ABENGOA BIOENERGY

RED Bioenergy Sustainability Assurance Scheme

Title:	**GHG Emission Methodology**				
Code:	RBSA_003	**Revision:**	02	**Date:**	2011 / 02 / 25

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Principle reference: Directive 2009 / 28 / EC (RED) of the European Parliament and of the Council of 23rd April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001 / 77 / EC and 2003 / 30 / EC.

Secondary reference:

- EC communication, reference 2010 / C 160 / 02.
- RED Bioenergy Sustainability Assurance Scheme, reference RBSA_001.

1 Introduction

Abengoa Bioenergy has chosen to establish and implement a voluntary scheme as a mechanism for companies involved in bioenergy production to show that the sustainability criteria included in RED relating to GHG savings, land with high biodiversity value and with high carbon stock have been met, demonstrating compliance with the sustainability regime established in Article 17.2 to Article 17.5 of the RED.

The general rules and requirements of this scheme entitled "RED Bioenergy Sustainability Assurance" are described in reference RBSA_001. The specific objective of this document is the definition of the methodology for Greenhouse Gas (GHG) emissions in accordance with Annex V of the RED.

Therefore, this document has been structured in four main blocks:

- Methodology definition for the calculation of GHG emissions.
- Traceability provisions to maintain the information on GHG emissions relating to each biomass and biofuel consignment or sub-batch throughout the chain and to assign the sustainability information to the final products.
- System assurance: the methodology and traceability provisions included in this document will be implemented in practice through procedures containing suitable references to responsibilities, update of methodology and internal controls.
- Methodology verification.

It is relevant to point out that the methodology developed for calculating the emissions associated to the extraction and cultivation of biomass allows the use of averages calculated for smaller geographical areas than those used in the calculation of the default values (as an alternative to actual values), which is particularly useful for biomass where no default data exists or it is not applicable (EC communication, reference 2010/C 160/02 Annex II).

Finally, the practical implementation of the methodology hereby described for the GHG emissions calculation will be implemented through Information Technology (IT) Systems and associated procedure(s) to be observed by the responsible party appointed by Abengoa Bioenergy organization.

These IT Systems and associated procedures shall be audited against ISAE 3000 following requirements described in reference RBSA_001 of this scheme. In this way, all the GHG calculations generated from the procedures (according to RED methodology) will comply with the required external standard of independent auditing.

2 Definitions

- **Activity data:** characteristic parameter of the activity or equipment, facilities, processes or vehicles associated to a given source, which makes it possible to determine their emissions for a given period through calculation. Examples of activity data are fuel consumption, biomass consumption or the distance covered by vehicles.
- **Actual value** means the GHG emission for some or all of the steps of a specific biofuel production process calculated in accordance with the methodology laid down in part C of Annex V.
- **Agricultural production units** includes operational sites involved in the operations for the cultivation and subsequent harvesting of the biomass (as defined in this scheme), to be later converted into biofuels.
- **Batch of biomass / biofuel:** set of sub-batch(es) of biomass / biofuel.
- **Biofuel conversion unit** includes the facilities and related installations where the biomass is transformed into biofuel, with the quality level required for its use as fuel or blending of fuels.
- **Biofuel final consumer** include those agents that take legal ownership of the biofuel at the point where the energy consumption is accounted to the purposes referred to in Article 17.1 of the RED in accordance with national regulation (typically, in the excise duty point).
- **Biofuels** are defined as liquid or gaseous fuel for transport produced from biomass.
- **Biomass** is defined as the biodegradable fraction of products, waste and residues of biological origin from agricultural (including plant and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste.
- **Default value** means a value derived from a typical value by the application of pre-determined factors and that may, in circumstances specified in RED, be used in place of an actual value.
- **EC recognized biomass supplier** is defined as a biomass supplier that can provide external guarantees for specific biomass dispatches on complying with all or part of the RED sustainability criteria (Article 17. 2 to 17.5) through an EC recognized Scheme or agreement.
- **EC recognized biofuel supplier** is defined as a biofuel supplier that can provide external guarantees for specific biofuel dispatches on complying with all or part of the RED sustainability criteria (Article 17. 2 to 17.5) through an EC recognized Scheme or agreement.
- **Economic operators** within the framework of this document are those agents involved in a biofuel pathway (physical or commercial) that could be subject to an audit on compliance with RBSA scheme requirements. This comprises:
  - Agricultural production unit.
  - First collector supplier

- Intermediate biomass supplier.
- Biofuel conversion unit.
- Intermediate biofuel supplier.

