Public Project Description

This document is a project description made available in the Puro Registry to summarize the information available about a certified production facility. The project description is organized as follow:

1 Production Facility and Supplier information

This project description corresponds to the following **Production Facility** and **CO_2 Removal supplier**, acting as registering entity of the facility.

Production Facility	
Production Facility name	Nian'da Biochar Facility
Registration date (YYYY-MM-DD)	2024-09-05
Production Facility ID	577494
Location of facility	Dazhoudi, Dapeng Village, Longtan Street, Qixia District, Nanjing
Host Country of removal	China
Has this facility been registered in another registry?	☒No ☐Yes, additional information (registration periods):
This table is filled in by the CO_2 Removal Supplier.	

CO_2 Removal Supplier	
Supplier name	Miao Ying Ling Tan Information & Technology (Beijing) Co., Ltd
Supplier address	Unit 811, Floor 7, Building 2, No.5 Guanghua Road, Chaoyang District, Beijing
Business ID	91110108MA020K6B19
KYC status	Completed
This table is filled in by the CO_2 Removal Supplier.	

The above-mentioned production facility has undergone the following audit, during which the project description, alongside other audit documents were verified.

Facility Audit	
Type of audit	Combined Facility and Output Audit
General Rules version	4.0
Methodology name	Biochar Methodology Edition
Methodology edition and version	Edition: 2022 Version: v3
Date of audit completion	2025-03-25
Conclusion of audit	The auditor confirms that the project meets all Puro Standard requirements, and 330.96 CORCs are verified and approved for issuance
Auditing body	Earthood Services Limited
Start date of crediting period	2023-08-08

End date of crediting period	2028-08-07
This table is filled in by the Issuing Body.	

2 Overview of activity, its location, and operators

The information in this section provides an overview of how and where carbon dioxide removal is achieved, and by whom.

2.1 Non-technical description

Instructions	*Please provide a non-technical description of the carbon removal activity taking place at the production facility. Word limit: 100 words.*
Non-technical description	The facility takes the waste straw of crops as feedstocks, processes it into biochar by pyrolysis process under the condition of hypoxia, and applies the biochar to nearby farmland to repair the soil polluted by excessive fertilization. Originally, these stalks would be crushed to return to the field, over time, it will lead to soil acidification, diseases and pests, and the unique "yellow water" phenomenon in southern China. Biochar can solve these environmental problems well, not only long-term fixed CO2, but also have many co-benefits on agriculture and the terrestrial ecosystem, which is loved by farmers!
This table is filled-in by the supplier and verified by the auditor.	

2.2 Locations

Instructions	*Please provide a list of locations associated with the carbon removal activity. Additional locations or areas can refer to e.g. the location of the storage site, the spatial extent of the area of use of a carbon removal product or sourcing of a specific feedstock.*
Production Facility Location (as registered)	Address: Dazhoudi, Dapeng Village, Longtan Street, Qixia District Coordinates (WSG84, decimal format): Latitude: 32.20939 Longitude: 119.16278
Additional location(s)	*Specify purpose, location, address, coordinates, to the extent possible, for one or multiple additional locations relevant to the removal activity.* Dazhoudi, Dapeng Village, Longtan Street, Qixia District
This table is filled-in by the supplier and verified by the auditor.	

2.3 Operators

Instructions	*Please provide a full list of operators or organizations that contribute to the removal activity. Add rows as necessary. For each entity, provide the name, a business ID, an address, and the role of the entity.*
CO_2 Removal Supplier	*Entity name: Miao Ying Ling Tan Information & Technology (Beijing) Co., Ltd* *Entity business ID: 91110108MA020K6B19* *Entity address: Unit 811, Floor 7, Building 2, No.5 Guanghua Road, Chaoyang District, Beijing* *Role of entity: Project developer*

Organization 2	*Entity name: NANJING NIAN'DA ENVIRONMENTAL TECHNOLOGY CO., LTD* *Entity business ID: 91320113MA20K7Q12L* *Entity address: No.6, Qimin Road, Xianlin Street, Qixia District, Nanjing* *Role of entity: Facility owner*
Organization 3	*Entity name:* *Entity business ID:* *Entity address:* *Role of entity:*
This table is filled-in by the supplier and verified by the auditor.	

3 Technical description of the removal activity

The information in this section provides more technical details about the technologies and processes deployed to achieve carbon dioxide removal.

