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2011

BONSUCRO™
BETTER SUGAR CANE INITIATIVE



Bonsucro Mass Balance Chain of Custody Standard
Including Bonsucro EU Mass Balance ChoC Standard

BONSUCRO

MASS BALANCE CHAIN OF CUSTODY STANDARD

INCLUDING BONSUCRO EU MASS BALANCE

CHAIN OF CUSTODY STANDARD

Version 3.0 March 2011

HISTORY OF THE DOCUMENT

The first version of this Chain of Custody Standard for the Mass Balance System was set up in June 2010 and send around for socialization to the members of the Bonsucro EU Sub Committee.

The revised version was reviewed by the Bonsucro Management Committee on July 6, 2010 and adopted by the Management Committee on July 27, 2010.

In December 2010 and in February 2011 this version was revised based on feedback received from the EU on the level of compliance of the Bonsucro Certification System with EU RED requirements as well as feedback received from the first pilot audits and training.

Consultants on the project for Bonsucro in the development of this Chain of Custody Standard have been: NewForesight™ and SGS.

Revision round	Date	Description of amendment
A	June 2010	Draft version send to Bonsucro EU Sub Committee
B	July 2010	Final version approved by Bonsucro Management Committee
C	December 2010	Revision made based on compliance with EU RED
D	February 2011	Revision made based on compliance with EU RED

This document is a work in progress. Especially during the first year of implementation, Bonsucro encourages feedback with suggestions for overcoming difficulties and improving the process.

This document is written in the English language. Bonsucro does not assume any liability for errors or misunderstandings introduced when this document is translated into other languages.

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1 INTRODUCTION

1.1 BONSUCRO

Bonsucro is a global multi-stakeholder non-profit initiative dedicated to reducing the environmental and social impacts of sugarcane production. The mission of Bonsucro is to ensure that current and new sugarcane production and all sugarcane derived products are produced sustainably. Bonsucro aims to achieve this mission through designing and organization the process of multi-stakeholder definition for sustainable sugarcane production and all sugarcane derived products (i.e. 'Standard Setting') and ensuring the integrity of its implementation (i.e. 'Certification').

1.2 BONSUCRO CERTIFICATION SYSTEM

The Bonsucro Certification System consists of 3 main elements:

1. Standards: Bonsucro has developed 2 standards:

- The “*Bonsucro Production Standard*” contains principles and criteria for achieving sustainable production from sugarcane and all sugarcane derived products in respect of economic, social and environmental dimensions. In addition, the Production Standard contains a set of technical and administrative requirements for enabling the tracking of claims on this sustainable production of Bonsucro sugarcane and all sugarcane derived products in the cane supply area and in the milling operations including the transport of cane to the mill¹.
- The “*Bonsucro Mass Balance Chain of Custody Standard*” contains a set of technical and administrative requirements for enabling the tracking of claims on the sustainable production of Bonsucro sugarcane and all sugarcane derived products along the entire supply chain after the mill and its cane supply; through production (e.g. conversion, processing, manufacturing, transformation), warehousing, transportation and trade to use of sugarcane and all sugarcane derived products.

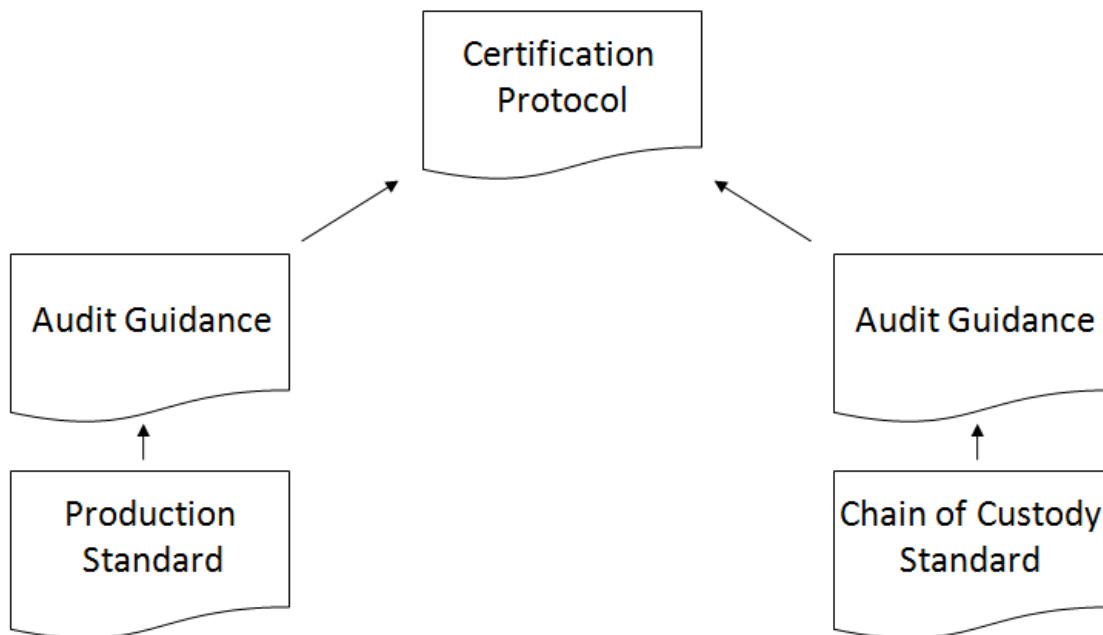
NOTE: Those Chain of Custody requirements that are applicable to the mill and its cane supply area are already included within the Production Standard and are identical to those of the Mass Balance Chain of Custody Standard.

2. Audit Guidance: Bonsucro has developed guidance and clarification documents for members and auditors on how to become compliant with the Bonsucro Production Standard and/or Chain of Custody Standard. This includes: 1.) description of how to interpret the principles and criteria from the Bonsucro standards, 2.) audit instructions to verify compliance through indicators and verifiers, 3.) information related to exceptional situations, 4.) objective criteria for critical limits, and 5.) Tools and calculations for audit

¹ These requirements are identical to the requirements of the BSI Mass Balance Chain of Custody Standard.

3. Certification Protocol: Bonsucro has developed a Certification Protocol for members and auditors that lists the process and procedures for certification against the Bonsucro standards. This includes: 1.) rules and requirements for Certification Bodies to audit against the Bonsucro standards, 2.) certification requirements for economic operators to demonstrate compliance to the Bonsucro standards, and 3.) audit procedures for Certification Bodies to verify compliance with the Bonsucro standards.

Together these 3 elements form the Bonsucro Certification System. As such, these individual documents can never be used as stand-alone documents and must always be used in relation to each other.



The scope of the Bonsucro Certification System can be with or without compliance to EU Renewable Energy Directive (RED) and its similar provisions in the EU Fuel Quality Directive (FQD). As such, the Bonsucro Certification System makes a distinction between 2 main scopes:

1. “Bonsucro”: compliant with Bonsucro requirements
2. “Bonsucro EU”: compliant with Bonsucro requirements PLUS additional requirements that are needed for EU RED compliance

Within the Bonsucro Certification System documents (i.e. Standards, Audit Guidance, and Certification Protocol) the extra Bonsucro EU requirements are clearly marked. Both the Bonsucro scope and the Bonsucro EU scope form part of the overall ‘Bonsucro Certification System’ and will be referred to as such from here onwards.

For compliance with the Bonsucro EU scope ALL requirements need to be met (e.g. Bonsucro PLUS additional EU RED requirements). Bonsucro EU certification is equivalent to Bonsucro certification. Whereas the contrary does not apply; Bonsucro certification is not equivalent to Bonsucro EU certification. Members that do not wish to become Bonsucro EU

compliant are excluded from this Bonsucro EU scope extension and do not have to comply with the additional EU RED requirements

1.3 INTENT OF THIS DOCUMENT

The intent of this Bonsucro Chain of Custody Standard for the Mass Balance System (further Choc) is in addition to the Bonsucro Principles and Criteria (P&C) to provide a voluntary international scheme that covers key economic, environmental and social considerations in order to produce sugarcane products, including biofuels and bioliquids world wide in a sustainable matter”. This Choc is especially designed for use in the entire supply chain of sugarcane, products and by products of sugarcane, bioliquids and biofuel produced from sugarcane. In the supply chain there is a need for both suppliers and clients in every “link” of the chain to demonstrate and claim compliance with sustainability criteria. The verification of compliance with EU sustainability criteria needs to follow the mass balance system.

