Sustainable Biomass for Energy – WBA Verification Scheme

Edition		Based on:
1	26/08/2011	- Certification Criteria for Sustainable Biomass for Energy (WBA)
2	21/11/2011	- Open quality scope to all type of biomass. - Amendments on CO2 counting and Governance scheme.

CONTENT

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1 INTRODUCTION AND GOAL

The purpose of the World Bioenergy Association (WBA) is to promote the increasing utilization of bioenergy globally in an efficient, sustainable, economically and environmentally appropriate way.

To help provide a clear frame of reference on which to base its activities the WBA has commissioned production of reports on a number of key aspects of biomass to energy within a global perspective. A project realized by WBA and the Swedish University of Agricultural Sciences, SLU, and financed by the Swedish Board of Agriculture resulted in three scientific reports.

1: Global Potential of Sustainable Biomass for Energy (Report 013, ISSN 1654-9406, Swedish University of Agricultural Sciences)

2: Certification Criteria on Sustainable Biomass for Energy (Report 026, ISSN 1654-9406, Swedish University of Agricultural Sciences)

3: Biomass for Energy versus Food and Feed, Land Use Analyses and Water Supply (Report 022, ISSN 1654-9406, Swedish University of Agricultural Sciences)
http://www.worldbioenergy.org/content/news-and-comments-wba

These reports are the base for WBA' s sustainability criteria.

The verification scheme should be used as a manual for accrediting the sustainability of Biomass for Energy. The manual will guide how to check that the criteria are met and the producer will get the WBA sustainability logo.

The role of verification processes in this report is to participate in creation of a global market for bioenergy and biofuels. The minimum universal criteria were developed after comparing the standards, principles, criteria and indicators developed by the existing and emerging voluntary standards around the world.
Instead of creating a totally new verification scheme, we **comply with existing** or upcoming **standards**. By doing this, the meta-standard scheme is build on existing experiences in better management practices and roundtables, with international consultation.

The goal of the following verification scheme for biomass is to secure the sustainability criteria for biomass, the supply of biomass in a sustainable way with clearly defined and consistent quality for specific purposes. So, the scheme requires at least:

- The **traceability** of the resources that are produced and managed in a sustainable way
- The **evaluation** of the energy consumptions
- The **evaluation** of the greenhouse gas (GHG) emissions
- Biomass **quality specifications**

To guarantee a consistent scheme the processes that are necessary for the production and logistics of biomass will be verified in the scope of this scheme – as a result, aspects of product verification will be combined with those of system verification.

The other major issue is that sustainable production of biomass must be shown to **not reduce production or availability of food, fibre and water**, or of **living space and living standards for rural and indigenous people.** Clearly, for the sustainable and equitable production and transport of biomass and biofuels to be done on an extensive scale there must be effective internationally recognized monitoring and verification schemes in place.

The WBA verification scheme contains the following essential points:

- Requirements of sustainability of raw materials and process
- Requirements for the products
- Recognitions of other quality systems of products production
- Requirements for labeling and the use of logo

World Bioenergy Association will receive the license rights of the WBA Sustainable Biomass Verification Scheme. The independence of the verification scheme will be guaranteed through the involvement of accredited verification organizations.

NORMATIVE REFERENCES

- RED 2009/28 for 3 criteria GHG, Carbon stock, bio-diversity (WILL)
- NTA8080 for 5 principles Soil, Water, Air, Economics, Social
- Sustainable Biomass for Energy – WBA Verification Scheme (WBA)

2 DEFINITIONS OF TERMS

Other terms and descriptions related to sustainability and biomass.

2.1 Biomass Producer / Participant on Verification Scheme

Biomass producers are companies that are involved in the production of any kind of biomass, which can be used for energy purpose.

2.2 Verification Body

Verification Bodies assure the independence of the verification system helping the WBA to monitor the procedures. Together with WBA verifies the data delivered by the biomass producer on the declaration form, and provides the producer the "producer code" and an identification number. It must be subcontracted by the producer.

2.3 Local Inspection Body

The Local inspection body is a part of the verification body or an independent third party that audits and visits the company **annually** and verifies the data delivered by the biomass producer on the declaration form. If the inspection body is independent from the verification body, it must be subcontracted by the producer. The Local Inspection Body submits the report to the System Verification Body and informs the WBA Secretariat.

2.4 World Bioenergy Association

WBA is the global organization that represents the interest of the Biomass Sector. WBA is the party that monitors verifying procedures and gives the right to use the verification logo to the company for advertising or commercial purposes.

WBA also is the responsible of communication and diffusion of the verification scheme and logo.

3 VERIFICATION SCHEME

3.1 Overview

The WBA Verification Scheme aims at helping verifiable entities to know where they are with regard to the sustainability criteria and energy consumption implementation and keep the momentum on the continuous improvement path. The verification service is performed by professional independent third-party verifier companies approved by the WBA.

The verification procedure has three essential components:

- The sustainability of the process and the raw material, including the verification of the origin of the raw material
- The characteristics and specifications of the biomass product
- The energy consumption and GHG balance in production and local transport

3.2 Operating Verification Scheme

The WBA Sustainable Biomass Verification Scheme is a **voluntary scheme** of the WBA and producers/participants on verification scheme. The producers that have decided to operate into this scheme will periodically realize the audit of the system through a sustainability statement verified by independent bodies.

These producers are recognized with the WBA logo, which **guarantee the reliability** of the information given by the producer.

The WBA Verification Scheme has a governance to ensure the system compliance and periodically review the sustainability and quality requirements.

The Verification Scheme Requirements can be divided in:

- **Sustainability** Verification Requirements
- **Quality** Verification Requirements
- **Energy** and **GHG** Verification Requirements

3.2.1 Sustainability Verification Requirements

The goal of the following verification scheme for biomass is to secure the sustainability criteria for biomass.

The minimum universal criteria were developed from a scientific report[1] (1) comparing the standards, principles, criteria and indicators developed by the existing and emerging voluntary standards around the world.

The result is a proposal of **15 criteria** listed below.

	WBA Proposed Criteria
1.	The use of chemicals
2.	Forest/land management, planning
3.	Forest/land monitoring
4.	Contribution to local prosperity related to forest/land management, and the protection of employees
5.	Provision of information to increase public awareness of management, planning, operations and/or outcomes
6.	Protection of areas of particular historic, cultural or spiritual value
7.	Maintenance or enhancement of the economic viability of operations
8.	Maintenance of biological diversity
9.	Protections of areas of high ecological value
10.	Protection of the soil and prevention of erosion
11.	Protection or enhancement of water quality
12.	Regeneration following harvesting
13.	The rights of children
14.	Recognition and respect for the customary and traditional rights of indigenous/local people
15.	GHG and energy balance

[1] http://www.worldbioenergy.org/sites/default/files/Report_Certifiering_110405_SL.pdf

One of the key aspects in the sustainability process will be the **evaluation** of the **energy consumptions, and GHG emissions**.

If any of the producers has already a label based on an existent scheme, the verification will focus on criteria that those schemes don't match.

3.2.2 Quality Verification Requirements

The WBA scheme verifies the high quality of biomass for energy. Instead of creating new specifications or standards, WBA will include existing technical standards based on requirements from the customer. An example could be the proposed Quality characteristics for pellets of the European Pellets Council.

3.2.3 Energy and GHG Verification Requirements

The evaluation of the energy consumptions along the biomass supply chain must be considered. Based on the data fulfilled by the producer and Transport Company, and validated by the local inspection body, the Verification Body computes the Energy use and the GHG Balance.