- **Emission factor:** parameter that indicates the quantity of a particular contaminant emitted directly or indirectly from a particular activity by unit of product, volume, duration, quantity of biomass or fuel etc., and that is by unit of what has been designated as activity data.
- **Final EC recognized biomass supplier** is defined as the final supplier (physical or commercial) to a Biofuel conversion unit that provides external guarantees for specific biomass dispatches on complying with all or part of the RED sustainability criteria (Article 17. 2 to 17.5) through an EC recognized Scheme or agreement.
- **First collector supplier** includes those agents different to the Agricultural production units that receive biomass directly from the Agricultural production unit, and supply it to following agents in the supply chain, in the procurement of biomass into a Biofuel conversion unit.
- **GHG:** Greenhouse Gases, those included in Annex V. C point 5 within the RED are considered in this document: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).
- **Input:** product, material or energy flow that enters a unit process.
- **Intermediate biomass supplier** includes those agents (physical or commercial) that receive biomass from a First collector supplier or another Intermediate supplier (not from an Agricultural production unit), in the procurement of biomass into a Biofuel conversion unit.
- **Intermediate biofuel supplier** includes those agents (physical or commercial) that receive biofuel from an upstream supplier (typically a Biofuel conversion unit or another Intermediate biofuel supplier) and transfer the biofuel to the next step in the biofuel supply chain through a commercial trading process.
- **Involved suppliers** are those economic operators that comply with the requirements set out in the RBSA scheme, and are allowed to supply RBSA products (biomass or biofuel) under the certificate of a validated supplier when they pass a qualifying audit prior to any RBSA claims.

  Involved suppliers can supply from the installations / premises covered under their RBSA verification of conformity, which is addressed to their Validated supplier.
- **IT system** is a set of computer applications or related software developed in order to facilitate and systematize relevant parts of this scheme; mainly for the practical GHG calculations and the development of sustainable maps.
- **Land under agricultural use** is those croplands where the stem of the crop is usually annually harvested. Fallow areas are also included.
- **Origin** is the geographic denomination that stands for the cultivation and harvesting zone of the biomass to be further processed into biofuel.
- **Output:** product, material or energy flow that leaves a unit process.
- **Perennial crop** is considered to be multi - annual crops whose stem is usually not annually harvested, such as short rotation coppice or palm oil.

- **RBSA certificate** this may also be interpreted or presented as a "certificate" on compliance with the requirements described in this scheme for validated suppliers as defined in other parts of this section.
- **RBSA or RBSA scheme** (RED Bioenergy Assurance) is the sustainability assurance scheme that Abengoa Bioenergy has developed in order to comply with the RED sustainable regime in its operations as biofuel producer (also useable for other economic operators).
- **RBSA sustainable claims** are those statements regarding compliance with the requirements included in the RBSA scheme by the validated (biomass / biofuel) suppliers.
- **RBSA sustainable origin** is the origin of the biomass which is deemed to comply with the RED sustainability criteria (Article 17.3 to 17.5) and in which land use change since 2008 has not been observed through external guarantees.
- **Sub-batch of biomass / biofuel** consignment of biomass / biofuel with the same sustainability attributes.
- **Sustainable attributes** are considered the following characteristics of a sub-batch of biomass / biofuel:
  - Biomass type.
  - Origin of the biomass.
  - GHG data (not necessary for economic operator for whom RBSA_003 could be used).
- **Validated suppliers** are those economic operators that comply with the requirements set out in the RBSA scheme, and are allowed to supply RBSA products (biomass or biofuel) to another Validated supplier when they pass a qualifying audit prior to any RBSA claim.

  Validated suppliers can supply RBSA products from the installations / premises covered under their RBSA certificate, or from the installations of their Involved suppliers - in the terms described for them.

3 Objective and scope

The operational scope of the GHG emission methodology described in this document covers:

- Biomass: any type of the biomass to be processed into biofuel.
- Type of product: biofuel.
- Production process: biofuel production pathway.
- Biofuel logistics: transportation during the biofuel chain, depot and filling station.