3.1 Technical description

Instructions	*Please provide a technical description of the carbon removal activity taking place at the production facility. Word limit: 500 words.*
Technical description	The rotary carbonization furnace used in the project is manufactured by NANJING NIAN'DA ENVIRONMENTAL TECHNOLOGY CO., LTD. The company has been committed to the field of industrial stoves and heat treatment equipment for more than 50 years, long-term close cooperation with universities and colleges, and has accumulated rich technical experience. The company's leading products passed the CE certification of the European Union in 2009, and its business scope covers all over the world. The carbonization furnace equipment is composed of shredder, feed hopper platform, chain conveyor, rotary carbonization furnace, cooling furnace, secondary combustion chamber, waste heat utilization drying furnace, cyclone dust collector, water bath dust collector and related pipes. The equipment is powered by liquefied petroleum gas when it is started, and the supply of liquefied petroleum gas is stopped after about 20 minutes. At this time, the equipment can be maintained at about 600 °C by the secondary combustion of syngas and tar generated by raw materials. At the same time when the equipment is started, the biomass raw materials are continuously transported to the rotary kiln hopper through the belt conveyor, and then pushed to the inside of the rotary kiln by the cylinder. At the same time when the raw material is burned in the furnace under oxygen, the stir-frying mechanism inside the rotary kiln drives the raw material to flow to the position of the carbon outlet, so the raw material pyrolysis reaction occurs at the same time during the flow process. In the process of pyrolysis, organic matter in raw materials is decomposed to produce biochar, syngas, tar, wood vinegar and so on. The unburned hydrocarbons will be diverted back to the combustion chamber for secondary combustion, and finally filtered through the cyclone and water bath precipitator before reaching the standard discharge. After verification, the equipment can consume 600 kg of raw materials per hour, and the biochar production rate is more than 30%. However, since the farmers were not familiar with biochar and worried about the impact on food production, we rented 14.4 ha of farmland around the

	factory and conducted experiments with the support of the local government. In the past year, after we added biochar into the fields, we planted local varieties of rice on it and managed it according to the normal pattern. The result was that ordinary rice became very tasty, and only needed half of the usual amount of fertilizer to achieve normal yields. Now the local government is coordinating about 133.3 ha of farmland to participate in the project, so we're going to produce 1080 tons of biochar per year, and fix about 1500 tons of CO_2 for over 100 years. This project not only helps the local government solve the problem of difficult processing of straw, but also helps farmers increase their income. Of course, it is also contributed to the mitigation of climate change.
This table is filled-in by the supplier and verified by the auditor.	

3.2 Illustration

Instructions	*Please provide up to three illustrations of the process and technologies described above (e.g. picture of equipment, flowcharts of process).* *Note that you must own the rights to reproduce and publish the illustration and that you also authorize puro.earth to reproduce and publish the illustration in the Puro Registry.*
Authorization to reproduce and publish the illustration	☒ Puro.earth is authorized to reproduce and publish the illustrations below, for use in the Puro Registry.

4 Application of the Puro Standard (boundary, baseline, additionality, quantification)

4.1 Scope and project boundary

Instructions	*Please provide a brief demonstration that the removal activity described above fits within the scope of the methodology and that the system boundaries of the removal activity correspond to the ones defined in the methodology. Word limit: 150 words.*

Scope and system boundary	The biomass used in the project comes from farmland within 3 km of the factory, which is all waste from agricultural production, collected by the village committee and transported to the factory. The production process consumes exogenous electricity and LPG, the biochar use stage consumes some diesel, and the final use site of biochar is also included in the farmland where the biomass feedstock is produced. Since the by-products are all burned for heat, all carbon emissions generated within the system boundaries are shared by biochar.
This table is filled-in by the supplier and verified by the auditor.	

4.2 Baseline scenario

*The information in this section provides a summary of the project-specific **baseline scenario**.*

Instructions	*Please provide a summary of the project-specific baseline scenario. The summary shall be based on the additionality questionnaire (available separately). Word limit: 150 words.*
Summary of the project-specific baseline scenario	
How to deal with agricultural waste is a big problem in China. Farmers used to burn straw, but the practice has been banned by the government because it causes air pollution. The current practice is to crush the straw and return it to the field, which lead to new environmental pollution such as anaerobic fermentation of organic matter, increase of diseases and pests and soil acidification, etc. Therefore, in this baseline scenario, no carbon removal occurs.	
This table is filled-in by the supplier and verified by the auditor.	

