Mass balance calculation methodology

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Content

1 Introduction

This document describes the mass balance calculation methodology for physical segregation and mass balance based on the framework conditions laid down in document ISCC 203 „Requirements for traceability“.

2 Scope

This document describes the basic elements which have to be considered for the requirements for mass balance calculation:

(1) Farm/plantation (cultivation of sustainable biomass)[1]

(2) First gathering point (generally operations, warehouses or traders which source biomass from a variety of farms or plantations)

(3) Conversion of sustainable biomass (in case that the conversion unit is not the final interface)

(4) Conversion of sustainable biomass (in case that the conversion unit is the final interface, e.g., refining of sustainable liquid biomass)

(5) Supplier (of sustainable liquid biomass after the last interface)

(6) Warehouse (Storage of sustainable biomass, e.g. in farms, interfaces and warehouses or storage of liquid biomass or biofuels in interfaces or warehouses)

(7) Transport of sustainable products (e.g. with truck, train, barge or vessel)

3 Normative references

As a basic principle, all relevant ISCC documents are valid for the scope. The normative references display the documents whose contents are linked and have to be considered as conjoint points.

Relevant references:

ISCC	201	System Basics
ISCC	203	Requirements for Traceability
ISCC		Audit Procedures

[1] Within the framework of the BioKraft-NachV, the mass balance must also be verified at a producer of residues (e.g. starch residues from a starch factory). However, no GHG emissions are attached to the production of residues. If these residues are produced in a factory and not on a farm/ plantation a proof of sustainability is also not necessary.

4 Mass balance calculation methodology

4.1 General requirements

The mass balance calculation must always be performed in relation to the product. A particular type of biomass may not be replaced by another type once it has been added into the system.

It must be noted that it is a prerequisite for a mass balance calculation system that all sustainable biomass traded is actually present at the relevant location. For example, if a company has two sites, Site A and Site B, and sustainable biomass is only held at Site A, then goods at Site B may not be sold as sustainable. The system must include checks to ensure this. The term 'mass balance system' refers to a system of record keeping that ensures full traceability in terms of the balance of quantities at all stages of biomass production and throughout the subsequent supply chain. This balancing ensures that the quantity of regulatory-compliant biomass that is removed is never greater than the quantity of regulatory-compliant biomass that previously entered into the system. The sustainable biomass is entered into the mass balance system according to type, quantity and other important attributes. The physical biomass that is transferred to the next location and associated with the quantity of biomass entered into the mass balance system does not, therefore, necessarily have to be the exact same biomass as was originally delivered, but rather an equivalent quantity of biomass. Nonetheless, it must be ensured that for each type of biomass entered into the mass balance system, only corresponding equivalent quantities may be transferred onwards, and that no other biomass may be recorded as such. For example, the quantity of palm oil in the mass balance system may not be reduced in order to increase the amount of rapeseed oil.

4.1.1 Basic methods of mass balance calculation

With respect to the framework conditions outlined in document ISCC 203 „Requirements for traceability" the following systems can be distinguished:

(1) Physical segregation

a. Segregation of all batches with different origin and properties (Identity preservation or hard IP)

b. Segregation of sustainable and non sustainable products (Soft IP or bulk commodity)

(2) Mass balance

a. Physical mixing and retention of batches via bookkeeping

b. Physical mixing and documentation of quantity credits

c. Physical mixing and documentation of percentages

i. Documentation of percentages company internal and for withdrawal

ii. Documentation of percentages company internal and quantity credits for withdrawal

4.1.2 Provision of conversion factors

Within the mass balance calculation conversion factors have to be provided for all elements of the production and distribution chain, whose company internal processes include conversion. This has to be applied both for physical segregation and mixing. When using partial default values for calculation, the corresponding conversion factors have to be taken from EU publications or those of its relevant member states. Within individual GHG calculations the conversion factor has to be taken either as an average value of the actual process yield for one period or a shorter time frame from the reporting of the actual yields. The conversion factor for a certain period is defined as follows:

C (%) = Ao/Ai * 100

C: **C**onversion factor
Ai: **A**mount of the process **i**nput material
Ao: **A**mount of **o**utput yielded by the internal process based on input Mi

Under the framework of the mass balance calculation of conversion processes the amount of sold or withdrawn sustainable products within one period should not be larger than the product of the amount Ai going into the process times the conversion factor C.