The scope of the methodology for GHG emissions can comprise from the point of extraction and cultivation through the chain until the last point under the control of the Intermediate biofuel supplier; therefore, extraction and cultivation of biomass, biofuel processing and transportation and distribution are included.

4 GHG emission calculation methodology description

GHG emissions must be calculated according to the general formula included in Annex V point C.1 in RED:

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

Equation I

Where:

E = total emissions from the use of biofuel.

e_{ec} = emissions from the extraction or cultivation of raw material (biomass in the framework of this scheme).

e_l = annualized 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 saving 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.

Emissions from land use change (e_l) do not need to be calculated and the value to be taken is zero. According to the General Scheme, reference RBSA_001, the supply chain shall prove with evidence that since 2008 no land use change between the six land categories used by the IPCC (forest land, grassland, cropland, wetlands, settlements and other land) plus a seventh category of perennial crop has occurred. Evidence can be through RBSA sustainable origin and Agricultural production unit self–declaration, both cases are subject to external verification.

Emissions from the fuel in use (e_u) are considered zero for biofuel and therefore not considered in the methodology.

The rest of factors of the formula (Equation I) shall be determined using one of the following options according to Article 19.1 of the RED:

- **Option 1:** use a default value for GHG emission saving for the production pathway included in part A or B of Annex V. Disaggregated default values in part D or E of Annex V can also be used for some factors.
- **Option 2:** actual value.
- **Option 3:** combination of default and actual value.

The GHG emissions final result shall be expressed in terms of g CO_2/$MJ_{biofuel}$. The GHG taken into account are CO_2, CH_4 and N_2O and the global warming potential (GWP) for each one is as follows:

- CO_2: 1.
- CH_4: 23.
- N_2O: 296.

Therefore, to calculate the GHG emissions, the process is:

- Firstly, to calculate the individual emission of each of the mentioned gases.
- Secondly, to multiply by its GWP compared to CO_2, in order to add all the individual emissions in the same reference units.

According to the above, this methodology includes the use of default value or actual value calculation.

4.1 Use of default data

The methodology described in this RBSA scheme allows the use of default data as defined in RED. Next it is described the situations when approved default values by EC are permitted:

- Extraction and cultivation (e_{ec}):
  - Default data can be used when the biomass is:
    - ✓ Cultivated outside the European Community.
    - ✓ Cultivated inside the European Community in areas included in the lists defined in Article 19.2 of the RED.
    - ✓ Waste or residues other than agricultural, aquaculture and fisheries residues.
- Processing (e_p – e_{ee})
- Transport and distribution (e_{td})

The default value can be updated or created as new by the Commission. The process of updating the default values is addressed in the Communication on voluntary schemes and default values (EC communication, reference 2010/C 160/02).

4.2 Actual data calculation

This RBSA scheme only considers actual data from an EC recognized biomass / biofuel supplier if the data is provided under an EC recognized voluntary scheme or international agreement.

For other situations, a specific methodology is defined in accordance with the methodology described in point C of Annex V in RED to calculate actual data under the RBSA scheme. The calculation is grouped in three phases defined as follows:

- **Phase 1:** Biomass extraction and cultivation and logistics emission calculation (e_{ec}, e_{sca}, e_{td}). Through this phase emissions related to biomass cultivation, transport and storage of biomass are included.
- **Phase 2:** Biofuel conversion unit (e_p, e_{ccs}, e_{ccr}, e_{ee}). GHG emissions related to the processing, carbon capture and geological storage, carbon capture and replacement and emissions saving from excess electricity from cogeneration are included.
- **Phase 3:** Biofuel logistics (e_{td}). GHG emissions associated to biofuel logistics until the point of dispatch, depot and filling station.

The calculation of each phase is composed of different stages, while these stages are disaggregated in operations. Each individual operation is calculated according to a general formula:

$$\text{Emissions}_{\text{operation}} = \text{ActivityData} \cdot \text{EmissionFactor}$$

Equation II

The phase is calculated with the sum of each individual operation:

$$\text{Emissions}_{\text{phase}} = \sum_{-}^{n} \text{Emissions}_{\text{operation}}$$

Equation III

Where

n = number of operations in a phase.

