Round Table on Responsible Soy Association

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RTRS EU RED Compliance Requirements for the Supply Chain

I. Introduction

The RTRS EU RED Compliance Requirements for the Supply Chain has been developed on request of the RTRS Executive Board. It is part of the RTRS EU RED Scheme, which will allow soy producers and processors to meet the requirements for supplying soy-based biofuels to European Union member states. The *European Union Directive 2009/28/EC on the promotion of the use of energy from renewable sources* (also known as the 'EU RED') sets out the land use and carbon savings requirements for eligible biofuels and bioliquids. It is important to note that the EU RED sets a minimum Greenhouse Gas savings for biofuels, which is 35%[1] as compared to fossil fuel. The EU has provided 'default' values for most biofuel feedstocks which economic operators can use to calculate whether the fuel they are supplying meets the minimum savings threshold. However, for soy default values do not meet the 35% savings. In practice, this means that some supply chain operators will have to record actual values and calculations to show the minimum 35% savings is met[2].

II. Scope

This document sets out the requirements against which an economic operator in the soy supply chain will be assessed to demonstrate compliance with the EU RED. The soy supply chain includes the following operators: producers (growers), crush, refining, esterification and blending, and takes into account storage and transportation up until the point the product is delivered to the market. The RTRS EU RED Compliance Requirements for Producers applies to producers (growers) and the RTRS EU RED Compliance Requirements for the Supply Chain applies to all supply chain operators. The RTRS EU RED Compliance Requirements for the Supply are mandatory for all supply chain operators seeking to supply soy, soy derivatives and soy products to the EU biofuel market and wanting to communicate RTRS EU RED data, including claiming compliance with RTRS EU RED. Claims can only be made about compliance with the RTRS EU RED requirements if the operator has been successfully assessed against the RTRS EU RED requirements. The unit of certification is the organization's physical site.

It is anticipated that the RTRS will either develop a GHG calculator, or will assess and approve an existing GHG calculator for use with these RTRS EU RED Compliance Requirements for the Supply Chain. Any approval of a calculator will be undertaken using the methodology set out in Section VII of this document and Section VII of the RTRS EU RED Compliance Requirements for Producers, and be subject to independent verification prior to approval.

III. Changes from previous version of this document

Section 2.4.1, Guidance 1.1.1, 2.4.1, 3.1.1, IX Methodology for Calculating GHG

IV. How to use this document

The RTRS EU RED Compliance Requirements for the Supply Chain includes the following sections:

- V Definitions
- VI List of Acronyms
- VII Compliance Requirements for the Supply Chain
- VIII Guidance for principles and criteria

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[1] This minimum threshold will increase to 50% from January 2017, and 60% from January 2018 for biofuels and bioliquids produced in installations that were in operation on or after 1 January 2017.
[2] If an installation was in operation before January 2008, the biofuel is exempt from the minimum 35% savings until 1 April 2013. Installations are defined as any processing installation in the production, and do not include farms. For this reason, the grandfathering requirements are only set out in the EU RED Requirements for the Supply Chain, and are not included in the EU RED Requirements for Producers.

- IX Methodology for Calculating Greenhouse Gas Emissions for the soy supply chain under the European Commission – Renewable Energy Directive (EU-RED)

Supply chain operators and auditors using this document to assess compliance must also refer to the RTRS EU RED Scheme: System Description.

V. Definitions

Bulk	Where the soy product and non-soy product occupy the same physical space at the same time
Country of origin	The country where the soybeans were grown
Criteria	The 'content' level of a standard. Conditions that need to be met in order to achieve a Principle.
Economic operator	Organisation which is responsible for one or several steps in the chain of custody
Installation	Any processing installation used in the production process. It does not include production facilities that have been intentionally added to the production chain to qualify for the exemption set out in Directive 2009/28/EC article 17. 2
Legal ownership	An enforceable claim or title to an asset or property, and is recognized as such by law. This includes the right to possession, the privilege of use, and the power to convey those rights and privileges.
Organization	The entity which is implementing the EU RED Requirements for the Supply Chain and an RTRS Chain of Custody System.
RTRS Material accounting system	A requirement of the RTRS Chain of Custody Standard which requires operators to control input and output data about the RTRS material. For example, this could be a database.

VI. List of Acronyms

GHG	Greenhouse Gas
HGV	Heavy Goods Vehicle
P&C	Principles and Criteria
RED	Renewable Energy Directive
RTRS	Round Table on Responsible Soy

VII. Compliance Requirements for the Supply Chain

1. Exemption until 1 April 2013

1.1.1.   Where the installation was in operation on 23 January 2008, or the product was supplied from an installation that was in operation on 23 January 2008, the requirements set out in '2. Calculation of GHG emissions for the supply chain' do not need not be applied until 1 April 2013.

2. Calculation of GHG emissions for the supply chain

2.1.   Greenhouse gas (GHG) emissions from soy processing are measured and recorded.

Option 1 – Default value

2.1.1.   The organization may use a default value of 26 gCO_2eq/MJ soy biodiesel for processing. However, use of the default value will prevent the use of actual values for processing in the supply chain and may preclude the end product from meeting the minimum GHG savings as required in the EU RED (see guidance).

Option 2 – Calculations

These requirements are applicable only if an organization is processing material.