Further information on the baseline scenario:

Instructions	*If the methodology explicitly defines one or several possible baseline scenarios for the removal activity, please specify which ones was selected:*
Selected baseline scenario	Click or tap here to enter text.
This table is filled-in by the supplier and verified by the auditor.	

4.3 Demonstration of additionality

*The information in this section provides a summary of the project-specific **additionality assessment**.*

Instructions	*Please provide a summary of the project-specific additionality assessment, considering baseline removal, regulatory and financial additionality. The summary shall be based on the additionality questionnaire (available separately). Word limit: 150 words.*
Summary of additionality assessment	
The project achieved a net removal of CO_2 by converting easily decomposed straw into biochar after it was applied to farmland. This practice is not required by law, regulation or binding obligations. The project was launched with the support of the local government and experts to promote the use of biochar to solve the problem of local agricultural pollution and ultimately provide people with healthy food. So, farmers provide the raw materials to the factory for free, and the factory processes them into biochar and gives them to the farmer for free, hoping to eventually increase the farmer's income by improving the quality of the food. Therefore, the project has no revenue from the sale of biochar and can only be sustained by the support of carbon finance.	
This table is filled-in by the supplier and verified by the auditor.	

The following files are further made available in the Puro Registry.

Additionality questionnaire (required)	Filename	Additionality_Nian'da Biochar Facility
	Description	Additionality questionnaire signed and audited, used to determine the additionality of the project following the Puro requirements for additionality.
Additional file (optional)	Filename	
	Description	
Additional file (optional)	Filename	
	Description	
Add rows as necessary, following same template as for additional file. The filename shall be the exact filename as provided in the audit documentation. The description shall be at most a 3-line summary of what the file contains. This table is filled-in by the supplier and verified by the auditor.		

4.4 Quantification of net carbon dioxide removal

*The information in this section provides a description of how **quantification of net carbon dioxide removal removals** is achieved, including **monitoring** of the removal activity, and calculation of **supply-chain emissions**.*

Quantification implementation

Instructions	*Please describe how the quantification of net carbon dioxide removal, as described in the methodology (see CORC equation), is implemented by the supplier. Word limit: 200 words.*
Description of quantification implementation	
First, the CORC equation was used to calculate the amount of CO_2 that biochar application activities could retain on a 100-year timescale, and $CORCs=E_{stored}-E_{biomass}-E_{production}-E_{use}$. E_{stored} was based on the organic carbon content of biochar, the molar ratio of hydrogen to carbon, the annual soil temperature of the sites where it was used, and the dry weight of biochar. $E_{biomass}$ was based on fossil fuels consumed in transport (the waste material ignored carbon emissions from production). $E_{production}$ is calculated based on the weight of production equipment and raw materials, electricity and fossil fuels consumed, and E_{use} is calculated based on fossil fuels consumed during the use of biochar. Therefore, we accurately measured and recorded the weight and water content of the biochar during the first accounting period (to obtain dry weight), analyzed the hydrogen and organic carbon content of the biochar, provided LCI for the biomass source, biochar production, biochar end use and other stages, and confirmed the local average annual soil temperature combined with the site of final use. Finally, CORC was confirmed by calculation based on these data.	
This table is filled-in by the supplier and verified by the auditor.	

Monitoring and reporting

Instructions	*Please provide a summary of the monitoring procedures and monitoring plan which are in place at the production facility to ensure i) the safety of the removal activity, ii) the eligibility of the removal activity, and iii) the precise quantification of CORCs. The summary shall be project-specific and based on related evidence pieces that were submitted in the audit documentation. Word limit: 500 words.*
Summary of monitoring and reporting plan	
First of all, we developed the workshop production management rules and regulations, and all employees were trained, the purpose is to ensure the safety of production activities. For example, N95 masks, dust masks and earplugs must be worn during production to protect the health and safety of workers; The workshop is equipped with firefighting device, and its effectiveness is	