The data collection is also identified for each of the phases, including both activity data and emission factors (direct and indirect GHG emissions are accounted in them). Additional variables, needed for some calculations, are also collected, for example the cultivation yield. Specific details for information selection is included within Annex I and Annex II.

It would not be necessary to include in the calculation inputs which will have little or no effect on the result, such as chemicals used in low amounts in processing.

4.2.1 Phase 1: biomass (extraction and cultivation) and logistic emission calculation

4.2.1.1 Stages definition

The methodology described enables the calculation for this phase based on the use of averages (for a particular geographical area) as an alternative to actual values (EC communication, reference 2010 / C 160 / 02 Annex II).

Member States can draw up lists of such average values; they could also be incorporated in this scheme when approved by the EC (EC communication, reference 2010 / C 160 / 02).

The calculation must be split into different stages, disaggregated in operations that are involved in biomass production and logistics. These stages and corresponding operations are:

4.2.1.1.1 Cultivation (e_{ec})

The methodology hereby described covers the calculation from the cultivation including emissions from the extraction or cultivation process itself (i), from collection of biomass (ii), from waste and leakages (iii) and from production of chemicals or products used in extraction or cultivation (iv).

GHG emissions for each individual operation are expressed as kg CO_2eq/t d.m[1] biomass.

- Emissions from the extraction or cultivation process (i) includes the following operations:
  - Tillage: associated to fuel consumption during the tillage operation, multiplied by the fuel emission factor.

    Step 1:

    Step 2:

    Step 3:

    Step 4:
  - Seed fabrication: associated to the quantity of seed consumed in the seeding operation, multiplied by the seed fabrication emission factor.

    Step 1:

    Step 2:

    Step 3:

    Step 4:
  - Sowing: associated to fuel consumption during the sowing operation, multiplied by the fuel emission factor.

[1] d.m: dry matter
[2] Any different units shall be converted using conversion table in Annex III

Step 1:

Step 2:

Step 3:

Step 4:

- Irrigation: associated to the electricity consumed for the water pumping, multiplied by the emission factor of the electricity mix.

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

- Fertilizer application: associated to fuel consumption during the fertilizer application operation, multiplied by the fuel emission factor.

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

- Organic amendments application: associated to the inorganic nitrogen fertilization substitution. This calculation affects on N_2O emissions and N fertilizer fabrication.

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

- o N2O direct and indirect emissions: associated to nitrous oxide emissions from soil due to direct nitrogen emissions and leaching and volatilization of nitrogen, multiplied by the corresponding emission factor.

  Step 1:

  Step 2:

  Step 3:

  Step 4:

- o Pesticides application: associated to fuel consumption during the pesticide application multiplied by the fuel emission factor.

  Step 1:

  Step 2:

  Step 3:

  Step 4:

  Step 5:

- Emissions from the collection of biomass (ii) includes the following operations:
  - o Harvest: associated to fuel consumption during the harvest operation, multiplied by the fuel emission factor.

    Step 1:

    Step 2:

    Step 3:

    Step 4:

  - o Biomass field transport: associated to the fuel consumption during the biomass transportation within the field, multiplied by the fuel emission factor.

    Step 1:

    Step 2:

    Step 3:

    Step 4:

- Transport biomass to storage: associated to fuel consumption during the biomass transportation to the initial storage (where the harvested biomass is compiled), multiplied by the fuel emission factor.

  Step 1:

  Step 2:

  Step 3:

  Step 4:

- Emissions from waste and leakages (iii) under this paragraph the methodology includes the operations that involve the biomass waste management practices:
  - Raking: associated to the fuel consumption during the raking of the straw spread out on the soil, multiplied by the fuel emission factor.

    Step 1:

    Step 2:

    Step 3:

    Step 4:

  - Baling: associated to fuel consumption during straw baling forming bales that are placed on the soil, multiplied by the fuel emission factor.

    Step 1:

    Step 2:

    Step 3:

    Step 4:

  - Collecting bales: associated to fuel consumption during collection of the straw bales and preparation to be transported to the storage, multiplied by the emission factor.

    Step 1:

    Step 2:

    Step 3:

    Step 4:

  - Transport bales to storage: associated to fuel consumption during straw bales transportation to storage, multiplied by the emission factor.