2.1.2.   Product yield data (including subsidiary products) is measured, monitored and recorded

2.1.3.   Electricity consumption is measured, monitored and recorded.

2.1.4.   Where the processing facility co-generates electricity (CHP), surplus electricity is measured, monitored and recorded.

2.1.5.   Where the processing facility co-generates electricity (CHP), fuel type is recorded.

2.1.6.   Where the processing facility co-generates electricity (CHP), type of CHP plant is recorded.

2.1.7.   Heat generation for processing is measured, monitored and recorded.

2.1.8.   Fuel used in processing is measured, monitored and recorded

2.1.9.   Operating materials used in processing are measured, monitored and recorded.

2.1.10.   Effluent quantities from processing are measured, monitored and recorded.

2.1.11.   GHG emissions for the soy processing facility are calculated.

Note: These calculations can be made using an RTRS approved on-line GHG-emissions calculator

2.2.   Greenhouse gas (GHG) emissions from transport of soy products are measured and recorded.

This requirement is applicable to the organization that has control of the transport of soy products between the two economic operators (e.g. between production area and grain silo or crush, between crush and refinery, between refinery and manufacturer, etc).

Option 1 – Default value

2.2.1.   The organization may use a default value of 13 gCO_2eq/MJ soy biodiesel for transportation. However, use of the default value will prevent the use of actual values for transportation in the supply chain and may preclude the end product from meeting the minimum GHG savings as required in the EU RED (see guidance).

Option 2 – Calculations

2.2.2.   Where transportation to the next economic operator is under the control of the organization, the following is measured and recorded:

a)   The distance between the organization's physical site and the next economic operator,

b)   The type of transport used to transport the soy product,

c)   The quantity of soy product transported.

d)   For soy beans, the moisture content of the transported crop.

2.2.3.   GHG emissions for transportation are calculated.

Note: These calculations can be made using an RTRS approved on-line GHG-emissions calculator

2.3.   Supply chain greenhouse gas (GHG) emissions are calculated

2.3.1.   Where the organization produces co-products and by-products, actual values for GHG emissions for the supply chain (up to and including the organization) shall be allocated to the soy products in proportion to the energy content of the co-products and by-products, including:

a)   actual processing values

b)   actual transportation values

c)   actual cultivation and land use change values

2.3.2.   The organization shall calculate the total GHG emissions for processing up to and including their own processing facility, for each input recorded in the material accounting system for RTRS data**.**

2.3.3.   The organization shall calculate the total GHG emissions from transport up to and including transport within their own control, for each input recorded in the material accounting system for RTRS data.

Note: These calculations can be made using an RTRS approved on-line GHG-emissions calculator

2.4   Total greenhouse gas (GHG) emissions are calculated

2.4.1   The last economic operator in the supply chain shall calculate the total soy biodiesel greenhouse gas emissions for cultivation, land use change, transportation and processing. When using actual values, the producer of soy methyl ester shall also add the following emissions:

a)   emissions at the filling station

a)   emissions at fuel storage depot(s) and transport to and from the depot(s)

Note: These calculations can be made using an RTRS approved on-line GHG-emissions calculator

3. Communication of information

3.1.1.   The organization shall identify consignments of RTRS material as EU RED compliant only when they meet the land use requirements, as determined by information provided by economic operators supplying inputs into the organization's material accounting system for RTRS data, and

a)   Have been processed by an installation that was in operation on 23 January 2008, and the consignment is delivered by the organization before 1 April 2013

Or

b) When the total GHG emissions savings meet the minimum EU RED threshold.

3.1.2 The organization shall communicate GHG emissions data about each RTRS consignment to the next economic operator in the supply chain, including:

a) Calculated GHG savings

b) Total GHG emissions for cultivation and land use,

c) Total GHG emissions for transportation up to and including transport within their own control,

d) Total GHG emissions for processing up to and including the processing facility.

3.1.3 The organization shall communicate the following information about consignments to the next economic operator:

a) Country of origin,

b) Whether processing of soy products involved installations which were in operation on 23 January 2008,

c) The status of the land in January 2008 of the soy products supplied.

3.1.4 Where the soy products are supplied in bulk with non-soy products, the soy component (proportion or quantity) is communicated to the next economic operator in the supply chain.

3.1.5 The organization shall only communicate information about RTRS soy on GHG data, calculations, origin, date of installations and land use status where the information has been received from economic operators who have a valid RTRS Chain of Custody certificate that includes the RTRS EU RED Compliance Requirements for the Supply Chain in its scope, or where the organization buys directly from farmers, a valid RTRS certificate that includes the RTRS EU RED Compliance Requirements for Producers within its scope.

3.1.6 The organization shall operate an RTRS EU RED Mass Balance Chain of Custody system (including Modules A and E) and/or an RTRS Segregated Chain of Custody system.

3.1.7 The organization shall operate a documented management system, including an auditable system for the evidence related to the claims they make or rely on.