The proposed Energy and GHG Balance form is attached in Annex 3.

3.3 Verification documents

The WBA verification scheme is based on these documents:

- **Application form producer**. The producer sign a form in which allows an independent inspection third party to visit the production site in order to verify the declaration made by the producer. In this document the producer declares that the biomass has traceable origin, control the GHG emissions during the process, and their products are compatible with determined specifications (according to the type of biomass).
- **Audit check list/procedure.** This document describes the procedure for auditors to make the audits on biomass processing site. This procedure is focused on these aspects:
    - Raw biomass origin and certification

- Production chain
- Energy and GHG Balance
- Transportation of the biomass

- **Audit Report**. Once the auditors have visited the processing site, they prepare a clear and illustrated report according to the four relevant aspects included on the audit check-list/procedure. The auditor report is signed by the local inspection company, verified by a System Verification Body (Verification Body) and WBA that provide the **Biomass producer code**.
- **Biomass producer declaration form**. The producer makes an official declaration that relies on the information gathered in the audit report (made by an independent body). The audit report is attached to the declaration form as a separate document.

3.4 Biomass producer code

Through a system of unique identification numbers, each delivery should be able to be traced back from the end customer, through the various links in the logistics chain, back to the producer.

Each identification number has five characters, which specify which country the participant comes from. The first two spaces indicate the country where the biomass is produced. The three numbers after the country code provide the number of the respective verifying scheme participant in the country.

WBA **provides this code** to each participant on the verification scheme after checking with the Verification Body that the Biomass producer declaration fulfilled all the requirements.

3.5 Requirements for labeling and the use of logo

When the verification is issued, the participant in the Biomass Sustainability Verifying Scheme acquires the right to use the verification seal for the products and to use for advertising purposes.

The verification seal will be linked to the identification number of the participant.

This chapter will include the design of the logo and the identification number. It will also include the color variations.

3.5.1 Monitoring Inspections

During the auditing of the voluntary declaration, defects can occur. When major defects have occurred, the inspection body must immediately inform WBA. WBA contact the biomass producer and inform the company that it is not allowed to use the verification logo, until the deviations are corrected, or corrective measures have been taken.

4 GOVERNANCE

4.1 The Verification Scheme Framework

A comprehensive initiative like this has to build on a globally applicable and credible verification scheme. External verifications by independent third party verifiers ensure the long term credibility of the Code and the learning process of the verification scheme.

The Verification Scheme Framework consists of three main elements: World Sustainable Biomass *Secretariat (WSB Secretariat), System Verification and Local Inspection.*

- **Local Inspection** ensures the correctness of the rating in the Self Assessment of producers at local level.
- **System Verification** ensures the credibility of Local Inspection and the functioning of the Verification Scheme.
- **WSB secretariat** ensures the credibility of the scheme at international level and the functioning of the Verification Scheme.

This document gives an overview of the different roles and responsibilities of the Verification Scheme and describes the verification processes of Local as well as System Verification.

Furthermore, the document takes into account the importance of continuous improvement and the exclusion of unacceptable practices.

At the image 1 and 2, it is shown a Diagram Overview of the executive part of the Verification Scheme:

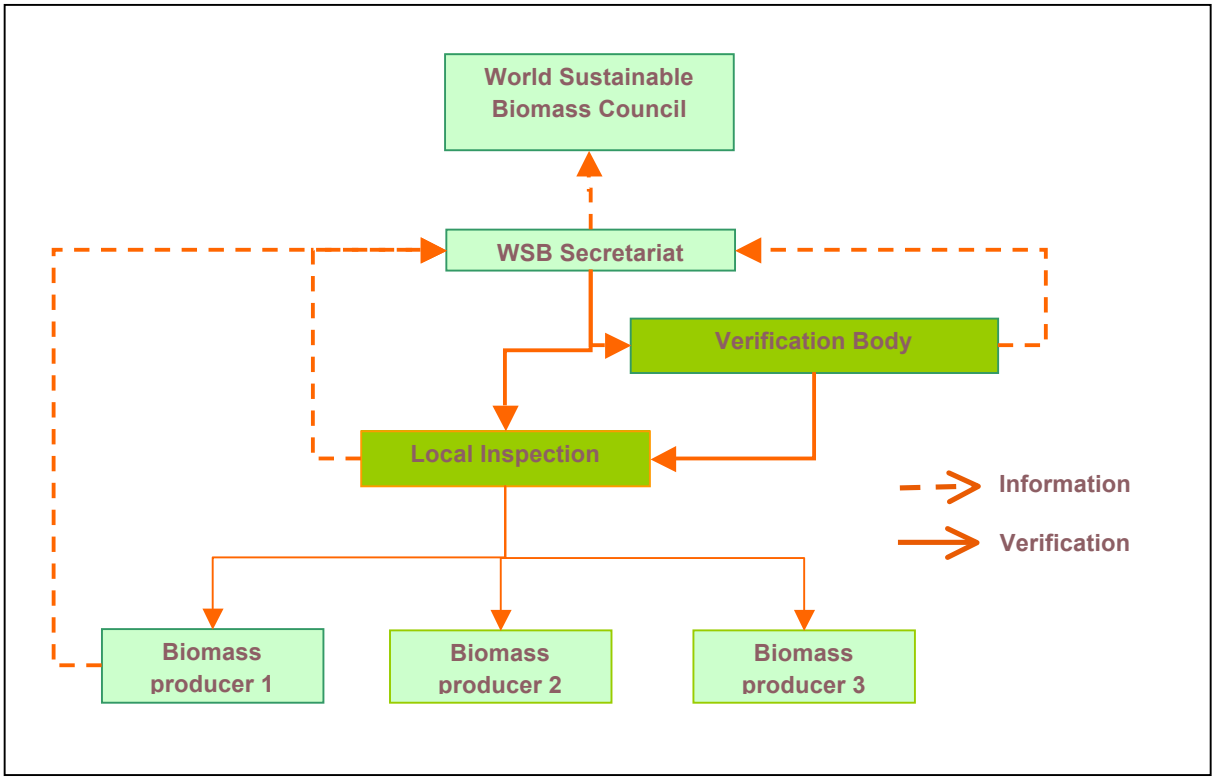

Image 1: Verification Scheme Diagram. Executive part.

