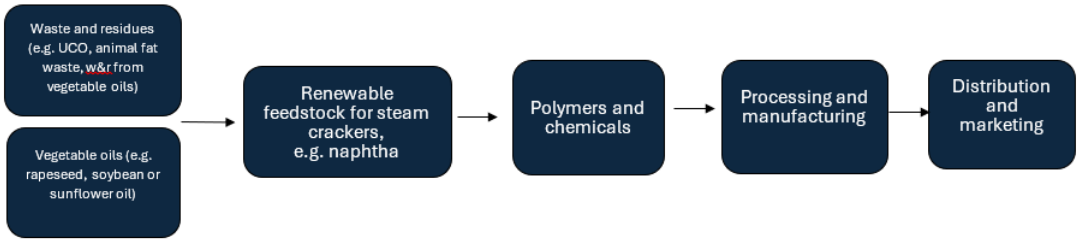
The above supply chain types are closely related to bioenergy and often ISCC Plus or REDcert2 certified. The alignment of ecological requirements with the REDII is therefore expected to fit the needs of these chains. When it comes to chain of custody, the mass balance approach is applied, but with extra flexibility around the accumulation of credits without physical stock, as well as the credit transfer between different sites without physical movement of the product.

Supply chain example 9			
Typical certification schemes	COC options	First certified scope	Last certified scope
ISCC EU/Plus	EU: Mass Balance, (Physical Segregation) Plus: Mass Balance (with different allocation models that can be equal to controlled blending), Physical Segregation	Collecting point	Trader/ Storage, entity that brings the product on the market

Supply chain example 10: A chain in which bio feedstock is partly or fully replacing fossil feedstock to produce products of similar, high quality compared to products made of virgin fossil feedstock.

This supply chain example is another variation on that what has been presented in chains 7, 8 and 9, with the main difference that it shows that the technical potential is there to fully replace a fossil naphtha based supply chain to produce polymers for the chemical sector into a bio-based chain using vegetable oils (from agricultural origin, or waste/residues). Multiple experts have confirmed the feasibility, but the demand to transform these supply chains is still very little,

meaning in most cases only pilots are executed with small portions in the chemical mix. This shows as well that mass balance with extra flexibility will help to increase attractiveness, as well as assuring that the end users of this sector have the incentive to use bio-based raw materials, in a similar way as the bioenergy sector. Again, ISCC (EU or Plus) would be a typical certification scheme applicable for such a value chain.

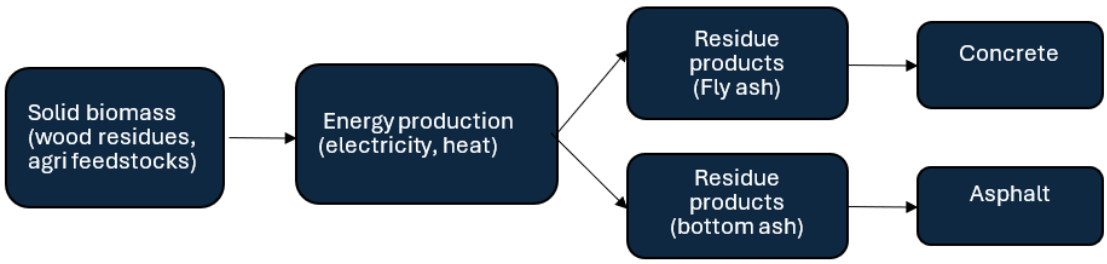


Supply chain example 10			
Typical certification schemes	Typical COC options	First certified scope	Last certified scope
ISCC EU/Plus	EU: Mass Balance, (Physical Segregation) Plus: Mass Balance (with different allocation models that can be equal to controlled blending), Physical Segregation	Collecting point	Trader/ Storage, entity that brings the product on the market

Supply chain example 11: An energy utility producing heat and electricity with up to 100% biobased materials, producing fly ash and bottom ash for the construction sector.

This supply chain example came up from experts from large utilities producing electricity and heat. Same as the liquid bioenergy market, these chains are already incentivized to replace their fossil input (coal) with a biomass component. In the Netherlands, the SDE++ framework is incentivizing this transition. There are also residues coming out of these utilities: fly ash, bottom ash and plaster. Specifically the first two could be seen as bio-

based residues, especially when 100% of the input of the utility is from biomass. These products come out of the utility separately and already have applications in the building sector, fly ash for the production of concrete and bottom ash for asphalt. Here, relevant certification schemes could include GGL, SBP, Better Biomass (raw materials can originally be FSC, PEFC, SFI), Sure, and ISCC.

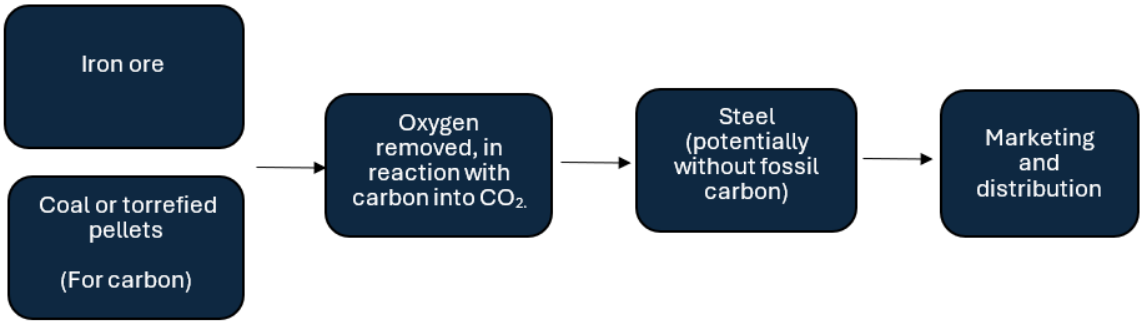


Supply chain example 11			
Typical certification schemes	Typical COC options	First certified scope	Last certified scope
GGL	Mass balance	First gathering point or collecting point	Trader/ Storage, entity that brings the product on the market
SBP	Mass balance,	First gathering point or collecting point, covered under the supply base evaluation	Trader/ Storage, entity that brings the product on the market
Better Biomass	Segregation, Mass Balance	First gathering point or collecting point	Trader/ Storage, entity that brings the product on the market
Sure	Mass balance	First gathering point or collecting point	Trader/ Storage, entity that brings the product on the market

Supply chain example 12: The production of steel where the use of coal shall be phased out, resulting in steel with only biobased carbon.