3.1.8 The organization shall prepare any information related to the auditing of evidence described in 3.1.7.

VIII. Guidance for Compliance Requirements

The guidance contained in this annex must be followed by:

I. auditors, evaluating compliance against the RTRS EU RED Compliance Requirements for the Supply Chain

II. organizations seeking to comply with the RTRS EU RED Compliance Requirements for the Supply Chain

Indicators	Guidance
1.1.1	If the installation was in operation on 23 January 2008, then the requirements of 2. do not need to apply until 1 April 2013. Material held in stock on or after 1 April 2013 will no longer be exempt, regardless of when it was processed. The exemption applies if any installation in the supply chain was in operation on 23 January 2008. See glossary definition of 'installation'. No exemptions are allowed anywhere in the supply chain after 1 April 2013. In practice, organizations should bear in mind the likely final delivery date to the end market when anticipating when to undertake GHG calculations. Products which are delivered to the final market on or after 1 April 2013 will not be exempt, regardless of when they were processed.
2.1.1	If the default value is used for a consignment, it will prevent the use of actual values for processing in the entire supply chain of that consignment. This is because the default value provided by the EU for processing includes the sum of all processing in the supply chain. It is therefore not possible to add actual values to the default value later in the supply chain. A default value for processing can only be used if actual values are used for cultivation and land use change, otherwise the minimum 35% GHG savings will not be met. Note this minimum threshold will increase to 50% from January 2017, and 60% from January 2018 for biofuels and bioliquids produced in installations that were in operation on or after 1 January 2017. The default value of 26 gCO_2eq/MJ soy biodiesel is from Annex V of Directive 2008/28/EC. It must be made clear to the next economic operator that the default value has been used for a consignment.
2.1.2	Yield main product [kg main product/a] is annual yield of main product e.g. kg soy oil/a and yield subsidiary product [kg subsidiary product/a]
2.1.3	Electricity consumption [kWh/a] is total annual consumption of electricity bought in, i.e. not produced in own CHP plant.
2.1.4	Surplus electricity [kWh/a] is electricity fed annually into an external network, which is manufactured in the business's own CHP plant in addition to it's own consumption,
2.1.5	Fuel type of the CHP plant is the type of fuel used in the CHP plant, e.g. fuel oil, gas, coal.
2.1.6	Type of CHP plant (e.g. block heat and power plant (BHPP), steam turbine plant (STP), gas

Indicators	Guidance
	turbine plant (G T/combined power plant).
2.1.7	Heat production – fuel type is type of fuel used to generate steam e.g. fuel oil, gas, crop residues
2.1.8	Fuel consumption [kg/a] is total annual consumption of fuel for heat generation, e.g. fuel oil [kg], gas [kg]
2.1.9	Operating materials [kg/a] is total annual consumption for processing. See Table 1 for example emission factors.
2.1.10	Effluent [l/a] is total annual production from processing.
2.1.11	See also 2.3.1 regarding allocation and Section IX. The units used shall be gCO_2 eq/kg intermediate product. Note that allocation is addressed below in 2.3.1.
2.2.1	If the default value is used for a consignment, it will prevent the use of actual values for transportation in the entire supply chain of that consignment. This is because the default value provided by the EU for transportation includes the sum of all transportation in the supply chain. It is therefore not possible to add actual values to the default value later in the supply chain. However, because the EU default value for transportation is the same as the typical value, there is a lower risk as compared to processing that using the default value will cause the GHG emissions to fall below the 35% savings. Note this minimum threshold will increase to 50% from January 2017, and 60% from January 2018 for biofuels and bioliquids produced in installations that were in operation on or after 1 January 2017. The default of 13 gCO_2eq/MJ soy biodiesel is from Annex V of Directive 2008/28/EC.. It must be made clear to the next economic operator that the default value has been used for a consignment.
2.2.2	This includes cases where the organization seeking or holding certification outsources activities to independent third parties (e.g. subcontracts for storage, transport or other outsourced activities). a) The transport distance [in km] is the distance, over which the biomass was transported to the next business or the next business site e.g. distance between the grower and the oil mill, including the (empty) return run b) e.g. 40t diesel HGV c) The quantity of biomass transported in the particular type of transport (e.g. 40T) d) For soy beans, the mass of the dry crop shall be used for the calculation.
2.2.3	These options are available for GHG calculations: • Using the default value of 13 gCO2eq/MJ soy biodiesel (see 2.2.1 guidance) • Using an RTRS approved RED GHG calculator. This is a software tool where input data is entered and the computer calculates the GHG emissions. • Using manual calculations for transport, as set out in Annex VII. The units used shall

Indicators	Guidance
	be gCO$_2$ eq/kg intermediate product.
2.3.1	Energy allocation is as per the lower calorific value of the co-products and by-products. See Section IX.

The units shall be gCO2eq/kg intermediate product.

Where default values are used, no allocation shall be applied to those values. Allocation shall be applied to actual cultivation and land use change values at each processing step even if a default value for processing is used.

GHG emissions from processing should not be added to GHG emissions from cultivation & land use change, or transportation. This is because an economic operator further downstream will not be able to use a default transport or processing value if an aggregate calculation is undertaken upstream. |
| 2.3.2 | GHG emissions from processing should not be added to GHG emissions from cultivation & land use change, or transportation for this requirement. This is because an economic operator further downstream will not be able to use a default transport or processing value if an aggregate calculation is undertaken upstream.

These options are available for GHG calculations:

- Using the default value of 26 gCO$_2$eq/MJ soy biodiesel (see 2.1.1 guidance)

- Using an RTRS approved RED GHG calculator. This is a software tool where input data is entered and the computer calculates the GHG emissions.