Those Chain of Custody requirements that are applicable to the mill and its cane supply area have been included within the Production Standard and are identical to those of this Mass Balance Chain of Custody Standard.

In addition there has been identified a need for demonstrating compliance with the requirements of the EU Renewable Energy Directive (EU RED) also identified as Directive 2009/28/EC and with the EU Fuel Quality Directive (2009/30/EC).” Both of these EU directives contain the same sustainability criteria, therefore it is considered practical that this standard refers to EU RED only as far as the sustainability criteria are concerned.

1.4 INTRODUCTION TO CONTENT DOCUMENT

The chapters of this document are based on the “Bonsucro Chain of Custody Standard for the Mass Balance System” elements and are worked out in criteria specifying the requirements.

In the document references are made to definitions, abbreviations, tools and annexes as listed in the Bonsucro Certification Protocol that can be used within the entire Bonsucro certification system and that are standardised with EU RED definitions and vocabulary.

Specific definitions for this document have been added. Where possible annexes that are applicable on both the Bonsucro Principles and Criteria and this Choc are put in the reference list. New annexes have been added to explain the consignment mixtures and split. The Mass Balance System and the format for the (minimum requirements) specification of sustainability characteristics and GHG Emission Claims to consignments.

2. SCOPE

2.1 SCOPE OF BONSUCRO CHAIN OF CUSTODY STANDARD FOR THE MASS BALANCE SYSTEM

The unit of certification will be all economic operators after the mill and its cane supply base who take legal ownership of the Bonsucro certified sugarcane products and/or all sugarcane products derives thereof. Those Chain of Custody requirements that are applicable to the mill and its cane supply area have been included within the Production Standard and are identical to those of this Mass Balance Chain of Custody Standard. Therefore mills and their cane supply area only need to comply with the Production Standard and the unit-of-certification for this Chain of Custody Standard starts *after* the mill.

This Chain of Custody Standard offers 2 scopes for certification:

1. “Bonsucro”: compliant with Bonsucro requirements
2. “Bonsucro EU”: compliant with Bonsucro requirements PLUS additional requirements that are needed for EU RED compliance

Within this Standard the additional Bonsucro EU requirements are clearly marked as such. For compliance with the Bonsucro EU scope ALL requirements need to be met (e.g. Bonsucro PLUS additional EU RED requirements). Bonsucro EU certification is equivalent to Bonsucro certification. Whereas the contrary does not apply; Bonsucro certification is not equivalent to Bonsucro EU certification. Members that do not wish to become Bonsucro EU compliant are excluded from this Bonsucro EU scope extension and do not have to comply with the additional EU RED requirements

2.2 CERTIFICATION REQUIREMENTS

No public claims relating to compliance of Bonsucro and/or Bonsucro EU certified sugarcane and all sugarcane derived products with the Bonsucro standard can be made without valid certification against the Bonsucro Certification System by an accredited Certification Body that is approved by Bonsucro to perform audits under the Bonsucro Certification System. Only after certification are economic operators allowed to participate in the scheme and buy and sell certified sustainable material and claim it as such.

Verification of compliance with this Chain of Custody standard needs to follow the “Mass balance system”. This Chain of Custody standard contains specific requirements for the control of a mass balance system that is in conformance with the EU legislative requirements. The mass balance system is an accounting system to show the balance between input and output of sustainable sugarcane and all sugarcane derived products.

In order to achieve compliance with Bonsucro Chain of Custody Standard, 80% of the

indicators contained in Elements 3.1 to 3.6 must be satisfied. In this, the specific Bonsucro EU requirements can be excluded from the scope (and thus compliance).

In order to achieve compliance with the Bonsucro EU Chain of Custody Standards, 80% of the indicators contained in Elements 3.1 to 3.6 must be satisfied. In addition, there are a number of Major Elements (3.2.3, 3.2.4, 3.3.3, 3.3.4, 3.3.5, 3.4.1) which must be satisfied before compliance will be considered.

2.3 REFERENCES

The Bonsucro Certification Protocol has been established based on the following references:

- a) ISO 9000: 2005 quality management terms and vocabulary
- b) ISO 9001:2008 quality management system
- c) ISO 19011: 2002 quality- and environmental management system's auditing
- d) ISO IEC Guide 65/EN 45011
- e) ISO Draft IEC Guide 17065
- f) ISO 14065:2007, IDT "Greenhouse gases- Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition"
- g) Draft ISO IEC Guide 17065
- h) ISO 14065:2007 IDT
- i) ISO 14064-3:2006
- j) ISEAL procedure P035 on Group Auditing
- k) EU RED 2009/28/EC and EU FQD 2009/30/EC directives, definitions and abbreviations
- l) 2010/335/: EU Commission Decision of 10 June 2010 on guidelines for the calculation of land carbon stocks for the purpose of Annex V to Directive 2009/28/EC OJ L 151, 17.06.2010
- m) Communication from the EU Commission on voluntary schemes and default values in the EU biofuels and bioliquids sustainability scheme OJ C 160, 19.6.2010
- n) Communication from the EU Commission on the practical implementation of the EU biofuels and bioliquids sustainability scheme and on counting rules for biofuels OJ C 160, 19.6.2010

2.4 DEFINITIONS AND ABBREVIATIONS

Chain of custody (choc): the supply chain of a product including all stages from the feedstock production up until the release of the product for consumption (RE: communication from the commission on voluntary schemes)

Client: next legal owner of the product in the choc.

Consignment: quantity (e.g. batch, lot, load) of product mass with unique identification # and attached data specifying the product content in terms of kg (or tons of sugar or litres (or m³) of ethanol, the sustainability characteristics and greenhouse gas emission values assigned to that quantity in terms of EU RED annex V

Economic operator: Legal owner; Individual or organization which has ownership or physical control of sugarcane and/or all sugarcane derived products, from their origin to their market availability, for one or several steps in the chain of custody.

Note 1 - Organization is being used here as defined in ISO 14001

EU legislative requirements: referring to both EU RED and EU FQD requirements.

Mass Balance System: a system in which sustainability characteristics remain assigned to consignments ((RE: communication from the commission on voluntary schemes)

Subcontractor: not the legal owner of the product that is providing a service e.g. harvesting, transport, manufacturing, storage
The subcontractor is operating under full responsibility of the legal owner.

Supplier: previous legal owner of the product in the choc.

Traceability: the ability of each economic operator in the chain of custody to trace back the product or raw material 1 step back to the supplier and one step forward to the client.

More definitions for the Bonsucro Certification System can be found in Appendix 7.

3. BASIC ELEMENTS OF THE CHAIN OF CUSTODY STANDARD

3.1 TRACEABILITY

The principle of traceability is that each economic operator in the chain of custody is responsible for the data supplied in the product declarations submitted to the next economic operator.

Criteria	Indicator	Standard	Notes
3.1.1	Final certified products can be traced from the dispatch area of the processor until next owner	> =90% traceable ¹	The processor keeps track of the transport until delivery to the next owner of the product Next owner signs for reception of the product and takes over responsibility from the processor
3.1.2	Each following link in the chain keeps track of the products	> =90% traceable	Each economic operator can trace back 1 step and trace forward 1 step

- 1) The auditor takes a sample of 10 and when this sample shows 0 or 1 defects this will be qualified compliant and reported $\geq 90\%$ a.. When more than 1 defect is found the criteria score will be reported $< 90\%$ and the criteria will be checked for non – compliant.