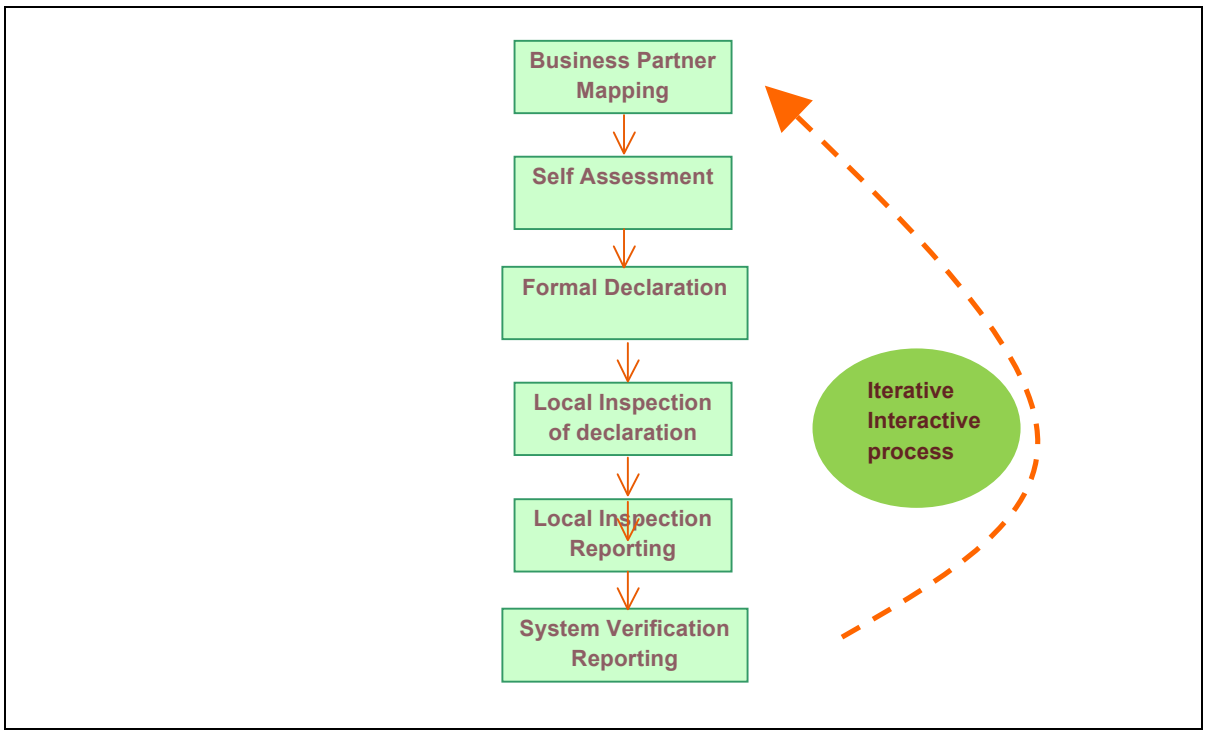

Image 2: Verification Scheme flow.

4.2 Governance responsibilities

This part gives an overview of the different roles and responsibilities of the Verification Scheme actors. At the image 3, it is shown a Diagram Overview of the relation between WBA Organization and the World Sustainable Biomass Council (WSBC):

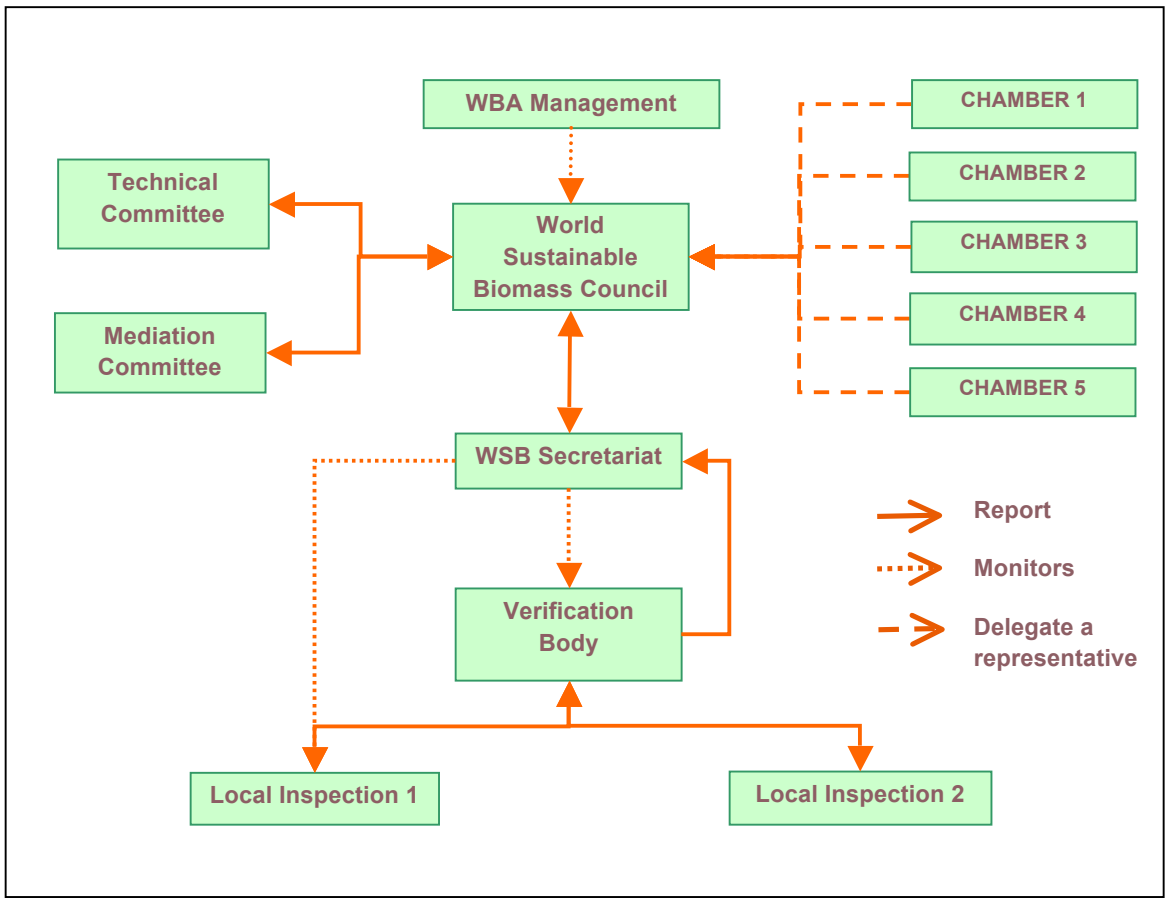

Image 3: WBA and WSB Council Governance

4.2.1 WBA Management

General Roles

(1) The WBA Management has the ultimate power of decision and represents the World Bioenergy Association (WBA). That means to examine and approve the annual report, the accounts and the balance sheet and in general, to decide about any activity of WSB Council. The WBA is open to different types of membership with respective involvement in the biomass supply chain.

Role within the Verification Scheme

(2) The WBA Management is responsible for electing the representatives to the WSB Council.

(3) The WBA Management is responsible for the approval of the WSB Council budget as well as the business plan. In addition, the WBA has ownership of the implementation of the Verification Scheme.

(4) The WBA Management appoints the System Verifiers and Local Inspection Bodies and approves the planned approach of System Verification.

4.2.2 WSB COUNCIL

General Roles

(1) The WBA Management elects the representatives of the WSB Council.

(2) The WSB Council is open to any entity interested in the development of the WSB Scheme.

(3) The WSB Council is responsible for electing the representatives of the Mediation Committee as well as the experts of the Technical Committee.

(4) The WSB Council is organised in 4 to 5 thematic chambers including: Users, Producers, Governments, NGOs and Researchers. Each thematic topic has to be discussed within the chamber before being discussed in the WSB Council.

Role within the Verification Scheme

(5) The WSB Council is responsible for decisions on revision of the Principles and Criteria, as well as the further development of the Principles and Criteria.

4.2.3 WSB SECRETARIAT

General Roles

(1) The WSB Secretariat is responsible for administrative as well as supportive activities of the Sustainable Biomass Verification Scheme.

(2) The WSB Secretariat is responsible of implementing the World Sustainable Biomass Council directives.

(3) The Director of Sustainability reports to the WBA Management and the World Sustainable Biomass Council.

Role within the Verification Scheme

(4) The WSB Secretariat *is responsible for the running of the Verification Scheme*, which includes the registration and listing of Local Verifiers.

(5) The WSB Secretariat *is responsible for identifying and contacting the allocated stakeholders* to schedule and undertake the verifications within the required time.

(6) The WSB Secretariat *collects and aggregates country based reports* from verifications. Summary results and analysis are subsequently reported to the Board, including performance indicators to measure success.