- Using manual calculations for transport, as set out in Section IX. |
| 2.3.3 | GHG emissions from transport should not be added to GHG emissions from cultivation & land use change, or processing for this requirement. This is because an economic operator further downstream will not be able to use a default transport or processing value if an aggregate calculation is undertaken upstream.

These options are available for GHG calculations:

- Using the default value of 13 gCO2eq/MJ soy biodiesel (see 2.2.1 guidance)

- Using an RTRS approved RED GHG calculator. This is a software tool where input data is entered and the computer calculates the GHG emissions.

- Using manual calculations for transport, as set out in Section IX. |
| 2.4.1 | Default values and actual values can be added together at this step. The units shall be gCO2eq/MJ soy biodiesel.

The lower calorific value of soy biodiesel shall be used to translate gCO2eq/kg soy biodiesel to gCO2eq/MJ soy biodiesel (see Table 2).

General formula:

$$emission_{ipr}\left[\frac{gCO_2eq}{MJ_{epr}}\right] = \frac{emissions_{ipr}\left[\frac{gCO_2eq}{kg_{ipr}}\right]*input\_ipr[kg]}{endproduct[kg]*CVn\_epr\left[\frac{MJ}{kg_{epr}}\right]}$$ |

Indicators	Guidance
	where

emissions$_{ipr}$: emissions intermediate product expressed in MJ endproduct

input_ipr: input intermediate product

CVn_epr: lower calorific value of the endproduct

MJ$_{epr}$: MJ of endproduct

Examples:

The following formula shall be used when default values for e_{ec} and e_{td} and actual values for e_p are applied:

$$emissions\_sum = e_{ec}\left[\tfrac{gCO_2eq}{MJ_{soybiodiesel}}\right] + e_{td}\left[\tfrac{gCO_2eq}{MJ_{soybiodiesel}}\right] + \frac{e_p\left[\tfrac{gCO_2eq}{kg_{soybiodiesel}}\right]}{37\tfrac{MJ}{kg_{soybiodiesel}}}$$

The following formula shall be used when default values for e_{ec} and actual values for e_{td} and e_p are applied:

$$emissions\_sum = e_{ec}\left[\tfrac{gCO_2eq}{MJ_{soybiodiesel}}\right] + \frac{e_{td} + e_p\left[\tfrac{gCO_2eq}{kg_{soybiodiesel}}\right]}{37\tfrac{MJ}{kg_{soybiodiesel}}}$$

The following formula shall be used when actual value for e_{ec} and default values for e_{td} and e_p is applied:

$$emissions\_sum = \left(\frac{e_{ec}\left[\tfrac{gCO_2eq}{kg_{soybeans}}\right]*input\_soybeans[kg]}{soy\_biodiesel[kg]*37\tfrac{MJ}{kg_{soybiodiesel}}}\right) + e_{td}\left[\tfrac{gCO_2eq}{MJ_{soybiodiesel}}\right] + e_p\left[\tfrac{gCO_2eq}{MJ_{soybiodiesel}}\right]$$

When actual values are used, the last economic operator shall add emissions relating to the depot and filling station to the total greenhouse gas emissions figure. Either actual values can be used, or standard emission factors taken from the BioGRACE GHG calculation tool[3] (http://www.biograce.net/content/ghgcalculationtools/overview). If actual values are used the calculations shall follow the instructions given in IX,2.1. of this document (for transport emissions) and IX 2.2. of this document (only using the variable "electricity consumption" for emissions at depot and filling station).

If the BioGrace tool is used:

a) the standard emission factor for the filling station shall be 0.44 gCO2/MJ soy methyl ester (based on electricity usage of 0.0034 MJ/MJ fuel and the standard value for Electricity EU mix LV) and

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[3] The BioGRACE standard emission factors are based on the input dataset published by the JRC (2008) for calculating the RED default GHG emissions. See: http://re.jrc.ec.europa.eu/biof/html/input_data_ghg.htm.

Indicators	Guidance
	b) the standard emission factor for depots the soy methyl ester is stored in, including transport to and from depots shall be: 0.82 gCO2/MJ soy methyl ester (based on electricity usage of 0.00084 MJ/MJ fuel and the standard values for Electricity NG CCGT and Electricity EU mix LV; average transport distance of 300km).

This standard emissions factor does not include actual emissions from overseas transport of soy methyl ester. Emissions from overseas transport from one depot to another shall still be calculated in accordance with 2.2. of this document. |
| 3.1.1 | This information shall be managed in the organization's material accounting system as per the requirements of the mass balance chain of custody system.

Identification will include for example indicating on invoices and transportation documents, as set out in the requirements RTRS Chain of Custody Standard and the RTRS EU RED Communication and Claims Policy.

a) In practice, organizations should bear in mind the likely final delivery date to the end market when communicating EU RED compliance. Products which are delivered to the final market after 1 April 2013 will not be exempt, regardless of when they were processed.

b) This calculation will only be undertaken by organizations producing soy methyl ester. The GHG savings shall be calculated using the value from 2.4 and the fossil comparator of 83,8g gCO2eq/MJ for biodiesel (the latest available actual average emissions as reported under Directive 98/70/EC shall supersede this value where they differ)

The following formula shall be used: SAVING = $(E_F - E_B)/E_F$,

where E_F is the fossil comparator and E_B is the total GHG emission value calculated as per 2.4.

If an organisation takes legal ownership of the soy methyl ester further downstream of the soy methyl ester processing organisation, that organisation shall add its emissions (see 2.4.2.) and calculate the GHG reduction potential.