Step 1:

Step 2:

Step 3:

Step 4:

- Emissions from the production of chemicals or products used in extraction or cultivation (iv).
  - Manufacturing of fertilizers (N, P, K and lime): associated to the fertilization needs of the biomass, multiplied by the emission factor relating to fertilizer production.

    Step 1:

    Step 2:

    Step 3:

    Step 4:
  - Pesticide manufacturing: associated to the pesticide consumption of the biomass, multiplied by the emission factor relating to pesticide production.

    Step 1:

    Step 2:

    Step 3:

    Step 4:

Once all applicable operations have been calculated, the emissions as g $CO_2/MJ_{biofuel}$ are obtained as follow:

Step 1:

Step 2:

Step 1:

Step 2:

Step 3:

4.2.1.1.2 Emission saving from soil carbon accumulation via improved management (e_{sca})

In order to consider an emission saving from soil carbon accumulation via improved management, the following practices shall be taken into account:

- Shifting to reduce or zero - tillage.
- Improved biomass rotations and/or cover biomass, including biomass waste management.
- Improved fertilizer or manure management.
- Use of soil improver (e.g. compost).

Evidence that the soil carbon has increased or that it can reasonably be expected to have increased over the period in which the biomass concerned was cultivated, shall be documented.

4.2.1.1.3 Transport and distribution (e_{td})

This phase covers the term e_{td} of the general formula (Equation I) associated to biomass transport and storage.

GHG emission for biomass transport is covered from field to facility. The means of transport considered are:

- Road transport: associated to the distance covered, multiplying by an emission factor.
- Rail transport: associated to the distance covered, multiplying by an emission factor.
- Barge transport: associated to the distance covered, multiplying by an emission factor.
- Ship transport: associated to the distance covered, multiplying by an emission factor.

The general steps to achieve the GHG emissions are:

Step 1:

Step 2:

Step 3:

Step 4:

Additional means of transport would be properly included the same way when necessary.

GHG emissions for biomass storage are also covered:

- Storage operation: associated to the electricity consumption due to the loading and unloading of the biomass and the internal movements for the aeration and maintenance in controlled conditions, multiplying by corresponding emission factor.

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Step 6:

4.2.1.2 Data collection

4.2.1.2.1 Data from supplier

The methodology requires some information from the supply chain. The minimum information that is needed to calculate GHG emissions associated to this phase is:

- Origin of biomass.
- Type of biomass.

Both inputs are provided through the Sustainable biomass attestation completed by validated biomass suppliers.

4.2.1.2.2 Databases and literature data

Each single variable identified (including activity data and emission factor) needed to obtain the calculation must be searched and gathered according to the specific criteria defined through Annex I and Annex II of this procedure.

4.2.2 Phase 2: Biofuel conversion unit

4.2.2.1 Stages definition

The calculation of this phase must be split into different stages, disaggregated in operations that are involved in the processing of biomass into the Biofuel conversion unit. These stages and corresponding operations are:

4.2.2.1.1 Emission from processing (e_p)

This covers emissions from the processing itself, from waste management and production of chemicals in processing.

Emissions associated to this stage are:

- Direct combustion of fuels for heat and electricity cogeneration: associated to fuel consumption, multiplying by an emission factor. These emissions are associated to the heat and electricity generated.

Step 1:

Step 2:

Step 3:

Step 4:

Step 1:

Step 2:

Step 3:

Step 4:

Step 1:

Step 2:

Step 3:

Step 4:

- Direct fuel consumption, multiplying by an emission factor.

  Step 1:

  Step 2:

  Step 3:

  Step 4:

- Electricity consumption: if the electricity is purchased from an external supplier, emissions are associated to electricity consumption, multiplying by an emission factor.

  Step 1:

  Step 2:

  Step 3:

- Heat consumption: if the heat is purchased from an external supplier, emissions are associated to heat consumption, multiplying by an emission factor.

  Step 1:

Step 2:

Step 3:

- Chemicals consumption: associated to the consumption of each chemical, multiplying by an emission factor.

  Step 1:

  Step 2:

  Step 3:

- Waste management: associated to the quantity of waste generated (including waste water), multiplying by an emission factor.

  Step 1:

  Step 2:

  Step 3:

4.2.2.1.2 Carbon capture and geological storage (e_{ccs})

Emission saving from carbon capture and geological storage that have not already been accounted for in e_p is taken into account for emissions avoided through the capture and sequestration of emitted CO_2 directly related to the extraction, transport, processing and distribution of fuel.