(7) The WSB Secretariat *assists the International and National Forums*; it provides general support, dissemination and guidance.

(8) The WSB Secretariat *resolves cases of conflict or promotes them* to the Mediation Board, if appropriate.

(9) The WSB Secretariat *proposes improvements to the Verification Scheme* to the Board considering recommendations of the Technical Committee and/or analysis of the reports from the System Verifiers.

(10) In those regions where there is no assigned Local Verifier, the WSB Secretariat *will take over the respective responsibilities*.

4.2.4 WSB TECHNICAL COMMITTEE

General Roles

(1) Two experts per chamber - are elected by the Council to form the Technical Committee. Their main task is on the one hand to revise the scheme Principles (sustainability, quality and GHG emissions) and make respective recommendations on amendments, and on the other hand to make accessible relevant information on sustainable biomass production.

(2) The recommendations on amendments to the Principles are reported to the Council who makes the final decision on potential amendments.

Role within the Verification Scheme

(3) The Technical Committee *does not have a direct role to play in the Verification Scheme*. However, *recommendations to the Verification Scheme* may be made to the Council.

4.2.5 WSB MEDIATION COMMITTEE

General Roles

(1) The Mediation Committee handles complaints and proposes respective solutions. One member from each chamber, who are named by the Council deal with the complaints. The committee meets on a case-by-case basis.

Role within the Verification Scheme

(2) In the case of respective complaints, the Mediation Committee *may play a role in the Verification Scheme*.

4.2.6 SUSTAINABLE BIOMASS SCHEME VERIFICATION BODY

General Roles

(1) The System Verification Body is an independent third-party verifier and is registered and approved by the WBA Management. The role of the System Verification Body has two main objectives: to give efficient comfort to the entire

WBA about the running and functioning of the Verification Scheme and to ensure the learning process of the Verification Scheme and, hence, its long-term credibility.

(2) The System Verification Body is responsible to verify the work of the Local Inspection Body as well as reporting to the WSB Secretariat. This may include examining the report of the Local Verifier.

(3) The System Verification Body decides together with the WSB Secretariat and WSB Council on the sample selection for verification, based on a risk-based approach and drafts the Plan.

(4) The System Verification Body submits a report to the WSB Secretariat based on the scope of agreed work.

4.2.7 SUSTAINABLE BIOMASS SCHEME LOCAL INSPECTION BODY

General Roles

(1) The Local Inspection Body is an independent third-party verifier and is listed by the WBA.

Role within the Verification Scheme

(2) The Local Inspection Body is responsible to verify the Self-Assessment of the local verifying Entity and report to the System Verification Body, including field checks.

(3) The Local Inspection Body decides on the sample selection for verification, based on a risk-based approach, drafts the Verification Plan and sends it to the System Verification Body for approval.

(4) The Local Inspection Body submits the report to the System Verification Body and informs the WSB Secretariat.

(5) Local Inspection Body ensure to be kept up to date with WBA verification requirements through the mechanisms offered by the WSB Secretariat.

5 LISTED INSPECTION AND VERIFYING BODIES

These organizations are qualified organizations that audit the Biomass producer declaration form according to the sustainability and quality requirements, and energy and GHG balance requirements.

These organizations fulfilled registration requirements that must be determined by the Governance Structure of the Scheme, including if necessary, a training course organized by WBA.

The qualified organizations will be listed on WBA website.

ANNEX 1: WBA CRITERIA AND INDICATORS PROPOSAL FOR SUSTAINABLE BIOMASS FOR ENERGY

CRITERION 1: The use of chemicals (FSC Principle 6.6 and 6.7; PEFC Principle 2; IWPB Principle 4, GBEP Principle 2 and 4)

1.1. Indicator: Assessment of environmental impacts.

Justification: Management systems shall promote the development and adoption of environmentally friendly non-chemical methods of pest management and strive to avoid the use of chemical pesticides. World Health Organization Type 1A and 1B and chlorinated hydrocarbon pesticides; pesticides that are persistent, toxic or whose derivatives remain biologically active and accumulate in the food chain beyond their intended use; as well as any pesticides banned by international agreement, shall be prohibited. If chemicals are used, proper equipment and training shall be provided to minimize health and environmental risks.

Parameters:

- Chemicals include any surfactants, dispersants or solvents used.
- Records of chemicals in use.
- Receipts and invoices.
- Procedures for the safe and appropriate use of chemicals
- Evidence that waste has been disposed off in an acceptable manner.

1.2. Indicator: Processing of wastes.

Justification: Chemicals, containers, liquid and solid non-organic wastes including fuel and oil shall be disposed of in an environmentally appropriate manner at off-site locations.

Parameters:

- Procedures for the safe and appropriate use of chemicals
- Evidence that waste has been disposed off in an acceptable manner.

CRITERION 2: Forest/land management planning (FSC Principle 7; PEFC Principle 1; IWPB Principle 2; GBEP Principles 3 and 8)

2.1. Indicator: Management plan

Justification: A management plan -- appropriate to the scale and intensity of

the operations – shall be written, implemented, and kept up to date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.

Parameters:

- The management plan and supporting documents shall provide:
  - Management objectives for past, present and future.
  - Description of the forest/land resources to be managed, environmental limitations, land use and ownership status, socio-economic conditions, and a profile of adjacent lands.
  - Maps of tree location.
  - Description of the management system, based on the ecology of the forest/land in question and information gathered through resource inventories.
  - Rationale for rate of annual harvest and species selection.
  - Provisions for monitoring of the growth and dynamics.
  - Environmental safeguards based on environmental assessments.
  - Plans for the identification and protection of rare, threatened and endangered species.
  - Maps describing the forest/land resource base including protected areas, planned management activities and land ownership.
  - Description and justification of harvesting techniques and equipment to be used.
  - Adequate measures are taken to protect the forest/land from fire.
  - Fire readiness and control procedures.

2.2. Indicator: Review of the management plan

Justification: The management plan shall be periodically revised to incorporate the results of monitoring or new scientific and technical information, as well as to respond to changing environmental, social and economic circumstances.

Parameters:

- Checking the plan exists and contains all the information required.
- Field observations of harvesting sites compared to areas planned for harvesting.
- Interviews with Forest Managers, staff and local experts. Managers' knowledge of local Best Operational Practices.
- Evidence of revised planning.

2.3. Indicator: Training

Justification: Forest workers shall receive adequate training and supervision to ensure proper implementation of the management plan.

Parameters:

- Interviews with Forest Managers, supervisors and workers testing their knowledge

of minimum requirements.

2.4. Indicator: Information

Justification: While respecting the confidentiality of information, the managers shall make publicly available a summary of the primary elements of the management plan, including those listed in Criterion 2.1.

Parameters:

- Summary of the primary elements of the management plan.

CRITERION 3: Forest/land monitoring (FSC Principle 8; PEFC Principle 2; IWPB Principle 2; GBEP Principle 8)

3.1. Indicator: Monitoring of consumption

Justification: Monitoring shall be conducted -- appropriate to the scale and intensity of the management -- to assess the chain of custody, management activities and their social and environmental impacts.

Parameters:

- The management should include the research and data collection needed to monitor, at a minimum, the following indicators:
  - Yield of all products harvested.
  - Growth rates, regeneration and condition of the forest/land.
  - Composition and observed changes in the flora and fauna.
  - Environmental and social impacts of harvesting and other operations.
  - Costs, productivity, and efficiency of the management.
- The results of monitoring shall be incorporated into the implementation and revision of the management plan.
- While respecting the confidentiality of information, the managers shall make publicly available a summary of the results of monitoring indicators, including those listed in Criterion 3.2.

