TEMPLATE

EY PROJECT INFORMATION & PROJECT DESIGN DOCUMENT (PDD)

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VERSION **v.1.5**

RELATED SUPPORT

- TEMPLATE GUIDE Key Project Information & Project Design Document

This document contains the following Sections

SECTION A. DESCRIPTION OF PROJECT
SECTION B. APPLICATION OF APPROVED GOLD STANDARD METHODOLOGY (IES) AND/OR DEMONSTRATION OF SDG CONTRIBUTIONS
SECTION C. DURATION AND CREDITING PERIOD
SECTION D. SUMMARY OF SAFEGUARDING PRINCIPLES AND GENDER SENSITIVE ASSESSMENT
SECTION E. SUMMARY OF LOCAL STAKEHOLDER CONSULTATION

Appendix 1 - Safeguarding Principles Assessment
Complete the Assessment below and copy all Mitigation Measures for each Principle into SECTION D above. Please refer to the instructions in the Guide to Completing this Form.
(mandatory)
Appendix 2 - Contact information of project developer(s) (mandatory)
Appendix 3 - LUF Additional Information (project specific)
Appendix 4 - Design Changes

This template has been revised to aid a consistent interpretation and to better support project developers submitting documentation for certification. Please read the accompanying guide to understand how to complete this template accurately.
TEMPLATE GUIDE Key Project Information & Project Design Document

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KEY PROJECT INFORMATION

GS ID of Project	
Title of Project	Sifuri Halisi Biochar Project
Time of First Submission Date	
Date of Design Certification	
Version number of the PDD	0.9a
Completion date of version	13.12.2023
Project Developer	atmosfair gGmbH
Project Representative	Lisa Bretschneider
Project Participants and any communities involved	atmosfair gGmbH Dark Earth Carbon Tz Ltd
Host Country (ies)	The United Republic of Tanzania
Activity Requirements applied	☒ Community Service Activity ☐ Renewable Energy ☐ Land-Use and Forests Activity Requirements/Risks & Capacities ☐ N/A
Scale of the project activity	☒ Micro scale ☐ Small Scale ☐ Large Scale
Other Requirements applied	
Methodology (ies) applied and version number	Proposing new methodology

Product Requirements applied	☒ GHG Emissions Reduction & Sequestration ☐ Renewable Energy Label ☐ N/A
Project Cycle:	☐ Regular ☒ Retroactive

Table 1 – Estimated Sustainable Development Contributions

SUSTAINABLE DEVELOPMENT GOALS TARGETED	SDG IMPACT (DEFINED IN B.6)	ESTIMATED ANNUAL AVERAGE	UNITS OR PRODUCTS
13 Climate Action (mandatory)	Emission reduction	6,489	VERs
3 Good Health and well-being	Tons of waste generation reduced (Feedstock)	15,200	Tons
8. Decent work and economic growth	Total number of jobs	7	Number
12. Responsible consumption and production	Tons of waste generation reduced (Feedstock)	15,200	Tons

SECTION A. DESCRIPTION OF PROJECT

A.1 Purpose and general description of project

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The project "Sifuri Halisi" aims to build several pyrolysis plants in order to produce biochar as soil improving amendment from residues from forest management and primary and secondary wood processing. "Sifuri Halisi" means absolute zero in Kiswahili. Biochar applied to the soil poses a stable carbon sink.

The project proponents, Dark Earth Carbon Tz. Ltd. (DEC) and atmosfair, seek to partner with smallholders, government plantations, and Tree Grower Associations (TGAs) as well as small and medium wood processing companies and use their wood residues. The wood residues from the forestry sector and timber industry in Tanzania are currently being burnt openly or degraded (without energetic valorization), which results in greenhouse gas emissions, increased wild fire risk and health problems. One of the fundamental reasons for the non-use of the residues is the lack of markets and sophisticated facilities in place for these end-of-life products. The project activity fills in this void by providing a possibility of using these wood residues and converting them into biochar. By demonstrating the untapped potential of wood residues to the local forestry sector and local stakeholders, and setting up the required infrastructure for direct purchase from smallholders the project wants to incentivise them to adopt not only a better waste management strategy but also more sustainable forestry practices. The project will curb the practice of burning wood residues in the forest, which will significantly reduce the risk of forest fires.

Another objective of the project is to improve the soil quality in Tanzania by introducing biochar as soil amendment to the local public. Biochar can improve soil quality and boost crop yields on tropical soils because of its impact on the soil water retention capacity, the soil pH and its ability to store nutrients. Improving arable soils would prove very beneficial in Tanzania since over 65% of the population depends on the agricultural sector for their livelihood.

A.1.1. Eligibility of the project under Gold Standard

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Table 2: General eligible criteria according "Principles & Requirements v1.2 para. 3.1.1"

(a) Types of project	Eligible projects shall include physical action/implementation on the ground. Pre-identified eligible project types are identified in the Eligibility Principles and Requirements section.	The project is eligible as a CSA-project as waste management projects are eligible per definition. The biomass feedstock is purchased from local smallholders and the produced biochar will be available on local markets. Therefore, the project activity provides and improves access to waste management services and

		resources for soil amendment at community level. The project is a sequestration project. Therefore, deviating from the standard CSA-projects the project is eligible for 5 Certification Renewal Cycles.
(b) Location of Project	Projects may be located in any part of the world.	The project is located in Tanzania.
(c) Project Area, Project Boundary and Scale	The Project Area and Project Boundary shall be defined. Projects may be developed at any scale although certain rules, requirements and limitations may apply under specific Activity Requirements, Impact Quantification Methodologies and Products Requirements. In order to avoid double counting the Project shall not be included in any other voluntary or compliance standards programme unless approved by Gold Standard (for example through dual certification). Also, if the Project Area overlaps with that of another Gold Standard or other voluntary or compliance standard programme of a similar nature, the project shall demonstrate that there is no	Project Area and Boundary: The United Republic of Tanzania; The physical geographic locations of the biochar production facilities are documented and registered in a database. Project Scale: This project is a microscale project, as the CSA project issues emission reductions less than or equal to 10,000 t CO2eq-per annum. Registration other voluntary or compliance schemes: The project is not registered with any other voluntary or compliance schemes. PP seek to accomplish dual certification similar to GS-CERs under the Carbon Sink standard by Carbon Standards International. The pyrolysis plants and other equipment that will be implemented under this project will be verified by the World Biochar Certificate (WBC). This will ensure the quality

	double counting of impacts at design and performance certification (for example use of similar technology or practices through which the potential arises for double counting or misestimation of impacts amongst projects).	of the production facility and of the produced biochar but will not generate any carbon credits.
(d) Host Country Requirements	Projects shall be in compliance with applicable Host Country's legal, environmental, ecological and social regulations.	In 2021, the 1997 National Environmental Policy (NEP) was reviewed and updated. Similarly, to its 1997's version, the 2021 NEP identified six major problems requiring urgent attention, one of which being land degradation, which reduces soil productivity in many parts of the country. Therefore, one of the objectives of the NEP is to prevent and control land degradation. In order to tackle the issue of land degradation, the NPE aims to "enhance environmentally sound management of land resources for socio-economic development". Using biochar as a soil amendment would therefore comply with such a measure since it improves soil quality, hence enabling farmers to boost their yield and increase their revenues.
(e) Contact Details	As part of the Project Documentation the Project Developer shall provide (i)	See Appendix 2 – Contact information of Project Developer(s) for more detailed information.

	name and (ii) contact details of all Project Participants; AND in case of an organisation (iii) the legal registration details and (iv) documentation by the governing jurisdiction that proves that the entity is in good standing (defined as being a legal or other appropriate entity registered in or allowed to operate within the required jurisdiction and with no evidence of insolvency or legal/criminal notices placed against it or any of its Directors). Gold Standard retains the right (at its own discretion) to refuse use of the Standard where reputational concerns are highlighted.	
(f) Legal Ownership	Full and uncontested legal ownership of any Products that are generated under Gold Standard Certification, (for example carbon credits) shall be demonstrated. Where such ownership is transferred from project beneficiaries this must be demonstrated transparently and with full, prior and informed consent (FPIC).	The biochar produced from the residues will be sold to local smallholder farmers or other clients and therefore, once sold, the biochar will become the legal property of these clients. However, while selling the biochar, it will be stressed that the corresponding emission removal will stay with the project participants. Legal ownership of the generated carbon credits is contractually

		agreed between the project participants.
(g) Other Rights	As well as legal title and ownership, the Project Developer shall also demonstrate where required uncontested legal rights and/or permissions concerning changes in use of other resources required to service the Project (for example, access rights, water rights etc.). Any known disputes or contested rights must be declared immediately to Gold Standard by the Project Developer and resolved prior to further project implementation in affected areas.	The PPs have all rights required to implement the project and operate the pyrolysis plant including the land rights and the building permit. Moreover, community engagement is secured as the required feedstock is bought from smallholders and the produced biochar will be available on local markets.
(h) Official Development Assistance (ODA) Declaration	All Project Developers applying for project activities located in a country named by the OECD Development Assistance Committee's ODA recipient list and seeking Gold Standard Certification for carbon credits shall declare the Official Development Assistance (ODA) support. The Project Developer shall follow the GHG Emissions Reduction & Sequestration Product Requirements and submit the	There is no public funding from Annex I parties for this PA. ODA Declaration was provided to the GS.

	declaration at the time of Design Certification.	

Table 3: Additional requirements according to the general eligible criteria of "Community Services Activity Requirements v1.2"

3.1.3 Suppressed Demand	Certain Impact Quantification methodologies allow projects to account Suppressed Demand scenario when establishing a baseline. In such cases, the application of Suppressed Demand baseline is limited to Small Scale and Microscale Projects. Where a Suppressed Demand baseline is applied, it is not possible to 'stack' Gold Standard Certified Impact Statements or Products as the definition of the baseline may be contradictory.	The project does not account for Suppressed Demand scenario.
3.1.4 (a)	Projects involving the distribution of a large number of devices for services such as heating, cooking, lighting, electricity generation, water treatment technology such as water filter, etc. shall provide a clear description of the ownership of the Products that are generated under Gold Standard Certification all along the investment chain. In line with the FPIC requirement, the	Not applicable

	proofs that end-users are aware of and willing to give up their rights on Products shall be provided.	
3.1.4 (b)	The transfer of Product ownership shall be discussed during local stakeholder consultations for projects.	The transfer of Product Ownership was discussed during local stakeholder consultations. Evidence in form of the Local Stakeholder Report was provided to the GS.

The project activity will make use of non-used renewable biomass resources in order to produce biochar, thus this project activity needs to meet additional requirements set by "ANNEX A: Additional Eligibility Criteria for Specific Project Type 2: Project activity using biomass resources"

Table 4: Additional requirements set by "ANNEX A: Additional Eligibility Criteria for Specific Project Type 2: Project activity using biomass resources"

2.1.1 Project activities making use of non-renewable biomass resources shall NOT be eligible for Gold Standard registration. Project developers shall, therefore, provide convincing evidence that the project activities make use of renewable biomass resources. The renewability of the biomass shall be monitored along the crediting period and be included in the Monitoring Plan, where required by the applied Impact quantification methodology.	This CSA project will make use of non-used renewable biomass resources in order to produce biochar. The biomass is renewable because the project will only make use of residue biomass from forest management (thinning, cuttings etc.) or wood processing. Following the definition of Renewable biomass by UNFCCC (EB 12 report Annex 18) the residue biomass used in this project fulfills the condition 4:

	"4. The biomass is a biomass residue[1] and the use of that biomass residue in the project activity does not involve a decrease of carbon pools, in particular dead wood, litter or soil organic carbon, on the land areas where the biomass residues are originating from." However, the project goes one step further and also puts great value on the fact that forests, where the biomass residues originate from follow sustainable management practices as well. Therefore, additionally condition 1 by UNFCCC (EB 12 report Annex 18) is met for the forests where the biomass originates from: *"1. The biomass is originating from land areas that are forests[2] where: (a) The land area remains a forest; and (b) Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and (c) Any national or regional forestry and nature conservation regulations are complied with."*

[1] Biomass residue is defined as biomass by-products, residues and waste streams from agriculture, forestry, and related industries. (Please refer to Annex 8 of the report of the twentieth meeting of the Executive Board, see http://cdm.unfccc.int/EB/Meetings/020/eb20rep.pdf).