4.1.3 Greenhouse gas calculation (GHG) within inventory bookkeeping

4.1.3.1 Inclusion of GHG values for transport

The requirements for calculating GHG emissions of relevant elements of the production and distribution chain and for transport are documented in ISCC 205 „Calculation methodology for GHG emissions and GHG-Audit".

Accordingly, the recipient of a batch of sustainable products, has to add the GHG value for transport e_{td} to the GHG value of the product as stated in the delivery order or the proof of compliance with sustainability requirements unless the partial default value for transport from annex 2 of the BioSt-NachV, Biokraft-NachV or Annex V RED has been used:

$E = e_{\text{delivery order}} + e_{td}$

E: GHG value, as captured as input value by the mass balance calculation.

$e_{\text{delivery order}}$: GHG value of the product, as stated in the delivery order/ proof of compliance with sustainability requirements

e_{td} : GHG value for transport of the sustainable product

In case of a mixture of sustainable products with different GHG values the GHG value E has to be aggregated.

4.1.3.2 Aggregation of different GHG values

If allowed the aggregated GHG value of a mixture of sustainable products with different GHG values has to be calculated based on the mean weighted average. The aggregated GHG value has to be calculated based on the following formula:

$$\mathbf{GHG_{new\ batch} = \Sigma\ (GHG_{Input\ batch\ i}\ x\ Ac_i) / \Sigma\ Ac_i} \quad \text{(for i=1 to n)}$$

$GHG_{new\ batch}$: Mean weighted average of the GHG values of n different batches
$GHG_{Input\ batch\ i}$: GHG value of the input batch **i**
Ac_i: **A**mount in kg of the sustainable product of the input batch **i**

GHG values of several batches of sustainable products can only be aggregated if all mixed batches complied before mixing with the GHG reduction potential requirements of § 8 of BioSt-NachV or BioKraft-NachV. In certain cases, mixtures of different quantities of biomass may be used for the production of liquid biomass in accordance with BioSt-NachV or the production of biofuels in accordance with Biokraft-NachV. In such cases, proofs of sustainability may not have been issued for all the biomass and there may be different greenhouse gas emissions for the various quantities of biomass. It is then only permissible to aggregate these greenhouse gas emission values if, before mixing, each quantity that is to be added to the mixture can be demonstrated to comply with the value specified for this stage of the production process by the European Community or the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. Aggregation may only be carried out after the date that the maximum values are notified in the Official Journal of the European Community or, where emissions are covered by the scope of ordinances Biokraft-NachV und BioSt-Nach, notified in the Bundesanzeiger (German Federal Gazette).

Also GHG values from batches of sustainable products are not allowed to be aggregated together with those from old operational units, if within the proof of compliance with sustainability requirements or delivery orders for the old operational units the GHG value is not explicitly stated.

In case it is not allowed to aggregate different GHG values, the sustainable batch can be split into partial batches of any size with identical GHG values as long as the sum of the partial batches does not exceed the amount of the total initial batch.

4.2 Physical segregation

4.2.1 General requirements for physical segregation

Organizations applying physical segregation shall ensure that the certified raw material or product is separated or clearly identifiable at all stages of the production or distribution process.

Organizations whose sustainable product is not mixed with other products and/or where the sustainable product can be identified as being sustainable during the whole process should use the physical segregation as the preferred option.

4.2.2 Physical segregation of batches

Batches have to be identifiable throughout the entire production and distribution process. This can be achieved by:

(1) Physical segregation of the production, storage and transport equipment (parallel process)

(2) Physical segregation by periodical separation (sequential process)

4.2.2.1 Physical segregation of all batches

By using this option all batches with different origin and properties will be segregated from each other. This applies as well for the segregation of batches of sustainable from non sustainable products as for batches of sustainable products with different origin and e.g. different GHG values (compare with following figure).