3.2. Indicator: Traceability

Justification: Documentation shall be provided by the manager to enable monitoring and certifying organizations to trace each product from its origin, a process known as the "chain of custody."

Parameters:

- Development of a traceability plan.

CRITERION 4: Contribution to local prosperity related to forest/land management, and the protection of employees (FSC Principle 2, 4; PEFC Principle 6; IWPB Principle 8; GBEP Principles 10 and 12)

4.1. Indicator: Local prosperity

Justification: The production of biomass must contribute towards local prosperity and the creation of jobs. In no cases may go against local people.

Parameters:

- Local processing and markets are provided access to forest/land products available from the FMU, unless there is a justifiable reason for not doing so.
- The utilization of non-timber forest products by local community enterprises is encouraged.
- The management plan must define and describe the measures taken for contribution to the local economy.
- Interviews with Forest/land Managers (and consultation with local communities).
- Evidence of opportunities to support local processing and markets.
- Evidence of NTFP[2] sales or licenses or permits issued.
- More detailed indicators can be found in EC1, EC6 and EC7 of the GRI reporting.

4.2. Indicator: Economical and social welfare

Justification: The management operations shall maintain or enhance the long-term social and economic well being of workers and local communities.

Parameters:

- The communities within, or adjacent to, the management area should be given opportunities for employment, training, and other services.
- The management should meet or exceed all applicable laws and/or regulations covering health and safety of employees and their families.

4.3. Indicator: Workers' rights

Justification: Forest management should meet or exceed all applicable laws and/or regulations covering health and safety of employees and their families

Parameters:

- The rights of workers to organize and voluntarily negotiate with their employers

[2] NTFP= Non Timber Forest Products.

shall be guaranteed as outlined in Conventions 87 and 98 of the International Labour Organisation (ILO).

- Management planning and operations shall incorporate the results of evaluations of social impact. Consultations shall be maintained with people and groups (both men and women) directly affected by management operations.
- Appropriate mechanisms shall be employed for resolving grievances and for providing fair compensation in the case of loss or damage affecting the legal or customary rights, property, resources, or livelihoods of local peoples. Measures shall be taken to avoid such loss or damage.
- Labour directives and inspection reports.
- Review of policies, procedures and personnel records.

4.4. Indicator: Creation of job

Justification: People in local communities are given opportunities in employment, training and contracting.

Parameters:

- Interviews with Forest Managers and workers.
- Consultation with representatives of local communities and labour unions.
- Training strategies.
- Job advertisements in local publications

CRITERION 5: Provision of information to increase public awareness of management, planning, operations and/or outcomes (FSC Principle 7, 8 and 9; PEFC Principle 1; IWPB Principle 2 and 8; GBEP Principles 3 and 10)

5.1. Indicator: Information

Justification: It is necessary a management plan and supporting documents in order to increase public awareness of management, planning, operations and/or outcomes. While respecting the confidentiality of information, the managers shall make publicly available a summary of the primary elements of the management plan and the results of the monitoring indicators, including those listed in Criterion 5.1 and 5.2.

Parameters:

- Management objectives.
- Description of the forest/land resources to be managed, environmental limitations, land use and ownership status, socio-economic conditions, and a profile of adjacent lands.
- Description of the management system, based on the ecology of the forest/land in

question and information gathered through resource inventories.

- Rationale for rate of annual harvest and species selection.
- Provisions for monitoring of the growth and dynamics.
- Environmental safeguards based on environmental assessments.
- Plans for the identification and protection of rare, threatened and endangered species.
- Maps describing the forest/land resource base including protected areas, planned management activities and land ownership.
- Description and justification of harvesting techniques and equipment to be used.
- The management should include the research and data collection needed to monitor, at a minimum, the following indicators:
    - Yield of all products harvested.
    - Growth rates, regeneration and condition of the forest/land.
    - Composition and observed changes in the flora and fauna.
    - Environmental and social impacts of harvesting and other operations.
    - Costs, productivity, and efficiency of the management.

CRITERION 6: Protection of areas of particular historic, cultural or spiritual value (FSC Principle 3 and 9; PEFC Principle 6; IWPB Principle 3; GBEP Principles none)

6.1. Indicator: Recognition of special areas

Justification: Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by the managers.

Parameters:

- Operational plans based on review of policies and procedures, forest plans and maps.
- Field observations and records of collection.
- Interviews with forest managers, regulatory authorities, local experts, staff and other stakeholders.
- Discussions with manager about plantation objectives.
- Plans for future planting.
- Management plans and maps
- Consultation with stakeholders and/or government agencies or evidence of input by these agents

CRITERION 7: Maintenance or enhancement of the economic viability of operations (FSC Principle 5 and 10; PEFC Principle 3 and 6; IWPB Principle 2; GBEP Principles 10 to 14)

7.1. Indicator: Use of forest/land's products and services

Justification: The management operations shall encourage the efficient use of the forest/land's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

Parameters:

- The management should strive toward economic viability, while taking into account the full environmental, social, and operational costs of production, and ensuring the investments necessary to maintain the ecological productivity of the forest/land.
- The management and marketing operations should encourage the optimal use and local processing of the forest/land's diversity of products.
- The management should minimize waste associated with harvesting and local processing operations and avoid damage to other forest/land resources.
- The management should strive to strengthen and diversify the local economy, avoiding dependence on a single forest/land product.
- The management operations shall recognize, maintains, and, where appropriate, enhances the value of forest/land services and resources such as watersheds and fisheries.
- The rate of harvest of forest/land products shall not exceed levels, which can be permanently sustained.

CRITERION 8: Maintenance of biological diversity (FSC Principle 1; PEFC Criterion 4; IWPB Principle 3; GBEP Principle 7)

8.1. Indicator: Ecosystem evaluation

Justification: The management planning shall aim to maintain, conserve and enhance biodiversity on ecosystem, species and genetic level and, where appropriate, diversity at landscape level.

Parameters:

- Field observations and records of collection.
- Plans for future planting.
- Description of current biodiversity (species, count, etc. from flora and fauna).
- Measures that manage hunting or collection of flora and fauna.
- Identification (and if possible, mapping) of protective forest varieties, plants and animals, ecological corridors.
- Protected and endangered plant and animal species shall not be exploited for

commercial purposes. Where necessary, measures shall be taken for their protection and, where relevant, to increase their population.

8.2. Indicator: Protected areas and endangered species control

Justification: The management planning and terrestrial inventory and mapping of forest/land resources shall identify and protect ecologically important biotopes, taking into account protected, rare, sensitive or representative ecosystems such as riparian areas and wetland biotopes; areas containing endemic species and habitats of threatened species, as defined in recognised reference lists; as well as endangered or protected genetic in situ resources.

Parameters:

- Operational documents based on review of policies, procedures and record.
- Description of current biodiversity (species, count, etc. from flora and fauna).
- Identification (and if possible, mapping) of protective forest varieties, plants and animals, ecological corridors.
- Risk assessment prior to harvesting operations to avoid damages to biodiversity.
- With due regard to management objectives, measures shall be taken to balance the pressure of animal populations and grazing on forest regeneration and growth as well as on biodiversity.
- Measures that manage hunting or collection of flora and fauna.

8.3. Indicator: Ecosystems or habitats conservation

Justification: The forest management shall provide for conservation of the key ecosystems or habitats in their natural state.

Parameters:

- Description of current biodiversity (species, count, etc. from flora and fauna).
- Documented environmental statement or assessment where legally required.
- Plans for future planting.