The minimum threshold will increase from 35% to 50% starting January 2017, and 60% from January 2018 for biofuels and bioliquids produced in installations that were in operation on or after 1 January 2017. |
| 3.1.2 | This information shall be managed in the organization's material accounting system as per the requirements of the mass balance chain of custody system.

The values should be provided separately (not as a single value).

a) only applies to producers of soy methyl ester. The unit should be gCO2eq/MJ liquid biofuel and % savings compared to the fossil equivalent. Where the GHG savings has been calculated and the minimum threshold is not met, no information set out in 3.1.2 shall be communicated about the consignment.

b) The production value unit should be in gCO2eq/ kg intermediate product (see 2.3.1 on allocation) or gCO2eq/MJ intermediate product (where the default value is used).

c) The transportation value unit should be in gCO2eq/kg intermediate product (where the actual value is used) or gCO2eq/MJ intermediate product (where the default value is used).

d) The processing value unit should be in gCO2eq/kg intermediate product.

Where the organization communicates information about non-RTRS soy, it must be clear that the information is not covered by the organization's RTRS EU RED Requirements for the |

Indicators	Guidance
	Supply Chain certification (which is part of their RTRS Chain of Custody certificate).

3.1.3	This information shall be managed in the organization's material account system as per the requirements of the mass balance chain of custody system.
	
	Where the GHG savings has been calculated (see 2.4 and 3.1.1 guidance) and the minimum threshold is not met, no information set out in 3.1.3 shall be communicated about the consignment.
	
	a) See glossary definition for country of origin.
	
	b) It is not necessary to communicate the specific date the installation began operation, provided it was before 23 January 2008. This communication can be based on a mass balance allocation, as set out in the RTRS Supply Chain Certification Protocol.
	
	c) The status of the land includes:
	
	   • Cropland;
	
	   • Perennial crops;
	
	   • Non-highly biodiverse or high carbon areas (where land use change has occurred but there is evidence that 2.2.1 and 2.3.1 of 'RTRS EU RED Compliance Requirements for producers' have been met)
	
	   • Areas designated for nature protection purposes, where cultivation did not interfere with these purposes should be reported as 'protected'.
	
	   • Areas designated for the protection of rare, threatened or endangered ecosystems or species recognised by the European Commission, where cultivation did not interfere with these purposes should be reported as 'protected'.
	
	   • Areas not designated for nature protection purposes should be reported as 'non-protected'.

3.1.4	See glossary definition for bulk.
3.1.5	This will be implemented as part of the organization's supply chain management system. See the RTRS Chain of Custody Standard.
3.1.6	The RTRS Chain of Custody certificate must include the mass balance and/or the segregated module within the scope of the certification, See the RTRS Chain of Custody Standard, modules A, B and E.
3.1.7	See also RTRS Chain of Custody Standard. VI. General Chain of Custody System Requirements for Producers 2.3 Records 2.3.2 The organization shall implement a record keeping system for all records and reports, including purchase and sales documents, training records, production records and volume summaries. The record retention period shall be specified by the organization and shall be at least five (5) years. VII. General Chain of Custody System Requirements the for the Supply Chain

Indicators	Guidance
	2.4 records

2.4.2 The organization shall implement a record keeping system for all records and reports, including purchase and sales documents, training records, production records and volume summaries. The record retention period shall be specified by the organization and shall be at least five (5) years. |

IX. Methodology for Calculating Greenhouse Gas Emissions for the soy supply chain under the European Commission – Renewable Energy Directive (EU-RED)[4]

> **The following methodology has been included as reference for the RTRS EU RED Compliance Requirements for Processors.**
>
> **In practice, GHG calculations will normally be undertaken by a processor.**
>
> **Computer software based on the following calculations is expected to be widely available. Any formal approval of a specific calculator by the RTRS will use the methodology set out below.**
>
> **Any calculator used by the RTRS will be independently verified against the following methodology prior to approval.**

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4 This document has been developed with permission using the ' Guide To Calculating Greenhouse Gas Emissions under the Biomass-Electricity-Sustainability Ordinance [Biomassestrom- Nachhaltigkeitsverordnung] (BioSt-NachV)' (November 2009) prepared by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH [German Technical Cooperation] In cooperation with the Institut für Energie- und Umweltforschung Heidelberg GmbH [Heidelberg Institute for Energy and Environmental Research]

Contents

1. Accurately-measured data

'Measured data' means data that are used to calculate the actual values. These data can either be 'measured' on site or taken from verifiable recognized scientific literature sources or databases, where the data is peer reviewed and consistent with other existing data sources.

The following data are regarded as being accurately-measured only if they are collected on site, in other words, the relevant quantities were taken from sources such as business documents:

- Quantity of main and by-products
- Quantity of chemicals used (e.g. methanol, NaOH, HCl, hexane, citric acid, bleaching clay)
- Fuel consumption, electricity consumption
- Consumption of thermal energy or energy sources consumed for process energy production

Accurately-measured data collected in the field must be documented (field calendar, delivery notes and invoices etc). The following data are considered to be accurately measured if they are taken from a scientifically-recognized literature source (including statistical data from government bodies):

- Calorific values of the main and by-products,
- Emission factor of chemicals, electricity, thermal energy, for example and

For values taken from literature sources or databases (calorific values, emission factors etc), the source (e.g. name of publication and author) and year of publication must be documented and shall be based on the most recent available data and updated over time.. The data should be peer reviewed before publication and consistent with other existing data sources. Where there are appropriate regional emission factors available, those regional emission factors should be used.