checked regularly to strictly ensure the production safety of the workshop; Accurately record accidents that occur during production. Secondly, the type and source of biomass raw materials, as well as the end use and use location of biochar are fully documented, ensuring the eligibility of carbon removal activities. Finally, the data of raw materials, electricity and fossil fuels consumed during production, as well as the data of fossil fuels consumed during the final use of biochar were accurately recorded to obtain the data of carbon emission activities within the boundaries of the project. The dry weight of biochar was obtained by accurately recording the weight and water content of biochar. Among them, the weighing equipment is an electronic hanging scale hung on the vehicle, the tool for detecting the moisture content is a handheld water analyzer, and the electricity meter is used to record the electricity consumption. Electronic hanging scales and handheld moisture meters do not require calibration (the equipment's manual does not record the calibration frequency), while the meter is usually calibrated once every five years. In addition, we commissioned a laboratory with national certification to adopt the biochar detection method developed by the Ministry of Agriculture and Rural Affairs of China to obtain data such as organic carbon content and hydrogen-carbon molar ratio of biochar, and obtained the average annual soil temperature of the area (15.5℃) according to the longitude and latitude coordinates of the biochar use site. Finally, according to the CORC equation, the number of CORCs in the reporting period is calculated, that is, 330.96 CORCs.
This table is filled-in by the supplier and verified by the auditor.

Optionally, the following documents may be made available in the Puro Registry once the facility has completed its first Output Audit:

Can the monitoring plan and procedures be made available in the Puro Registry?	
Answer	☐ Yes, entirely. ☐ Yes, in a redacted version. ☒ No. If no, please provide a reason: Not for public use
Filename(s) to be made public	
This table is filled-in by the supplier.	

Supply-chain emissions

The determination of the supply-chain emissions of the removal activity shall be based on a project-specific life cycle assessment, made of a report and calculations. Calculations are updated at least annually, during the Output Audits, with data captured through above-described monitoring.

Instructions	*Please provide a summary or an abstract of the LCA performed. Word limit: 500 words.*
Summary of life cycle assessment	
CORC calculations cover carbon emissions from the entire life cycle from raw material acquisition to biochar storage, that is, the entire process of biochar products from cradle to grave. This includes the supply of biomass raw materials, infrastructure, energy use in production (pyrolysis process), packaging of biochar, and the final use of biochar (given that the final use site is close to the factory during the current accounting period, the carbon emissions in the biochar transportation stage are negligible). The carbon emission ranges we calculated are as follows: Scope 1 includes direct emissions of LPG used in production, calculated through the actual factory use records and IPCC emission factors;	

Scope 2 includes electricity used in production, calculated through the actual factory use records and corresponding emission factors; Scope 3 includes 5 categories, including Category 1: purchased packaging bags, calculated through the actual factory use weight and corresponding emission factors; Category 2: fixed assets of production equipment, calculated through the material and weight data of the equipment and the corresponding emission factors; Category 3: upstream emissions of LPG and diesel, calculated through the actual factory use records and corresponding emission factors; Category 4: transportation stage of biomass raw materials, indirectly calculated through distance, weight and emission factors; Category 9: direct emissions of diesel, calculated through the actual factory use records and corresponding emission factors. **Note:** In the LCA report and model, the upstream emissions and direct emissions of LPG are in the energy consumption stage, and the upstream emissions and direct emissions of diesel are in the use stage.
This table is filled-in by the supplier and verified by the auditor.

Optionally, the following documents may be made available in the Puro Registry once the facility has completed its first Output Audit:

Can the LCA report be made available in the Puro Registry?	
Answer	☒ Yes, entirely. ☐ Yes, in a redacted version. ☐ No. If no, please provide a reason:
Filename(s) to be made public	LCA Report_Nian'da Biochar Facility
This table is filled-in by the supplier.	

5 Social and environmental safeguards

The information in this section provides a summary of the project-specific measures taken to avoid and minimize negative social and environmental effects, as well as maximize positive impacts contributing to the sustainable development goals (SDGs).

5.1 Stakeholder engagement

In line with the Puro General Rules, the CO_2 Removal Supplier must have conducted a stakeholder engagement process and reported its outcome in a written format.