8.4. Indicator: Forest/land maintenance

Justification: Standing and fallen dead wood, hollow trees, old groves and special rare tree species shall be left in quantities and distribution necessary to safeguard biological diversity, taking into account the potential effect on health and stability of forests and on surrounding ecosystems.

Parameter:

- Operational plans based on review of policies and procedures, forest plans and maps.
- Field observations and records of collection.
- Waste generated through harvesting operations, is minimised whilst leaving adequate organic material on the forest floor for soil conservation.

CRITERION 9: Protection of areas of high ecological value (FSC Principle 3 and 10; PEFC Criterion 4 and 6; IWPB Principle 3; GBEP Principle 2)

9.1. Indicator: Special sites for indigenous people.

Justification: Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by the managers.

Parameters:

- Biomass production in these areas is allowed only if:
  - Measures and controls are implemented to ensure continuous compliance with the legal requirement.
  - Human intervention has historically ensured protection of biodiversity values in these areas
  - It took place before the **relevant reference date** (1/1/1997 or relevant date fixed by the EC) and there was no production interruption meanwhile.
- Interviews with Forest Managers, regulatory authorities and other stakeholders.
- Operational documents based on review of policies, procedures and records.
- Management plans and maps.
- Consultation with stakeholders and/or government agencies or evidence of input by these agents.

9.2. Indicator: Environmental impacts.

Justification: Infrastructure shall be planned and constructed in a way that minimises damage to ecosystems, especially to rare, sensitive or representative ecosystems and genetic reserves, and that takes threatened or other key species - in particular their migration patterns - into consideration.

Parameters:

- Operational plans based on review of policies and procedures, forest plans and maps.
- Records of assessments and decisions.
- Manager's knowledge of site and impact operations.
- Documented environmental statement or assessment where legally required.
- Field observations and records of collection.
- Interviews with forest managers, local experts, staff.

9.3. Indicator: Key biotopes.

Justification: Special key biotopes in the forest such as water sources, wetlands, rocky outcrops and ravines shall be protected or, where appropriate, restored when damaged by forest practices.

Parameters:

- Manager's knowledge of the site and impacts of operations.

CRITERION 10: Protection of the soil and prevention of erosion. (PEFC Criterion 1, 3 and 5; IWPB Principle 4 and 5, GBEP Principle 2)

10.1. Indicator: Soil damages

Justification: The management planning shall aim to maintain and enhance protective functions of forest/land for society, such as protection of infrastructure, protection from soil erosion, protection of water resources and from adverse impacts of water such as floods or avalanches.

Parameters:

- Appropriate plantation species
- Restricted removal of the residual products (needles, branches).
- Reporting on the use and storage of chemicals, transport fuels, lubrication oil, etc.
- Documented site information and field observations on soil degradation through erosion, oil and chemical spills, etc

10.2. Indicator: Registration of areas

Justification: Areas that fulfil specific and recognised protective functions for society shall be registered and mapped, and the management plans or their equivalents shall take full account of these areas.

Parameters:

- Maps and interviews with Forest Managers, staff and local experts.

10.3. Indicator: Erosion areas.

Justification: Special care shall be given to silvicultural operations on sensitive soils and erosion prone areas as well as on areas where operations might lead to excessive erosion of soil into watercourses. Inappropriate techniques such as deep soil tillage and use of unsuitable machinery shall be avoided on such areas. Special measures to minimise the pressure of animal population shall be taken.

Parameters:

- Where soils are degraded from previous activities, there are plans to restore them.
- Appropriate plantation species.

- All forest management operations that may damage soil are known and methods to mitigate or avoid such damages are implemented.
- Documented site information and field observations on soil degradation through erosion.
- Analyze of appropriate techniques and adequate machinery to the soil of each area.

10.4. Indicator: Care in construction

Justification: Construction of roads, bridges and other infrastructure shall be carried out in a manner that minimises bare soil exposure, avoids the introduction of soil into watercourses and that preserve the natural level and function of water courses and river beds.

Parameters:

- Proper road drainage facilities shall be installed and maintained.
- Operational plans and field observations (water intakes, efficiency of water use, recycling of water, wastewater treatment).
- Maps showing new roads and locations of new and ongoing operations.
- Manager's knowledge of the site and impacts of operations.

CRITERION 11: Protection or enhancement of water quality (FSC Principle 6; PEFC Principle 1; IWPB Principle 5; GBEP Principle 5)

11.1. Indicator: Water

Justification: The management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest/land.

Parameters:

- Operational plans and field observations (water intakes, efficiency of water use, recycling of water, wastewater treatment).
- Written guidelines shall be prepared and implemented to: control erosion; minimize damage during harvesting, road construction, and all other mechanical disturbances; and protect water resources.

CRITERION 12: Regeneration following harvesting (PEFC Criterion 10; PEFC Principle 2 and 4; IWPB Principle 2; GBEP Principle 3, 6 and 17)

12.1. Indicator: Forest/land regeneration

Justification: Natural regeneration shall be preferred, provided that the

conditions are adequate to ensure the quantity and quality of the forests resources and that the existing provenance is of sufficient quality for the site.

Parameters:

- Strategic and tactical/operational harvest planning and harvest operations should carry out in accordance with national best practice guidelines.
- Techniques are designed to avoid log breakage, timber degrade and damage to the forest stand.
- Maps of tree location.
- Data on likely or actual growth rates of species harvested.
- For reforestation and afforestation, origins of native species and local provenances that are well adapted to site conditions shall be preferred, where appropriate. Only those introduced species, provenances or varieties shall be used whose impacts on the ecosystem and on the genetic integrity of native species and local provenances have been evaluated, and if negative impacts can be avoided or minimised.[3]
- Afforestation and reforestation activities that contribute to the improvement and restoration of ecological connectivity shall be promoted.
- Genetically modified trees shall not be used.
- Evidence of revised planning.

12.2. Indicator: Diversity

Justification: Forest management practices shall, where appropriate, promote a diversity of both horizontal and vertical structures such as uneven-aged stands and the diversity of species such as mixed stands. Where appropriate, the practices shall also aim to maintain and restore landscape diversity.

Parameters:

- Maps of tree location.
- Field observations of harvesting sites compared to areas planned for harvesting.
- Traditional management systems that have created valuable ecosystems, such as coppice, on appropriate sites shall be supported, when economically feasible.

12.3. Indicator: Harvesting

Justification: Tending and harvesting operations shall be conducted in a way that does not cause lasting damage to ecosystems.

[3] Note: CBD (Convention on Biological Diversity) Guiding Principles for the Prevention, Introduction, and Mitigation of Impacts of Alien Species that Threaten Ecosystems, Habitats or Species are recognized as guidance for avoidance of invasive species

Parameters:

- Wherever possible, practical measures shall be taken to improve or maintain biological diversity.
- Checking the plan exists and contains all the information required.
- Field checks that the plan has been implemented in the past and is currently still followed.
- Management plan, maps of specific areas and operational controls.
- Interviews with Forest Managers, staff and local experts.
- Evidence of revised planning

CRITERION 13: The rights of children (Unicef, The Convention on the Rights of the Child. IWPB, Principle 8)

13.1. Indicator: Rights

Justification: The management has to follow the *The Convention on the Rights of the Child*, which is the first legally binding international instrument to incorporate the full range of human rights—civil, cultural, economic, political and social rights. The Convention spells out the basic human rights that children everywhere have: the right to survival; to develop to the fullest; to protection from harmful influences, abuse and exploitation; and to participate fully in family, cultural and social life. The four core principles of the Convention are non-discrimination; devotion to the best interests of the child; the right to life, survival and development; and respect for the views of the child. Every right spelled out in the Convention is inherent to the human dignity and harmonious development of every child. The Convention protects children's rights by setting standards in health care; education; and legal, civil and social services.