[2] The forest definitions as established by the country in accordance with the decisions 11/CP.7 and 19/CP.9 should apply.

	This is ensured by the fact that the biomass residues from forest management are only sourced from plantations that fulfil the FairChar principle (see Appendix 5 – FairChar Principle). The principle reinforces the role of long-term land use planning and requires that conservation land exist. If the FairChar principle is not respected by a potential local vendor, the project participants will not work with the specific local stakeholder.
2.1.2 Project activities expected to make use of biomass resources already in use shall NOT be eligible for Gold Standard registration unless convincing evidence is provided to demonstrate that the current users agree with the envisioned shift of use (potential leakage associated to such a shift must be taken into account). In the absence of such an agreement, Project Developers shall demonstrate that their project activity makes use of surplus biomass for each type of biomass resources used[3]. They must do so once, ex-ante on time for validation for small-scale project activities (installed capacity up to 15 MW_{el} or 45 MW_{th}),	As mentioned in the above-mentioned point, the CSA project will only make use of biomass residues. In line with the criteria from Attachment C to Appendix B: General Guidance on Leakage in biomass projects the available biomass in the region is more than 25% larger than the quantity of biomass utilized. In the region no market for biomass residues exists and the targeted biomass residues are currently not used at all, but are openly burned or left to decompose.

[3] In accordance with the approach proposed in paragraph 18 of the Attachment C to Appendix B: General Guidance on Leakage in biomass projects (Attachment C to Appendix B of 4/CMP.1 Annex II) http://cdm.unfccc.int/Reference/Guidclarif/ssc/index_guid.html

and in time for validation and for each one of the verifications (inclusion in the Monitoring Plan) for project activities greater than 15 MW_{el} or 45 MW_{th}.	
2.1.3 Project Developers shall demonstrate that their project will only make use of degraded land and shall include this criterion in the Sustainability Monitoring Plan to ensure there is no diversion of land from other essential purposes like food production. Two exceptions may be considered: (a) Convincing evidence is provided showing that the envisioned energy crop is part of a traditional rotational cropping, OR (b) An increase of the productivity is obtained, locally and to the benefit of the current users, through measures implemented in the context of the activity so as to at minimum compensate for the part of the land newly allocated to growing the energy crop.	The project doesn't use energy crops. There is no land use change related with the project, this is additionally ensured by the FairChar principle. On the contrary, with the use of biomass residues the CSA project improves the existing land use by increasing the productivity use of the biomass resource.
2.1.4 Activities making use of GMOs shall also comply with the requirements prescribed in Safeguarding Principles & Requirements for Genetic Resources.	The CSA does not make use of GMOs
2.1.5 Avoidance of methane from biomass decay shall be eligible as long as biomass is used as a substitution for non-renewable fuels in project activities delivering energy services or for the production of a usable product with	Not applicable. Accounting for avoidance of methane is excluded for sake of conservative approach.

sustainable development benefits (e.g. composting).	
2.1.6 The use of non-renewable fuel in biomass heat and/or electricity generation plants is authorised as long as the renewable fuel share reaches 50% after the first 3 years of operation for retrofit projects, and represents 80% from the outset for Greenfield projects.	Not applicable
2.1.7 The eligibility of project activities making use of Palm oil and/or palm oil mill by-products or residues for electricity and/or heat generation, and/or for biofuel production shall be evaluated on a case-by-case basis by Gold Standard, at the time of preliminary review. The Project Developers shall provide the following on top of the usual project documentation: (a) A Stakeholder Consultation Report, in accordance with Stakeholder Consultation and Engagement Requirements, and provided as part of the documentation to be reviewed at the time of the preliminary review.	Not applicable
2.1.7 (b) A Compliance Report showing that the project is in compliance with the latest version of the Roundtable on Sustainable Palm Oil guidance document on Principles and Criteria for Sustainable Palm Oil Production (including the national interpretations),	Not applicable

validated by a GS-VVB, and provided as part of the documentation to be reviewed at the time of the registration review. Project Developers must demonstrate that they have started the process for RSPO compliance at the time of preliminary review. If the project is located in a country where a national interpretation of the RSPO principles has not been established and approved by the RSPO, compliance shall be established against the international RSPO Criteria. In such a case, the certification body must develop local indicators through a consultative process, available in the local language.	

A.1.2. Legal ownership of products generated by the project and legal rights to alter use of resources required to service the project

>> The pyrolysis plants will be owned legally by the respective PP. Since the project participants will buy the residues from different stakeholders, the project participants will be the legal owner of the mentioned residues. Finally, the biochar produced from the residues will be sold to local smallholder farmers or other clients and therefore, once sold, the biochar will become the legal property of these clients. However, while selling the biochar, it will be stressed that the corresponding emission removals will stay with the project participants.

A.2 Location of project

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The United Republic of Tanzania

Figure 1 Map of Tanzania

The first pyrolysis plant will be installed in Iringa Region, Mafinga district

Region: Iringa Region

City: Mafinga

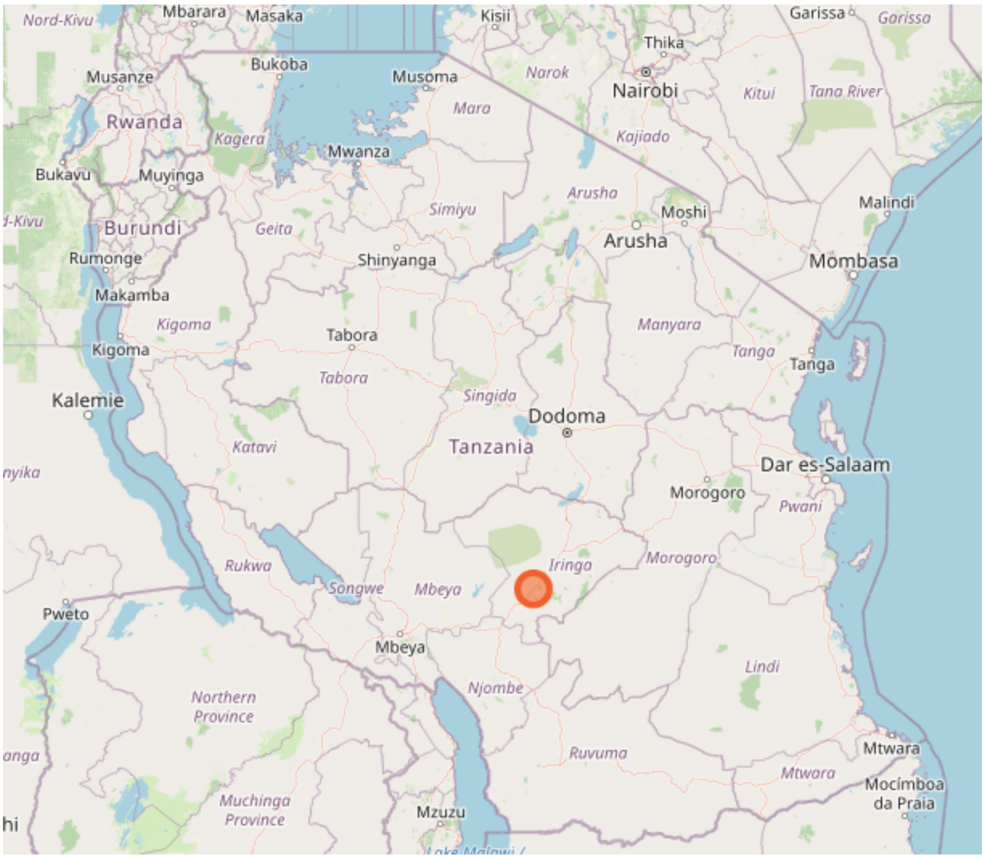

Figure 2: Location of Mafinga within the United Republic of Tanzania

Physical/Geographical location:

Geographical coordinates: -8.254680102675495, 35.33151852139911

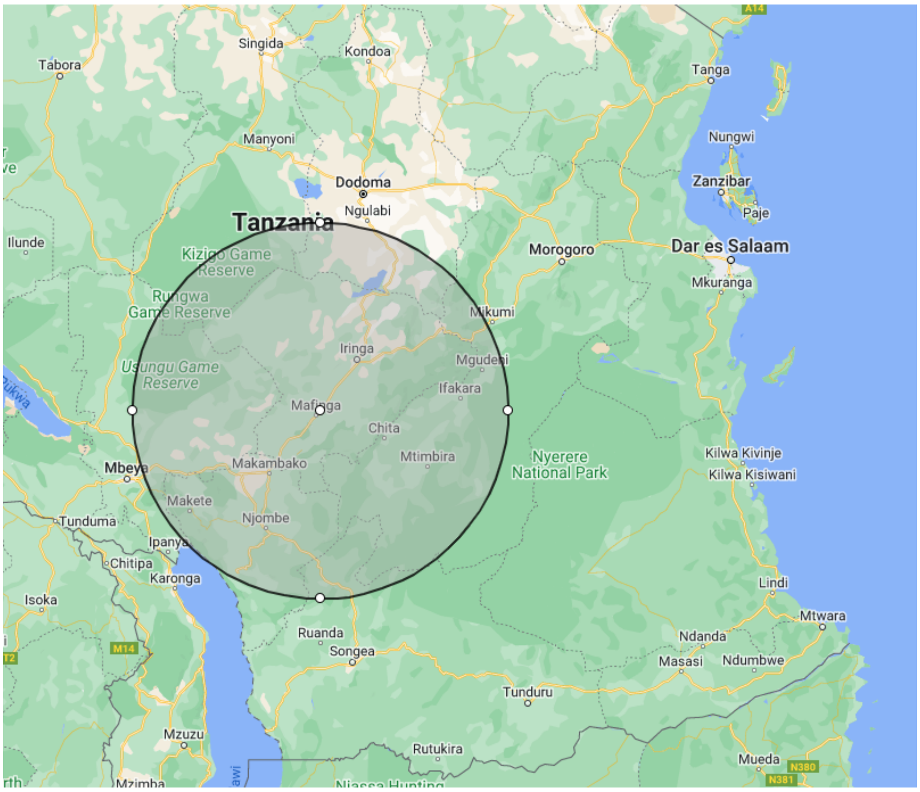

Figure 3: Sifuri Halisi Project Site I in Mafinga, within a 200 km Radius of Biomass Procurement

The geographical locations of the subsequently installed plants will be documented in a database.

A.3 Technologies and/or measures

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The project "Sifuri Halisi" aims to build rotary pyrolysis plants in order to produce biochar for soil amendment from residues from forest management and primary and secondary wood processing.

<u>General description of pyrolysis plants</u>

Pyrolysis means the thermo-chemical decomposition of the feedstock, here: wood chips, under the exclusion of oxygen. Pyrolysis plants produce solid (char), condensable liquids (tar), and gases.

The project aims to maximize the biochar output, therefore slow pyrolysis will be implemented. This characteristic subgroup of pyrolysis techniques optimises char output ahead of liquid tars and pyrolytic gases. A biochar yield between 25% - 35% is expected.

The first pyrolysis plant in Mafinga

The pyrolysis plant that is described in this section represents the type of pyrolysis plant that will be built as the first plant in Mafinga. The subsequent plants are not necessarily the same plant, but will work on the same principle.

The project site situated in Mafinga covers a total area of 59,500m^2. 50,000m^2 will be used for warehouses and 9,500m^2 for office space, toilets and changing rooms. The following figure represents the pyrolysis plant that will be operated in this project.

Figure 4 First pyrolysis plant implemented in the project

The pyrolysis plant has a capacity of processing 1 ton of woody biomass per hour. The continuously running screw reactor requires shredded biomass that will be fed by a conveyor. The operation of the type of pyrolysis plants considered for the project can be seen in the flowchart (**Fehler! Verweisquelle konnte nicht gefunden werden.**).