This supply chain has been added after talking to an expert in the steel industry, which we considered very relevant for the construction sector. Steel production is traditionally done with iron ore and coal. A chemical process under high temperature is producing steel. The coal is used for the heat, as well as to chemically remove the oxygen in the iron ore in a reaction where the carbon and oxygen react and form CO_2. Some of the carbon from the coal also remains in the

steel. Replacing the coal for a biomass input can work in the steel industry, similar as in the heat/electricity utilities, with the exception that the biomass needs to be torrefied to have a high enough energy content. In this replacement process, the steel industry is looking at other energy sources to reduce their footprint, but they will still need a source of carbon for the chemical reaction process. This could be done with the torrefied pellets, which will then cause the potential to use a bio-based claim on the steel. This will however be a relatively small portion but could still result in steel with a claim being produced "without fossil carbon". Relevant certification schemes include SBP and Sure.

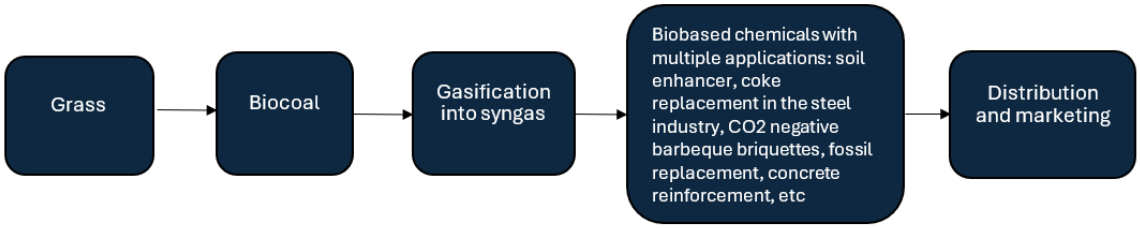


Supply chain example 12			
Typical certification schemes	Typical COC options	First certified scope	Last certified scope
SBP	Mass balance,	First gathering point or collecting point, covered under the supply base evaluation	Trader/ Storage, entity that brings the product on the market
Sure	Mass balance	First gathering point or collecting point	Trader/ Storage, entity that brings the product on the market

Supply chain example 13: Using grass to produce biocoal for various applications in the chemical and construction sector.

This supply chain has some similarities with example number 2 but uses grass as central raw material. The grass is converted into biocoal that turns into syngas after a gasification process. This can be used to produce biobased chemicals with various applications, such as a soil enhancer, coke replacement in steel (link to example number 12), the production of barbeque briquettes, and concrete reinforcement. Up to the production of syngas, this supply chain is separated, after that the application of mass balance is required depending on the exact

application used. Relevant schemes include Verified Carbon Standard (VCS), Green Gold Label (GGL), Sure, and Better Biomass. Similar as with our reference to SNK under supply chain example 2, we also choose to mention VCS as a carbon credit scheme here, since it is used by such supply chains as an incentive to build their business model on.



Supply chain example 13			
Typical certification schemes	Typical COC options	First certified scope	Last certified scope
VCS	Carbon crediting (e.g. book and claim)	Project level, covering the area the grass is produced up to the final processing	NA
GGL	Mass balance	First gathering point or collecting point	Trader/ Storage, entity that brings the product on the market
Sure	Mass balance	First gathering point or collecting point	Trader/ Storage, entity that brings the product on the market
Better Biomass	Segregation, Mass Balance	First gathering point or collecting point	Trader/ Storage

Review of relevant certification schemes

This section reviews the certification schemes which are used in the above chains. Peterson has determined the relevant schemes based on in-house expertise, as well as input from the interviews of the economic operators as part of this project. The outcome of this is that the relevant certification schemes can be clustered in either being REDII recognized (or in the process) and schemes that are not REDII recognized. Specifically for the latter category, more focus has been given to assessing the similarities and differences in their chain of custody models.

We have categorized the schemes accordingly in “REDII recognized schemes” and “Other relevant schemes” to present the findings in separate tables between schemes with a REDII recognition and those without this recognition. For the individual assessment of these schemes, we refer to the Certifications & Eco-labels: Detailed Factsheets - SustCert4Biobased Project, in which Peterson’s project team has supported.

Based on Peterson’s experience and the expert interviews, the CoC options have been categorized in accordance with ISO22095:2020. The green colour confirms that the scheme allows for this method, the red colour confirms this option is not allowed.

Certification scheme		**Hard IP**	**Soft IP**	**Controlled Blending**		**Mass balance**		**book and claim**
		Identity preserved	Physical seggregation	claim only based on real % in actual mix (averaging allowed)	RED II compliant	accumulation of credits	Credit transfer between sites	end-to-end without chain of custody
Schemes with a REDII approval (ISCC EU, REDcert EU, RSB EU etc.)								
ISCC Plus								
REDcert2								
RSB Global - advanced products								
Nordic Swan								
FSC								
GRS								
BCI								
Blue Angel								
EU Ecolabel								

The above categorization of CoC models and the schemes reviewed can be used as a fist indication which of the models is currently used. One of the challenges here is that the schemes use their own terminology which may cause confusion on which model they do allow and which not. As an example: ISCC Plus specifies 4 different mass balance models and refers to the “molecular approach” and “trace-the-atom” and using a “C12/C14 analysis” for actual determination/measurement of the sustainable/biobased share. By the ISO definition, these methods would rather be classified as “controlled blending”. The examples under supply chain 7 give more details/practical examples. It shows that in practice, the controlled blending CoC method can be used where fossil and bio components are mixed, but that within the bio component, the mass balance with free attribution can be applied.

Since the level of detail in the ISO 22095 is limited, a review of the draft ISO 13662:2024 has been done to see if potential harmonization with the combination of both standards can be a way forward. This resulted in the following observations:

- The draft ISO 13662 describes the relevant items that shall be defined in mass balance requirements very detailed. It sets however not the requirements itself, but describes what the “requirement setter” (e.g. a regulator or certification scheme) has to decide upon, as well as what an economic operator (referred to as “organization active in the chain”) shall comply to as a consequence of definitions set by the requirement setter.