NOTE: in order to prevent from double counting it is not possible to use the same non conformity in other criteria.

3.2 IDENTIFICATION, TRACEABILITY AND VERIFICATION OF SUSTAINABILITY CHARACTERISTICS

The sustainability criteria are listed in the Bonsucro production standard and are in compliance with the EU RED art. 17. For each consignment at any stage of the chain of custody sustainability characteristics need to be identified and assigned to the consignment.

Criteria	Indicator	Standard	Notes
3.2.1	Each consignment has a unique identification #	> =90% identified	The identification can be both physical and administrative and in that case needs to be identical It is allowed to have only administrative control of consignments
3.2.2	Each consignment contains a specification with at a minimum the data specified in Appendix 4	>= 90% with specification	When a next owner is accepting ownership for a consignment without specification or incomplete specification he takes responsibility to supply this information by himself
3.2.3 Bonsucro EU	Consignments clearly specify the scope of compliance: Non compliant Bonsucro compliant Bonsucro EU compliant	Major No false claims Eg. non compliant may not show up as compliant or Bonsucro compliant may not show up as Bonsucro EU compliant	By taking ownership over consignments that are non compliant the owner takes full responsibility over the consignment and needs to provide evidence of compliance before a claim of compliance can be made
3.2.4 Bonsucro EU	Each Bonsucro EU compliant consignment contains a specification with at a minimum the data specified in appendixes 4 and 5. GHG emissions figures must be calculated according to specifications laid down in appendixes 2 and 3.	Major	Only for option Bonsucro EU in addition to the above data for Bonsucro

3.3 CONTROL OF MASS BALANCE SYSTEM

The mass balance system, according to article 18 of the EU RED means a system in which “sustainability characteristics” remain assigned to “consignments” and evidence showing compliance with these characteristics are required and need to be documented and recorded. See Appendix 6 for principles.

The mass balance system must be controlled

- a) in periods of time in which the balance of Bonsucro certified sustainable product versus not sustainable product should be equal or positive at the moment of balance. Evidence of balance must be recorded and must be verifiable by periodic balance reports over that particular period, showing all inputs, mixes, conversions, stocks and outputs.

The accounting year for Mass Balance includes a full annual harvest cycle, which is not allowed to be divided over 2 accounting years.

Criteria	Indicator	Standard	Notes
3.3.1	The accounting system for the control of the mass balance is documented and mass balance records and data are maintained on a daily base and verifiable	>= 90 % validated within 1 week	The economic operator may collect data and records within intervals as documented in procedures on site before entering these in the accounting system; data must be updated and verifiable within one week the latest, preferably within 36 hours
3.3.2	Validation of data before official entering in the accounting system. The management representative is responsible for validation, as indicated in Bonsucro certification protocol 3.5.3.	>= 90 % validated within 1 week	Once validated the data entered can not be changed (are fixed within the software) or are clearly marked as validated showing data and time. The management representative has physically signed the documents or either approved through digital procedures for validation.
3.3.3 Bonsucro EU	Mass Balance “in time periods” shows over the time period the evidence that the balance of certified sustainable product versus not certified sustainable product is at least equal or positive. The management representative or a third party (RE the above art 3.3.2) is responsible for	Major in case of absence of data or longer than 1 period (max month) no report of balance Major in case of negative balance and no actions taken to correct	The interval for the documented periodic mass balance reports is maximum 1 month. Each period (month) balance must be validated by the management representative. Cumulative month to date mass balance report must be recorded showing the development of the mass balance data during the harvest period and/or accounting year .

Criteria	Indicator	Standard	Notes
	validation	within next period	
3.3.4 Bonsucro EU	<p>The mass balance is based on sugar or alcohol weight or volume calculation based on sampling and analysis by a qualified laboratory; using normative methods and results of measuring are validated by an accredited laboratory preferably (but not mandatory) holding an ISO IEC 17025 accreditation (RE: to reference list ISO IEC 17025 for the accreditation of testing laboratory).</p> <p>Metering and weighing equipment in the operations or used by subcontractors for volume or weight input and output of the mass balance is required calibration with a minimum frequency of 1 x year by a calibration and testing organisation preferably (but not mandatory) accredited for ISO IEC 17025</p>	<p>Major In case of total failure to calibrate</p> <p>Minor Otherwise: too late > 1 year</p> <p>Not complete</p>	<p>Volumes may vary because of concentrating or diluting processes. For this reason and effective mass balance on volumes only is not possible.</p> <p>The basis for the balance is the combination of weight (mass), volume, and the content of the consignment in either % of sugar (w/w) or alcohol % (v/v)</p> <p>Through conversion calculations sugar may be expressed in alcohol vice versa</p> <p>Permitted methods for the calculation conversions are given in the Bonsucro P&C chapter 3 and in the Choc Appendixes 1, 2, 3</p> <p>Methods applied require documentation and validation and cannot vary within one accounting year.</p>
3.3.5	<p>The total mass balance in the period is reliable within a tolerance of +/- 5% calculated over the total sugar and/or alcohol content input - output In case of losses or spillage this is counted for By products are also counted for as these may contain sugar and/or alcohol rests that require to be reported</p>	>= 90 % of mass balance within tolerance	<p>The mass balance is the result of all inputs and outputs in a period. Many data entries occur and laboratory testing takes place. Given the fact that volumes, weight and % have tolerances the total result needs to give confidence that the whole accounting, measuring and testing system is reliable; Exceeding the level of 5% difference in balance might indicate errors that require correction.</p>

3.4 CONTROL OF CONSIGNMENTS

Key for identification and traceability of sugarcane during the production stages, logistics and trading is to keep control over the consignments and keep records of production data including, volumes, weight, products specifications, sugar % and alcohol % , density etc. (minimum set of data as specified in the criteria) together with the records about the sustainability characteristics assigned to the consignment.

Criteria	Indicator	Standard	Notes
3.4.1 Bonsucro EU	Consignments have a unique # for identification; the # identifies the accounting year for the harvest, the unit of operation (farm, site etc.) and the # is generated by the accounting system in sequence of time when the consignment was first entered in the system. Each time when new consignments are created either by mixing or splitting new unique consignment # will be generated for the mixture or for each consignment that has been split off. Each new # contains references to the previous consignment # (see below mixing and splitting of consignments how to address these operations). From the consignment #, date and time the physical location of the consignment can be retrieved	Major System is not operational Minor > =90% compliance	The consignment and all attached information can be identified and traced back and forward by using the consignment #

3.5 CONTROL OF MIXES OF CONSIGNMENTS

It is common and often inevitable in sugarcane production, logistics and trade that consignments are mixed. Mixing of consignments with different sustainability characteristics is allowed and also the mixing of not sustainable with sustainable consignments is permitted as long as the balance (see 3) of sustainable product keeps positive. A mixture can have any form where consignments would normally be in contact, such as in a container, processing or logistical facility or site (defined as geographical location with precise boundaries within which products can be mixed). There are rules to be respected in order to control the mixing of consignments that are specified in the criteria below.

Criteria	Indicator	Standard	Notes
3.5.1	A new consignment # is generated for a mix; procedure is equal to the individual consignment	> = 90% compliance	It depends on the accounting system how the mix will show up and which # is possible in terms of characters Some systems allow for indicators identifying a mix
3.5.2	The separate sizes and sustainability characteristics of each individual consignment remain assigned to the mixture	> =90% compliance	See Appendix 6
3.5.3	Provides the sum of all consignments withdrawn from the mixture to be described having the same sustainability characteristics in the same quantities , as the sum of all consignments added to the mixture	>=90% compliance	See Appendix 6
3.5.4	To avoid double counting: at the moment the individual assignments are assigned to the mixture they will automatically booked off from the previous # as “sold” to the new # of the mix	>= 90% compliance	The way this happens may be different depending on the possibilities of the accounting system

3.6 CONTROL OF SPLITTING OF CONSIGNMENTS FROM MIXTURES

Once the sustainability characteristics have been assigned to consignments the values can be calculated and added to the specification of the consignment. The calculation methods, terms, definitions, tools and default values are listed and referred to in the criteria below.