Parameters:

- Setting standards in health care; education; and legal, civil and social services.
- Interviews with Forest Managers, workers and union representatives.
- Guidelines/regulations are readily available.
- Labour directives and inspection reports.
- Review of policies, procedures and personnel records.

CRITERION 14: Recognition and respect for the customary and traditional rights of indigenous/local people (FSC Principle 1,2 and 3; IWPB Principle 7 and 8; GBEP Principles 9,10 and 12)

14.1. Indicator: Traditional rights

Justification: The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected.

Parameters:

- Documentation with appropriate legal status.
- Maps clearly indicating the boundaries of the FMU.
- Management plans and maps.
- Consultation with representatives of indigenous peoples.
- Indigenous peoples shall control the management on their lands and territories unless they delegate control with free and informed consent to other agencies.
- The management shall not threaten or diminish, either directly or indirectly, the resources or tenure rights of indigenous peoples.

14.2. Indicator: Significant sites to indigenous.

Justification: Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by forest managers.

Parameters:

- Reporting of the Forest managers on impact assessments and consultation with representatives of indigenous peoples, local communities and stakeholders.

14.3. Indicator: Traditional knowledge.

Justification: Indigenous people shall be compensated for the application of their traditional knowledge regarding the use of forest/land species or management systems in forest/land operations.

Parameters:

- This compensation shall be formally agreed upon with their free and informed consent before forest/land operations commence.

CRITERION 15: GHG and Energy Balance (IWPB Principle 1; GBEP Principles 1, 4 and 18)

15.1. Indicator: Overall energy consumption

Justification: In order to be sustainable, it is necessary not only to consider if we are using biomass in a sustainable way, but also, we must take into account the quantity and origin of the energy used in the different stages of biomass life cycle. Thus, it is necessary to try to minimize energy consumption during cultivation, harvest, extraction, processing, transportation and combustion.

Parameters:

- The auditor must verify all data and comment on the following issues:
  - It must be detailed energy resources that are used on the raw material production site, and justified if energy consumption is not needed.
  - It is obligatory to recorder any energy use on the intermediary platforms.
  - It is necessary to describe energy consumption, which may be calculated trough different methods.
- Comment on the energy resources that are used within the forest management unit (e.g. for maintenance, harvesting, transport, preparation of raw material):
  - Example: electricity mix characterization, biomass, gasoil, gas,..
  - If no energy consumption is needed, then please justify

ANNEX 2: ENERGY BALANCE FORM

A proposal methodology for counting the Energy balance form is presented in the coming table. Parameters of conversion need to be agreed, until now recommendations of the IPCC are taken into account.

- Energy balance form -

RAW MATERIAL TRANSPORT

Road transport by diesel trucks	K	0	km
	H	37,825	MJ/litre, heating value fossil fuel
	L	30	litre fuel /100km
	Q	0	tons of raw material per truck
	RRT	0,0	kWhp/ton raw material
	= (K x L x H) / (100 x 3,6 x Q)		
Diesel trains	K	0	km
	H	37,825	MJ/litre, heating value fossil fuel
	LTKM	0,016	litre/ton.km
	RDT	0	kWhp/ton raw material
	RDT	0,0	kWhp/ton raw material
	= (K x L x H) / (100 x 3,6 x Q)		
River flatboats	S	0	number of sea miles
	H	42500	MJ/ton, heating value fuel
	D	0	number of days transport
	L	0	ton of fuel per day
	RRB	0,0	kWhp/ton pellet
	= (K x L x H) / (100 x 3,6 x Q)		

SUBTOTAL AND CONVERSION RATE

Sum energy consumption for raw material transportation **(kWh/ton raw material)**	RT	0,0	kWhp/ton raw material
	= RRT + RDT + RRB		
Conversion rate (ton finished product / ton raw material)	IMD	122%	initial moisture (dry basis)
	FMD	9%	final moisture (dry basis)
	CR	0,489	ton/ton
	= (1+FM) / (1+IM)		
Sum energy consumption for raw material transportation **(kWh/ton finished product)**	RT'	0,0	kWhp/ton pellet
	= RT / CR		

PRODUCTION

Average **electricity** consumption needed for making the biomass (whatever the origin of the electricity)	E	0,0	kWhe/ton pellet
for making the final biomass ss & renewable sources)	V	0	select units
	LHV	0	select units
	F1	0,0	kWhp/ton pellet
	= V x LHV		
	V	0	select units
	LHV	0	select units
	F1	0,0	kWhp/ton pellet
	= V x LHV		

FINISHED PRODUCT : INLAND TRANSPORT

Road transport by diesel trucks	K	0	km
	H	37,825	MJ/litre, heating value fossil fuel
	L	30	litre fuel /100km
	Q	0	tons of biomass per truck
	PRT	0,0	kWhp/ton pellet
	= (K x L x H) / (100 x 3,6 x Q)		
Diesel trains	K	0	km
	H	37,825	MJ/litre, heating value fossil fuel
	LTKM	0,016	litre fuel /100km
	PDT	0,0	kWhp/ton raw material
	= (K x L x H) / (100 x 3,6 x Q)		
Electric trains	K	0	km
	KTKM	0,03	kWhe/tonkm
	PET	0,0	kWhe/ton pellet
	= K x L		
River flatboats	S	0	number of sea miles
	H	42500	MJ/ton, heating value fuel
	D	0	number of days transport
	L	0	ton of fuel per day
	Q	0	tons of boat capacity
	PRB	0,0	kWhp/ton pellet
	= (K x L x H) / (100 x 3,6 x Q)		

INTERNATIONAL SEA/RIVER TRANSPORT

Sea/river vessels	S	0	number of sea miles
	H	42500	MJ/ton, heating value fuel
	D	0	number of days transport
	L	0	ton of fuel per day
	Q	0	tons of boat capacity

	PI	0,0	kWhp/ton pellet
	= (D x L x H) / (3,6 x Q)		

TOTAL

Total fossil primary energy	TFP	0,0	kWhp/ton pellet
	= RT' + F1 + F2 + PRT + PDT + PRB + PI		
Total electricity	TE	0,0	kWhe/ton pellet
	= E + PET		
Grand total (Energy consumption in equivalent electricity, assuming fossil energy is converted into electricity with a 55% efficiency)	TE	0,0	kWhe/ton pellet
	= TE + (TFP x 0.55)		

ANNEX 3: CARBON BALANCE FORM

Since GHG emissions are caused not only by bioenergy cultivation, but also by downstream processing, a GHG standard for bioenergy needs to address both:

- A maximum life-cycle GHG balance of bioenergy cultivation
- The processing of biomass must demonstrate a minimum conversion efficiency.

GHG emission limits can be developed for final biobased products such as liquid biofuels for transport or heating (e.g. bioethanol, biodiesel), solid chips or pellets for combustion, biogenic gases (such as biogas, bio- SNG or woodgas), bio-electricity (to take into account the different conversion routes) and by-products. [4]

GBEP GHG methodological framework

The methodology is based on 10-step greenhouse gas (GHG) inventory framework. It is intended to guide policy makers and institutions when calculating GHG emissions from bioenergy and to enable life cycle assessments (LCA) of the GHG emissions of bioenergy to be compared on an equal basis. Not all 10 steps will apply to all biofuel or bioenergy systems, so in some applications it will be necessary to skip one or more steps of the Framework. At all stages, the user is invited to provide units of measurement and description of methodologies to add specificity to the report.[5]

Proposed methodological framework

The following table shows the Carbon balance form. Parameters of conversion need to be agreed, until now recommendations of the IPCC are taken into account.