- The standard is describing the different CoC models in the order of strictness in which the administrative traceability is connected to the physical molecule. Within the mass balancing method, the different attribution options are listed but without making a decision or hierarchy in what requirements in mass balance are more robust than others. It requires thorough documentation that proves the implementation of the requirements that are set but does not guide what requirements are more stringent than others. As an example, REDII mass balance approach is clearly defining a mass balance location to be with the boundary of an address, and any storage or processing on a different address would require a separate mass balance administration. This ISO standard describes that requirement setters shall define what is considered within the geographical boundaries and also if balancing among multiple of these sites is allowed. RED has excluded this as an option, and ISCC Plus does stick to site-specific balancing, but allows for credit transfers between sites. This could be seen as a multi-site balance, but then with clearer traceability of internal credit transactions.

- The standard is setting a framework on connecting the selected mass balance requirements to claims, being transparent and accurate, also on this topic there is no hierarchy presented on what is a hierarchically better claim.

Our overall conclusion is that this draft standard can become helpful to requirement setters to define mass balance requirements, but it is not classifying the robustness of the options that a standard setter can require. In our reflection of the CoC requirements we suggested that schemes do not necessarily need to follow the exact definition of the ISO standards, but shall submit a reference table that show how their CoC options are applied and how they link to the definition of these ISO standards to assure alignment is provided. This will also make the ISO standards better known by the schemes and will increase the chance of further harmonization with the content of these ISO standards in the future.

REDII recognised schemes: ISCC, REDCert, RSB, Bonsucro, RTRS, SURE, SBP, Better Biomass

Assessment topic	Outcome
What are the first and last items typically certified by certification schemes in these chains?	In all these schemes it starts with raw materials coming from agriculture, forestry or from waste/residues. Some of these schemes also allow non-bio-based residues. Some schemes focus on specific raw materials (Bonsucro on sugarcane, RTRS on soy, SBP on woody biomass), others are open to all materials, mostly specified in their materials lists. These schemes have in common to have a REDII recognition, which shows eligibility with these requirements. The end point of these chains can however also be in feed, food, or bio-based markets outside energy. Our interviews with stakeholders made clear that most of the material ends up in the bio-energy sector, since there the final market has clear incentives. Initiatives in other sectors are still in the pilot phase, when looking to the volumes of certified materials.
What scopes are relevant (farmer, producer, trader etc.)?	Raw materials: Agricultural/forestry: Farm/plantation and first gathering point. Waste/residues: Point of origin and collecting point Intermediate and final products: Processing Unit (can be Oil Mill, Crushing Plant, Refinery, PET plant, Polymerization plant, Mechanical of Chemical Recycling Plant, Cracker, etc.) Trader (with storage) Logistics Centre Warehouse Final Product refinement: Companies conducting - Blowing or forming from a preform (if the process does not use a preform, the scope processing unit is necessary) - Cutting - Labelling - Assembling - Printing - Sealing

	- > Filling
What claims are allowed (1 claim or multiple variants)?	**Sustainability claim** The schemes mainly use their scheme name to claim that the product is certified against its standard. The REDII recognition obliges them to also cross-recognize each other (exceptions are allowed when justified). This means that REDcert certified companies can sell to ISCC certified companies. The ISCC certified company can then sell the product as RED compliant (as ISCC compliance was not possible due to the different certification of their supplier). **Product related claim** Sustainability declarations will include the original raw material. Some schemes go beyond that and confirm the status of the product, specified in a bio-based, circular based or bio-circular based content claim. **CoC claim** Schemes that allow different CoC options require the CoC method used to be mentioned on the sustainability declaration. Going from a stricter to a less strict option is allowed It therefore is confirmed how the chain of custody of the product has been till the last transaction.
Which COC methodologies are typically applied in this chain (Preferably in terms of terms of ISO 22095:2020)?	See list of schemes with all COC models.
Is it always clear from the POS delivery documents which methodologies have been used by the relevant certified market party?	This depends on the requirements of the schemes, documents declaring the sustainability characteristics evolve over time and shall include characteristics that are deemed relevant for the claim of the final product. There were schemes allowing for different CoC options, it only makes sense that this information is provided, and there should not be something in the way for a framework like this one from RVO to require that.
What are common allocation methods among the different market parties in the chain?	Free allocation is the most popular method based on our experience and the interviews. It has to be taken into account that free allocation also has limitations in processing units to what actually can physically end up in the final product. This reduces the risk that sustainable share is allocated on fossil components. Controlled blending is used in cases where a consumer facing claim shall confirm an actual biobased sustainable share. It has to be noted that some schemes refer to this differently (example: in ISCC Plus this is referred to as mass balance allocation based on molecular approach).

How do schemes deal with mass balance periods, multi sites, credits transfer etc.?	Mass balance requirements of these schemes are linked to the REDII; therefore they are normally 3 months long. For the non-REDII requirements these are in most cases dealt with more flexible, the below points describe the most important differences: - REDII has **aligned MB periods with the quarters** but allows MB of 12 months for raw materials, outside the RED the 3-month period can start/end flexible - **Credit transfer to the next MB period:** REDII only allows transfer of sustainability credits to the next period, if there is physical stock. Non-REDII schemes deal with this differently, and in most cases allow credit accumulation without presence of physical stock. - **Credit transfer between sites:** The REDII only allows credit transfer between sites, when the product is physically moved. It is causing a closer link with reality but causes extra physical movements (that cause emissions). Some schemes therefore allow for credit transfer between sites without physical movement, as long as all sites are certified and the product/credit remains in the same ownership (e.g. no credit trading, which makes this still stricter than book and claim).
What are common methods prescribed by certification schemes to determine biogenic content?	REDII supply chains are commonly bio-based until the moment they are blended in the fossil fuel (with exception of co-processed fuel). Biogenic content determination is therefore only relevant for the parts of the chain where there is a mix with fossil material. Most schemes offer various solutions, and for their non-REDII recognized requirements the methods are less strict. There where various solutions are possible, the methods used shall be mentioned on the scope certificate as well as on the sustainability declaration, to assure transparency and to assure that the method stays on an equal level or down-grading is applied (and to avoid up-grading).
An assessment of the robustness of these methodologies, both when it comes to the sustainability claims of the biogenic part, and when it comes to the biogenic share in a mix with fossil.	There, where various solutions are possible, this creates additional complexity in the supply chains. The methods used shall be mentioned on the scope certificate as well as on the sustainability declaration, to assure transparency and to assure that the method stays on an equal level or down-grading is applied (and to avoid up-grading).