Criteria	Indicator	Standard	Notes
3.6.1	Any consignment split off from a mixture or split off from an individual consignment requires a new #; use procedure above for generating a new consignment	>= 90% compliance	It depends on the accounting system how the split will show up and which # is possible in terms of characters Some systems allow for indicators identifying a new consignment as split from previous mixes
3.6.2	The sustainability characteristics of the mixture consignment remain assigned to the consignments# that have been split off in proportion of the volume that has been split off	>= 90% compliance	Appendix 6 NO AVERAGING
3.6.3	To avoid double counting: at the moment a new unique nr. Has been assigned to the to the split this will automatically be booked off from the previous # from the mix as "sold" to the new # of the split consignment	>= 90% compliance	The way this happens may be different depending on the possibilities of the accounting system

Quality management system

The quality management system elements are harmonised for the Bonsucro certification system and can be found in the Bonsucro Certification Protocol.

APPENDIX 1: GHG CALCULATION

Criterion 3.2 from the production standard

3.2 To monitor global warming emissions with a view to minimizing climate change impacts.	Global warming burden per unit mass product	•	•	t CO ₂ eq/t sugar	Total <0.4	Only used if sugar is being produced. Field-to-gate emissions. Environmental Burden is t carbon dioxide equivalent.
		•	•	g CO ₂ eq/MJ Fuel	Total < 24	Only used if ethanol is produced. Environmental Burden is g carbon dioxide equivalent.

1. System Boundary

The operational boundary includes growing and processing of sugarcane. It considers the boundary to include each individual mill and its growers as a unit, rather than a company owning and operating more than one mill. In the case of IPPs (Independent Power Producers) providing steam and power to a mill from bagasse that has been provided by the mill, the IPP is considered together with the mill concerned. The system boundary includes in addition the energy embedded in the manufacture and supply of all fertilizers and chemicals, but excludes the energy embedded in agricultural and milling capital equipment. All the activities of a plant on one site are considered, to reflect the sustainability of the total system producing food, fuel, energy and chemicals. This analysis represents a B2B analysis, considering the operation of a cane sugar processing facility, producing raw sugar and/or ethanol at the factory gate. Stand-alone refineries are not considered to be within the boundary. It accounts for the provision of products to a third party that is not the end user (cradle-to-gate).

2. Direct and indirect effects

The energy and GHG calculations are associated with direct energy inputs and at a second level by indirect inputs. Direct inputs are mainly fuel and power inputs, expressed in terms of their primary energy value. Indirect inputs include, in addition, the energy required for the production of chemicals, fertilizers and other materials used. The indirect inputs do not include the additional energy necessary for the manufacture and construction of farm, transport and industrial equipment and buildings.

3. Land Use Change

Land use change can be separated into direct and indirect components:

- Direct land change refers to a change from the original state of the land to use for sugarcane production. Depending on the previous use of the land in question, it is surmised that the land use change can unlock some of the carbon in the existing soil and vegetation.
- Indirect land use change concerns secondary effects induced by large scale expansion. This displaces existing crops, leading to expansion of crop land elsewhere, either in the same country or in other parts of the world. The effects of these changes are very difficult to estimate.

If the product's supply chain directly caused non-agricultural land to be converted to agricultural use on or after 1 January 2008, then GHG emissions associated with the direct land use change are included in the carbon footprint calculation. The table of IPCC default land use change values for selected countries published in the PAS 2050 are used in the calculation.

4. Handling of co-products and multiple products

Two approaches are possible:

- The “substitution” or “displacement” method attempts to model reality by tracking the likely fate of by-products. Each co-product generates an energy and emission credit equal to the energy and emissions saved by not producing the material that the co-product is most likely to displace.
- The “allocation” method allocates energy and emissions from a process to the various products according to mass or energy contents or monetary values.

In the case of sugarcane processing, a factory exporting power or bagasse achieves a credit in terms of energy and emissions saved, according to the displacement of energy in that country. Some standards recommend the use of the grid average GHG intensity to calculate the GHG credit for the exported power, although it may be more realistic to use the marginal energy mix. Since the marginal energy provision is likely to be from fossil fuels, the saving estimate is conservative when using the average generation mix. In this case, the approach aligned with the EU RED is adopted, which states that for calculating exported power credits, the average factor should be used. The country specific table of values used is given in the Annexure.

Where a factory produces only sugar and molasses, the allocation in proportion to market value is adopted; in most cases the allocation to molasses is less than 10 % of the total. Although the prices will change over time, the relative values will be far more stable. It is possible to use a displacement calculation, assuming that molasses displaces certain ingredients in an animal feed. However this is likely to vary significantly in different countries.

In the case of a factory producing more or less equivalent quantities of sugar and ethanol, the split of energy input and GHG emissions between the two products becomes a more difficult issue. The calculation assumes that allocation should be by energy content of the products. Sugar has a calorific value of 16500 MJ/t and ethanol 21 MJ/L; on the basis that 600 L of ethanol are produced from one tonne of sucrose, this implies a sugar equivalent value of 27.5 MJ/L for sucrose. On this basis, 57 % of the emissions should be allocated to sugar and 43 % to ethanol. As an alternative, the calculation procedure also allocates the energy use and emissions on a mass basis on equivalent sugar, on the basis that 1 tonne sugar is equivalent to 600 L ethanol.

In the case of an autonomous distillery, where the only product is ethanol, energy use and emissions are related to litres of ethanol produced or to MJ in ethanol.

5. Components contributing to emissions

CO₂ from sugarcane emitted in combustion and in ethanol fermentation is considered zero CO₂ emission to the air, because this is the carbon taken in from the air during sugarcane growth. CO and VOCs emitted in combustion are assumed to be converted to CO₂ fairly rapidly, but methane and nitrous oxides from burning bagasse are accounted for in GHG emissions. CO₂ emissions arising from biogenic carbon sources are excluded from the calculation of GHG emissions from the life cycle of products, except where the CO₂ arises from direct land use change. The greenhouse gases covered are CO₂, N₂O and CH₄. Methane and N₂O have global warming potentials 23 and 296 times that of CO₂ respectively (IPCC 2007). Greenhouse gas emissions are aggregated on a carbon dioxide equivalent (CO₂eq) basis. Non-CO₂ emissions arising from both fossil and biogenic carbon sources are included in the calculation of GHG emissions. In the case of burning bagasse in sugar mill boilers, it is assumed that 30 g CH₄ and 4 g N₂O are produced per 1000 MJ of energy in the bagasse burnt, based on IPCC data for burning of biomass. Changes in the carbon content of soils, either emissions or sequestration, other than those arising from direct land use change, are excluded from the assessment of GHG emissions. Any GHG emissions arising from transport required during the product and raw materials life cycle are included in the carbon footprint assessment. Emission factors for transport include emissions associated with creating and transporting the fuels required.

6. Calculation method

A materiality threshold of 1 % has been suggested to ensure that very minor sources of life cycle GHG emissions do not require the same treatment as more significant sources. Both the energy usage and emissions are calculated in the same spreadsheet, since the latter are largely determined by the former. The calculation includes the effects of the manufacture of fertilizer. Farming operations include chemicals application, irrigation, tillage and harvesting (and preparation of cane sets for planting). Cane transport covers getting the cane to the mill. The cane is processed to sugar and molasses or ethanol, and may include export of electric power or bagasse. The energy embedded in the manufacture of milling and other equipment is excluded. Inclusion of energy embedded in capital goods and equipment generally has an effect of less than 10 % on calculated emissions and is excluded. No allowance for transport of products from the factory is allowed for. Transport of workers is not included.

The primary energy is calculated. It differs from the direct energy input in that it takes into account the efficiency of generation and supply of the secondary energy source e.g. using a conversion factor from energy in the fuel used to generate electricity to the energy in the power produced. This applies to power, fuel, steam and any other energy input.