Operators also always have the option of collecting data by taking measurements themselves. In this case, the method must be clearly documented and explained so that the calculations can be understood.

Figures for greenhouse gas savings are rounded to the nearest percentage point.

2. GHG emissions calculation methodology for EU-RED

According to the formula in Annex V of the EU-RED the greenhouse gas emissions for soya oil should be worked out as follows:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee}$$

Where

E = total emissions from the use of the soy methyl ester

e_{ec} = emissions from the cultivation of soy

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

e_p = emissions from processing

e_{td} = emissions from transport and distribution

e_u = emissions from the fuel in use

e_{sca} = emission savings from soil carbon accumulation via improved agricultural management

e_{ccs} = emission saving from carbon capture and geological storage

e_{ccr} = emission saving from carbon capture and replacement

e_{ee} = emission saving from excess electricity from cogeneration

Units: In this formula, the unit given for emission, E, is g CO2eq/MJ liquid biofuel.

If the values are calculated along a manufacturing chain from the accumulation of several supply and processing operators using a mass balance system, this formula cannot be used directly in this structure. Records should therefore be expressed in grams of carbon dioxide equivalent as an absolute value (cumulative over all operators lower down the chain) in kg CO2eq per tonne of the batch of sustainable soy product received.

The main reasons for this are:

a.   The soy producer at cultivation level (e_{ec}) or the manufacturer of an intermediate product (e.g. crush) cannot foresee how many MJ of liquid biofuel will be obtained from the product at a later stage.

b.   Only a single default value is available for the components processing (e_p) and transport (e_{td}), although they are generally sub-divided into several stages (e.g.: transport of soya -> crush -> transport of oil -> refining of the oil -> esterification

In practice, when using actual values, the first part of the formula must therefore be restructured as follows:

$$E = (\underbrace{((e_{ec}'+e_l'-e_{sca}')}_{cultivation} + \underbrace{e_{td}'1 + e_p'1)}_{mill} + \underbrace{e_{td}'2 + e_p'2 + e_{td}'3)}_{refinery\_(last\_\mathrm{int}erface)}$$

where each 'bracket' represents an operator level, which relates the calculated emission value to the mass of the product in question up to the last interface which shows the total value in g CO2eq/MJ liquid biofuel.

Note: The variables e_{sca}, e_{ccs}, e_{ccr} and e_{ee} are not included in this description for reasons of simplification.

2.1   Calculating the GHG emissions from transport (e_{td})

If the organization has control of the transportation, the following formula is used to calculate the GHG emissions for transport e_{td} of biomass including all transport steps:

$$e_{td}' = \frac{(transport\_dis\tan ce_{laden}[km]*FC_{laden}\left[\frac{1}{km}\right] + transport\_dis\tan ce_{empty}[km]*FC_{empty}\left[\frac{1}{km}\right])*emission\_factor_{fuel}\left[\frac{kgCO_2}{l}\right]}{transported\_biomass[kg]}$$

The GHG emissions already taken into account for raw material production and cultivation are not included in the calculations.

To calculate e_{td}

- the transport distances [in km] – distance, over which the biomass was transported to the next business or the next business site e.g. distance between the grower and the oil mill, including the (empty) return run.

- the means of transport (e.g. 40t diesel HGV) and

- the quantity of biomass transported in the particular means of transport (e.g. 40t) and for soy beans the moisture content of the transported crop

are stated.

For soy beans, the mass of the dry crop shall be used for the calculation.

To calculate e_{td},

- the emission factor fuel,

- FCladen[l/km] – fuel consumption of the particular means of transport per km when laden and

- FCempty[l/km] – fuel consumption of the particular means of transport per km on an empty run (return run)

are stated or taken from a scientific literature source which has been peer reviewed before publication and are consistent with other existing data sources.

Peer reviewed scientific publications are used as sources for emission factors, and are consistent with other available emission factor figures. Examples can be found in Table 1.

The reference unit for transport of intermediate products is kg of intermediate product.

2.2 Calculating the GHG emissions from processing (e_p)

Each organization in the supply chain processing soy ensures that all the GHG emissions from processing e_p, GHG emissions from waste (effluent) and GHG emissions from the manufacture of all resources necessary for the process are included in the calculation of the GHG emissions and uses the following formula:

$$e_p' = \frac{em_{electricity\_consumption}\left[\frac{kgCO_2}{a}\right] + em_{heat\_generation}\left[\frac{kgCO_2}{a}\right] + em_{operating\_materials}\left[\frac{kgCO_2}{a}\right] + Em_{effluent}}{yield_{main\_product}\left[\frac{kg\_yield}{a}\right]}$$

Meaning of the variables (em = emission):

$$em_{elec} = elec\left[\frac{kWh}{a}\right] * emission\_factor_{regional\_elec\_mix}\left[\frac{kgCO_2}{kWh}\right]$$

$$em_{heat\_generation} = fuel\_consumption\left[\frac{kg}{a}\right] * emission\_factor_{fuel}\left[\frac{kgCO_2}{kg}\right]$$

$$em_{op\_material} = op\_mat\_consumption\left[\frac{kg}{a}\right] * emission\_factor_{op\_mat}\left[\frac{kgCO_2}{kg}\right]$$

$$em_{effluent} = effluent\left[\frac{1}{a}\right] * emission\_factor_{effluent}\left[\frac{kgCO_2}{1}\right]$$

To calculate the emissions from processing (e_p) at least the data presented below are collected on site, in other words the corresponding quantities are taken from business documents. Alternative reference values (month, kg of main product etc) may be used:

- electricity consumption [kWh/a] – total annual consumption of electricity bought in, i.e. not produced in own CHP plant.