- Carbon balance form-

RAW MATERIAL SOURCING

Nature of raw material	saw dust		
Moisture contents of raw material	fresh wood		
	IMW	55%	initial moisture raw material (wet basis)
	IMD	122%	initial moisture raw material (dry

[4] http://www.biofuelstp.eu/downloads/WWF_Sustainable_Bioenergy_final_version.pdf

[5] http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/GHG_clearing_house/GBEP_Meth_Framework_V_1.pdf

			basis)
	FMW	8%	final moisture pellets (wet basis)
	FMD	9%	final moisture pellets (dry basis)
Harvesting raw material and/or chipping off site	Harvesting/chipping	0.0000	kg CO2/kWhp
	LHV chips	1941	kWh / ton
	OS	0.0	kg CO2/ton raw material

RAW MATERIAL TRANSPORT

Road transport by diesel trucks	K	0	km
	H	37.825	MJ/litre, heating value fossil fuel
	L	30	litre fuel /100km
	Q	0	tons of raw material per truck
	OR	0.5	occupancy rate
	RRT	0.0	kWhp/ton raw material
	EF	0.306	kg CO2 / KWhp (emission factor diesel)
	CRRT	0.0	kg CO2/ton raw material
Diesel trains	K	0	km
	H	37.825	MJ/litre, heating value fossil fuel
	LTKM	0.016	litre/ton.km
	OR	0.9	occupancy rate
	RDT	0.0	kWhp/ton raw material
	EF	0.306	kg CO2 / KWhp (emission factor diesel)
	CRDT	0.0	kg CO2/ton raw material
River flatboats	S	0	number of sea miles
	H	42500	MJ/ton, heating value fuel
	D	0	number of days transport
	L	0	ton of fuel per day
	Q	0	tons of boat capacity
	OR	0.7	occupancy rate
	RRB	0.0	kWhp/ton pellet
	EF	0.310	kg CO2 / KWhp (em. fact. LFO-MFO-HFO)

	CRRB	0.0	kg CO2/ton raw material

SUBTOTAL AND CONVERSION RATE

Sum of carbon emissions for raw material sourcing **(kg CO2/ton raw material)**	CRT	0.0	kg CO2/ton raw material
	= CRRT + CRDT + CRRB		
Conversion rate (ton finished product / ton raw material)	CR	0.489	ton/ton
Sum of carbon emissions for raw material transportation **(kg CO2/ton finished product)**	CRT'	0.0	kg CO2/ton pellet
	= CRT / CR		

PRODUCTION

Average **electricity** consumption needed for making the biomass (whatever the origin of the elctricity)	E	0.0	kWhe/ton pellet
	EF	0.456	kg CO2 / KWhe (reference for electricity)
	CE	0.0	kg CO2/ton pellet
Average **primary fossil energy** used for making the final biomass product (thus excluding biomass & renewable sources)	diesel/natural gas/....		
	V		select units
	LHV		select units
	F1	0.0	kWhp/ton pellet
	EF		kg CO2 / KWhp (emission factor fuel 1)
	CF1	0.0	kg CO2/ton pellet
	diesel/natural gas/....		
	V		select units
	LHV		select units
	F1	0.0	kWhp/ton pellet
	EF		kg CO2 / KWhp (emission factor fuel 2)
	CF2	0.0	kg CO2/ton pellet
Average **heat obtained from biomass boiler** needed for drying the biomass	heat source:	biomass boiler	
	biomass fuel type :	wood residues	
	biomass fuel orgin :		km radius
	E	792	kWh /ton pellet (enthalpy moisture evaporation)
	DE	58%	dryer efficiency
	D	1366	kWh steam /ton pellet
	W	*1203*	*kWh steam /ton vaporized water*
	BE	81%	boiler efficiency
	B	1686	kWh p /ton pellet

	EF1	0	kg CO2 / KWhp (wood harvesting/milling , no drying)
	EF2	0	kg CO2 / KWhp (wood transport, including return empty)
	EFT	0	kg CO2 / KWhp (total EF1-EF2)
	CB	0.0	kg CO2/ton pellet
Average **heat obtained from biomass CHP** needed for drying the biomass	heat source:	biomass based cogeneration (combined heat and power plant)	
	biomass fuel type :	wood residues	
	biomass fuel orgin :		km radius
	D	1243	kWh steam /ton pellet
	W	*1095*	*kWh steam /ton vaporized water*
	BE	60%	CHP total efficiency
	B	2072	kWh p /ton pellet
	EF1	0	kg CO2 / KWhp (wood harvesting/milling , no drying)
	EF2	0	kg CO2 / KWhp (wood transport, including return empty)
	EFT	0	kg CO2 / KWhp (total EF1-EF2)
	CB	0.0	kg CO2/ton pellet

FINISHED PRODUCT : INLAND TRANSPORT

Road transport by diesel trucks	K	0	km
	H	37.825	MJ/litre, heating value fossil fuel
	L	30	litre fuel /100km
	Q	0	tons of biomass per truck
	OR	0.5	occupancy rate
	PRT	0.0	kWhp/ton pellet
	EF	0.306	kg CO2 / KWhp (emission factor diesel)
	CPRT	0.0	kg CO2/ton raw material
Diesel trains	K	0	km
	H	37.825	MJ/litre, heating value fossil fuel

	LTKM	0.016	litre fuel /100km
	OR	0.9	occupancy rate
	PDT	0.0	kWhp/ton raw material
	EF	0.306	kg CO2 / KWhp (emission factor diesel)
	CPDT	0.0	kg CO2/ton raw material
Electric trains	K	0	km
	KTKM	0.03	kWhe/tonkm
	OR	0.9	occupancy rate
	PET	0.0	kWhe/ton pellet
	EF	0.456	kg CO2 / KWhe (reference for electricity)
	CPET	0.0	kg CO2/ton raw material
River flatboats	S	0	number of sea miles
	H	42500	MJ/ton, heating value fuel
	D	0	number of days transport
	L	0	ton of fuel per day
	Q	0	tons of boat capacity
	OR	0.7	occupancy rate
	PRB	0.0	kWhp/ton pellet
	EF	0.310	kg CO2 / KWhp (em. fact. LFO-MFO-HFO)
	CPRB	0.0	kg CO2/ton raw material

INTERNATIONAL SEA/RIVER TRANSPORT

Sea/river vessels	S	0	number of sea miles
	H	42500	MJ/ton, heating value fuel
	D	0	number of days of sea
	L	0	ton of fuel per day
	Q	0	tons of boat capacity
	OR	0.7	occupancy rate
	PI	0.0	kWhp/ton pellet
	EF	0.310	kg CO2 / KWhp (em. fact. LFO-MFO-HFO)

	CPI	0.0	kg CO2/ton raw material

TOTAL

Grand total (Energy consumption in eqivalent electricity, assuming fossil energy is converted into electricity with a 55% efficiency)	TC	0.0 = CRT' + CE + CF1 + CF2 + CPRT + CPDT + CPET + CPRT + CPI	kg CO2/ton pellet
LHV pellets	LHV	16000	MJ / ton pellet
Emission factor for pellet supply chain	EFP	0.0 = TC /LHV x 3600	kg CO2/MWhp
		0 result rounded to the nearest multiple of 5	**kg CO2/MWhp**