Step 1:

Step 2:

Evidence of the carbon capture and geological storage shall be documented.

4.2.2.1.3 Carbon capture and replacement (e_{ccr})

Emission saving from carbon capture and replacement is taken into account for emissions avoided through the capture of CO_2 of which the carbon originates from biomass and which is used to replace fossil - derived CO_2 used in commercial products and services.

Step 1:

Step 2:

Evidence of the biomass carbon capture and replacement shall be documented.

4.2.2.1.4 Excess electricity (e_{ee})

When the facility uses heat and electricity from a cogeneration unit, an emission saving from the excess electricity generated is taken into account in relation to the excess electricity produced by the fuel production system that uses cogeneration except where the fuel used for the cogeneration is a co-product other than agricultural biomass waste / residue.

The cogeneration unit for the saving calculation is achieved with the minimum size of the cogeneration unit necessary to supply heat that is needed to produce the biofuel. The GHG emission saving associated to that excess electricity is taken with an equivalent amount of electricity generated with a power plant using the same fuel as the cogeneration unit (reference conversion unit).

General steps for the calculation are:

Step 1:

Step 2:

Step 3:

Step 4:

4.2.2.1.5 Allocation method

The conversion process for biofuel also involves the production of co-products. That means that emissions from e_{ec} and e_{td} (calculated for biomass transport and storage) and those fractions of e_p, e_{ee} that take place up to and including the process step at which the co-product is produced, must be split between the biofuel and the co-product in proportion to their energy content (determined by lower heating value of the entire co-product, not only the dry fraction in the case of co-product other than electricity). The following formula shall be used:

$$AF = \frac{Q_{biofuel} \cdot LHV_{biofuel\ wet\ basis}}{\left(Q_{biofuel} \cdot LHV_{biofuel\ wet\ basis}\right) + \left(Q_{coproduct} \cdot LHV_{coproduct\ wet\ basis}\right)}$$

Equation IV

Where:

AF = Allocation Factor.

Q = Quantity of biofuel or co-product (kg).

LHV = Lower Heating Value of the biofuel or co-product (MJ / kg).

In addition, those feedstock considered as residues and wastes for the purposes of Annex V, Part C,18 included in Annex VIII of this scheme (RBSA_001) shall be considered to have zero life cycle GHG emissions up to the collection process of those materials.

4.2.2.2 Data collection

4.2.2.2.1 Data from supply chain

There are different pieces of information needed to calculate GHG emissions that are obtained directly onsite:

- Activity data: data must be collected from the production process operation according to the requirements defined through Annex I of this document. The collected data are:
  - Fuel consumption.
  - Heat consumption.
  - Electricity consumption generated and exported.
  - Stream conditions: pressure, temperature, enthalpy, humidity and flow.
  - Yield of products and co-products.
  - Chemical consumption.
  - Waste generation.
  - CO_2 captured.
- Emission factors: emission factor for fuels, electricity (when it is purchased), heat (when it is purchased), chemicals and waste management are collected from the supplier. All data must be validated according the requirements defined through Annex I of this document.

The use of technical instructions in order to achieve consistent results on the gathering of data at conversion unit level is expressly recommended. The set of data for the calculations should be determined specifically for each Biofuel conversion unit configuration.

4.2.2.2.2 Databases and literature data

Some data needed for the calculation can be obtained from databases or literature according to the requirements defined through Annex I of this document.

4.2.3 Phase 3: biofuel logistics

4.2.3.1 Stage definition

This phase includes the calculation of GHG emission related to transport, depot and filling station of biofuel included in the term e_{td} of the general formula (Equation I).

4.2.3.1.1 Transportation

Emissions associated to this stage are calculated through the distance covered, multiplying by an emission factor. The emission factor depends on the transportation, considering the following:

- Pipeline.
- Diesel train.
- Electric train.
- Diesel barge.
- Biodiesel barge.

- Diesel truck.
- Biodiesel truck.
- Sea vessel.

The steps to calculate the associated GHG emissions are:

Step 1:

Step 2:

Step 3:

Additional means of transport would be included the same way.

4.2.3.1.2 Depot

Emissions associated to this stage are calculated through the electricity usage, multiplying by an emission factor.