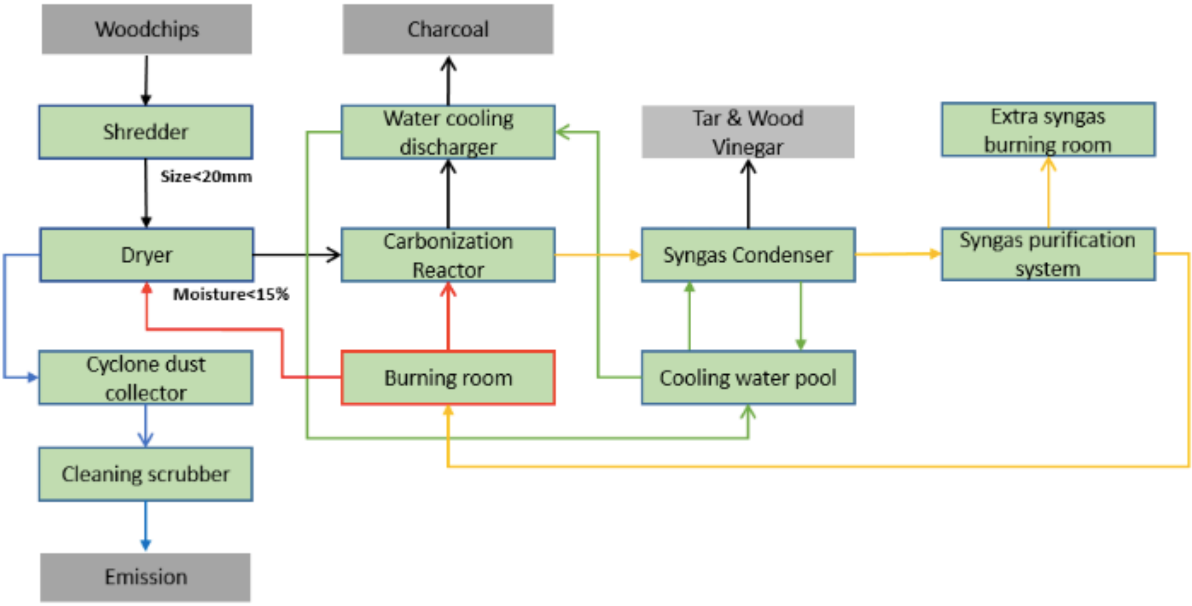

Figure 5: Flowchart representing the operation of the type of pyrolysis plants that will be used in the project. Yellow: syngases, green: cooling water, red: heat.

For starting, the reactor requires a gas injection into the burning room where it is incinerated and provides the heat necessary to pyrolyse the biomass in the carbonisation reactor. When the machine is running, no extra gas injection is needed as syngases (indicated in yellow) from the pyrolysis itself are captured and transported to the burning room through a pipeline to heat the carbonisation reactor. Any extra syngas is combusted in the burning room to prevent release into the atmosphere.

The project participants estimate that there will be few restarts requiring external gas provision monthy.

The plant requires electricity for the motor to turn the central rotors and conveyors as well as the controls.

The cooling water (indicated in green) is circulated in the plant.

Waste heat from the carbonisation reactor will be used for wood and biomass drying. Heat streams are indicated in red in **Fehler! Verweisquelle konnte nicht gefunden werden.**.

Biomass pre-processing

The woody biomass is first shredded (to a size of <20mm) so that the wood chips can be dried using the waste heat from the reactor in order to reach <15% of moisture content.
Depending on the origin of biomass, the chipping will either take place in the permanently installed chipper on the factory site or in a mobile chipper in close vicinity of the forests.

Biochar: output of the pyrolysis plant

Biochar is the solid end product of the pyrolysis.. Biochar can be used as a soil amendment on lands because of its properties of increasing water retention, soil pH, and storing nutrients. In addition, biochar is very stable and degrades very slowly when added into the terrestrial ecosystem. Therefore, biochar is a very important tool to sequester carbon and mitigate climate change.
Not only does it have the potential to be used to mitigate global climate change, but due to its properties it also adds to local resilience in countries highly exposed and sensitive to impacts of climate change, such as least-developed countries (LDCs).

A.4 Scale of the project

>> The emission reduction/removal is less than 10,000 tons of CO_2eq in each and every year of the crediting period. Thus, this PA is a micro-scale project.

A.5 Funding sources of project

>> This PA will be funded by private funding sources provided by atmosfair gGmbH and individuals.

SECTION B. APPLICATION OF APPROVED GOLD STANDARD METHODOLOGY (IES) AND/OR DEMONSTRATION OF SDG CONTRIBUTIONS

B.1. Reference of approved methodology (ies)

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The Methodology comprises activities for production and utilisation of biochar for the purpose of carbon sequestration. The biochar in the project activities is not burned, and remains in the terrestrial system.

The feedstock for the production of biochar may only be one or a combination of the options below:

(a) Biomass from forest management, i.e. off-cuts, sawdust, and other material produced as a byproduct of forest management (pruning, thinning) or harvesting from forests that fulfill the FairChar Principle (APPENDIX 5)

(b) Residues from wood processing

Processing refers to a manufacturing process that converts a wood resource into a commodity of real economic value. Residues are parts and fragments of the source material that are not incorporated into the final product. Residues from wood processing used in this project may originate from primary (direct processing of the raw material of untouched wood, e.g. in a saw mill that manufactures lumber from raw wood) or secondary (creation of products from these lumbers, such as mouldings, plywood and flooring) wood processing.

Projects that use biomass as feedstock have a special responsibility to ensure that this biomass is sustainable. In addition, we acknowledge that using biomass as a feedstock poses the general risk of land use change and destruction of ecosystems or even land conflicts, as well as the risk of contesting the feedstock of other potential activities. To ensure sustainability and to minimize the aforementioned risk, we have added further tailored principles to the Safeguarding Principles (APPENDIX 5 - FairChar Principle). We will also document all our suppliers, which provides a level of trackability of the biomass in an appropriate manner for a LDC.

To fully achieve the effect of carbon sequestration by biochar, biochar must be tracked until it is incorporated in a composite system that ensures the permanency of the sequestration. This is ensured by a monitoring plan that complies the options provided in B.3. Project boundary.

The methodology furthermore provides the calculation rules for the CO2e sequestered, under consideration of the emissions occurring during the processing. To calculate these emissions, the following CDM methodology tools are used:
“Tool 05 – Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”
“Tool 03 -Tool to calculate project or leakage CO2 emissions from fossil fuel combustion”.
“Tool 07 - Tool to calculate the emission factor for an electricity system”.

To enhance comprehension of this novel methodology, several additional definitions have been introduced in accordance with the logic used in “Methodology: Carbon sequestration through accelerated carbonation of concrete aggregate”, tailored to harmonise with the specific context underpinning its development:

Gross Sink Capacity (GSC): Gross Sink Capacity denotes the biogenic carbon content of biochar, which is quantified in terms of metric tons of CO2e units as opposed to carbon.
In other words: Physical Properties right after production
Influenced by: Properties of feedstock, Parameters set for Pyrolysis

Gross Project Sink (GPS): Gross Project Sink denotes the minimum amount of biogenic CO2e present in the composite system after 100 years from the year of formation of the composite system.
In other words: Physical Properties after 100 years
Influenced by: Properties of feedstock, Parameters set for Pyrolysis, Type of Application and resulting degradation

Net Sink Capacity (NSC): Net sink capacity of biochar refers to the quantity of biogenic CO2e that is effectively available for sequestration in a composite biochar system. It equals the GSC adjusted by all project emissions, expect from emissions caused by degredation, and leakages incurred throughout the life cycle of the biochar.
In other words: Physical Properties right after production corrected by occurring emissions
Influenced by: Properties of feedstock, Parameters set for Pyrolysis, Pre- & Post-Processing-Emissions and Leakages, Transport

Net Project Sink (NPS): Net project sink is equivalent to emission removal (ER) through biochar. It is defined as the amount of net biogenic CO2 that is effectively removed from the atmosphere and safely stored in a composite system for an extended period of time, at least 100 years from the year of formation of the composite system.

In other words: Physical Properties right after production corrected by occurring emissions after 100 years

Influenced by: Properties of feedstock, Parameters set for Pyrolysis, Pre- & Post-Processing-Emissions and Leakages, Transport, Type of Application and related degradation

B.2. Applicability of methodology (ies)

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Table 5: Applicability of methodology according to proposed methodology in section B.1

1.	The methodology is only applicable to biochar that can prove to meet the conditions (See ANNEX I :FairChar Principle and B.3. Project boundary) set for proof of origin and proof of usage. Note: If the project does not meet the supplementary criteria it cannot be approved under this methodology.	The biomass feedstock is purchased mainly from local smallholders, and the procurement and sourcing of the feedstock follows the social, ecological and economic principles in the FairChar Principle (APPENDIX 5 - FairChar Principle) including the requirements of the GS safeguarding principles (see Appendix 1 - Safeguarding principles assessment).
2.	Biochar used for the purpose of incineration or any other kind of application that does not result directly or indirectly in application into (agricultural) soils is not applicable.	Biochar produced under the project activities will be applied directly or indirectly into soils, no biochar will be incinerated.
3.	If the origin of the biomass cannot be tracked or if the carbon content of the biomass was already credited in another	The origin of the biomass will be documented and follows the requirements set by the FairChar

	carbon emission reduction project this methodology is not applicable. This does not apply if the biochar is produced as a by-product in an another type of project, where the climate impact of the biochar is not accounted for, e.g. efficient cookstove project. However, in this case it needs to be assured that also the emissions associated with generating the by-product are taken into account.	Principle (APPENDIX 5 - FairChar Principle). The carbon content of the biomass is not credited in another carbon emission reduction project[4].
4.	The evaluation of biochar characteristics is a mandatory annual requirement within the context of the biochar project. Threshold values must be met. This assessment is to be conducted based on test categories specifically designed for the utilization of biochar as a soil amendment. The test must be carried out for each production batch[5], denoted as the "Batch Analysis of biochar properties" and must be included in the monitoring report.	Tests are performed according to the requirements and test results are reported to GS. Test results will be submitted as supporting documents when the project reaches the implementation phase.
5.	To prevent dust formation and thus also spontaneous combustion, the biochar must be adjusted to an adequate water content (30% is recommended).	PP follows these requirements. Biochar is quenched with water after leaving the reactor.

[4] This means that there is no other project with a different focus in which the same biomass is certified and emission reductions are obtained. It should not contradict the intended double certification with the Carbon sink standard hosted by Carbon Standards International.

[5] Production batch refers to the quantity of biochar that is produced over a certain period of time with the same feedstock and the same pyrolysis plant settings. The production period may not exceed one year.

6.	At the time of first crediting period renewal, at least 70% of the waste heat shall be utilised.	Additional usage of excess heat will be elaborated in the first years of project runtime. At the time of first crediting period renewal, at least 70% of the waste heat shall be utilised.

B.3. Project boundary

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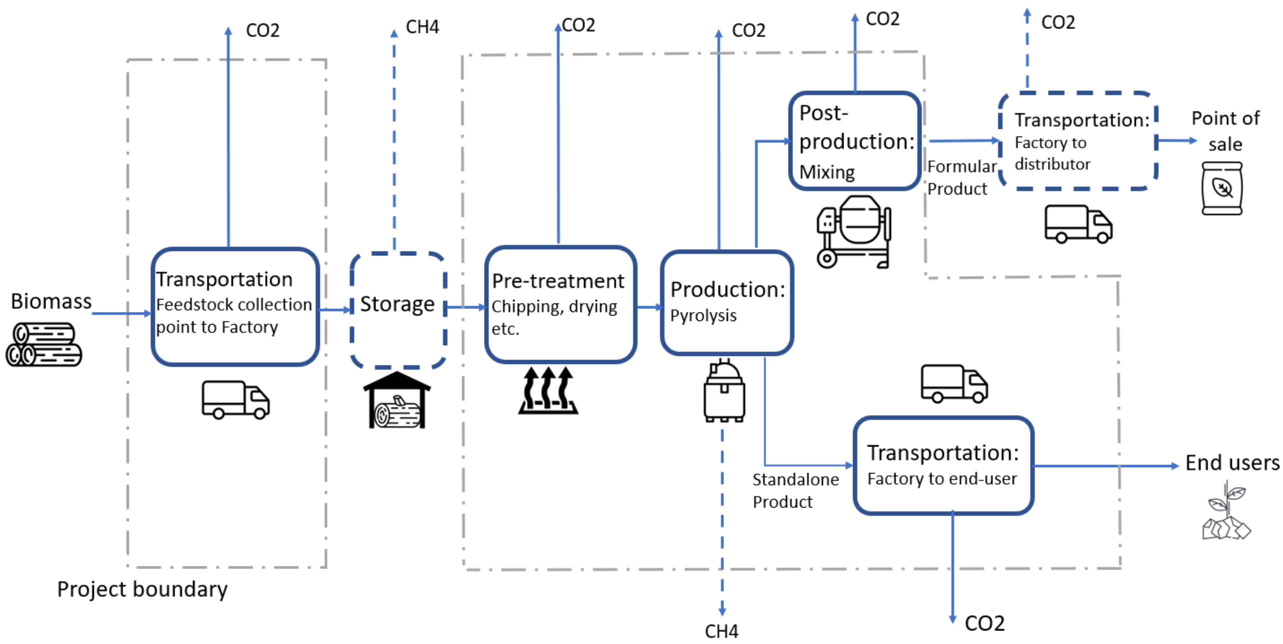


Figure 6 Schematic view of the project boundary. On the upper right side, the composite system is formed when biochar is added into a formular product, in the lower right side end-to-end approach is chosen and composite system is formed with application of biochar to soil.