Other relevant schemes: FSC, BCI, Blue Angel, EU-Ecolabel, Nordic Swan

Based on the detailed scheme assessment, it became clear that of all these schemes, FSC is a very relevant one as it is endorsed by Blue Angel, EU-Ecolabel and Nordic Swan. BCI is as a scheme considered, but in practice we have not encountered any initiative using cotton in the chemical or construction sector. Our advice is therefore to not take that scheme into account.

The other schemes will to a large extent depend on the possibility of FSC to be approved under this framework. For the management criteria, our high-level assessment indicates good potential for those schemes, but the fact that they endorse FSC and other schemes for the raw material certification, may become a challenge. In the below table, we therefore specifically address the topic of endorsement in the relevant assessment topics.

Assessment topic	Outcome
What are the first and last items typically certified by certification schemes in these chains?	Apart from FSC and BCI, these schemes are more in the specialty products, certifying end products in the plastics, construction, woodworking, textiles, paper and chemicals sector. Most of these schemes accept the input from the schemes that focus on the biobased commodities, therewith endorsing their ecological and chain of custody requirements.
What scopes are relevant (farmer, producer, trader etc.)?	FSC and BCI cover the full chain and go back to the original raw material producer (forest manager and farmer respectively). The other schemes endorse raw materials from other schemes.
What claims are allowed (1 claim or multiple variants)?	The systems all use mass balance related claims and follow the methodology of the schemes they endorse such as FSC, RSPO, ISCC, FSA.
Which COC methodologies are typically applied in this chain (Preferably in terms of terms of ISO 22095:2020)?	The schemes cover the full supply chain. The schemes Blue Angel, EU Ecolabel and Nordic Swan cover the small segments in most cases endorse the chain of custody methods of the large schemes that cover certain commodities, such as FSC, RSPO, ISCC, FSA.
Is it always clear from the POS delivery documents which methodologies have been used by the relevant certified market party?	This is a point of attention, particularly since the endorsement of raw material schemes do in most cases do not stipulate in detail, how sustainability characteristics shall be transferred in the sustainability declaration.
What are common allocation methods among the different market parties in the chain?	Most companies with these schemes use free allocation methods, for FSC and when FSC raw material is used under the other schemes, an average percentage claim is used as per FSC CoC model, but only with controlled wood. This gives clear limitations to mix with fully non-certified materials.
How do schemes deal with mass balance periods, multi sites, credits transfer etc.?	Mass balances are site specific, like required in the REDII, the topic of allocation is different for FSC and standards endorsing the FSC scheme

What are common methods prescribed by certification schemes to determine biogenic content?	In most cases the schemes address only fully biobased materials, there where a mix is allowed, this is based on a percentage claim.
An assessment of the robustness of these methodologies, both when it comes to the sustainability claims of the biogenic part, and when it comes to the biogenic share in a mix with fossil.	Where various solutions are possible, this creates additional complexity in the supply chains, specifically there where endorsements are made for schemes covering the raw materials. The methods used shall be mentioned on the scope certificate as well as on the sustainability declaration, to assure transparency and to assure that the method stays on an equal level or down-grading is applied (and to avoid up-grading).

Reflection on the alignment of ecological requirements with non-REDII schemes

FSC is indirectly most ecological requirements from the REDII, but in almost all cases it is not exactly matching the REDII requirement. This may be one fundamental reason why FSC never formally applied to become RED recognized. The other schemes in the above table do not refer to this as they leave it to schemes covering raw material (such as FSC) to define this.

It is relevant to reflect why sustainable forestry schemes such as FSC have different requirements when it comes to land use. Principally, these schemes are there to protect the forest, and the certification of this forest is ensuring sustainable forest management without land use change but enabling the use of wood from this forest. The RED is initially created for other commodities, that mostly come from agricultural production, therefore the RED must look at land use change, in perspective of the moment when the land was converted to agricultural land. It is therefore advised that the Dutch legislation distinguishes its sustainability requirements for agricultural and forestry products, whereby FSC and PEFC or equivalent standards can be accepted for areas where certified wood is produced. This recommendation is also based on the clarity on this topic from the expert interviews, as well as our experience in the coverage of these schemes, making sustainable wood available on the market. It is however also clear that forestry schemes cannot by default be accepted. The main challenging element is that the REDII has a strict cut-off date for the conversion of land with high conservation values, of January 2008. FSC allows for conversion of small areas under specific conditions. Therefore, adopting these specific allowances in exceptional cases would make it possible to match the requirements. To put this recommendation into action, it is recommended that the indicators linked to REDII articles 29(6) and 29(7) shall be used, but where relevant with an additional exception for forest biomass, where a land status after January 2008 is exceptionally allowed if this:

a) affected a very limited portion* of the Management Unit, and

b) is producing clear, substantial, additional, secure long-term conservation* and social benefits in the Management Unit, and

c) did not threaten High Conservation Values, nor any sites or resources necessary to maintain or enhance those High Conservation Values

This has been included in the exception indicators of the ecological requirements, listed in row 24, 28 and 31. The indicators to row 24 and 28 related to agricultural biomass, we still decided to keep the exception in there in case an FSC certified product not coming from forest biomass is relevant that has not came up in this project.

This solution is in our view justifying the situation around sustainable forestry certification schemes and their justified misalignment with REDII. For schemes active in agricultural commodities such as RSPO and FSA, something similar is not recommended, to safeguard the level playing field with the agricultural commodities already used in the bioenergy sector, without simply saying that criteria from specific schemes are allowed alongside the REDII criteria.

The table in the previous section also describes various challenges in the endorsement of some of the non REDII schemes do for schemes that cover ecological requirements of their raw materials. This may give the impression that endorsements or cross-recognitions of schemes is only making their approvals towards such frameworks more complex, which is to a certain extent the case. However, such endorsement mechanisms also help supply chains to reduce the portfolio of certificates that individual economic operators need to have to fulfill supply chain needs. Especially for those producing a raw material or intermediate product that has applications in various sectors, it should be avoided that every sector requires a different certificate, that all have equal requirements, but just are not aligned.