Instructions	*Please reproduce the summary of the stakeholder engagement report. Word limit: 500 words.*
Summary of stakeholder engagement	
Through the survey, we identified five types of local stakeholders directly or indirectly related to the project, such as workers, villagers, street residents, local environmental protection authorities, and related industry experts. We then posted invitations to the project survey on the public board and sent paper versions of 30 questionnaires to the identified stakeholders. Finally, within 21 days of validity, we recovered all the questionnaires, and the recovery rate reached 100%. By analyzing all the questionnaires, we found that the vast majority of respondents supported the construction and operation of the project because they believed that the project brought many positive benefits to the local community. In addition, rules and regulations have been formulated during the operation of the project, and the rights and interests of workers have been protected. While the vast majority of respondents said they knew about biochar, only 30% said they knew a lot about biochar, indicating that more publicity is still needed to get people to truly understand	

biochar. In addition, 80% of people expressed interest in the price of biochar carbon credits, far more than the demand, indicating that a favorable price of biochar carbon credits will encourage more people to learn about biochar and join the ranks of biochar production and use. In addition, three of them suggested that the government should introduce measures to encourage similar enterprises, and that the company should continue to increase construction and produce more biochar to help improve the local soil condition. Since no one opposes the construction and operation of the project, no response has been made for the time being. The project operator will continue to open feedback channels and welcome suggestions or comments from stakeholders at any time, whether agree or against. We will try our best to answer all the doubts and seek the support of more people.
This table is filled-in by the supplier and verified by the auditor.

In addition, the following documents are made available in the Puro Registry once the facility has completed its first Output Audit:

Stakeholder Engagement Report (required)	Filename	Stakeholder Engagement Report
	Description	Stakeholder engagement report completed and audited, following the Puro requirements for stakeholder engagement.
The filename shall be the exact filename as provided in the audit documentation. This table is filled-in by the supplier.		

5.2 Environmental and social safeguards

In line with the Puro General Rules, the CO_2 Removal Supplier must ensure that environmental and social safeguards are in place.

Instructions	*Please summarize the environmental and social impacts relevant to the project, based on the answers provided to the corresponding questionnaire in the audit documentation. Word limit: 500 words.*
Summary of environmental and social safeguards questionnaire	
General speaking, 1, this project uses straw to produce biochar, and uses it to improve the soil, so it is not classified as an industrial production project. 2, the construction site of this project is 10.6km away from the nearest ecological protection red line -- Longtan Drinking Water Source Protection Area, so it is not within the scope of ecological protection red line and ecological control space. 3, the waste gas generated by this project will be purified by bag dust collectors and water bath dust collectors before being discharged. The wastewater is only domestic sewage, which will be collected and used to make organic fertilizer. There are two types of solid waste, dust particles and domestic solid waste. Dust particles are organic matter, so they will be collected and applied to farmland, while domestic solid waste will be collected and handed over to the sanitation department for unified incineration. All waste treatment methods comply with local laws and regulations, so they will not cause harm to the surrounding environment. 4, the project has complete infrastructure and sufficient water and electricity supply, and will not reach the upper limit of resource utilization. 5, according to the environmental impact assessment report, the project of making biochar from straw only produces ash dust and domestic waste, and does not produce toxic and harmful pollutants, which is not in the negative list of environmental access of China, so it will not have a significant impact on the environment and society and risk. 6, we are committed to abide by Chinese laws, respect employees' human rights, gender equality and non-discrimination; and abide by the International Bill of Rights.	

7, we are committed to recognize, respect, and promote the protection of the rights of IPs & LCs (indigenous peoples and local communities). However, this requirement is not applicable to the project, as there is no indigenous people on the project site. 8, the project will not adversely affect the surrounding community and will have no impact or risk on cultural heritage, cultural and religious sites. 9, all the raw materials are waste straw from the surrounding countryside, which causing secondary pollution, so the local government and farmers are very supportive of this project to solve the problem, so the raw materials are sustainable supply.
This table is filled-in by the supplier and verified by the auditor.

In addition, the following document is made available in the Puro Registry once the facility has completed its first Output Audit:

Stakeholder Engagement Report (required)	Filename	Environmental and Social Safeguard Questionnaire
	Description	Questionnaire based on a template provided by Puro, to ensure compliance with the Puro General Rules, regarding social and environmental safeguards.
The filename shall be the exact filename as provided in the audit documentation. This table is filled-in by the supplier.		

5.3 Permits, risk assessments and impact assessments

Depending on the nature and scale of the removal activity, the CO_2 Removal Supplier may have obtained permits or conducted specific environmental assessments (e.g. Environmental and Social Impact Assessment, Environmental Risk Assessment) for compliance with local laws and regulations.