	Source	GHGs	Included?	Justification/Explanation
Baseline scenario	Gross Sink Capacity	CO_2	Yes	The organic carbon of biochar is quantified in terms of metric tons of CO2 reasoned by the fact that the biogenic carbon originates from CO2 captured from the atmosphere and converted into hydrocarbons during the photosynthesis carried out by the plant.

		CH_4	No	The organic carbon of biochar is quantified in terms of metric tons of CO2 as it does not originate from CH4. Furthermore, methane emissions from baseline are not accounted for as practices (open burning, decay) are not taken into account on behalf of conservativeness. The project does not introduce any new sources of methane emissions but rather avoids them.
		N_2O	No	Negligible
Project scenario	Emissions from transport to facility & storage	CO_2	Yes	Major emission source
		CH_4	No	Negligible
		N_2O	No	Negligible
	pre-processing of woody biomass	CO_2	Yes	Major emission source
		CH_4	No	Negligible
		N_2O	No	Negligible
	Emissions from the pyrolysis reactor	CO_2	Yes	Major emission source
		CH_4	No	Included in the leakage emission
		N_2O	No	Negligible
	Emissions from post production & Application	CO_2	Yes	Major emission source
		CH_4	No	Negligible
		N_2O	No	Negligible
	Emissions from transport to end users	CO_2	Yes	Major emission source
		CH_4	No	Negligible
		N_2O	No	Negligible

It is essential for the project activity that the whereabouts of the produced biochar are known. Only when the biochar has transformed into a composite system, the Gross Project Sink can be converted into Net Project Sink and pose an emission removal. There are two ways to achieve the formation of a composite system, while the End-to-end approach shall be chosen wherever feasible.

<u>Option A: End-to-end approach</u>

After undergoing the pyrolysis process, the resulting biochar exhibits the inherent capacity to serve as a Project Sink. At this stage, it is accurately characterized by its Net Sink Capacity. Each sub-batch of the production shall be tracked until it reaches its final destination and is incorporated into soil, see Figure 6. When applied to the soil, the formation of a composite system is achieved. All accruing emissions are accounted as project emissions and the Net Project Sink is calculated.

Under option A, the following data shall be monitored for all sub-batches of produced biochar:

a. The geographical coordinates and owner of the final sink;
b. Photographic evidence of biochar applied to the soil;

<u>Option B: Indirect approach</u>

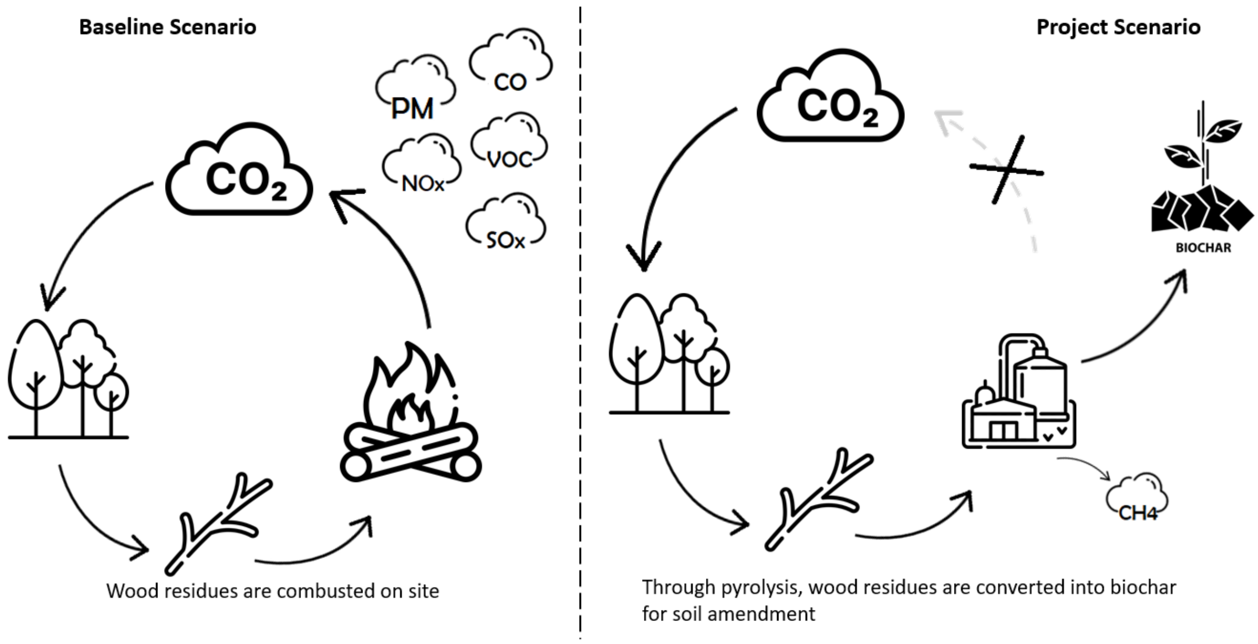
If the option of direct end-to-end approach is not viable, and the biochar is transformed into a formular product, e.g., biochar is mixed with agriculture substrates as organic fertiliser, the mixing step can be acknowledged as formation of the composite system. It must be ensured that the biochar can no longer be used for energy purposes. Hence, the Project Sink is established, and the project boundary terminated after delivering the product to the manufacturer of the formular product. Further emissions are taken into account as leakage emissions.

Under option B, the following data shall be monitored for all sub-batches of produced biochar:

a. Documentary evidence of purchasing agreement
b. Description of application provided by purchaser(s)

B.4. Establishment and description of baseline scenario

>>



Tanzania is considered a major exporter of low-grade forestry products (such as poles, boards, tanks, etc.) since over a century. As such, the supply of residues from the management of timber concessions (e.g., from thinning or pruning) is abundant, and, no land use change will occur as a result of the project.

These biomass residues from forest management and wood processing are currently being left to decay or being burned due to the large volumes generated by the operators. The fumes affect both the air quality for residents in the town and increase the forest fire hazard and risks due to open fire. In the year 2022, an extensive expanse of mountainous forest spanning over 300 hectares was detrimentally impacted by an unintentionally ignited wildfire within the Kilimanjaro region (Kizito Makoye 2022). Incidents of this nature pose considerable threats to both smallholder plantation efforts and the broader context of national forestry initiatives in Tanzania.

The project scenario does not change the baseline scenario with regard to the emissions related to the cultivation and harvesting of feedstock. Potential positive effects are neglected. Explanations are listed below for different feedstocks:

(i) Biomass Residues from forest management

As the project only uses the residues from efficient forest management, the activities would also take place without the project activities. Pruning and thinning are

necessary practices to maximise wood quality and tree growth (biomass production) in the managed forests. Harvesting takes place when a tree reaches maturity.
In the baseline scenario off-cuts, sawdust and non-processable branches or tree tops are left in the plantation. They are either combusted purposefully or pose a risk for wildfires that affect the whole plantation. The project activity therefore represents a wildfire prevention measure.
In addition, by utilising woody biomass for biochar production via pyrolysis, intended for soil amendment rather than energy production, the project activities will not involve a decrease of carbon pools, but rather will promote the preservation and enhancement of carbon pools.
(ii) Biomass residues from wood processing:
Processing refers to a manufacturing process that converts a wood resource into a commodity of real economic value. Residues are parts and fragments of the source material that are not incorporated into the final product. In the baseline scenario, residues from wood processing remain predominantly unused. For residues from primary wood processing in mobile sawmills the same arguments as for (i) are valid.

The purpose of the project is to sequester biogenic CO2 in the terrestrial system. By integrating biochar into a system, the composite biochar system serves as a long-term carbon sink. Therefore, the term "Project Sink" is applied instead of the term "Baseline emissions" in subsequent sections.

B.5. Demonstration of additionality

Use this table for Automatic Additionality Only – delete if N/A

Specify the methodology, activity requirement or product requirement that establishes deemed additionality for the proposed project (including the version number and the specific paragraph, if applicable).	According to GS COMMUNITY SERVICES ACTIVITY REQUIREMENTS Version 1.2: Principle 5 – Financial Additionality & Ongoing Financial Need, 4.1.9 Projects that meet any of the following criteria are considered as deemed additional and therefore are not required to prove Financial Additionality at the time of Design Certification: (a) Positive list (Annex B of this document) (b) Projects located in LDC, SIDS, LLDC

	(c) Microscale projects
Describe how the proposed project meets the criteria for deemed additionality.	Following the paragraph 4.1.9 c) of Principle 5 - Financial Additionality & Ongoing Financial Need (GS COMMUNITY SERVICES ACTIVITY REQUIREMENTS Version 1.2), this project is a microscale project and therefore meets the criteria for deemed additionality.

B.5.1 Prior Consideration

>>Project start date is 27/03/2023 with the commitment to expenditures related to the implementation of the Project.

B.5.2 Ongoing Financial Need

>>N/A

B.6. Sustainable Development Goals (SDG) outcomes

Relevant Target/Indicator for each of the three SDGs

SUSTAINABLE DEVELOPMENT GOALS TARGETED	MOST RELEVANT SDG TARGET	SDG IMPACT **INDICATOR (PROPOSED OR SDG INDICATOR)**
13 Climate Action (mandatory)	N/A	Emission removals
3 Good Health and well-being	3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	Amount of residues (tons) purchased for production of biochar (Feedstock)[6]

[6] Indicator in based on SDG indicator 3.9.1 "Mortality rate attributes to household and ambient air pollution", since amount of feedstock is directly linked to less forest fires and related ambient air pollution.

8 Decent work and economic growth	8.5 By 2030, achieving full and productive employment and decent work for all women and men, including young people and persons with disabilities, and equal pay for work of equal values 8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	Total number of jobs
12 Responsible consumption and production	12.5 By 2023, substantially reduce waste generation through prevention, reduction, recycling and reduce	Amount of residues (tons) purchased for production of biochar (Feedstock)[7]*

B.6.1 Explanation of methodological choices/approaches for estimating the SDG Impact

>>

SDG 3

In the project scenario, biomass residues are processed that otherwise would have been burnt predominantly. Thus, the amount of feedstock is directly linked to less forest fires and related ambient air pollution. The amount of wood residues processed is therefore indirectly proportional to the ambient air pollution caused by open forest fires.

SDG 8

In the project scenario, jobs are created at the pyrolysis plant. Employment generation is monitored directly through a staff registry of all skilled and unskilled workers at the pyrolysis plant. Staff registry is issued and signed by the facility operator.

SDG 12

In the project scenario, biomass residues are recycled for biochar production, which reduces waste generation. Prevention of waste generation is measured by the tons of

[7] Indicator based on SDG indicator 12.5.1 "National recycling rate, tons of material recycled", since it corresponds directly to avoided waste.

biomass collected as feedstock material. Wood residues that are delivered to the facility enter the plant via a weighbridge or equivalent. Records of the weights of entering feedstock are taken.

SDG 13

Baseline Emissions:

The baseline scenario does not generate any positive or negative emissions while the purpose of the project is to sequester biogenic CO2 in the terrestrial system. By integrating biochar into a system, the composite biochar system serves as a long-term carbon sink. Therefore, the term "Project Sink" is applied instead of the term "Baseline emissions" in subsequent sections.