The GHG balance is particularly uncertain because of fertilizer nitrous oxide emissions and error margins can be enormous. The use of nitrogen fertilizers results in GHG emissions in two stages: fertilizer manufacture (primarily CO₂ emissions from energy used) and fertilizer application (primarily N₂O emissions from nitrification and denitrification processes in the soil). The assumption is made that 1.325 % of N in nitrogen fertilizer is converted to N in N₂O through nitrification and denitrification, following the IPCC recommendations.

In addition, agricultural lime application results in GHG emissions from both production energy use and in-soil reactions that release CO₂. These latter emissions are a further source of uncertainty. The model uses the IPCC factor of 0.44 kg CO₂eq/kg lime, which assumes that all C in lime becomes CO₂. This is the upper limit; it is possible in weakly acidic soils that limestone results in a net sink of CO₂.

The calculation approach adopted in this study is similar to that used in the EBAMM model (Farrell et al. 2006), which itself is similar to the GREET model (Wang et al. 2008). These models have been used in the past mainly to model the production of biofuels from corn, and they have had to be modified for sugarcane to incorporate additional issues as follows:

1. Modifications to incorporate sugar manufacture as the major activity. This includes power, fuels and lubricants.
2. Emissions due to cane burning. This is based on IPCC emission factors for burning biomass of 0.07 kg N₂O/t dry matter and 2.7 kg CH₄/t dry matter
3. Allowance for N₂O emissions from filter cake, vinasse and cane residue left in the field. This assumes 1.225 % of N in the residue is converted to N in N₂O (Macedo et al. 2008).
4. Emissions of CH₄ and N₂O in burning bagasse in sugar mill boilers; values of 30 and 4 g /1000 MJ energy in bagasse respectively are used (Wang et al. 2008).
5. Energy value of process chemicals.
6. A credit for molasses (where produced) based on its economic value relative to that of sugar.
7. Emissions from anaerobic treatment of effluent in the case that methane is not captured and used as a fuel. IPCC guidelines suggest 0.21 t CH₄ produced per t COD removed.
8. Allowance for any imports of molasses, bagasse and/or other biomass.

7. Default and secondary data

Secondary data (obtained from sources other than direct measurement) are used to calculate emissions where primary data are not available or inappropriate, to enable consistency and, where possible, comparability:

- Global warming potential of greenhouse gases
- Electricity emissions (in kg CO₂eq/kWh) from various energy sources
- Energy content of fertilizers per kg
- Energy use of pesticides and herbicides per kg
- Fuel emissions per litre
- Waste emissions per kg• N₂O and CH₄ emissions from burning bagasse
- N₂O and CH₄ emissions from burning cane
- Energy embedded and emissions for process chemicals
- Direct land use change
- Agriculture emissions from soils

Default values used are given in the Annexure.

8. Presentation of results

The agricultural and processing phases are dealt with separately. Thus outputs are available as:

Net energy use in agriculture	MJ/ha or MJ/t cane
Energy used in cane transport	MJ/t cane
Net energy use in processing	MJ/t cane or MJ/t sugar
Total net energy use	MJ/t sugar or MJ/L ethanol
Agricultural GHG emissions	kg CO ₂ eq/t cane
Processing GHG emissions	kg CO ₂ eq/t cane or kg CO ₂ eq/t sugar
Total net GHG emissions	g CO ₂ eq/g sugar g CO ₂ eq/L ethanol and/or g CO ₂ eq/MJ ethanol

9. References

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Wang M.; Wu M.; Huo H.; Liu J. (2008). Life-cycle energy use and greenhouse gas emission implications of Brazilian sugarcane ethanol simulated with the GREET model. *Int. Sugar J.* 110, 1317, 527-545

ANNEXURE DEFAULT VALUES USED

It is expected that some of these default values will change as more accurate or realistic values are published. Further fine tuning may also be incorporated in future e.g. in allowing for different emissions from different types of nitrogenous fertilizer. It may also be necessary to introduce country specific default values where they are seen to make a material difference to the calculations.

Most of the default values are obtained from the EBAMM model (Farrell et al. 2006), often based on the GREET model using data from Shapouri et al. (2004) and Graboski (2002), or from Macedo et al. (2008).

Fertilizer and agricultural chemicals, in MJ/kg:

	Energy Demand (MJ/kg)	Emissions Factor (kg CO ₂ eq/kg)	Emissions on Application (kg CO ₂ eq/kg)
Nitrogen (elemental)	56,9	4	6,2
Potash (K ₂ O)	7	1,6	
Phosphate (P ₂ O ₅)	9,3	0,71	
Lime (CaCO ₃)	0,12	0,07	0,44
Herbicide	355,6	25	
Insecticide	358	29	

Data from EBAMM

Primary energy inputs and emissions:

	Energy Demand (MJ/MJ fuel)	Total emissions (g CO ₂ eq/MJ)
Gasoline	1,14	85
Diesel	1,16	91
Fuel Oil	1,24	96
Natural Gas	1,12	66
Coal	1	107
Electricity	2,5	150*

Energy demand data from Macedo et al. (2008), emissions from EBAMM

*Average value; country specific values should be used.

The energy value is multiplied by the Energy Demand factor to give the primary energy value.

Embedded energy and emissions for process chemicals:

	Energy Demand (MJ/kg)	Emissions Factor (g CO ₂ eq/MJ)
Lime (CaO)	0,11	951
Biocide	3,02	951
Nitrogen	56,33	951
Caustic	75	951
Sulfuric acid	2,4	951
Anti-foam	10	951
Miscellaneous	50	95

¹ Macedo et al. (2008); ² Mortimer et al. (2004); ³ EBAMM

Emissions factor for electricity, in kg CO₂/MJ:

Country/Region	Grid average
Argentina	0,0763
Australia	0,241
Brazil	0,022
Canada	0,062
China	0,214
Finland	0,0826
France	0,0228
Germany	0,139
India	0,253
Indonesia	0,216
Ireland	0,165
Malaysia	0,137
Mozambique	0,0009
Netherlands	0,13
Pakistan	0,103
Philippines	0,128
Poland	0,184
Portugal	0,115
South Africa	0,237
Spain	0,106
Sweden	0,016
Russia	0,091
Ukraine	0,095
United Kingdom	0,131
United States	0,16

Source: RFA, UK

APPENDIX 2: EU RED FOR THE CALCULATION OF THE “EL” VALUE FOR ANNUALIZED EMISSION FROM CARBON STOCK CHANGE CAUSE BY LAND USE CHANGES

The default value of 24 g CO₂eq/MJ fuel should be used if there was no land use change after January 2008. Note that planting cane to former crop land is not regarded as land use change.

The following default values should be used:

	Default greenhouse gas emissions (g CO ₂ eq/MJ)
Disaggregated default values for cultivation: ‘eec’	14
Disaggregated default values for processing (including excess electricity): ‘ep – eee’	1
Disaggregated default values for transport and distribution: ‘etd’	9

The total default value is 24 g CO₂eq/MJ fuel. If there has been direct land use change after January 2008, then an amount el needs to be added to the default value of 24 g CO₂eq/MJ. This estimates the change in carbon stock as a consequence of direct land use change.

Annualized emissions from carbon stock changes caused by land-use change after 1 January 2008, el, shall be calculated by dividing total emissions equally over 20 years. Change from one crop to another is not regarded as land use change. For the calculation of those emissions the following rule shall be applied:

$$el = (CSR - CSA) \times 3,664 \times 1/20 \times 1/P^{(1)}$$

where

el = annualized greenhouse gas emissions from carbon stock change due to land-use change (measured as mass of CO₂-equivalent per unit biofuel energy);

CSR = the carbon stock per unit area associated with the reference land use (measured as mass of carbon per unit area, including both soil and vegetation). The reference land use shall be the land use in January 2008 or 20 years before the raw material was obtained, whichever was the later;

CSA = the carbon stock per unit area associated with the actual land use (measured as mass of carbon per unit area, including both soil and vegetation). In cases where the carbon stock accumulates over more than one year, the value attributed to CSA shall be the estimated stock per unit area after 20 years or when the crop reaches maturity, whichever the earlier;

P = the productivity of the crop (measured as biofuel or bioliquid energy per unit area per year); and

⁽¹⁾ The quotient obtained by dividing the molecular weight of CO₂ (44,010 g/mol) by the molecular weight of carbon (12,011 g/mol) is equal to 3,664.