Reflection on CoC options used in the construction and chemical sector

This section will address the chain of custody options that are relevant for bio-based products, in line with the models of the ISO 202095:2020. As suggested by RVO, the mass balance model is specified further, in which we see next to REDII compliance two relevant other characteristics in the transfer of mass balance credits, which are not allowed under REDII. These are the allowance to transfer credits into the next period without the presence of physical stock of the material, and the transfer of credits between certified sites without physical movement of the product. These options do both allow for extra flexibility that is currently used in the chemical sector supply chains (which end up in the construction sector as well). Below the table of COC options is given. Based on Peterson's expertise and the expert interviews, the applicability/necessity to allow a certain mass balance is marked in a traffic light system.

			Identity preserved	**Physical seggregation**	**Controlled Blending**	**Mass balance**			**book and claim**
Supply chain number	Supply chain summary	Sector relevance	Hard IP	Soft IP	claim only based on real % in actual mix (averaging allowed)	RED II compliant	accumulation of credits without stock	Credit transfer between sites	end-to-end without chain of custody
1	primary wood - timber - building elements/windows	construction							
2	hemp or flax - insulation material	construction							
3	maize/sugercane - liquid chemical - paint	both							
4	ethylene/ethanol - bioplastic	both							
5	bio and fossil feedstock blended (example ethylene)	chemical							
6	palm oil - cosmetics/shampoo	chemical							
7	bio and fossil feedstock in chemical reaction	chemical							
8	biodiesel plant producing co-products for further use	both							
9	co-product from bioenergy refinery - bioplastic	both							
10	biofuel - olefins-polyolefins - plastic applications	both							
11	solid biomass (wood/agri) - energy - residues - concrete/asphalt	construction		Only when 100%					
12	Steel production replacing coal for biomass	construction		Only when 100%					
13	using grass for biocoal and syngas production into various applications	both	Potentially in the first steps	Only in the first steps					

	Not likely to be used
	May not work in every SC example
	Commonly used
	Possible, not commonly used

From this table, the following conclusions can be drawn:

- Mass balance shall be a crucial CoC method for the supply chains reviewed in this report. Currently, some chains also use book and claim, which could be a good (temporary) incentive to start up new chains with biobased materials. However, it is advised that allowing book and claim should always be of a temporary nature to start the engine, making clear to the sector that the aim should be to go to mass balance with sustainability characteristics only allocated on the bio component, leaning towards controlled blending.
- For supply chains with a link with the chemical sector, the REDII mass balance approach is stricter than what is currently implemented. The two elements of additional flexibility (accumulation of credits, and credit transfer between sites are currently common practice, or will help companies that start to keep their current practices.

Review of the fuel-use exempt mass balance model

There are various detailed differences possible in the mass balance model. During this project, it was deemed relevant to address the fuel-use except model, as it has been a model that is called for by various sectors, but also been advised against as it may cause the perception of greenwashing. In essence, this method would "exclude fuel used as energy in the process and co-products produced and used as fuels, with the remaining outputs freely allocated" (source: https://www.packaginginsights.com/news/mass-balance-debate-should-the-eu-implement-fuel-exempt-calculation-standards-for-recycling.html). With the limited time in this project, we can share the following insights:

- Free allocation within mass balance system is commonly used, and also allowed under the REDII. When the fuel exempt method is claimed to be greenwashing, the same could apply for other free allocation methods. The fact that a product is not physically in the mix is inherent to accepting free allocation.
- The REDII mass balance requirements also focus on the input and output molecules, and any inputs that are used as energy are not directly traceable in the outputs of the physical product. However, the free allocation allowance of REDII has certain boundaries. It is not allowed to freely allocate sustainability attributes in cases where the physical output beyond the proportion that the output can technically/chemically contain the sustainable input.

In the end, all mass balance methodologies allow companies to re-allocate sustainable attributes, to make a claim on single batches where this claim is valued. In that way, supply chains can become more sustainable with a relevant claim. A product containing just 3, 5 or 12% of biobased content will not be seen as sustainable, and no added value can be found in the market. Just a small portion of that product being 70, 80 or 90% biobased, is something that can be valued and incentivizes supply chains who can convert more of their inputs whilst the demand is growing.

Reflection on the proposed CoC requirements

RVO requirement	Reflection	Proposed updated requirement
The POS information that shall be used between all certified market parties regarding the sustainability information, is clear on the COC method used, according to ISO22095 chapter 4 and 5 (or other suggestions from this project)	The ISO22095 CoC models are in most cases aligned with the CoC requirements of the scheme. The controlled blending model is however referred to as “mass balance – molecular approach” in for example ISCC Plus	A sustainability declaration shall be used to transfer the sustainability characteristics **confirming the ecological requirements** of the bio-based content between economic operators and shall include a claim on the CoC model in line with ISO22095. If mass balance is used, this shall include further specifications of attribution options that are allowed.
When applicable, the POS information that shall be used between all certified market parties regarding the fossil/bio content, is clear on the COC method used, according to ISO22095 chapter 4 and 5,	A change is proposed to make clearer in which case this is applicable.	In case the product is a physical mix of bio and fossil molecules (through blend or chemical reaction) the CoC method used to determine the fossil/bio content shall be in line with ISO22095. If mass balance is used, this shall include further specifications of attribution options that are allowed.
The COC methods used are performed robustly	This requirement is formulated more broadly, and it is suggested to check the robustness of the implementation of these methods with the schemes.	The CoC methods of the scheme shall be in line with the terminology and definitions used in ISO 22095 and concept ISO standard 13662 (until then defined in this regulation). There, where schemes use different terminology, the scheme shall submit a cross-reference table to allow their economic operators to use their own scheme terminology. The CoC claim made on the product must be in line with the respective scheme requirements to assure they are verified in annual audits accordance to the scheme rules.