As defined in B.1 Gross Sink Capacity corresponds to the biogenic carbon content of the biochar produced in a year y, which is quantified in terms of metric tons of CO2e units as opposed to carbon. It determines the total amount of Carbon available.

$$GSC_y = M_{prod,y} \times F_{orgC,y} \times k$$

(1)

Where:

GSCy	=	Gross Sink Capacity in year y of the respective Project Sink (t CO2e)
Mprod,y	=	Dry mass of biochar produced in year y (t)
ForgC,y	=	Carbon content of biochar – the amount of organic carbon in the biochar as a mass proportion based on the biochar's dry weight (%)
k	=	carbon to carbon dioxide conversion factor, ratio of the atomic mass of carbon dioxide and the molecular mass of carbon = 44 u / 12 u = 0.2727

Biochar, like any material, can degrade over time. Biochar degradation is a complex process that is influenced by a variety of environmental and biological factors, as well as the properties of the biochar itself. Gross Project Sink in these project activities is calculated as the Gross Sink Capacity of the respective project sink multiplied by the degradation factor. It corresponds to the amount of biogenic CO2e of biochar stably sequestered in a composite system that secures its existence for at least 100 years from the year of formation of the composite system.

$$GPS_{y,n} = GSC_y \times r_n$$

(2)

$GPS_{y,n}$	=	Gross Project Sink realized in year y by formation of the composite system by application n corresponding to the minimum amount of biogenic CO2e present in the composite system in year y+100. (t CO2e)
GSC_y	=	Gross Sink Capacity of the biochar used for the respective Project Sink for biochar produced in year y. (t CO2e)
r_n	=	Degradation factor corresponding to the specific proportion of the original organic carbon of biochar for application activity n that is permanently fixed for at least 100 years in the system (%).
n	=	The Index n indicates that the variable either takes different values depending on the type of application activity or that only the fraction of a total amount is refered to that is used for an specific application activity. This takes account of the fact that degradation rates, processing and transportation routes depend on the application activity.

Emission Removal:

- **Net Sink Capacity(NSC_y):**

Net sink capacity of biochar refers to the quantity of biogenic CO2e that is effectively available for sequestration in a composite biochar system. It equals the GSC adjusted by all project emissions, except emissions resulting from degradation, and leakages incurred throughout the life cycle of the biochar.
The net sink capacity of biochar is calculated as:

$$NSC_{y,n} = GSC_{y,n} - PE_{pre,y,n} - PE_{prod,y,n} - PE_{post,fp,y,n} - PE_{post,trsp,y,n} - LE_{storage,y,n} - LE_{methane,y,n}$$

(3)

Where:

$NSC_{y,n}$	Net Sink Capacity of the biochar used for the respective Project Sink for biochar produced in year y for application activity n. (t CO2e)
$GSC_{y,n}$	Gross Sink Capacity of the biochar used for the respective Project Sink for biochar produced in year y for application activity n. (t CO2e)
$PE_{pre,y,n}$	Project emissions due to feedstock pre-treatment in year y for application activity n. (tCO2e)
$PE_{prod,y,n}$	Project emissions due to production process (pyrolysis) in year y for application activity n. (tCO2e)
$PE_{post,fp,y,n}$	Project emissions due to repropressing process in the post-production stage (e.g., mixing and activation etc.) in year y for application activity n. (tCO2e)
$PE_{post,trsp,y,n}$	Project emission due to transportation of biochar from the production facility to the site of end application in the year y for application activity n. (tCO2e)
$LE_{storage,y,n}$	Leakage emissions due to storage of biomass feedstock for application activity n. (t CO2e)
$LE_{methane,y,n}$	Methane leakage emission during pyrolysis process in year y for application activity n. (t CO2e)

Note, since $PE_{post,fp,y}$ and $PE_{post,trsp,y}$ depend on the type and location of storage NSC_y can only be calculated separately in sub-batches corresponding to each application activity n.

$$NSC_y = \sum_n NSC_{y,n} = GSC_y - PE_{pre,y} - PE_{prod,y} - \sum_n (PE_{post,fp,y,n} - PE_{post,trsp,y,n}) - LE_{storage,y} - LE_{methane,y}$$

- **Net Project Sink/Emission Removal (NPS_y/ER_y)**

Net project sink is equivalent to emission removal (ER) through biochar. It is defined as the amount of net biogenic CO2 that is effectively removed from the atmosphere and safely stored in a composite system for an extended period of time, at least 100 years from the year of formation of the composite system.

It is calculated as:

$$ER_y = NPS_y = \sum_{i=1}^{y} \sum_{n} \left(NSC_{i,n} \times \frac{M_{end-user,i,n,y}}{M_{prod,i}} \right) - PE_{post,degradation,y} - LE_{trsp,y}$$

(4)

ER_y	=	Emission removal through biochar realized in year y (t CO2e)
NPS_y	=	Net Project Sink: the amount of net biogenic CO2 that is effectively removed from the atmosphere and safely stored in a composite system for an extended period of time in year y (t CO2e)
$NSC_{i,n}$	=	Net Sink Capacity of the biochar used for the respective Project Sink for biochar being part of production batch i for application activity n. (t CO2e)
$M_{end-user,i,n,y}$	=	Dry mass of Biochar being part of production batch i, that is consumed by end-user in year y for application activity n (t)
$M_{prod,i}$	=	Dry mass of all biochar of production batch i (t)
$PE_{post,degradation,}$	=	Project emission due to breakdown and decomposition of biochar in year y (t CO2e)
$LE_{trsp,y}$	=	Leakage emissions due to post-production transportation activities in year y (t CO2e)
i		Production batch refers to the quantity of biochar that is produced over a certain period of time with the same feedstock and the same pyrolysis plant settings. The production period may not exceed one year.

Note, the somewhat unwieldy summation depending on the production batch is necessary because GSC and NSC vary with the properties of the biochar while GSP and NSP depend on the year of formation of the composite system. However, due to the continuity of production, carryovers from one batch to the next are unavoidable. To keep it as clear as possible, in this project activity the biochar stock shall be organized according to the first-in-first-out principle.

For monitoring:

The calculation of net project sink (NPS) is contingent upon the prior determination of the end-user application (as shown in i and ii), the quantification of biochar applied by end users (as shown in iii). This is evidenced by the following facts as in equation (4):

(i) Project emission due to degradation is directly attributable to end-user application activities. As shown in equation (9). Degradation factor r_n depends on the mode of application;

(ii) Leakage emission requires prior determination of the project boundaries depending on the approaches given in B.3. Project boundary;

(iii)the biochar applied in the monitoring year ($M_{end-user}$) may come from different production years, and thus possess different NSC.

Project Emission:

Pre-processing ($PE_{pre,y}$)

$$PE_{pre,y} = \sum_{m} (Q_{m,y} \times EF_{m,y}) + PE_{pre,trsp,y}$$

(5)

Where:

PEpre,y	=	Project emissions due to feedstock pre-treatment in year y (tCO2e)
Qm,y	=	Amount of energy used at the pre-treatment stage, by energy source m in year y (mass or volume unit)
EFm,y	=	Emission factor for energy used by source m in year y
PEpre,trsp,y	=	Project emissions due to transport of biomass feedstock to processing facilities in year y (tCO2e). Transportation within the radius of 200km is considered negligible. All transportation related project emissions exceeding the radius of 200km should be calculated according

to “CDM Methodological Tool 12 - Project and leakage emissions from transportation of freight”.

- **Production Process ($PE_{prod,y}$)**

Even though the production of biochar usually produces a surplus of energy from the combustion of the pyrolysis gases, external energy is always required to start the pyrolysis process or to operate pyrolysis plants. In industrial-scale reactors, electrical energy is required for the control and regulation technology as well as for conveying the biomasses and biochar. Depending on the type of plant, (fossil) fuel gas or electricity is also required to preheat the reactors. This methodology does not allow the use of fossil fuels to drive the pyrolytic reactions except for preheating the reactor.

For industrial scale reactors, the external energy sources and amount of used energy needs to be monitored and therefore, it is necessary that each plant is equipped with an electricity meter. The emission due to external energy input during the pyrolysis process is calculated below.

$$PE_{prod,y} = \sum_{m} (Q_{m,y} \times EF_{m,y})$$

(6)

Where:

PEprod,y	=	Project emissions due to production process (pyrolysis) in year y (tCO2e)
Qm,y	=	Amount of energy used at the production stage, by energy source m in year y (mass or volume unit)
EFm,y		Emission factor for energy used by source m in year y

- **Post Production and Application ($PE_{post,y}$)**

Project participants shall document post-production activities that will occur under the project activity according to the project boundary definition (see B.3. Project boundary), option A (End-to-end approach) or Option B (Indirect Approach).

Post-production processing emissions are calculated as:

$$PE_{post,y} = PE_{post,fp,y} + PE_{post,trsp,y} + PE_{post,degradation,y}$$

(7)

Where:

$PE_{post,y}$	=	Project emission due to project activities in the post production and application phase in year y (t CO2e)
$PE_{post,fp,y}$	=	Project emissions due to further processing in the post-production stage (e.g., mixing and activation etc.) in year y (tCO2e)
$PE_{post,trsp,y}$	=	Project emission due to transportation of biochar from the production facility to the site of end application in the year y (tCO2e) Transportation within the radius of 200km is considered negligible. All transportation related project emissions exceeding the radius of 200km should be calculated according to “CDM Methodological Tool 12 - Project and leakage emissions from transportation of freight”.
$PE_{post,degradation}$	=	Project emission due to degradation of biochar applied in a composite system in the year y of formation of the composite system. All cumulative emissions over the life span of 100 years are considered according to the degradation rate and assigned to year y. (t CO2e)

For further processing:

$$PE_{post,fp,y} = \sum_{m} (Q_{m,y} \times EF_{m,y})$$

(8)

Where:

PEpost,fp,y	=	Project emissions due to further processing in the post-production stage (e.g., mixing and activation etc.) in year y (tCO2e)

Qm,y	=	Amount of energy used at the post-production stage, by energy source m in year y (mass or volume unit)
EFm,y	=	Emission factor for energy used by source m in year y Depending on the energy source used, emission factors can be calculated according to CDM methodology: 1. Electricity as energy source (tCO2/MWh): "Tool 07 - Tool to calculate the emission factor for an electricity system". 2. Fossil fuel as energy source（tCO2/mass or volume unit): EFi,j corresponds according to CO2 emission coefficient of fuel type i in year y (COEFi,y) "Tool 03 - Tool to calculate project or leakage CO2 emissions from fossil fuel combustion"

For transportation:

It is essential to emphasise that project emissions resulting from transportation of biochar are limited to the transportation activities occurring within the project boundary. Only those transportation activities that are monitored and reported under Option A: End-to-end approach, as outlined B.3. Project boundary, should be included in this category.

However, transportation activities to end-users that fall under Option B: Indirect approach (see B.3. Project boundary) are classified as leakage emissions.

Transportation within the radius of 200km is considered negligible. All transportation related project emissions exceeding the radius of 200km should be calculated according to "CDM Methodological Tool 12 - Project and leakage emissions from transportation of freight".

For biochar degradation:

The degradation of biochar is an inherent characteristic that must be considered prior to its production, as it ultimately impacts the project's emissions. While the degradation occurs after the biochar is tracked down to the end-user, it is crucial to acknowledge and address the potential for such degradation in advance.

In these project activities, $PE_{post,degradation}$ is defined as project emissions due to degradation of biochar applied in the composite system over the life span of 100 years, it is equivalent to the difference between the Gross Sink Capacity (GSC) of the biochar and the Gross Project Sink (GPS). All cumulative emissions over the life span of 100 years are considered according to the degradation rate and assigned to year y. (t CO2e)

The Gross Sink Capacity (GSC) varies with the properties of the biochar as in equation (1). Therefore, depending on the production date and relating production batch, the biochar may possess varying levels of organic carbon content ($F_{org,C}$) based on the feedstock utilised or plant settings and as a result might have a different GSC. GSC is determined by the properties of the biochar at production date.

In contrast, the determination of Gross Project Sink (GPS) is reliant on knowledge of its usage and therefore accurate identification of the distribution of biochar amongst end-users and the quantities involved.