Were the obtention of one or several construction or environmental permits required for the removal activity, for compliance with local laws and regulations?	
Answer	☐Yes, permits were required and successfully obtained. ☒ No, permits were not required.
Permits obtained	Name of permit: ID of permit: Issuer of permit: Date of issuance: Permit file (.pdf): Permit URL (if available):
If several permits were obtained, provide the information for each of them. This table is filled-in by the supplier and verified by the auditor.	

Was an environmental and social impact assessment study (EIA) conducted?	
Answer	☒ Yes, an EIA was legally required and thereby conducted. ☐ Yes, an EIA was not legally required but conducted voluntarily. ☐ No, an EIA was not legally required and not conducted.
EIA Report (if conducted)	Title of study: Investment project of demonstration project of comprehensive utilization of biomass from straw to biochar Filename of report: Environmental impact assessment_Nian'da Biochar Facility Can the report be published in the Puro Registry: No
This table is filled-in by the supplier and verified by the auditor.	

Was an environmental risk assessment study (ERA) conducted?	
Answer	☐ Yes, an ERA was legally required and thereby conducted. ☐ Yes, an ERA was not legally required but conducted voluntarily. ☒ No, an ERA was not legally required and not conducted.
ERA Report (if conducted)	Title of study: Filename of report: Can the report be published in the Puro Registry:
This table is filled-in by the supplier and verified by the auditor.	

5.4 Positive impacts on SDGs

Depending on the nature of the removal activity, the activity may have positive impacts on the UN Sustainable Development Goals (SDGs).

Instructions	*Please provide a summary of the positive impacts on the SDGs that the removal activity has or plans to has. This summary shall be project-specific and based on related evidence pieces that were submitted in the audit documentation (SDG Reporting files). Word limit: 150 words.*
Summary	No SDGs are claimed.
This table is filled-in by the supplier and verified by the auditor.	

In addition, the following document is made available in the Puro Registry once the facility has completed its first Output Audit:

SDG Reporting (required)	Filename	n/a
	Description	SDG Reporting based on a template provided by Puro, disclosing with SDG indicators are reported and how they are or will be demonstrated.
The filename shall be the exact filename as provided in the audit documentation. This table is filled-in by the supplier.		

6 Other documents available in the Puro Registry

Alongside this project description, several other documents are made available in the Puro Registry for more details.

The documents referenced in this project description are compiled in the following table:

Instructions	To finalize the project description, please list the names of all the public documents to be made available in the Puro Registry, in the order they appear, specifying the number of pages of each document. Add rows as necessary.

#	Document names	No of pages
1	Additionality_Nian'da Biochar Facility	9
2	LCA Report_Nian'da Biochar Facility	19
3	Stakeholder Engagement Report	6
4	Environmental and Social Safeguard Questionnaire	11
5	Environmental Evaluation Report	4
6	Statement of understanding of physical-product decoupling	1
7		
8		

This table is filled-in by the supplier.

Besides the documents referenced in this project description, the 3rd-party auditor has reviewed a complete audit package containing numerous documents, performed a site visit, and prepared an audit report and statement.

The facility described here will further be audited annually, in Output Audits, to verify the performance of the removal activity, resulting in the issuance of CORCs. All audits lead to audit reports and statements, which will be available in the Puro Registry, alongside further details on CORC quantification for each monitoring period.

Baseline and Additionality Assessment

The baseline and additionality assessment is a requirement for eligibility under the Puro Standard. The assessment is made by the CO2 Removal Supplier and verified by the independent 3rd party auditor. **The assessment made in this document will be publicly available in the Puro Registry.**

The Puro Standard only certifies durable carbon removals from the atmosphere that are net-negative and does not certify emissions reductions or avoidance. The CORCs (Carbon dioxide removal certificates), issued therefore represent a net carbon removal (1 $tCO_2eq.$ net) from the atmosphere to a durable storage of minimum 100 years, and for mineralization and geological storage minimum 1000 years. Net carbon removal is determined from stored gross CO_2 volume by subtracting supply-chain emissions from the project, any re-emissions over the guaranteed storage time, any baseline removals taking place in a baseline scenario, and any negative indirect leakage effects relative to the baseline scenario.