Recommendations for further steps

This report and the excel spreadsheets with ecological and management requirements and the assessment of non REDII schemes, shall form the input for the Sustainability Framework for Bio-Based Materials in the Netherlands, for the chemical- and construction sector. Peterson has the following recommendations for the setup of this framework and the relevant legislation:

- The current set of requirements, indicators and guidance/evidence that have been laid down in the excel files, has come together using our expertise in supply chains around sustainability compliance. It is recommended to have a review from a legal perspective for the enforcement of these.
- From various expert interviews, we received a clear perspective that the chemical and construction sector should get, wherever possible, similar requirements as the bio-energy sector, since in most cases they compete for the same raw materials and intermediate products. In that way, compliance remains raw material specific and does not become specific towards the sector the material ends up in.
- We understand that the incentives around the framework currently set up are not decided upon yet. However, when level playing field is created based on sustainability compliance, incentives shall be needed similarly to the bio-energy sector or the sustainable wood sector, in order to make it attractive for companies to sell these materials in the respective end uses. E.g. if a biodiesel producer receives a better price for its product from a fuel distribution company, compared to the price a chemical processor can offer, then the product will flow towards the fuel company.
- A few experts interviewed, also emphasized that for this framework to be setup, it shall be relevant to align this with other relevant regulations in these sectors, which could be related to EU Taxonomy, EU ETS, or other incentives to reduce carbon emissions.

Annex I: Interview protocol for expert interviews

Thank you for taking the time to participate in this project and giving your input and feedback!

As mentioned in the invitation email, the Netherlands Enterprise Agency (RVO) has assigned Peterson to help shape the sustainability framework for bio-based raw-materials for the chemicals- and construction sector.

As part of this work, we are conducting these expert interviews. With your feedback, we can balance the aims of the policy makers with a practical implementation.

Let us start with presenting the main types of supply chains that this project seeks input for:

a) **A chain from wood from primary forests to timber frame construction or other innovative building elements**
b) **A chain of agricultural raw material such as hemp or flax to be used into building products, especially insulation materials**
c) **A chain of maize/sugarcane processed outside the EU into liquid chemicals from which paint is produced in NL.**
d) **A chain of ethylene or ethanol from Brazil that is made into a bioplastic. Variations: road transport versus pipeline, Bio ethylene from cracker in EU.**
e) **A chain of palm oil from Malaysia processed, ending up in shampoo.**
f) **A chain mixing bio feedstock and fossil feedstock. E.g. fossil/bio blend ethylene pipeline.**
g) **A chain in which bio feedstock and fossil feedstock enter into a chemical reaction to produce a new material.**
h) **Co-products from a bioenergy refinery that are used by the chemical sector to produce (xxx)**

Nr.	Question	Answer
1	These were example value chains. Does your company relate to one of the above-mentioned value chains, or should another value chain be added? Are there any other typical value chains that you think should be included in the list?	
2.	Roughly said, the value chains are related to either the chemical or construction sector. Is your company rather active in the chemicals, construction, or both sectors?	

3.	What typical (intermediate) products from bio-based raw materials is your company using/processing?	
4.	Which certification schemes are commonly applied in these production chains? (Follow-up question, if not clear from response: Is your company certified, and if yes, which certification scheme(s)? If the answer is no, follow-up question: What type of certification would you go for if you were to get certified? -	
5.	A. Please describe in as much details as possible: -which input products go into the process -what outputs come out of the process (relevant for the construction/ chemical sector? B. How can the link between output and input be traced back? With which chain of custody option can this be attributed?	
6.	Is mixing taking place between biogenic feedstock and fossil feedstock? Where is the blending taking place?	
7.	Are there chemical processes between fossil and biogenic feedstocks? What is the impact on COC in certification?	
8.	Is down grading of COC method taking place in your supply chain? E.g. from ISCC EU > ISCC plus. Or from mass balance, to book and claim?	
9.	There is a new ISO standard currently in development, which will standardize the mass balance approach as a chain of custody option. Are you aware of this upcoming standard? (ISO/CD 13662:2024; currently under review by the technical committee) If yes: is your company in any way involved in the development of the standard (e.g. through public consultation)?	
10.	Any other comments	

Many thanks for your responses! We will treat them with confidentiality and anonymize any responses.

Annex 2: Aggregated feedback from stakeholder interviews

The below text summarises the outcomes from the expert stakeholder interviews.

Firstly, when asked which certification schemes are commonly applied in the relevant production chains, the following replies were given:

- ISCC Plus is relevant for this scope. We also have RSB recently in some refineries, but that is an exception or a specific need for supply chains where ISCC Plus is not feasible.
- For sugarcane, mostly Bonsucro is relevant. We additionally use our own supplier code, which is similar and often inspired by Bonsucro. This is then audited by a third party; this is done for cost reasons and due to availability of certified sugar.
- VCS/ Verified Carbon Standard. This we have in place already. Other important ones include Green Gold Label (GGL), which is all about traceability and feedstock control. You could also do SURE or Better Biomass, or even Puro.earth

  It is important to use certification that is not only under woody biomass. The legislation is getting more stringent there; the certification will become more limited, and the price will likely go up.
- ISCC Plus
- Mainly SBP and SURE may be relevant.
- Better Biomass is used. ISCC has some drawbacks, Better Biomass is better fitted; could be used for chemical sector, but that sector will need to get acquainted to.
- ISCC Plus seems to be the most relevant. We are in the process of getting it.
- GGL, SBP, Better Biomass (raw materials can originally be FSC, PEFC, SFI), in the future we potentially also look into Sure and ISCC.
- We currently mainly have certifications for our biodiesel, for the energy sector: ISCC EU, EPA registration, INS, as well as the environmental management system ISO 14001.

- So far, no specific expectation from our customers. We have ISCC+
- ISCC+ certification is important. We do have an ISCC+ certification.
- ISCC+ certification scheme is applied for transparent and credible value chain and chain of custody compliance. All our refineries hold ISCC certificates, and they comply with EU RED and EPA requirements. However, not all raw materials need certification; instead, we can verify sustainability according to our policies, local legislation, and the destination country's regulations.
- For polymers and chemicals: ISCC PLUS and yes, we are certified. For fuels: ISCC EU.
- Bonsucro is by far the largest for sugarcane and ISCC+ is the largest for others. RSB is also a relevant certification scheme. We have Bonsucro and ISCC+.
- Sards for chemicals, sometimes EcoLabel and alike. We are B-Corp certified. Products sometimes EcoLabel certified, LCA / CF and starting with EPD formatting.

The companies were then asked to describe their processes in terms of how the link between output and input can be traced back, and with which chain of custody option this can be attributed. The following comments were provided:

- We use the ISCC Plus traceability options. So far, we are using as much as possible the flexible attribution. However, it is a market question; if the market wanted something stricter, we could also do it. Some companies are demanding something more robust. The market will decide it until there is a mandatory mechanism in Europe.