Consequently, in order to take into account that biochar utilised in a given year might be derived from different production batches, PEpost,degradation is calculated and monitored as below:

$$PE_{post,degradation,y} = GSC_y - GPS_y = \sum_i \sum_n (1 - r_n) GSC_{i,n}$$

$$= \sum_i \sum_n M_{end-user,i,n,y} \times F_{orgC,i} \times k \times (1 - r_n)$$

(9)

Where:

$PE_{post,degradation}$	=	Project emission in year y due to degredation of biochar applied in a composite system with a life span of 100 years. (t CO2e) Note: All cumulative emissions over the life span for which Emission Removal is claimed are considered according to the degradation rate and assigned to year y. (t CO2e)
$F_{orgC,i}$	=	Carbon content of biochar – the amount of organic carbon in the biochar as a mass proportion based on the biochar's dry weight (%) for biochar being part of production batch i.
GSC_y	=	Gross Sink Capacity of the biochar used for the respective Project Sink for biochar produced in year y. (t CO2e)
$GSC_{i,n}$	=	Gross Sink Capacity of the biochar used for the respective Project Sink by application n for biochar being part of production batch i. (t CO2e)

GPS_y = Gross Project Sink realized in year y by formation of the composite system by application n corresponding to the minimum amount of biogenic CO2e present in the composite system in year y+100. (t CO2e)

$M_{end-user,i,n,y}$ = Dry mass of biochar being part of production batch i, that is consumed by end-user in year y for application activity n (t)

k = carbon to carbon dioxide conversion factor, ratio of the atomic mass of carbon dioxide and the molecular mass of carbon = 44 u / 12 u = 0.2727

r_n = Degradation factor corresponds to the specific proportion of the original organic carbon of biochar for application activity n that is permanently fixed for at least 100 years in the system. (%)

i Production batch refers to the quantity of biochar that is produced over a certain period of time with the same feedstock and the same pyrolysis plant settings. The production period may not exceed one year.

Leakage emissions

$$LE_y = LE_{storage,y} + LE_{methane,y} + LE_{trsp,y}$$

(10)

LE_y = Total leakage emissions in year y (tCO2e)

$LE_{storage,y}$ = Leakage emissions due to storage of biomass feedstock (t CO2e)

$LE_{methane,y}$ = Methane leakages emission during pyrolysis process (t CO2e)

$LE_{trsp,y}$ = Leakage emissions due to post-production transportation activities in year y (t CO2e).

Applicable if Option B is chosen in section B.3. Project boundary. Transportation within the radius of 200km is considered negligible.

Default value for Option A: 0.

- **Leakages due to storage of biomass ($LE_{storage,y}$)**

To minimize the risk of leakage due to storage chipped biomass will not be stored regularly for more than 7 days. Furthermore, constant monitoring is carried out.

The internal temperature of stored biomass must be measured daily. When the internal temperature of stored biomass is more than 40°C, leakage emissions due to biomass storage shall not be accounted as negligible and leakage emission shall be assessed and calculated.

Biomass storage facility should have good ventilation to allow wood chips to dry. If storage time exceeds 10 days, daily moisture measurements must be taken. If water content is higher than 25% leakage emissions due to biomass storage shall not be accounted as negligible and leakage emission shall be assessed and calculated.

If the above measures cannot be implemented or the water content exceeds the threshold value after 10 days, the methane emissions resulting from storage must be included in the carbon footprint with a sufficient safety margin. For this, the project activity accounts as follows:

$$LE_{storage,y} = x \times z \times \frac{d}{30{,}5} \times GWP_{meth} \times M_{storage} \times (1 - \mathrm{mc}) \times F_{orgC,bm} \times \mathrm{k}$$

(11)

LEstorage,y	=	Leakages due to storage of biomass feedstock (CO2e)
x	=	Monthly loss of organic carbon content due to storage of biomass (%); Default value of 2% is taken according to Whittaker et al., 2016
z	=	Percentage of C loss from biomass storage in the form of CH4 (%); Default value of 20% is taken according to Cao et al., 2019; Pier and Kelly, 1997; Pipatti et al., 2006; Whittaker et al., 2016a

GWP_{meth} = Global warming potential of methane on a 20-year time scale (tCo2e/t CH4), default value of 86

d = Storage duration (days)

$M_{storage}$ = Mass of stored biomass

$F_{orgC,bm}$ = Carbon content of biomass – the amount of organic carbon in the biomass as a mass proportion based on the biomass dry weight (%); default value for pine 50% (Węgiel et al., 2019) and 35% for eucalyptus (Muhdi et al., 2020)

k = carbon to carbon dioxide conversion factor, ratio of the atomic mass of carbon dioxide and the molecular mass of carbon = 44 u / 12 u = 0.2727

mc = Moisture content of the biomass stored

- **Methane leakages emission during pyrolysis process ($LE_{methane,y}$)**

Even though the pyrolysis gas is used in the process there is a risk to release methane as part of the exhaust gases of the reactor.
Since only pyrolysis gas burned under controlled conditions is emitted, the methane concentration is expected to be very low.

Methane leakages emission is calculated as:

$$LE_{methane,y} = C(methane) \times \ GWP_{methane} \times V_{gas,y} \ \times 10^{-9}$$

(12)

$LE_{methane,y}$ Methane leakage emission during pyrolysis process in year y (t CO2e)

C(methane) Methane content in the flue gas (mg CH4/m3)

GWP_{meth} Global warming potential of methane on a 20-year time scale (t COeq/t CH4)

$V_{gas,y}$ Exhaust gas volume flow in year y (m3)

B.6.2 Data and parameters fixed ex ante

Copy the table for each piece of data and parameter; use headings to group parameter tables by SDG

SDG13

Data/parameter	k
Unit	-
Description	carbon dioxide to carbon conversion factor
Source of data	-
Value(s) applied	≈3.6667
Choice of data or Measurement methods and procedures	ratio of the molar mass of carbon dioxide and the molar mass of carbon = 44 $\frac{g}{mol}$ / 12 $\frac{g}{mol}$
Purpose of data	calculation of carbon related emission removals in production stage when biochar become a C-sink (CRy)
Additional comment	-

Data/parameter	r_{soil}
Unit	Estimated average degradation factor of biochar for soil application
Description	%
Source of data	Budai et al., 2013; Camps-Arbestain et al., 2015
Value(s) applied	74%
Choice of data or Measurement methods and procedures	If biochar is applied directly to soils or indirectly into soils via its use in animal feed, livestock bedding, slurry management, compost, or anaerobic digesters, a conservative average degradation rate of 0.3% per year may be assumed for higher temperature biochars with a

	H : Corg ratio below 0.4 (following: Budai et al., 2013; Camps-Arbestain et al., 2015) [8]. Degradation factor is calculated as r_n =(1-degradation rate per year)^(number of years); r_{soil} =(1-0.3%)^100).
Purpose of data	Determination of $PE_{post,degradation}$, what is equivalent to the difference between the Gross Sink Capacity (GSC) of the biochar and the Gross Project Sink (GPS). All cumulative emissions over the life span of 100 years are considered according to the degradation rate and assigned to year y. (t CO2e)
Additional comment	For soil application, the biochar degradation rate varies significantly depending on experimental duration, feedstock, pyrolysis temperature, and soil clay content. (Wang et al.,2016). However, extensive research on the correlation of the degradation of biochar and its properties as well as surrounding conditions has been done. This resulted in threshold values on the basis of which a conservative estimate for the permanent carbon content can be made. In 2023, we observe that the scientific literature is very unanimous on these upper values in relation to degradation within a hundred years. The degradation factor r_{soil} for 100 years is conservatively assumed to be the default value of 74% for soil application. There are publications that imply that the r_{soil} of 74% would also be valid for longer time spans, i.e. 1000 years (Schmidt HP, Abiven S, Hagemann N, Meyer zu Drewer J: Permanence of soil applied biochar, the Biochar Journal 2022). Other sources determined significantly lower degradation rates depending on the degree of pyrolysis and the experimental design (e.g. IPCC, 2019; Kuzyakov et al., 2014; Lehmann et al., 2015; Zimmerman and Gao, 2013). Should these findings deepen, the methodology can be updated accordingly.

Data/parameter	$EF_{diesel,y}$

[8] This condition is recorded in the Batch Analysis of biochar properties and the value represents the threshold value as per B.2 applicability condition 4.

Unit	t CO2/MWh
Description	emission coefficient of diesel used in year y
Source of data	Literature Reference: IPCC 2011 - Renewable Energy in the Context of Sustainable Development (https://www.ipcc.ch/site/assets/uploads/2018/03/Chapter-9-Renewable-Energy-in-the-Context-of-Sustainable-Development-1.pdf)
Value(s) applied	1.2
Choice of data or Measurement methods and procedures	IPCC 2011 https://www.ipcc.ch/site/assets/uploads/2018/03/Chapter-9-Renewable-Energy-in-the-Context-of-Sustainable-Development-1.pdf
Purpose of data	Calculation of Project emissions due to diesel generators. (In this project activity, emissions due to mobile chippers)
Additional comment	-

Data/parameter	$EF_{elec,y,CO2}$
Unit	t CO2/MWh
Description	emissions coefficient of electricity used in year y
Source of data	Tanzanian Grid Emission Factor from IGES_GRID_EF_v10.11_2021.xlsx sourced from https://www.iges.or.jp/en/pub/list-grid-emission-factor/en on 5th Feb 2022
Value(s) applied	0.5081
Choice of data or Measurement methods and procedures	Tanzania Grid Emission Factor from IGES, this parameter will be updated according to the latest verion of "IGES List of Grid Emission factors "
Purpose of data	Calculation of Combined emission factor for electricity used in project activities (EFelec,y)
Additional comment	-

Data/parameter	$EF_{gas,y}$
Unit	kg CO2/m3
Description	Emission coefficient of natural gas
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories, http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html
Value(s) applied	1.88
Choice of data or Measurement methods and procedures	Default value for natural gas in usage of stationary combustion. It is calculated based on IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Purpose of data	Calculation of Project emissions due to machine restart of pyrolysis reactor
Additional comment	-

Data/parameter	$EF_{CO2,f}$
Unit	g CO2/t km
Description	Default CO2 emission factor for freight transportation activities f
Source of data	CDM Methodology TOOL 12 -Methodological tool: Project and leakage emissions from transportation of freight Version 01.1.0
Value(s) applied	<table><tr><td>Vehicle Class</td><td>Emission factor (g CO2/t km)</td></tr><tr><td>Light vehicles</td><td>245</td></tr><tr><td>Heavy vehicles</td><td>129</td></tr></table>
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of project emissions due to transportation
Additional comment	Applicable to Option B of CDM Methodology TOOL 12. The default CO2 emission factors take into account emissions generated by loaded outbound trips and empty return trips. The default emission factors have been obtained from two sources. For light vehicles, the emission factor was obtained from empirical data from European vehicles. For heavy vehicles, the emission factor has been derived

	based on custom design transient speed-time-gradient drive cycle (adapted from the international FIGE cycle), vehicle dimensional data, mathematical analysis of loading scenarios, and dynamic modelling based on engine power profiles, which, in turn, are a function of gross vehicle mass (GVM), load factor, speed/acceleration profiles and road gradient. The following assumptions on key parameters have been made: an average driving speed of 30 km/h, an average gradient of 1%, and a load factor attained when biomass is transported were assumed

Data/parameter	$EF_{elec,y}$
Unit	t CO2/MWh
Description	Combined emission factor for electricity used in project activities
Source of data	IPCC 2011 https://www.ipcc.ch/site/assets/uploads/2018/03/Chapter-9-Renewable-Energy-in-the-Context-of-Sustainable-Development-1.pdf Tanzanian Grid Emission Factor from IGES_GRID_EF_v10.11_2021.xlsx sourced from https://www.iges.or.jp/en/pub/list-grid-emission-factor/en on 5th Feb 2022
Value(s) applied	0.542695
Choice of data or Measurement methods and procedures	According to IPCC, diesel generator emission factor is 1.2, and Tanzania’s emission factor is 0.5081 t CO2e/MWh, according to IGES. It is assumed that 95% of energy supporting project activities will be from grid-connected electricity, 5% will be from diesel backup generator. Combined Emission factor thus will be 95%*0.5081+5%*1.2=0.542695 t CO2e/MWh
Purpose of data	Calculation of project emissions due to pyrolysis process
Additional comment	-

Data/parameter	x
Unit	%
Description	Montly C-loss due to storage of biomass
Source of data	Whittaker et al., 2016
Value(s) applied	2%
Choice of data or Measurement methods and procedures	A monthly C-loss of 2% (Whittaker et al.,2016) is assumed for the storage of biomass with a water content of more

	than 25% for more than two weeks without active ventilation.
Purpose of data	Calculation of leakage emission due to storage of biomass
Additional comment	-

Data/parameter	y
Unit	%
Description	Percentage of C loss from biomass storage in the form of CH_4
Source of data	Pier and Kelly, 1997; Pipatti et al., 2006; Whittaker et al., 2016
Value(s) applied	20%
Choice of data or Measurement methods and procedures	It is further assumed that 20% of the C loss from biomass storage is emitted in the form of CH_4, the climate impact of which must be subtracted from the sink potential (Pier and Kelly, 1997; Pipatti et al., 2006; Whittaker et al., 2016)
Purpose of data	Calculation of leakage emission due to storage of biomass
Additional comment	-