Land carbon stocks are calculated according to the guidelines published by the European Commission, for land converted after 1 January 2008. These are outlined in the

Commission Decision of 10 June 2010 on guidelines for the calculation of land carbon stocks for the purpose of Annex V of Directive 2009/28/EC, published in the EU Official Journal L151 of 17 June 2010, p. 19. Details for the calculation of carbon stocks are provided in Appendix 4 of the Production Standard Audit Guidance.

Bonsucro will communicate to economic operators any details of lists on protected areas as soon as they are available from the EC.

Additional mandatory requirement for biofuels under the EU Renewable Energy Directive (2009/28/EC), included in section 6 and this Appendix, shall be modified according to the publication by the European Union of new communications and decisions, including on the definition of highly biodiverse grasslands, degraded lands, and default values, as well as any modification related to the EU Directive 2009/28/EC.

The fossil fuel comparator for calculation of GHG reductions recommended for use by the EU is 83.8 g CO₂eq/MJ. The figure of GHG emissions to appear on Bonsucro EU certificates shall be calculated as follows: $SAVING = ((83.8 - \text{Emissions from criterion 6.1}) / 83.8) \times 100$ per cent

APPENDIX 3: MONITOR GLOBAL WARMING EMISSIONS WITH A VIEW TO MINIMIZING CLIMATE CHANGE IMPACTS

Greenhouse gas emissions from the production and use of transport fuels, biofuels and bioliquids shall be calculated as:

$E = eec + el + ep + etd + eu - esca - eccs - eccr - eee,$
where

E = total emissions from the use of the fuel; in g CO₂eq/MJ

eec = emissions from the extraction or cultivation of raw materials;

el = annualised emissions from carbon stock changes caused by land-use change;

ep = emissions from processing;

etd = emissions from transport and distribution;

eu = emissions from the fuel in use;

esca = emission saving from soil carbon accumulation via improved agricultural management;

eccs = emission saving from carbon capture and geological storage;

eccr = emission saving from carbon capture and replacement; and

eee = emission saving from excess electricity from cogeneration.

Emissions from the manufacture of machinery and equipment shall not be taken into account.

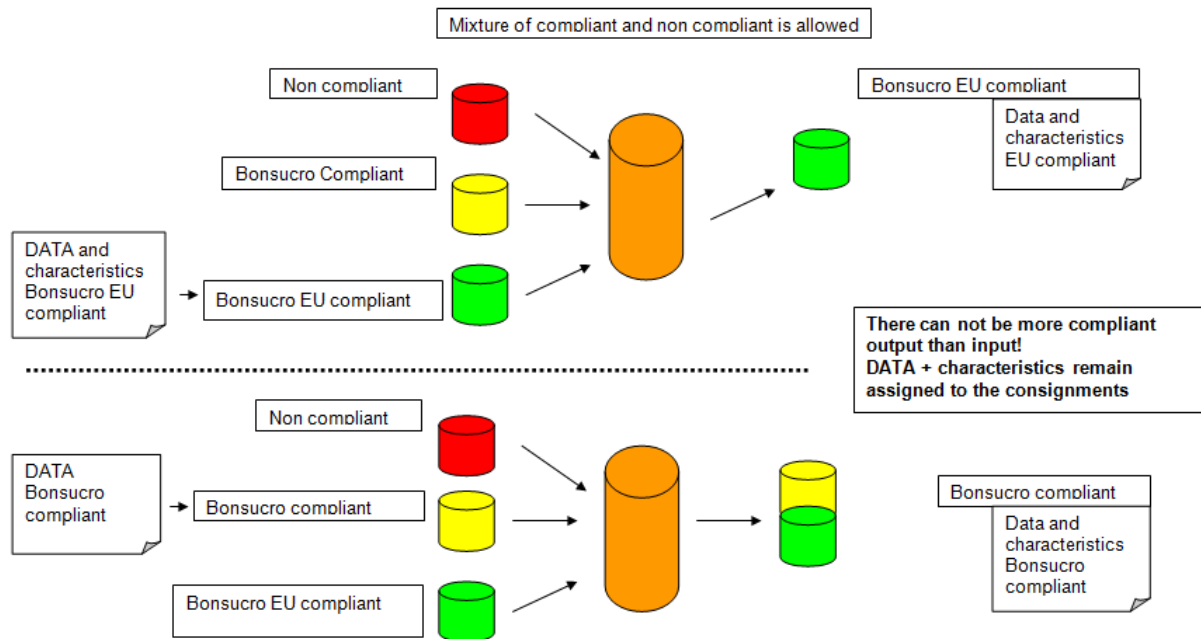
APPENDIX 4: MINIMUM DATA ASSIGNED TO CONSIGNMENTS FOR BONSUCRO COMPLIANCE

- Description of the raw material (sugarcane)
- The quantity, kg (tons) or litres (m³)
- Sugar content in % w/w or alcohol content in % v/v
- Evidence showing compliance with the Bonsucro Production Standard

APPENDIX 5: ADDITIONAL DATA ASSIGNED TO CONSIGNMENTS FOR BONSUCRO EU COMPLIANCE

- A statement that the production was awarded a certificate Bonsucro EU from recognized voluntary scheme Bonsucro
- A statement that the sugarcane was obtained in a way that complies with the land use restriction criteria; and/or
- A GHG emission figure derived from Appendix 1
- Country of origin
- The proportion of processing residues (molasses) used in the production

APPENDIX 6: PRINCIPLE OF MASS BALANCE APPLIED ON BONSUCRO COMPLIANT AND BONSUCRO EU COMPLIANT



APPENDIX 7: TERMS AND DEFINITIONS

Normative references for definitions referring to:

ISO 9000:2005; ISO 14001:2004; ISO IEC Guide 17000:2004; EU RED (2009/28/EC); EU FQD (2009/30/EC); CEN/TC383

Accreditation: Third-party attestation related to a conformity assessment body conveying formal demonstration of its competence to carry out specific conformity assessment tasks (Source: Adapted from ISO/IEC 17000:2004)

Accreditation body: Authoritative body that performs accreditation

Note: The authority of an accreditation body is generally derived from government (Source: Adapted from ISO/IEC 17000:2004)

Audit: i.e. Conformity assessment, verification; demonstration that specified requirements relating to a product, process, system, person or body are fulfilled

Note 1 - the subject field of conformity assessment includes activities defined elsewhere in this standard, such as testing, inspection and certification, as well as the accreditation of conformity assessment bodies.

Note 2 - The expression “object of conformity assessment” or “object” is used in this standard to encompass any particular material, product, installation, process, system, person or body to which conformity assessment is applied.

(Source: Adapted from ISO/IEC 17000:2004)

Auditor: i.e. Assessor, Verifier; person that performs the audit (i.e. assessment, verification)

Actual value: The greenhouse gas emission saving for some or all of the steps of a specific biofuel production process; (Source: EU RED 2009/28/EC)

Agricultural Worker Categories: Summary of broad categories of agricultural workers.