- heat production – fuel type– type of fuel used to generate steam e.g. fuel oil, gas, crop residues,

- fuel consumption [kg/a] – total annual consumption of fuel for heat generation, e.g. fuel oil [kg], gas [kg], bagasse [kg],

- op_mat_consumption [kg operating materials/a]

- effluent quantity [l/a] – annual quantity of effluent

- yield_main product [kg main product/a] – annual yield of main product e.g. kg soy oil/a

- yield_subsidiary product [kg subsidiary product/a]

The GHG emissions from waste are included in the calculation of e_p.

To calculate e_p the following emission factors can be taken from a scientific literature source which is peer reviewed and consistent with other existing data sources (examples can be found in Table 1):

- emission factor of fuel [kg CO_2/kg]

- emission factors for operating materials [kg CO_2/kg]

- emission factor effluent [kg CO_2/l] and

- emission factor national or regional electricity mix [kg CO_2/kWh]

The GHG emissions are calculated per unit mass of main product (e.g. CO_2 emissions [kg] / soybeans oil [kg]).

When calculating the GHG emissions of electricity consumption (where additional electricity is bought in) the emission factor for electricity is calculated according to the GHG emissions of the regional or national electricity network. In the case of the EU the average of the EU can be applied.

If waste, the crop residues straw, bagasse, husks, maize cobs and nut shells and product residues including raw glycerine are used in a process for manufacturing liquid fuels, the GHG emissions of these materials are set at zero up to collection.

2.3 Calculating emission savings from surplus electricity e_{ee}

Emission savings from surplus electricity produced by cogeneration (CHP) (e_{ee}) are calculated on the basis of the following formula:

$$e_{ee} = \frac{surplus\_electricity\left[\frac{kWh}{a}\right] * emission\_factor_{fuel}\left[\frac{kgCO_2}{kWh}\right]}{yield_{main\_product}\left[\frac{kg}{a}\right]}$$

The general allocation rule in section 5 does not apply for electricity from CHP when the CHP runs on

(i) fossil fuels;

(ii) bioenergy, where this is not a co-product from the same process; or

(iii) agricultural crop residues, even if they are a co-product from the same process.

Instead, the following rule applies:

(a) Where the CHP supplies heat not only to the biofuel/bioliquid process but also for other purposes, the size of the CHP should be notionally reduced — for the calculation — to the size that is necessary to supply only the heat necessary for the biofuel/bioliquid process. The primary electricity output of the CHP should be notionally reduced in proportion.

(b) To the amount of electricity that remains — after this notional adjustment and after covering any actual internal electricity needs — a greenhouse gas credit should be assigned that should be subtracted from the processing emissions.

(c) The amount of this benefit is equal to the life cycle emissions attributable to the production of an equal amount of electricity from the same type of fuel in a power plant.

The calculation is based on the assumption that the CHP plant is the minimum size required to supply the heat required to manufacture the liquid fuel.

The GHG emission saving from the surplus electricity is the GHG quantity that would be emitted when generating an equivalent quantity of power in a power plant that uses the same fossil fuels as the CHP plant.

To calculate e_{ee} the following data are measured on site:

- surplus electricity [kWh/a] – electricity fed annually into an external network, which is manufactured in the business's own CHP plant in addition to it's own consumption,

- fuel type of the CHP plant – type of fuel used in the CHP plant, e.g. fuel oil, gas, coal,

- $yield_{mainproduct}$ [kg CO_2/a] – annual yield of the main product, e.g. soybeans oil [kg/a] and

- type of CHP plant (e.g. block heat and power plant (BHPP), steam turbine plant (STP), gas turbine plant (G T/combined power plant).

To calculate e_{ee} the following data can be taken from a scientific literature source which is peer reviewed and consistent with other existing data sources: emission $factor_{fuel}$ [kg CO_2/kWh] – emission factor corresponding to the type of CHP plant (examples can be found in Table 1).

4. Averaging of GHG values in mixtures

If consignments of RTRS certified material are mixed, the GHG figures of these consignments cannot be averaged.

5. Allocation

The emissions from production (e_{ec}), land use change (e_l) and those fractions of processing (e_p), transport (e_{td}) and emissions savings from excess electricity from co-generation (e_{ee}) that take place up to and including the process stage where a co-product is produced shall be divided between the main and the co-products. The GHG emissions shall be divided in proportion to their energy content (except for electricity). The energy content is determined by the lower calorific value. The lower calorific value used shall be that of the entire (co-)product, not only of the dry fraction of it. In case of nearly-dry products, the lower calorific value of the dry fraction can be used.

If any allocation to co-products has taken place at an earlier process step in the life-cycle, the fraction of those emissions assigned in the last such process step to the intermediate fuel product shall be used for the purpose of allocation.