Data/parameter	GWP(methane)
Unit	t CO_2eq/tCH_4
Description	Global warming potential of methane on a 20-year time scale
Source of data	IPCC Third Assessment Report
Value(s) applied	86
Choice of data or Measurement methods and procedures	Methane has a global warming potential (GWP100) 34 times higher than CO_2 over a 100-year period CO_2 (Myrhe et al., 2013). However, in as much as the critical period for limiting global warming is the coming decades to 2050, the climate warming potential over the 20-year period (GWP20) should be used instead of GWP100 to promote avoidance of these critical emissions. The GWP20 of methane is 86, so within the first 20 years of

	emission, the climate-warming effect of methane is 86 times greater than that of CO_2 over the same period.
Purpose of data	Calculation of leakage emission due to storage of biomass and methane leakages during pyrolysis process
Additional comment	-

Data/parameter	$F_{orgC,bm}$
Unit	%
Description	Carbon content of biomass – the amount of organic carbon in the biomass as a mass proportion based on the biomass dry weight
Source of data	Węgiel et al., 2019 and Muhdi et al., 2020
Value(s) applied	default value for pine 50% and 35% for eucalyptus
Choice of data or Measurement methods and procedures	
Purpose of data	Calculation of leakage emission due to storage of biomass
Additional comment	-

B.6.3 Ex ante estimation of SDG Impact

>>

SDG 3

In the project scenario, biomass residues are processed that otherwise would have been burnt predominantly. Thus, the amount of feedstock is directly linked to less forest fires and related ambient air pollution. The amount of wood residues processed is therefore indirectly proportional to the ambient air pollution caused by open forest fires.

Project partners expect around 8,000 tons of feedstock are collected from forestry sector every year during full production.

SDG 8

In the project scenario, jobs are created at the pyrolysis plant. Employment generation is monitored directly through a staff registry of all skilled and unskilled workers at the pyrolysis plant. Staff registry is issued and signed by the facility operator.

Project partners expect a total of 35 full-time positions created at the facility.

SDG 12

In the project scenario, biomass residues are recycled for biochar production, which reduces waste generation. Prevention of waste generation is measured by the tons of biomass collected as feedstock material. Wood residues that are delivered to the facility enter the plant via a weighbridge. The outcome of the weighbridge is monitored by records of feedstock entering the facility.

Project partners expect around 8,000 tons of feedstock are collected from the forestry sector every year during full production.

SDG13:

According to B.6.1 the impact of this project is quantified by the establishment of Project Sink as opposed to reduction of Baseline emissions.

For the ex-ante calculation of project sinks, the following formula is used:

$$GSC_y = M_{prod,y} \times F_{orgC,y} \times k$$

(1)

Where:

GSCy	=	Gross Sink Capacity in year y of the respective project sink (t CO2e)
Mprod,y	=	Dry mass of biochar produced in year y (t)
ForgC,y	=	Carbon content of biochar – the amount of organic carbon stored in the biochar as a mass proportion based on the biochar's dry weight (%)
k	=	ratio of the molar mass of carbon dioxide and the molar mass of carbon = 44 $\frac{g}{mol}$ / 12 $\frac{g}{mol}$ = 3.6667

XXXX [will be continued in final version]

B.6.4 Summary of ex ante estimates of each SDG Impact

SDG 8 – Total Number of Jobs

YEAR	BASELINE ESTIMATE	PROJECT ESTIMATE	NET BENEFIT
Year 1	0	15	15
Year 2	0	0	0

Year 2	0	10	10
Year 4	0	10	10
Year 5	0	0	0
Total	0	35	35
Total number of crediting years		5	
Annual average over the crediting period	0	7	7

SDG 12 – Total of Waste generation reduced (Feedstock)

YEAR	BASELINE ESTIMATE	PROJECT ESTIMATE	NET BENEFIT
Year 1	0	4,000	4,000
Year 2	0	8,000	8,000
Year 2	0	16,000	16,000
Year 4	0	24,000	24,000
Year 5	0	24,000	24,000
Total	0	76,000	76,000
Total number of crediting years		5	
Annual average over the crediting period	0	15,200	15,200

SDG 13 – Emission Reduction

YEAR	BASELINE ESTIMATE	PROJECT ESTIMATE	NET BENEFIT
Year 1	2,750	1,223	1,334
Year 2	5,500	2,040	3,227
Year 2	11,000	3,673	7,162
Year 4	16,500	5,305	10,947
Year 5	16,500	5,305	10,947
Total	52,250	17,547	33,947
Total number of crediting years		5	

Annual average over the crediting period	10,450	3,509	6,723

B.7. Monitoring plan

B.7.1 Data and parameters to be monitored

[Details for this section will follow. Gives an impression on the date that shall be monitored]

(Copy the table for each piece of data and parameter; use headings to group parameter tables by SDG)

SDG 13

Data / Parameter	FairChar Compliance
Unit	-
Description	FairChar Principle Report
Source of data	PP
Value(s) applied	Fulfilled/Not fulfilled
Measurement methods and procedures	A report based on FairChair Principle with proof/practice for each indicator should be submitted, to ensure that the biomass source follows sustainable practice, and follows the social, ecological and economic principles.
Monitoring frequency	Once, per change of feedstock supplier; For existing supplier, once per crediting period renewal.
QA/QC procedures	-
Purpose of data	For applicability of the methodology applied
Additional comment	-

Data / Parameter	Batch Analysis of biochar properties
Unit	-
Description	Batch Analysis of biochar properties
Source of data	"Guidelines of the European Biochar Certificate - Version 10.3" for EBC-Agro class. At the date of registration Project Proponent must validate whether these are still in line with the data published by Carbon Standard International.
Value(s) applied	-

Data / Parameter	Batch Analysis of biochar properties		
Measurement methods and procedures	Required Analysis	Criteria/ Threshold values	
	Elemental analysis	Declaration of Ctot, Corg, H, N, O, S, ash (% of total mass, dry matter)	
		H / Corg	<0.49
		O/Corg	<0.410
	Physical parameters	Declaration of Water content, dry matter (DM), bulk density (as received and @ < 3 mm particle size), WHC, pH, salt content, electrical conductivity of the solid biochar	
	Nutrients	Declaration of N, P, K, Mg, Ca, Fe	
	Heavy metals (maximum)	Pb	< 120 g/t DM
		Cd	< 1,5 g/t DM
		Cu	< 100 g/t DM
		Ni	< 50 g/t DM
		Hg	< 1 g/t DM
		Zn	< 400 g/t DM
		Cr	< 90 g/t DM

[9] This value deviates from the EBC guidelines. It represents a characteristic for the aromatization and thus the stability of the biochar. It is the prerequisite for using the degradation rates given in this methodology.
[10] Since the direct measurement of the O content is expensive and currently not standardized, the calculation of the O content from the C, H, N, S and ash content is accepted.

<table>
<tr><td>Data / Parameter</td><td>Batch Analysis of biochar properties</td></tr>
<tr><td></td><td>
<table>
<tr><td></td><td>As</td><td>< 13 g/t DM</td></tr>
<tr><td rowspan="4">Organic contaminants</td><td>16 EPA PAH</td><td>< 6.0+2.4 g/t DM</td></tr>
<tr><td>8 EFSA PAH</td><td>< 1.0 g/t DM</td></tr>
<tr><td>benzo[e]pyrene</td><td>< 1.0 g/t DM</td></tr>
<tr><td>benzo[j]fluoranthene</td><td>< 1.0 g/t DM</td></tr>
</table>
</td></tr>
<tr><td>Monitoring frequency</td><td>Per production batch, maximum annually</td></tr>
<tr><td>QA/QC procedures</td><td>If there are changes compared with the data published by Carbon Standard International., Project Proponent must assess which are more reasonable to ensure environmental compatibility and science-based calculation of Net Sink Capacity and state reasons for the decision.</td></tr>
<tr><td>Purpose of data</td><td>Mandatory requirement to ultilise biochar as a soil amendment according to B.2 applicability condition 4.</td></tr>
<tr><td>Additional comment</td><td>Analysis may only be conducted in laboratories accredited for WBC (World Biochar Certificate). An up-to-date list of these laboratories can be found on the EBC webpage. The laboratories that are accredited at the time of submission of this methodology can be seen in Appendix I.</td></tr>
</table>

Data / Parameter	$M_{end\text{-}user,i,n,y}$
Unit	t
Description	Dry mass of Biochar being part of production batch i, that is consumed by end-user in year y for application activity n (t)
Source of data	According to usage/sale records
Value(s) applied	
Measurement methods and procedures	

Monitoring frequency	
QA/QC procedures	
Purpose of data	
Additional comment	

Data / Parameter	Mprod,i
Unit	t
Description	Dry mass of annual biochar of production batch i (t)
Source of data	According to pyrolysis plant records
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	Calculation of gross sink capacity (GSC) and Net project sink (NPS)
Additional comment	-

Data / Parameter	F,orgC
Unit	%
Description	Carbon content of biochar – the amount of organic carbon stored in the biochar as a mass proportion based on the biochar's dry weight (%)
Source of data	Tested as per requirements in "Table 5: Applicability of methodology according to proposed methodology in section B.1"
Value(s) applied	
Measurement methods and procedures	F,orgC is derived from the total carbon content minus the inorganic carbon content (CO2) in the sample.
Monitoring frequency	Every year
QA/QC procedures	-
Purpose of data	Calculation of gross sink capacity (GSC), Project emission due to breakdown and decomposition of biochar in year y (PEpost,degradation,y)
Additional comment	-

Data / Parameter	Qelec,y
Unit	MWh
Description	Amount of electricity used by the plant
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	Calculation of project emissions
Additional comment	

Data / Parameter	Qgas,y
Unit	m3/year
Description	Amount of gas used for carbonizer pre-heating
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	Calculation of project emissions due to pyrolysis process (PEprod)
Additional comment	Pre-heating process

Data / Parameter	Df,y
Unit	km
Description	Return trip distance between the origin and destination of freight transportation activities f in monitoring period y
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	

Purpose of data	Calculation of project and/or leakage emissions due to transport for all transportation activities exceeding 200km
Additional comment	Transportation activities include from feedstock to production site, and from production site to end-user

Data / Parameter	Mstorage
Unit	t
Description	Mass of stored biomass
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	Calculation of leakage emissions due to storage of biomass
Additional comment	

Data / Parameter	d
Unit	day
Description	Storage duration (days)
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	Calculation of leakage emissions due to storage of biomass
Additional comment	

Data / Parameter	mc
Unit	%
Description	Moisture content of stored biomass
Source of data	Daily measurements
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	

QA/QC procedures	
Purpose of data	Calculation of leakage emissions due to storage of biomass
Additional comment	

Data / Parameter	C(methane)
Unit	%
Description	Methane content of the exhaust gas stream
Source of data	
Value(s) applied	
Measurement methods and procedures	In order to determine the methane emissions, at least two independent, state-accredited measurements are to be carried out prior to the commissioning of the plant. For reason of conservativeness higher bound values are used. A further independent measurement must be carried out once a year.
Monitoring frequency	annual
QA/QC procedures	
Purpose of data	
Additional comment	

Data / Parameter	V_{gas}
Unit	m^3
Description	Volume of exhaust gas stream
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	daily
QA/QC procedures	
Purpose of data	
Additional comment	

Data / Parameter	Destination of biochar under end-to-end approach
Unit	GPS coordinates, text
Description	The geographical coordinates and owner of the final sink; Photographic evidence of biochar applied to the soil;

Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	Data is collected continuously,
QA/QC procedures	
Purpose of data	
Additional comment	

Data / Parameter	application provided by purchasers under indirect approach
Unit	-
Description	
Source of data	purchasing agreement
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	Data is collected continuously,
QA/QC procedures	
Purpose of data	
Additional comment	

SDG 8

Data / Parameter	
Unit	
Description	
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	
Additional comment	

SDG 12

Data / Parameter	
Unit	
Description	
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	
Additional comment	

B.7.2 Sampling plan

>>

B.7.3 Other elements of monitoring plan

>>

SECTION C. DURATION AND CREDITING PERIOD

C.1. Duration of project

C.1.1 Start date of project

>> 27.03.2023

C.1.2 Expected operational lifetime of project

>> Projects are eligible to claim GSVERs for no more than a maximum of five Certification Renewal Cycles (i.e. Crediting Period of 30 years). Project is aiming for five Certification Renewal Cycles and a resulting lifetime of 30 years.