There is a lack of clear-cut distinctions between different categories of workers. Consequently, there are numerous types of labour relations and different forms of labour force participation. The different categories of workers also vary within each country and, in certain cases, a single farmer may be grouped in more than one category. Many smallholders supplement their income with wages earned by working in large commercial farms during harvesting periods. (Source: ILO)

Aerothermal energy: Energy stored in the form of heat in the ambient air (Source: EU RED 2009/28/EC)

Biofuels: Means liquid or gaseous fuel for transport produced from biomass (Source: EU RED 2009/28/EC)

Biofuel production: Transformation of biomass or of an intermediate product derived from biomass into a biofuel. (Source: CEN/TC383)

Bioliquids: Means liquid fuel for energy purposes other than for transport, including electricity and heating and cooling, produced from biomass. (Source: EU RED 2009/28/EC)

Biomass: Means the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste. (Source: EU RED 2009/28/EC)

Biomass processing: Transformation of biomass into an intermediate product (Source: CEN/TC383)

Bonsucro certified members: Bonsucro members who have been certified by Bonsucro approved Certification Bodies to be in compliance with the Bonsucro Certification System

Cane supply area: area which a mill defines as the farms/estates supplying cane for the purposes of certification.

Certificate period: 1-year period as part of the 3-year certification validity. Certificate period 1 runs from the issue date of certificate till the start date of the annual surveillance audit. Certificate period 2 runs from the start of the first annual surveillance audit till the start date of the second surveillance audit. Certificate period 3 runs from the start date of the second certificate period till the end date of the certification.

Certification Body: i.e. Conformity Assessment Body; Body that performs the audit
Note 1 - An accreditation body is not a conformity assessment body (ISO/IEC 17000:2004) (Source: Adapted from ISO/IEC 17011:2005)

Chain of custody (choc): The supply chain of a product including all stages from the feedstock production up until the release of the product for consumption (RE: communication from the commission on voluntary schemes). (Source: EU RED 2009/28/EC)

Chain of custody stage: Changes of ownership or physical control of biomass, intermediate products, semi-finished products. (Source: CEN/TC383)

Child: Any person less than 15 years of age, unless local minimum age law stipulates a higher age for work or mandatory schooling, in which case the higher age would apply. If however, local minimum age law is set at 14 years of age in accordance with developing country exceptions under ILO convention 138, the lower age will apply. (Source: ILO)

The ILO Minimum Age Convention, No. 138 (1973) states that the minimum age of employment should not be less than the age of completion of compulsory schooling and, in any case, shall not be less than 15 years. However a Member country whose economy and educational facilities are insufficiently developed, may under certain conditions initially specify a minimum age of 14 years. (Source: ILO)

Child labour: Any work by a child younger than the age (s) specified in the above definition of a child, except as provided by ILO recommendation 146. (Source: ILO)

Client: Next legal owner of the product in the choc.

Company: The entirety of any organization or business entity responsible for implementing the standard. (Source: SA 8000)

Conducting business with integrity: Businesses should work against corruption in all its forms, including extortion and bribery. (Source: Principle 10 UN Global Compact)

Consignment: quantity (e.g. batch, lot, load) of product mass with unique identification # and attached data specifying the product content in terms of kg (or tons of sugar or litres (or m³) of ethanol, the sustainability characteristics and greenhouse gas emission values assigned to that quantity in terms of EU RED annex V

Default value: Means a value derived from a typical value by the application of pre-determined factors and that may, in circumstances specified in this Directive, be used in place of an actual value. (Source: EU RED 2009/28/EC)

Discrimination

1. The term **discrimination** includes—(Art 1 C111)
 - (a) any distinction, exclusion or preference made on the basis of race, colour, sex, religion, political opinion, national extraction or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation;
 - (b) such other distinction, exclusion or preference which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation as may be determined by the Member concerned after consultation with representative employers' and workers' organisations, where such exist, and with other appropriate bodies.
2. Any distinction, exclusion or preference in respect of a particular job based on the inherent requirements thereof shall not be deemed to be discrimination.
3. For the purpose of this Convention the terms **employment** and **occupation** include access to vocational training, access to employment and to particular occupations, and terms and conditions of employment. (Source: ILO Convention C111)

District heating or district cooling: Means the distribution of thermal energy in the form of steam, hot water or chilled liquids, from a central source of production through a network to multiple buildings or sites, for the use of space or process heating or cooling. (Source: EU RED 2009/28/EC)

Document: Information and its supporting medium

Note 1 - The medium can be paper, magnetic, electronic or optical computer disk, photograph or master sample, or a combination thereof;

Note 2 - Adapted from ISO 9001:2000; ISO 14001:2004

Economic operator: Legal owner; Individual or organisation which has ownership or physical control of sugarcane and/or all sugarcane derived products, from their origin to their market availability, for one or several steps in the chain of custody.

Note 1 - Organization is being used here as defined in ISO 14001

Energy from renewable sources: Means energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. (Source: EU RED 2009/28/EC)

EU legislative requirements: referring to both EU RED and EU FQD requirements.

Forced or compulsory labour: This shall mean all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily. (Source: ILO Convention C29)

Most common forms of forced or compulsory labour:

Forced labour can take many forms - some imposed by the State, but the majority in the private economy.... Forced labour can be an outcome of trafficking in persons and irregular migration... Mechanisms of force applied include debt bondage, slavery, misuse of customary practices and deceptive recruitment systems. Some of the most common forms of forced labour include (for a full list see ILO Handbook)

Combating forced labour: A handbook for employers and business, booklet 2

Debt-induced forced labour:

Commonly referred to as “bonded labour” in south Asia, where the practice is most common, but also known as “debt bondage”. .. Debt bondage arises when a person mortgages his or her services or those of his family members to someone providing credit in order to repay the loan or advance.

Forced labour as an outcome of human trafficking:

Trafficking in persons, or human trafficking, is often linked to forced labour. It is fuelled by organised criminal networks or individuals and can involve deceptive recruitment, racketeering and blackmailing for the purpose of labour exploitation.

Forced labour linked to exploitation in labour contract systems:

This can be found almost everywhere in the world today. For example, migrant workers can find themselves “bonded” to a labour contractor because excessive fees have been charged and with limited if any possibility to change the employer once they arrive in the destination country.

Geothermal energy: Energy stored in the form of heat beneath the surface of solid earth. (Source: EU RED 2009/28/EC)

Greenhouse gas / GHG: Gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. (Source: CEN/TC383)

Note - GHGs include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydro-fluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

Greenhouse gas emission Mass of a GHG released to the atmosphere over a specified period of time. (Source: Adapted from ISO 14064-1:2006)

Gross final consumption of energy: Means the energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat indistribution and transmission. (Source: EU RED 2009/28/EC)

Guarantee of origin: Means an electronic document which has the sole function of providing proof to a final customer that a given share or quantity of energy was produced from renewable sources as required by Article 3(6) of Directive 2003/54/EC. (Source: EU RED 2009/28/EC)

Hazardous child labour: Hazardous child labour is defined by Article 3 (d) of the ILO Convention concerning the Prohibition and Immediate Action for the elimination of the worst forms of child labour, 1999 (182) 3D work which, by its nature or its circumstances in which it is carried out is likely to harm the health, safety or morals of children. (Source: ILO)

High Conservation Value (HCV): High Conservation Value (HCV) areas are defined as natural habitats where conservation/ biodiversity values are considered to be of outstanding significance or critical importance based on factors such as the presence of rare or endemic species, sacred sites, or resources harvested by local residents (see www.hcvnetwork.org). For implementation of the Bonsucro standard each country is required to provide a country specific and official interpretation of High Conservation Value which will be used for audits in that country. A cut off date of 1 January 2008 will apply.

The six High Conservation Values (HCVs):

HCV 1 Areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, refugia).

HCV 2 Areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance.

HCV 3 Areas that are in or contain rare, threatened or endangered ecosystems.

HCV 4 Areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control).

HCV 5 Areas fundamental to meeting basic needs of local communities (e.g. subsistence, health).