The CO_2 Removal Supplier must in this assessment:

- **Define** and quantify all reasonable **baseline alternatives** to the proposed project activity to remove carbon with carbon financing. A baseline is a scenario that reasonably represents the natural and anthropogenic carbon removals to a permanent storage (storage durability over 100 or 1000 years) in the absence of the carbon removal activity proposed by the CO_2 Removal Supplier. Although anthropogenic emissions may take place in the baseline scenarios, these emissions do not constitute a reference point for the quantification of CORCs (only the baseline removals do).
- Demonstrate **carbon additionality to the baseline,** meaning that the project must convincingly demonstrate that it is resulting to higher volumes of carbon removals than the likely baseline alternatives (question A1 and A2.).
- Demonstrate **regulatory additionality,** meaning that the project is not required by existing laws, regulations, or other binding obligations (question A4.).
- Demonstrate **prior consideration of carbon credits** through documentation demonstrating that the time period between the commitment date and production facility audit is max. 3 years. (question A5)
- Demonstrate **financial additionality,** meaning that the CO_2 removals achieved are a result of carbon finance. This means that the CO_2 Removal Supplier must show that the carbon credits were needed to secure the investment or to overcome specific barriers to the investment.
- To support the claim the of financial additionality, the project activity cannot already be *common practice* without carbon finance (question A6).

Reference documents: Puro Standard general Rules v4.0, section 6.5 and Additionality Assessment requirements v2.0.

1. General questions to all CO_2 Removal Suppliers

A1. Baseline Determination			
Activity name	**Activity description**	**Removals to storage (100+ yr) due to project activity (human activity)**	**Natural removals to storage (100+ yr), not man-made**
Baseline: *Biomass is crushed and returned to the field*	*How to deal with agricultural waste is a big problem in China. Farmers used to burn straw, but the practice has been banned by the government because it causes air pollution. The current practice is to crush the straw and return it to the field, which lead to new environmental pollution such as anaerobic fermentation of organic matter, increase of diseases and pests and soil acidification, etc., so how to properly deal with crop straw has become the first problem of the basic-level government.*	None	None
Project activity: *Biomass is pyrolyzed into biochar*	Therefore, we used a pyrolysis process to convert crop straw into biochar as a soil amendment for use in the fields around the plant, which not only solved the problem of straw pollution, but also improved the soil structure, reduced the use of fertilizers, and improved the quality of the crops.	1500 CORCs/Year	None
Alternative scenarios 1		None	None
Alternative scenarios 2		None	None

A2. Does the project lead to higher volumes of durable carbon removal than the baseline?	**Yes / No**
In the baseline scenario biomass waste will decompose naturally, which produces greenhouse gases, but the project converts biomass into biochar, which can stably store CO2 for hundred of years, so the project will lead to more CO2 removal than the baseline.	Yes

A3. Is the project scenario aligned with net-zero transition? The following activities are considered not to be aligned with net-zero transition: a) directly leading to an increase in the extraction of fossil fuels, b) relating to coal-fired electricity generation, or c) involving other unabated fossil fuel-powered electricity generation, other than new gas-fired generation that is part of increased zero-emissions generation capacity in support of national low carbon energy transitions	**Yes / No**
The project uses biomass as raw material, only uses a small amount of liquefied natural gas in the equipment start-up process, and will output biomass natural gas at the terminal, which can be used to provide zero-carbon thermal steam or electricity, and belongs to the project to support the national zero-carbon transformation.	Yes

A4. Is the project required by existing laws, regulations, or other binding obligations?	**Yes / No**
There is no legal requirement to process biomass into biochar and apply this biochar to farmland.	No

A5. What was the Commitment Date of this facility? Commitment Date is defined as "The calendar date on which the CO_2 Removal Supplier committed to implementing the CO_2 Removal activity (e.g., the date when contracts for the purchase or installation of equipment required for the mitigation activity were signed). In the case where a mitigation activity does not involve capital expenditure, it refers to the date when the first physical actions were taken to implement the mitigation activity." If an exception listed in clause 2.1.3 of the Additionality Assessment Requirement applies, describe the situation here.	Date
The biomass carbonization furnace equipment processing contract was signed on January 22, 2024, and was installed and commissioned in May, and officially operated on August 8. Therefore, the earliest commitment date can be confirmed as January 22th, 2024.	January, 22th, 2024

A6. Is the Technological Readiness Level of the Methodology 8 or 9?	Yes/No
The Biochar's TRL is 6-7.	No

If the answer to question A6 is Yes, please answer question A6.1 to A6.3. Questions A6.2 and A6.3 are different based on whether you are applying a distributed technology (such as enhanced rock weathering) or more centralized technology based on plants/factories producing something. See clauses 3.2.5 and 3.2.6 in the Puro Additionality Assessment Requirements with references for more information.