C.2. Crediting period of project

C.2.1 Start date of crediting period

>> 01/01/2024

C.2.2 Total length of crediting period

>>30 Years, this project is eligible to claim GSVERs for no more than a maximum of five Certification Renewal Cycles (i.e. Crediting Period of 30 years)

SECTION D. SUMMARY OF SAFEGUARDING PRINCIPLES AND GENDER SENSITIVE ASSESSMENT

D.1 Safeguarding Principles that will be monitored

A completed Safeguarding Principles Assessment is in Appendix 1, ongoing monitoring is summarised below.

PRINCIPLES	MITIGATION MEASURES ADDED TO THE MONITORING PLAN
Principle x.y	

D.2. Assessment that project complies with GS4GG Gender Sensitive requirements

Question 1 - Explain how the project reflects the key issues and requirements of Gender Sensitive design and implementation as outlined in the Gender Policy?	The project partner has designed a "Her Farm, Her Future" approach that focuses on 7 key domains for achieving women's empowerment in agriculture: Decision making power Control over productive resources Control over the use of income Social capital and leadership Time use/time poverty Human capital access Use of technologies. Applying this gender lens, PP will partner and work with women both as suppliers of feedstock and end users of biochar-based products. PP's approach fits with many elements of the National Strategy for Gender Development from the Tanzanian

	department of Community Development, Gender and Children. Specifically in relation to agriculture where women are over-represented: Objective 2.1.6.3: Having women economically empowered and their opportunities enhanced Objective 5.10.1.1: Increase availability, accessibility and utilisation of adequate food
Question 2 - Explain how the project aligns with existing country policies, strategies and best practices	In Tanzania's NDC submission document the following gender specific adaptation measures were outlined as part of gender mainstreaming: a) enhancing gender equity in climate change adaptation actions. b) Promoting measures to address negative impacts of climate change on young people, women, old and other groups facing inequality, including people with disabilities. Our project and its particular gender approach aligns bother with the objectives form the national gender strategy and the submissions in the Tanzania's NDC document
Question 3 - Is an Expert required for the Gender Safeguarding Principles & Requirements?	No
Question 4 - Is an Expert required to assist with Gender issues at the Stakeholder Consultation?	No

SECTION E. SUMMARY OF LOCAL STAKEHOLDER CONSULTATION

The below is a summary of the 2 step GS4GG Consultation for monitoring purposes. Please refer to the separate Stakeholder Consultation Report for a complete report on the initial consultation and stakeholder feedback round.

E.1 Summary of stakeholder mitigation measures

>>

E.2 Final continuous input / grievance mechanism

METHOD	INCLUDE ALL DETAILS OF CHOSEN METHOD (S) SO THAT THEY MAY BE UNDERSTOOD AND, WHERE RELEVANT, USED BY READERS.
Continuous Input / Grievance Expression Process Book (mandatory)	
GS Contact (mandatory)	help@goldstandard.org
Other	

APPENDIX 1 - SAFEGUARDING PRINCIPLES ASSESSMENT

Complete the Assessment below and copy all Mitigation Measures for each Principle into SECTION D above. Please refer to the instructions in the Guide to Completing this Form.

APPENDIX 2 - CONTACT INFORMATION OF PROJECT DEVELOPER(S)

Organization name	
Registration number with relevant authority	
Street/P.O. Box	
Building	
City	
State/Region	
Postcode	
Country	
Telephone	
E-mail	
Website	
Contact person	
Title	
Salutation	
Last name	
Middle name	
First name	
Department	
Mobile	

Direct tel.	
Personal e-mail	

APPENDIX 3 - LUF ADDITIONAL INFORMATION

Risk of change to the Project Area during Project Certification Period:	
Risk of change to the Project activities during Project Certification Period:	
Land-use history and current status of Project Area:	
Socio-Economic history:	
Forest management applied (past and future)	
Forest characteristics (including main tree species planted)	
Main social impacts (risks and benefits)	
Main environmental impacts (risks and benefits)	
Financial structure	
Infrastructure (roads/houses etc):	
Water bodies:	
Sites with special significance for indigenous p eople and local communities - resulting from the Stakeholder Consultation:	
Where indigenous people and local communities are situated:	
Where indigenous people and local communities have legal rights, customary rights or sites with special cultural, ecological, economic, religious or spiritual significance:	

APPENDIX 4 - DESIGN CHANGES

A4.1. Details of proposed or actual design change

>>

A4.2. Describe the impacts of design change on the following

a. Additionality

>>

b. Applicability of methodology and other methodological regulatory documents with which the project activity has been certified

>>

c. Compliance with the monitoring plan of the applied methodology

>>

d. Level of accuracy and completeness in the monitoring of the project activity compared with the requirements contained in the registered monitoring plan

>>

e. Scale of the project activity

>>

f. Stakeholder consultation

>>

g. Sustainable development criteria

>>

h. Safeguarding assessment

>>

i. *Compliance with applicable legislation*

>>

j. <u>Only for LUF Projects</u>: Transparent summary of all approved changes in Project Area, Eligible Area and accompanying changes in ex-ante emissions removals.

DATE OF APPROVED DESIGN CHANGE (MM/DD/YYYY)	PROJECT AREA (HA)		ELIGIBLE AREA (HA)		EX-ANTE ESTIMATE (TCO2E)	
	INCREASE OR DECREASE ?	VALUE (HA)	INCREASE OR DECREASE?	VALUE (HA)	INCREASE OR DECREASE ?	PERCENTAGE (%)

Revision History

Version	Date	Remarks
1.5	29 June 2023	Editorial changes to match V2.1 of the Safeguarding Principles Requirements
1.4	21 June 2023	Editorial changes to match V2.0 of the Safeguarding Principles Requirements
1.3	14 April 2023	Integrated the design change memo as annex of the document. Editorial changes
1.2	14 October 2020	Hyperlinked section summary to enable quick access to key sections Improved clarity on Key Project Information Inclusion criteria table added Gender sensitive requirements added Prior consideration (1 yr rule) and Ongoing Financial Need added Safeguard Principles Assessment as annex and a new section to include applicable safeguards for clarity Improved Clarity on SDG contribution/SDG Impact term used throughout Clarity on Stakeholder Consultation information required Provision of an accompanying Guide to help the user understand detailed rules and requirements
1.1	24 August 2017	Updated to include section A.8 on 'gender sensitive' requirements
1.0	10 July 2017	Initial adoption

APPENDIX 5 – FAIRCHAR PRINCIPLE

The entity responsible for the biomass source must adhere to sustainable practices and comply with the social, ecological and economic principle defined in the FairChar Principle. The FairChar Principle consists of the SAFEGUARDING PRINCIPLES & REQUIREMENTS and several other supplementary criteria. A report covering the supplementary criteria with proof/practice shall be submitted along with the Monitoring Report.

Supplementary Criteria

1. Origin of biomass: In a monitoring period a minimum of 30% of the biomass must originate from tree growers with less than 20 ha of forest[11]. For all larger plantations that biomass is sourced from PP have to prove that the ratio of forest to conservation area does not exceed 10:1.
2. PP shall provide a village land[12] use planning or other official environmental management plans or provide a statement from the village land committee or an equivalent authorised entity that all biomass is sourced from areas managed in accordance with official vision for long term land use planning. PPs shall not convert natural forest for plantation purposes and/or ask other entities to make such conversion for themselves or any other subsidiary.
3. The operating entity holds regular local meetings (min. 1 in 2 years) where it provides information on the operations performed to employers and local community members. The meeting shall at minimum include the following information: key business figures, information on processed feedstock broken down by place of origin, information on produced biochar and place of usage, information on performed trainings and announcement of future trainings on biodiversity and sustainable management practices.

[11] This criterion applies from 2 years after the start of production.
[12] Shall include designated areas for managed forests and conservation areas and the plan should show that someone has thought about land development.

REFERENCES

Forster P, Storelvmo T, Armour K, Collins W, Dufresne J-L, Frame D, et al. The earth's energy budget, climate feedbacks, and climate sensitivity. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press; 2021. In Press.

Svedberg URA, HögbergH-E, HögbergJ, GalleB. Emission of hexanal and carbon monoxide from storage of wood pellets, a potential occupational and domestic health hazard.Ann Occup Hyg2004; 48:339–49.

Budai, A., Zimmerman, A.R., Cowie, A.L., Webber, J.B.W., Singh, B.P., Glaser, B., Masiello, C.A., Andersson, D., Shields, F., Lehmann, J., Camps Arbestain, M., Williams, M., Sohi, S., Joseph, S., 2013. Biochar carbon stability test method: An assessment of methods to determine biochar carbon stability'

Camps-Arbestain, M., Amonette, J.E., Singh, B., Wang, T., Schmidt, H.-P., 2015. A biochar classification system and associated test methods, in: Lehmann, J., Joseph, S. (Eds.), Biochar for Environmental Management. Routledge, London, pp. 165–194.

Wang, J., Xiong, Z., & Kuzyakov, Y. (2015). Biochar stability in soil: meta-analysis of decomposition and priming effects. GCB Bioenergy, 8(3), 512–523. doi:10.1111/gcbb.12266

Schmidt HP, Abiven S, Hagemann N, Meyer zu Drewer J: Permanence of soil applied biochar, the Biochar Journal 2022

IPCC, 2019. Method for estimating the change in mineral soil organic carbon stocks from biochar amendments: basis for future methodological development, in: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. IPCC, p. Ap4.1.

Kuzyakov, Y., Bogomolova, I., Glaser, B., 2014. Biochar stability in soil: Decomposition during eight years and transformation as assessed by compoundspecific 14C analysis. Soil Biol. Biochem. 70, 229–236. https://doi.org/10.1016/j.soilbio.2013.12.021

Lehmann, J., Abiven, S., Kleber, M., Pan, G., Singh, B.P., Sohi, S.P., Zimmerman, A.R., 2015. Persistence of biochar in soil, in: Lehmann, Johannes, Joseph, S.D. (Eds.), Biochar for Environmental Management. Routledge, London, pp. 235–299.

Zimmerman, A.R., Gao, B., 2013. The Stability of Biochar in the Environment, in: Ladygina, N., Rineau, F. (Eds.), Biochar and Soil Biota. Boca Raton, pp. 1–40.

Whittaker, C., Macalpine, W., Yates, N.E., Shield, I., 2016. Dry Matter Losses and Methane Emissions During Wood Chip Storage: the Impact on Full Life Cycle Greenhouse Gas Savings of Short Rotation Coppice Willow for Heat. BioEnergy Res. 9, 820–835. https://doi.org/10.1007/s12155-016-9728-0

Pier, P.A., Kelly, J.M., 1997. Measured and estimated methane and carbon dioxide emissions from sawdust waste in the Tennessee Valley under alternative management strategies. Bioresour. Technol. 61, 213–220. https://doi.org/10.1016/S0960-8524(97)00064-3

Pipatti, R., Silva Alves, J., et al., 2006. Biological treatment of solid waste, in: IPCC Guidelines for National Greenhouse Gas Inventory.

Myrhe, G.D., Chindell, F.-M., Bréon, W., Collins, J., Fuglestvedt, J., Huang, D., Koch, J.-F., Lamarque, D., Lee, B., Mendoza, T., Nakajima, A., Robick, G., Stephens, T., Takemura,T., Zhang, H., 2013. Anthropogenic and Natural Radiative Forcing, in: Stocker, T.F., Qin,D., Plattner, G.-K., Tignor, M., Allen, S.K., Boschung, J., Nauels, A., Xia, Y., Bex, V., Midgley, P.M. (Eds.), Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, USA.

Andrzej Wegiel and Krzysztof Polowy, 2020. Aboveground Carbon Content and Storage in Mature Scots Pine Stands of Different Densities. In: Forests 2020, 11, 240; doi:10.3390/f11020240

Muhdi, A Sahar, D S Hanafiah, A Zaitunah and F W B Nababan, 2019. Analysis of biomass and carbon potential on eucalyptus stand in industrial plantation forest, North Sumatra, Indonesia, in: IOP Conf. Ser.: Earth Environ. Sci. 374 012054