Main soy (co-)products include for example soy oil and soy meal.

Allocation shall be applied directly after a co-product (a substance that would normally be storable or tradable) and biofuel/bioliquid/intermediate product are produced at a process step. This can be a process step within a plant after which further 'downstream' processing takes place, for either product. However, if downstream processing of the (co-) products concerned is interlinked (by material or energy feedback loops) with any upstream part of the processing, the system is considered a 'refinery' and allocation is applied at the points where each product has no further downstream processing that is interlinked by material or energy feedback-loops with any upstream part of the processing.

Since heat does not have a lower calorific value no emissions can be allocated to it on that basis.

No emissions are allocated to wastes and agricultural crop and processing residues.

Wastes are any substance or object which the holder discards or intends or is required to discard, including materials that have to be withdrawn from the market for health and safety reasons. Examples include straw, bagasse, husks, cobs and nut shells. Raw materials that have been intentionally modified to count as waste are not considered wastes.

Residues include agricultural, aquaculture, fisheries and forestry residues and processing residues. A processing residue is a substance that is not the end product(s) that a production process directly seeks to produce. It is not a primary aim of the production process and the process has not been deliberately modified to produce it. Examples are crude glycerine, tall oil pitch and manure.

General allocation formula

$$emissions\_soyproduct\_alloc\left[\frac{gCO_2eq}{kg_{soyproduct}}\right]=$$

$$=\frac{emissions\_soyproduct\left[\frac{gCO_2eq}{kg_{soyproduct}}\right]*soy\_mainproduct[kg]*CVn\_soy\_mainproduct\left[\frac{MJ}{kg}\right]}{soy\_mainproduct[kg]*CVn\_soy\_mainproduct\left[\frac{MJ}{kg}\right]+soy\_coproduct[kg]*CVn\_soy\_coproduct\left[\frac{MJ}{kg}\right]}$$

where

emissions_soyproduct_alloc: Emissions of the soy product which need to be allocated after a processing step

CVn_soy_mainproduct: lower calorific value soy main product

CVn_soy_coproduct: lower calorific value of soy co-product

Allocation formula example

In this case the default values for e_{ec} are used. The default value is already allocated and expressed in gCO$_2$eq/MJ soy biodiesel and does not need to be considered here. For e_{td} and e_p actual values are used. Emissions from production and transport up to the point where co-product are produced (for which allocation is necessary) are allocated as follows. (In this case at the mill where the main product is soy oil and the co-product is soy meal).

$$e_{p+td}\_alloc.\left[\frac{gCO_2eq}{kg_{soyoil}}\right]=\frac{e_{p+td}\left[\frac{gCO_2eq}{kg_{soyoil}}\right]\cdot soyoil[kg]\cdot CVn\_soyoil\left[\frac{MJ}{kg}\right]}{soyoil[kg]\cdot CVn\_soyoil\left[\frac{MJ}{kg}\right]+soymeal[kg]\cdot CVn\_soymeal\left[\frac{MJ}{kg}\right]}$$

The result is then related to soy biodiesel and MJ. It can then be added to the default value e_{ec}.

$$e_{p+td}\_alloc.\left[\frac{gCO_2eq}{MJ_{soybiodiesel}}\right]=\frac{e_{p+td}\left[\frac{gCO_2eq}{kg_{soyoil}}\right]\cdot soyoil[kg]}{soybiodiesel[kg]*CVn\_soybiodiesel\left[\frac{MJ}{kg}\right]}$$

6. Examples

Table 1: Examples of background data for determining e_{ec}, e_p, e_{td} and e_{ee}

	Value	Unit	Source:
Transport e_{td}			
E-Factor diesel (manuf. and use)	2.1	kg CO2eq/kg diesel	TREMOD
Fuel consumption (laden)	0.49	litres / km	TREMOD (goods train with max. 24t useful load)
Fuel consumption (empty)	0.25	litres / km	
Processing e_p			
E-Factor: natural gas (manuf. & use)	0.0722	kg CO2eq/MJ	IFEU
E-Factor: EL fuel oil (manuf. & use)	0.1072	kg CO2eq/MJ	IFEU
E-Factor: lignite (manuf. & use)	0.1452	kg CO2eq/MJ	IFEU
E-Factor: biomass (use)	0.0028	kg CO2eq/MJ	IFEU
E-Factor: methanol (manuf.)	1.25	kg CO2eq/kg methanol	IFEU
E-Factor: iso-butene (manuf.)	1.27	kg CO2eq/kg iso-butene	IFEU
E-Factor: NaOH (manuf.)	1.12	kg CO2eq/kg NaOH	IFEU
E-Factor: HCl (manuf.)	0.35	kg CO2eq/kg HCl	IFEU
E-Factor: Citric acid (manuf.)	0.43	kg CO2eq/kg citric acid	ECOINVENT
E-Factor: Bleaching earth (manuf.)	0.24	kg CO2eq/kg bleaching	IFEU

Table 2: Examples of calorific values for soy

Calorific value		
Material	**(MJ/kg)**	**Source**
Soya oil (raw.ref.)	37 MJ/kg 34 MJ/l	Annex III Renewable Energy Directive
Soy biodiesel	37 MJ/kg 33 MJ/l	Annex III Renewable Energy Directive
Soya extraction waste	15.0	JRC