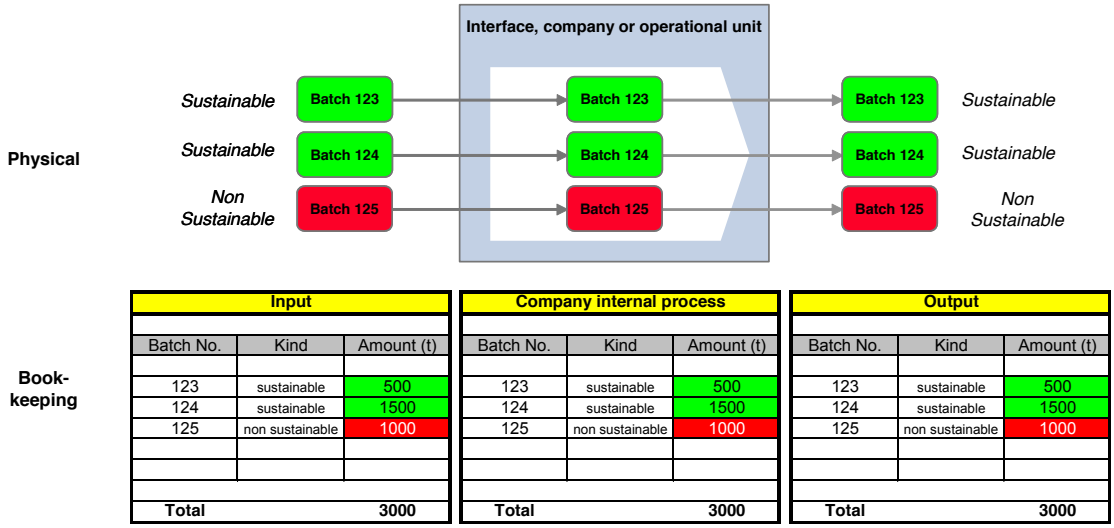


Figure 1: Physical segregation of all batches with different origin and properties

As batches with different GHG emissions are not mixed, every batch keeps its individual value.

4.2.2.2 Physical segregation of sustainable and non sustainable batches

Within this option only batches of sustainable products are segregated from non sustainable products. Batches of sustainable products can be mixed even if origin and properties are different (see also following figure).

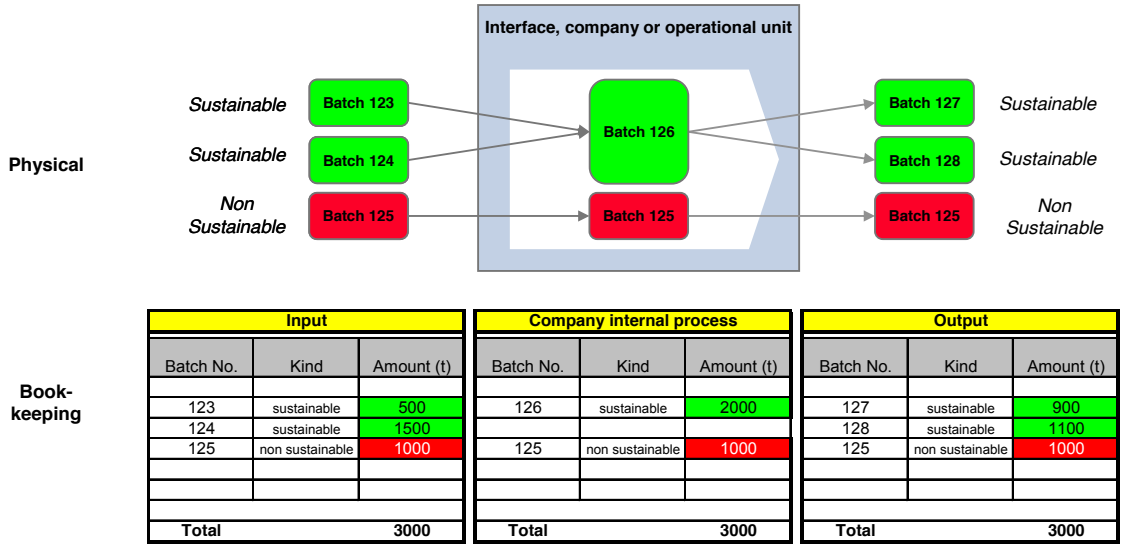


Figure 2: Physical segregation of batches with sustainable and non sustainable products

If batches of sustainable products may have different GHG values and aggregation is allowed, the aggregated GHG value or those of split batches is calculated by the mean weighted average (see also following figure).

Input			
Batch No.	Kind	GHG value (kg CO_{2equi}/t)	Amount (t)
123	sustainable	300	500
124	sustainable	400	1500
Total			2000

Company internal process			
Batch No.	Kind	GHG value (kg CO_{2equi}/t)	Amount (t)
126	sustainable	375	2000
Total			2000

Output			
Batch No.	Kind	GHG value (kg CO_{2equi}/t)	Amount (t)
127	sustainable	375	900
128	sustainable	375	1100
Total			2000

Figure 3: Aggregation by applying mean weighted average

4.3 Mass balance

4.3.1 Mass balance options

Mass balance methodology allows the mixing of batches of sustainable and non sustainable products on every stage of the value chain. Due to physical mixing the mixture looses its individual properties. The specific properties of sustainable product can therefore only be determined via bookkeeping. This requires calculation and period monitoring of the mass balance calculation. Several calculation options can be chosen:

(1) Retention of the input batches via bookkeeping

(2) Quantity credit methodology

(3) Percentage methodology

(4) Percentages methodology company internal and quantity credit methodology for withdrawal

Starting point for all four options is the definition of the timeframe for balancing (i.e. the period of the mass balance calculation).