  On the other hand, decarbonization might be difficult with a stricter method. If you want more demand on traceability, you will have lower volumes, and vice versa.
- We are not mixing biomass; Up to now there has been no need for CoC at our plants, this is not happening at the moment.

If we go to more sustainable feedstock or waste feedstock, we will start having those discussions, if you want to attribute certain characteristics to those feedstocks. However, at the moment we are not doing this. We are considering doing so in the future.

- We do everything ourselves, so it is easy to prove it. We use GGL, as mentioned. We aim to export to EU, but also Japan; in Japan there are different options, although it seems like they might also accept GGL in the future.
- Use of mass balance with free allocation where possible. Now with SAF under Corsia, composition tracking of the molecules is required, which is very unpractical.
- COC should be completely similar to bioenergy, everything is the same, only the end-use is different – mass balance is the basis there. A level playing field between all sectors for chain of custody, both for bioenergy, as well as chemicals and construction sector is needed.
- We are not certified yet. We are considering ISCC plus mass balance option as a chain of custody option.
- The main way to trace the inputs is through the allowed chain of custody systems, which is mostly mass balance.
- The traceability is done following the mass balance rules of RED II and the corresponding schemes we use (e.g. ISCC EU).
- Many of our products are not sold specifically because they are bio-based, that just happens to be the 'normal' feedstock source. Where they are specifically linked, we generally use ISCC+. The biogenic carbon could be tested via C14 tracking method. Bio-based content could be calculated based on the input of segregated feedstocks and BOMs.
- For bio-circular based feedstock we use mass balancing, certified and audited by ISCC+ .
- Our renewable feedstock is fully made of renewable feedstock. Different biobased feedstocks can be mixed, and mass balance chain of custody method is applied for mixing different biobased feedstocks. ISCC+ certification ensures a credible CoC method.
- ISCC PLUS, mass balance approach.
- As we buy certified and non-certified ethanol, mass balance is used to ensure we don't sell more certified (Bonsucro or ISCC+) polymer than the equivalent quantity of certified

ethanol needed to produce it, considering the appropriate conversion factor from our process.

- Certified labels, accountancy checked.

When asked if mixing was taking place between biogenic feedstock and fossil feedstock, and if so, where the blending was taking place, the following insight was collected:

- Yes, a small percentage into the fossil feedstock; this is the case for the rest of the industry too. Input versus output will be relatively small, and you need a lot of fossil material. We are using flexible allocation as it gives more flexibility.
- We are not mixing biomass.
- In the final uses yes. If you take bio-coal to the industry, we will replace a portion of the fossil coal with our bio-coal, so there would be a blending option there, but not in the process itself.
- Yes, in one place, but the bio portion is very small compared to the non-bio portion.
- Mixing only happens after producing the biobased product, e.g. green gas goes into the gas grid. Feedstock is all biobased.
- At the moment this is not happening. In the future, if it happens, it will be in the beginning of the process. We will have fossil and biogenic raw materials blended.
- In one of the faculties, yes.
- No, only biobased feedstocks.
- Yes, as biogenic feedstock is co-fed into naphtha crackers to produce the raw materials that we use.
- Mass balancing is based indeed on mixing large streams and small streams. We buy bio-based phenol, which is made from benzene, which is made from crude oil… in the “oil step” bio-based oil types are added.

- Our product is fully made of biobased feedstock and there is no mixing with fossil feedstock.
- Yes, either at: Our feedstock tanks, or our suppliers' feedstock tanks.
- For bio-based PE and EVA, small quantities up to ~20% of fossil co-monomers are fed to the polymerization plant. For bio-attributed solutions bio-naphtha is blended with fossil naphtha in a steam cracker.
- Yes. In our factory and for several products at the raw material supplier.

The next question was whether there are chemical processes between fossil and biogenic feedstocks, and what the role of COC is, and the following replies were given:

- We do have some products where we have lactic acid (biobased molecule), and for the chemical we need another chemical molecule that is fossil based. In that sense yes, part of the molecule is fossil based and part biobased. We are not certifying it; the impact of CoC might become relevant in the future. Based on the chemistry, it is a simple straightforward reaction; we can just do a C14 test. The composition of the molecule should be reflected on that. Currently we don't do this, but if we do, it would not be mass balance but C14 method.
- It is important to keep the COC options aligned between different purposes. It is now challenging in bioenergy with additional SAF (Corsia), where composition tracking is needed.
- Here it is relevant to discuss if any of the biobased feedstock would end up in the final product (steel). Only for a little portion a chemical reaction results in 4,5% carbon coming from coal/biomass ending up in the steel, but to optimize specs, this is removed until a level of 0,5%, meaning only a small amount of carbon actually ends up in the steel. There is not so much focus on making a "biobased carbon" claim on the carbon at the moment, the focus is on reducing carbon emissions.
- No co-processing, with syngas, bio-methanol can be produced and sold 100% bio based.
- For the bio-based feedstocks there are no chemical processes taking place.
- Biomass is burned for energy purposes.
- No, only biobased feedstocks.
- Yes, we react e.g. sucrose with PO. These products tend not to have a COC as they are not sold as being specifically bio-based. Chemical reaction and movement of atoms/molecules are taken into account and the calculation for the final bio-based

content flows are considered, so only the remaining molecules of bio-based origins are accounted for.

- No chemical processes between fossil and biogenic feedstocks. Our biobased feedstock is similar to the fossil based ones.
- No. Mass balance CoC certification is applied for mixing different biobased feedstocks.
- For our fuels applications. We react fossil butanes with bioethanol to produce ETBE. We are ISCC EU certified for this process.
- Yes, in the polymerization process. I believe the impact is that you can't attribute the biogenic carbon to the proportion that is coming exclusively from fossil feedstock. But this is not the case in our process.
- No, physical processes (mixing). None.