The steps to calculate the associated GHG emissions are:

Step 1:

Step 2:

Step 3:

4.2.3.1.3 Filling station

Emissions associated to this stage are calculated through the electricity usage, multiplying by an emission factor.

The steps to calculate the associated GHG emissions are:

Step 1:

Step 2:

Step 3:

4.2.3.2 Data collection

4.2.3.2.1 Data from chain

Activity data, in this case the distance covered and the electricity consumption in the depot and filling station, are gathered from the physical supplier process.

4.2.3.2.2 Databases and literature data

The emission factor for each means of transport and for electricity can be taken from a database or literature according to the requirements defined through Annex I of this document.

5 Description of Greenhouse gas saving calculation

Once all terms of the formula (Equation I) have been calculated, the operator involved in the calculation has to use the following formula to calculate the GHG emission saving:

$$\text{GHG emission saving} = (EF - EB)/\ EF \cdot 100$$

Equation V

EB = total emission from the biofuel, g CO_2eq/$MJ_{biofuel}$.

EF = total emission from the fossil fuel comparator. For biofuels for transport it shall be the latest available reported under Directive 98 / 70 / EC and subsequent amendments. If no such data are available, the value used shall be: 83, 8 g CO2eq/MJ.

GHG saving figures shall be rounded to the nearest percentage point.

6 GHG traceability provisions through the chain

Traceability is required in order to assure that the final information is in accordance with provisions described in this scheme.

Sections 7 to 7.2 of General Scheme, reference RBSA_001, describes how GHG methodology is put into practice along with the RBSA supply chain.

The traceability of the information from origin to the conversion unit is assured in accordance with the Mass Balance requirements system described in reference RBSA_002.

7 System assurance

In order to ensure the practical implementation of the methodology hereby described, IT systems and associated procedures will be developed. The procedures must contain, at least:

- Responsibilities.
- Methodology update.
  - Review of requirements.
  - Review of methodology.
- Data collection update.
- Documentary management.
- Access definition.
- Internal audit.

7.1 Responsibilities

The methodology shall be developed by specialized professionals in the life cycle analysis (LCA) area; all of them will have the academic degree (engineers) and technical background needed for that.

Specific training of responsible people for each task within the system and the period and forms of revision will be also recorded.

7.2 Methodology update

Each system component shall be reviewed in order to update the methodology:

- Review of requirements.
- Review of methodology.

The updating methodology must be recorded.

7.2.1 Review of requirements

The methodology developed covers all situations that have been currently identified according to the legislation in force on the date of approval of this document.

Any modifications caused by binding new legislation, EC communication and / or proper publications (i.e. in the transparency platform) shall be evaluated.

Although previously mentioned, the methodology hereby described is specifically developed to comply with provisions of the Annex V of the RED and subsequent EC communications on the matter (this shall be the main references in any case).

A procedure to evaluate new requirements and the necessary changes in methodology shall be defined.

7.2.2 Review of methodology

The methodology must be updated and reviewed in order to check the requirements and, in consequence, new methodology requirements shall be detected.

Afterwards, new developments must be introduced in the methodology in order to maintain continuous improvement of the system.

7.3 Data collection update

According to Annex I and Annex II.

7.4 Documentary management

Information and decisions taken shall be demonstrable through the use of a register or suitable records that shall be properly kept. The method for obtaining, keeping and controlling records has been described in each specific section.

7.5 Access definition

Control access to the IT systems for the methodology implementation shall be properly defined.

7.6 Internal audit

The proper use, control and maintenance of the methodology shall be covered with internal audits in order to ensure fulfilment of the requirements defined under the RBSA.

Appropriate skills for the internal auditors shall be observed.

8 Methodology verification

The practical implementation of the methodology described for GHG emission calculation according to RBSA_003 will be organized through IT systems and associated procedure (s) to be observed by the responsible party appointed by Abengoa Bioenergy organization.

These IT systems and associated procedures compliance with RED and RBSA specific procedures shall be externally verified according to ISAE 3000 by duly accredited auditing agencies according to section 9.1 of RBSA_001 for IT systems and procedures compliance audit, and according to section 10.1 of RBSA_001.

9 Annexes

Annex I: Procedure for information selection

Annex II: Procedure for information selection for cultivation

Annex III: Units conversion