4.3.2 Definition of the timeframe for balancing (period)

The mass balance calculation requires the definition of the timeframe. If not defined else where, this timeframe (period) is a maximum of three months. The quantities of sustainable biomass must be balanced at daily, monthly or quarterly intervals, depending on preference. Therefore the mass balance calculation for relevant elements of the supply chain must be balanced within the appropriate period for both incoming and outgoing sustainable products according to the RED, BioSt-NachV or BioKraft-NachV.

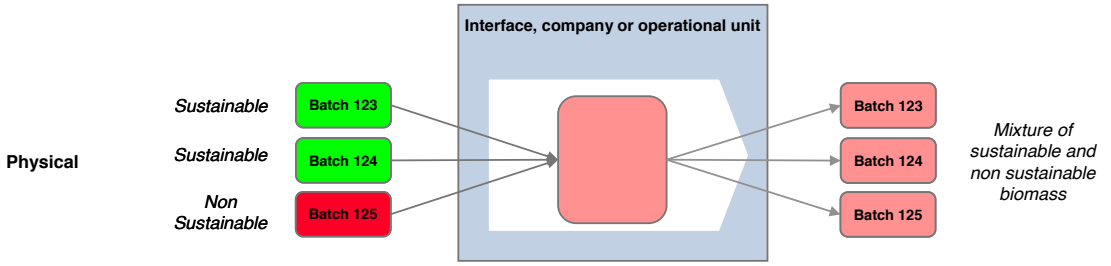
It is not permitted for more sustainable biomass to be supplied by a site during the chosen balancing period than has actually been physically received at that site. If at the end of the balancing period a site actually holds a stock of sustainable biomass, then this may be carried over to the following balancing period (transfer of credits). However, it is not permissible for “not yet used” proofs of sustainability for goods to be held at the end of a balancing period for one site, only for goods to be bought in at another site in order to then sell these as sustainable. If a company owns a site that has several silos, then these are counted as storage at a single site. However, if the silos are not sited at a single location, or the silos belong to different companies, then it is not permissible for goods to be reassigned from one silo to

another silo as sustainable, because in this case the other silo does not qualify as being part of the same single store or site.

For mass balance calculations up to and including 30 June 2011, balancing periods may in exceptional cases be extended to a maximum of 12 months, however this must be agreed in advance with the participating ministries. After 30 June 2011 no exceptions will be permitted and the maximum balancing period of 3 months shall apply again exclusively.

4.3.3 Retention of batches via bookkeeping

In this option batches of sustainable and non sustainable products are mixed within a company internal process but within the bookkeeping the batches are still kept separately, i.e. amounts and stated properties stay unchanged. Outgoing batches will be documented the same way as these batches were received by the respective element of the supply chain (e.g. as sustainable product, although physically the batch is mixture of sustainable and non sustainable products, see also following figure).



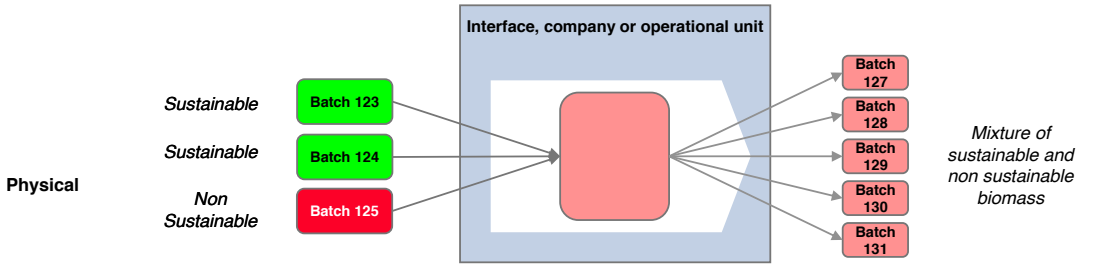
Book-keeping

Input			Company internal process			Output		
Batch No.	Kind	Amount (t)	Batch No.	Kind	Amount (t)	Batch No.	Kind	Amount (t)
123	sustainable	500	123	sustainable	500	123	sustainable	500
124	sustainable	1500	124	sustainable	1500	124	sustainable	1500
125	non sustainable	1000	125	non sustainable	1000	125	non sustainable	1000
Total		3000	Total		3000	Total		3000