HCV 6 Areas critical to local communities' traditional cultural identity (e.g. areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

Hydrothermal energy: Means energy stored in the form of heat in surface water. (Source: EU RED 2009/28/EC)

Intermediate product: Output from a unit process that is an input to other unit processes involving further transformation within the system. (Source: CEN/TC383)

Mass balance system: System which (where each economic operator within an EU member state or country) keeps track of the amount of sustainable biomass, biofuel or bioliquid it sources and the amount of sustainable biomass, biofuel or bioliquid it delivers and in which sustainability characteristics remain assigned to consignments. (Source: CEN/TC383)

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

Phosphate equivalent as a measure of eutrophication: Since phosphorus and nitrogen differ in their eutrophication effects, a phosphate equivalent conversion is used based on potency factors of 3.06 for phosphorus and 0.42 for nitrogen. Using 120 kg N /ha/y and 20 kg P /ha/y, the figure would be $(120 \times 0.42) + (20 \times 3.06) = 112$ kg phosphate/ha/y. (Source: IChemE (2002). Sustainable development progress metrics. Inst. Chem. Engrs. London.)

Product declaration Document passed on to the next economic operator in the chain of custody specifying properties, sustainability characteristics and GHG emission data of a defined consignment. (Source: CEN/TC383)

Occupational accident: an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work which results in one or more workers incurring a personal injury, disease or death. Included in occupational accidents are travel, transport or road traffic accidents in which workers are injured and which arise out of or in the course of work, i.e. while engaged in an economic activity, or at work, or carrying on the business of the employer.

Occupational injury: any personal injury, disease or death resulting from an occupational accident; an occupational injury is therefore distinct from an occupational disease, which is a disease contracted as a result of an exposure over a period of time to risk factors arising from work activity. ILO Resolution/Convention 155 on statistics of occupational injuries (resulting from occupational accidents), adopted by the Sixteenth International Conference of Labour Statisticians, (Oct.1998)

Occupational disease: A disease contracted as a result of an exposure to risk factors arising from work activity. (Source: ILO)

Renewable energy obligation: Means a national support scheme requiring energy producers to include a given proportion of energy from renewable sources in their production, requiring energy suppliers to include a given proportion of energy from renewable sources in their supply, or requiring energy consumers to include a given proportion of energy from renewable sources in their consumption. This includes schemes under which such requirements may be fulfilled by using green certificates. (Source: EU RED 2009/28/EC)

Record: Document stating results achieved or providing evidence of activities performed

Reporting period: This will be one year unless otherwise agreed. The period should include a single complete milling season.

Support scheme: Means any instrument, scheme or mechanism applied by a Member State or a group of Member States, that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased. This includes, but is not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and premium payments. (Source: EU RED 2009/28/EC)

Typical value: Means an estimate of the representative greenhouse gas emission saving for a particular biofuel production pathway. (Source: EU RED 2009/28/EC)

Theoretical recovery of sugar: The theoretical OR (Overall Recovery) normalized for juice purity and cane fibre content is calculated as:

$$OR = E \cdot BHR = 0,98 \cdot (100 - ((20 \cdot WFC) / (100 - WFC))) \cdot (1,5 - (50 / PJ))$$

where *wFC* is the fibre content of the cane in g/100 g and *PJ* the purity of the raw juice. In addition, refining all white sugar in a white end refinery is expected to

increase the undetermined loss by 0.4 % of the sugar in raw juice. Then the factor 0.98 becomes 0.976.

Traceability: The ability of each economic operator in the chain of custody to trace back the product or raw material 1 step back to the supplier and one step forward to the client.

Third-party conformity assessment activity: Conformity assessment activity that is performed by a person or body that is independent of the person or organization that provides the object, and or user interests in that object. Adapted from ISO/IEC 17000:2004

Raw material: Primary or secondary material that is used to produce a product. (Source: Adapted from ISO 14040:2006)

Note - Secondary material includes recycled material.

Significantly affected: A significant impact would be apparent if the operations of sugarcane farms or mills resulted in changes to the environment that resulted in (1) the quality and / or quantity of habitat supporting an endangered or threatened species being affected to the extent that the numbers and viability of the species (the classification from the IUCN red list) was adversely affected; (2) conversion, diminution or degradation of the integrity of an endangered habitat such that there was a measurable adverse impact on its ecological status in the opinion of a competent ecologist (3) ecosystem service (such as water supply) being sufficiently changed as to cause material adverse impacts to local communities or ecosystems (for example, flows contain additional nutrients that change downstream ecology or affect the availability of drinking water for downstream communities)

Sugarcane yield: Irrigated - 85; Supplementary 65; Rainfed 45 (total yield per year/total ha cut/weighted average age at harvest) for each category of water regime. Value for reporting period or 5 year rolling average can be used. Seedcane production (yields and area) should be excluded and non cane areas and roads and contours should be excluded from area harvested. (Supplementary = areas where irrigation is necessary to guarantee continuous sugarcane production).

Supplier/contractor A business entity which provides the company with goods and/or services integral to, and utilized in/for, the production of the company's goods and/or services. (Source: SA 8000)

Supplier: Previous legal owner of the product in the choc

Subcontractor/sub-supplier: A business entity in the supply chain which, directly or indirectly, provides the suppliers with goods and/or services integral to, and utilized in/for, the production of the supplier's and/or company's goods and/or services. (Source: SA 8000)

Subcontractor: Not the legal owner of the product that is providing a service e.g. harvesting, transport, manufacturing, storage. The subcontractor is operating under full responsibility of the legal owner.

Sustainability criteria: States or properties as a means of judging whether or not a sustainability principle has been fulfilled. (Source: CEN/TC383)

Young worker: Any worker over the age of a child as defined above and under the age of 18. (Source: ILO)

Worst forms of child labour: Whilst child labour takes many different forms, a priority is to eliminate without delay the worst forms of child labour as defined by Article 3 of ILO Convention 182. (Source: ILO)

Symbols and Abbreviations	<p>BOD biological oxygen demand ChoC Chain of Custody COD chemical oxygen demand EMP environmental management plan ESIA environmental and social impact assessment g grams GHG greenhouse gas ha hectares HCV high conservation value kg kilograms kJ kilojoules kWh kilowatt hours L litres MJ megajoules RS reducing (invert) sugars t metric tonnes tc tonnes cane TSAI total sugars expressed as invert y year</p>
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The information below has been taken from EU RED annex V C: Methodology
 Greenhouse gas emissions from the production and use of transport fuels, biofuels and bioliquids shall be calculated as:

$$E = eec + el + ep + etd + eu - esca - eccs - eCCR - eee,$$

where

E = total emissions from the use of the fuel;

eec = emissions from the extraction or cultivation of raw materials;

el = annualised emissions from carbon stock changes caused by land-use change;

ep = emissions from processing;

etd = emissions from transport and distribution;

eu = emissions from the fuel in use;

esca = emission saving from soil carbon accumulation via improved agricultural management;

eccs = emission saving from carbon capture and geological storage;

eCCR = emission saving from carbon capture and replacement; and

eee = emission saving from excess electricity from cogeneration.

Emissions from the manufacture of machinery and equipment shall not be taken into account.

$$\text{SAVING} = (EF - EB)/EF \text{ where } EB = \text{total emissions from the biofuel or bioliquid; and } EF = \text{total emission from the fossil fuel comparator}$$

$$el = (CSR - CSA) \times 3,664 \times 1/20 \times 1/P \quad (1)$$

(1) the quotient obtained by dividing the molecular weight of CO₂ (44,010 g/mol) by the molecular weight of carbon (12,011 g/mol) is equal to 3,664

CSR = carbon stock associated with the reference land use (measured as mass of carbon per unit area, including both soil and vegetation). The reference land use shall be the land in use in January 2008 or 20 years before the raw material was obtained, whichever was later.

CSA = the carbon stock per unit area associated with the actual land use (measured as mass of carbon per unit area, including both soil and vegetation). In cases where the carbon stock accumulates over more than one year, the value attributed to CSA shall be estimated stock per unit area after 20 years or when the crop reaches maturity, whichever is the earlier.

P = the productivity of crop (measured as biofuel or bioliquid energy per unit area per year).