When asked if down-grading of COC method was taking place in the supply chain, the following replies were provided:

- No, only mass balance.
- On the feedstock level; ISCC EU-Plus not downgrading, rather seen as assuring compatibility. You use feedstock that you can use for many enduses. You try to balance different needs (voluntary markets and others).
- No, this is not the case for us.
- No cross-recognition is a restriction of the market. This functions well under REDII, why not in the chemical sector? Actually, from ISCC-EU to ISCC-PLUS would be a "downgrading" that would take place. However, between schemes as e.g. ISCC-EU and RedCert, this is not the case. I'm not even sure which schemes would recognize (which) other schemes and which not.
- We are open to all chain of custody, as long as there is a level playing field, both within as outside EU. For example, related to electricity costs, which become more important in the transition moving away from coal.
- This is not current practice, all under the same scheme. Regarding the COC options, I am not sure, but book and claim is not allowed. Interchangeability of the REDII schemes is helpful, but for green gas this is currently not working.

- No; We are not yet certified, but we don't see it happening actually. I don't expect it to go down, mostly up. At the moment the options are mass balance, but later on we plan to have physical segregation, or chemical traceability options.

- Mass balance is used, but different periods – GGL 12 months, 3 months for SBP.

- Only ISCC EU related Mass Balance requirements are currently implemented for the products we sell under this certification. In case a demand comes for certified glycerine for the chemical sector, we would be interested in using ISCC Plus, for the surplus of credits we can keep in the balance, and the credit transfer systems between our sites.

- We use the segregated model where possible. For large volume chemicals where segregated feedstocks cannot be considered due to the economy of scale, we would apply mass balance attribution CoC model, e.g. ISCC PLUS certified.

- We only use ISCC Plus. Depending on the industries we are selling into it is already a challenge to convince parties to accept this COC… segregation is preferred, but the industry is not ready.

- ISCC+ certification is applied for chemicals and polymers value chain. Mass balance should always be linked to the physical flow of materials and use real site and process specific yields. We follow ISCC+ mass balance CoC but our customers or operators further in the value chain might apply mass balance or book and claim according to ISO 22095.

- We do not downgrade from ISCC EU to ISCC plus for our feedstocks. We use ISCC EU for our fuel product and ISCC PLUS for our other products.

- No, but we are open to using book and claim where allowed and as long as our customer communicates it in a transparent way.

- No. We are not using mass balance as a method but EN-NEN 16640 instead.

There is a new ISO standard currently in development, which will standardize the mass balance approach as a chain of custody option. The interviewees were asked if they were aware of this upcoming standard (ISO/CD 13662:2024; currently under review by the technical committee).

If yes, they were also asked if their company was in any way involved in the development of the standard (e.g. through public consultation). The replies were as follows:

- We are used to the methodologies that are a part of the certification schemes. ISO ultimately is voluntary, and you need a lot of consensus in the market to have it approved, and they are a bit late to the party. ISO sometimes are missing the commercial considerations.
- I'm aware that it is being developed; but not involved in it.
- No. This is my first time hearing about it. It sounds logical to have a more standardized approach. It will do good for the sustainability industry.
- This is not known to me, but could be interesting.
- No awareness.
- Not relevant.
- I am aware of it, but we are not a part of the consultation.
- Only relevant for the schemes.
- I am not aware of it.
- Yes, we are aware, but not directly involved; we are monitoring.
- Yes, I am and this would be of much help. We have been involved but seems that the process is very slow and very generic. The industry needs clarity and a clear set of rules. Multiple interpretable directions are not helping, in the contrary, they will slow down acceptation of various COC for industries which are hesitant (e.g. textile industry, et cetera).
- Yes, we are involved in the ISO working group developing the standard.
- We are involved in the development of the new standard.
- I believe a colleague is monitoring this.

- We are aware, yes. No, we are not involved; we are opposing the mass balance methods and use EN-NEN 16640 instead.

Finally, the participants had the chance to address any further points or make additional comments during the interview. The following additional feedback was provided:

- There is a lack of harmonization, with many individual approaches. I would say that is the main difficulty.

- Auditors have an important role in this; they know the rules. Nurture the role of auditors; third party certification schemes need to be embedded. Bureaucracy is still very common.

- When talking about simplifying the RED II approach; actually, we propose to strengthen it, not to simplify it. A suggestion would be to consider also social elements and the human rights elements in the value chain (Bonsucro for example covers these).

- The complexity compared to RED II is that the CO2 elements will be more of a challenge for the construction and chemical sector, compared to the energy sector; the calculations will be different. For energy, everything is in the end burned so you have a clearer benchmark with regards to the emissions savings. This will be different for the chemicals and construction sector, as nothing is burned, and calculations will be more complex. This would be a nice thing to have, but it will certainly be more complex.

- RVO should also start to embrace other solutions than cofiring wood. With SDE++ they started being more open; that was good. If you look at grass, the options for power generation, steel industry et cetera are huge. We can also demonstrate that it is great for biodiversity, regenerative agriculture, et cetera. It would be important to adopt a more open view to other feedstock than just wood.

- One more thing that would be important to mention: from the REDII, schemes are interchangeable but in reality they are not. They should acknowledge each other (e.g. if a part of the chain is ISCC certified and another part with another scheme like Better Biomass, they should be treated as completely sustainable. For green gas, this is not currently perceived to be the case. There you see that if a part is not fully ISCC certified, it is not deemed to be sustainable, which is not aligned with how the regulation should be. They should cross-recognize each other. There should be a level playing field.

- In our view, the scope of this assignment may be too small, the aim of RVO may overlap with directives and legislation around carbon removal, ETS, CCS+. It should be avoided

that any non-alignment is blocking the main aim of such frameworks, to assure they can be implemented successfully.

- There are various specific initiatives in the market which show that when there is market need and/or regulation, things can be moved or blocked, examples: On Dutch soccer fields, a pilot has happened to create biobased materials for the artificial fields. This went well until regulation demanded the biodegradability to be happening within 6 months, the product actually degraded in 2 years which brought this initiative to an end, now all the fields are still having fossil-based plastic.
  For the hand mowing machines with a short plastic rope, to cut next to roads, there is a regulation now to produce this from biodegradable plastic, so that parts that split off are degrading. Small amount per machine, but the total adds up to have a demand for the annual production of a bioplastic plant.

- It's a pity that your overview includes biobased sources which can be used as food or feed in a time that the global population is increasing. We made a conscious choice NOT to use any feedstock which can be used as food or feed.

- We believe that product carbon footprints are essential to demonstrate the benefits of the CO2 benefits of these products.

- Replace Mass Balance with EN-NEN 16640 which can be checked on the products delivered directly.