Figure 4: Retention of input batches via bookkeeping

4.3.4 Quantity credit methodology

When using the quantity credit option, batches of incoming sustainable products can be aggregated for the timeframe in form of quantity credit. The timeframe used for aggregation should not be longer than the period defined in chapter 4.3.2. Aggregation is based on the total sum of the amount of all batches of sustainable products. Within the timeframe, batches of sustainable products can be arbitrarily split as long as the total amount does not exceed the quantity credit (see also following figure).



Book-keeping

Input			Company internal process			Output		
Batch No.	Kind	Amount (t)	Batch No.	Kind	Amount (t)	Batch No.	Kind	Amount (t)
123	sustainable	1000	126	sustainable	2000	127	sustainable	700
124	sustainable	1000	125	non sustainable	1000	128	sustainable	800
125	non sustainable	1000				129	sustainable	500
						130	non sustainable	500

Figure 5: Documentation of sustainable products as quantity credits

If the derived quantity credit is not utilised during the calculation timeframe it can be transferred into the following period, if this does not violate further administrative regulations respectively explaining guidelines for the ordinances named above.

If the incoming sustainable batches have different GHG values and the aggregation of GHG values is allowed, the GHG value has to be calculated according to 4.1.3.2 (see also following figure).

Input			
Batch No.	Kind	GHG value (kg CO_{2equ}/t)	Amount (t)
123	sustainable	300	1000
124	sustainable	400	1000
125	non sustainable		1000
Total			**3000**

Company internal process			
Batch No.	Kind	GHG value (kg CO_{2equ}/t)	Amount (t)
126	sustainable	350	2000
125	non sustainable		1000
Total			**3000**

Output			
Batch No.	Kind	GHG value (kg CO_{2equ}/t)	Amount (t)
127	sustainable	350	700
128	sustainable	350	800
129	sustainable	350	500
130	non sustainable		500
131	non sustainable		500
Total			**3000**

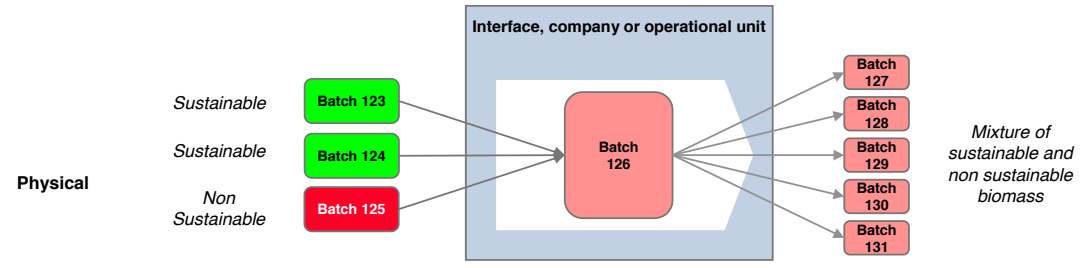
Figure 6: Calculation of the GHG value by applying mean weighted average

4.3.5 Percentage methodology

When the option of the percentage methodology is applied all incoming sustainable products within this timeframe are calculated as the percentage of the total incoming sustainable and non sustainable products. Within this timeframe (can be the same or shorter than the period), the percentage of sustainable products within one batch has to be calculated according to the following formula (see also figure 7):

Pc (%) = Ac/(Ac + An) * 100

Pc: Percentage of sustainable products (**c**ertified)
Ac: Amount of sustainable products (**c**ertified)
An: Amount of unsustainable products (**n**on certified)



Book-keeping

Input		
Batch No.	Kind	Amount (t)
123	sustainable	1000
124	sustainable	1000
125	non sustainable	1000
Total		**3000**

Company internal process		
Batch No.	Kind	Amount (t)
126	67% sustainable	3000
Total		**3000**

Output		
Batch No.	Kind	Amount (t)
127	67% sustainable	700
128	67% sustainable	800
129	67% sustainable	500
130	67% sustainable	500
131	67% sustainable	500
Total		**3000**

Figure 7: Documentation of sustainable products as percentage

If the incoming quantity of sustainable batches is documented by a percentage, the average percentage value for all batches within this timeframe has to be calculated according to the following formula:

$$Pc_{avg\ n}\ (\%) = \Sigma\ (Pc_i \times Ac_i) / \Sigma\ (Ac_i + An_i)\ \text{(for i=1 to n)}$$

$Pc_{avg\ n}$: Average **p**ercentage of sustainable (**c**ertified) products for n batches
Pc_i: **p**ercentage of sustainable (**c**ertified) products within batch i
Ac_i: **A**mount of sustainable (**c**ertified) products within batch i
An_i: **A**mount of non sustainable (**n**on certified) products within batch i

If the incoming sustainable batches have different GHG values the GHG valuehas to be calculated according to 4.1.3.2.

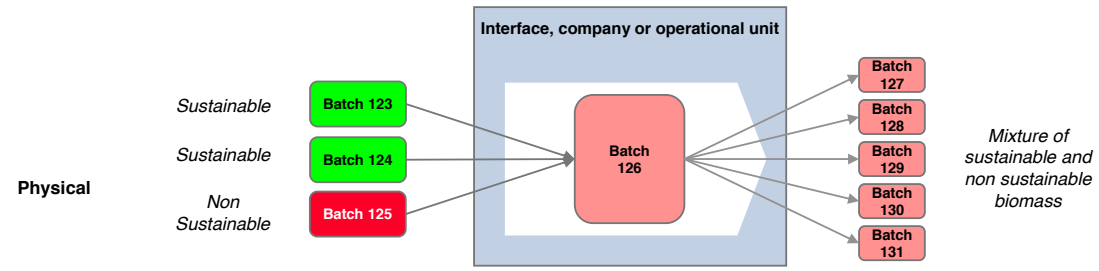
The above mentioned percentage values of sustainable products can be calculated and stated either as:

a. Simple percentage or

b. Rolling average

4.3.6 Percentage methodology company internal, quantity credit methodology for withdrawal

Is the share of sustainable products for company internal processes characterised by a percentage value, it can be transferred for withdrawal into a quantity credit (see also figure 8).



Book-keeping

Input		
Batch No.	Kind	Amount (t)
123	sustainable	1000
124	sustainable	1000
125	non sustainable	1000
Total		3000

Company internal process		
Batch No.	Kind	Amount (t)
126	67% sustainable	3000
Total		3000

Output		
Batch No.	Kind	Amount (t)
127	sustainable	700
128	sustainable	800
129	sustainable	500
130	non sustainable	500
131	non sustainable	500
Total		3000

Figure 8: Documentation of percentage methodology company internal, quantity credit methodology for withdrawal

If the incoming sustainable batches have different GHG values the GHG value has to be calculated for the respective period according to 4.1.3.2.

4.3.7 Mixture

Mixture in the context of mass balance calculation is normally a mixture of sustainable and non sustainable products (biomass, bioliquids or biofuels) of the same crop origin. For the mass balance calculation, the definition of the periodical and spatial boundary is of crucial importance. The periodical boundary defines the timeframe for which the mass balance is calculated and the output of sustainable biomass product does not exceed the input. The spatial boundary defines for which spatial entity the mass balance must be applied.

The periodical boundary is taken as three months and the spatial boundary as the plant/ site.

4.3.8 Use of a consistent GHG value

Should there be different GHG values E as input values for the mass balance calculation, the highest GHG emission value can be used consistently for the entire input if required. However, this is only allowed if possibly prescribed maximum emission values according to Biokraft-NachV or BioSt-NachV and their implementation requirements (administrative regulation and Guideline for the Produciton of Sustainable Biomass) are not exceeded. This procedure can ease the handling of GHG values within a mass balance calculation for companies.

4.3.9 Deductions with respect to the transitional provisions

For biomass that was already supplied in 2010 by the first gathering point, but for which a certificate covering the period up to 31/12/2010 is not available, this means that the downstream interfaces must in the first instance deduct this quantity from their mass balance (sustainable biomass). The quantity may then only be added back in (activated) when the relevant first gathering point is able to present a valid certificate. In other words, the biomass that was supplied in 2010 is not automatically irrevocably classified as non-sustainable, but rather temporarily classified as such until a certificate is made available by the first gathering point. This must also be traceable in the mass balance. By contrast, from 01/01/2011 onwards deliveries of sustainable biomass may only take place if a valid certificate is presented or at time of transfer/processing.