A6.1. Please define the region being considered and explain why it is relevant level of aggregation for the assessment if different from the host country.
[Information]

A6.2. Market size or current installations **Distributed technology:** What is your estimate for a realistic target market size and what constraints to the market size growth have you identified? **Centralized technology (plants):** What projects have you identified that fulfil the criteria in Additionality Assessment Requirements clause 3.2.6? a) output range of +/- 50% of the project, b) located in the same region, c) applying the same measure, d) produce comparable goods or services in terms of quality, properties, and applications, e) started commercial operation before the proposed start date of the project, and f) are not registered in a carbon crediting program. How many of them apply a different technology? **Please mention or link to any sources you have.**
[Information]

A6.3. Market penetration rate **Distributed technology:** What is your estimate of the market penetration rate of the activity? How common or widespread is the project activity or similar activities in the relevant sector and region, and what is the trend of adoption over time? **Centralized technology (plants):** Provide your calculation of market penetration rate based on the formula in clause 3.2.6 in Additionality Assessment Requirements.
[Information]

A7. Does the carbon removal project have other income sources besides carbon finance? Include also information about any subsidies you receive or expect to receive. Please describe your business model here, in a short answer (max. 100 words).	Yes / No
In this project, farmers provide straw to the factory for free, and the factory makes it into biochar and sends it to farmers for free, with the aim of improving soil quality, thereby leading farmers to increase their income by increasing their food income. This project is a public welfare project, so it urgently needs carbon credit income to maintain and expand its scale.	No

Please note: Questions under headings '2. Simple cost analysis', '3. Investment analysis', and ' 4. Barrier Analysis' are mutually exclusive options.

2. Simple cost analysis or investment analysis

Some projects may demonstrate additionality through simple cost analysis: this is applicable for projects that have no other source of income besides carbon finance or where ex-ante investment analysis is not applicable, because capital expenditure (capex) is modest compared to operating expenditure (opex). This can include e.g. enhanced rock weathering projects.

B1. Describe how the criteria above applies to your project
This project is for public benefit. Soil pollution caused by excessive use of chemical fertilizers has affected food security, so the project owner invested in the construction of this project with the technical support of university professors, hoping that through the use of biochar, the contaminated soil can be repaired and food security can be protected. However, farmers only believe in the efficacy of fertilizer and are unwilling to use biochar. Finally, we reached a cooperation with the surrounding villages, that is, the villagers provide straw for free, and the supplier processes the waste crop straw into biochar for free and provides it to the farmers. Therefore, the project has no income from biochar.

<table>
<tr><th>B Simple cost analysis</th><th>Project response</th></tr>
<tr><td>B2. Please describe your cost structure here and include evidence in attachment.</td><td>As shown in the following table, the expenditure mainly includes capital expenditure (4163730 CNY) and the operational expenditure (732254 CNY).</td></tr>
<tr><td>B3. Please summarize the simple cost analysis here. Please include any public subsidies received or expected. Compare with alternative scenarios, if relevant.</td><td>
<table>
<tr><th>Category 1</th><th>Category 2</th><th>Cost-CNY</th></tr>
<tr><td rowspan="3">Capital Expenditure</td><td>Carbonization furnace production line</td><td>3300000</td></tr>
<tr><td>Workshop</td><td>513730</td></tr>
<tr><td>Supporting equipment</td><td>350000</td></tr>
<tr><td rowspan="3">Operational Expenditure</td><td>Leased farmland</td><td>183600/year</td></tr>
<tr><td>Energy cost</td><td>55514/Year</td></tr>
<tr><td>Labor cost</td><td>493140/Year</td></tr>
</table>
</td></tr>
<tr><td>B4. Please provide additional calculation spreadsheet in attachment. All formulas used in the spreadsheet shall be readable to the verifier and all relevant cells shall be viewable and unprotected. Mark confidential when needed.</td><td>See attachment: ”Simple cost analysis-confidentiality.xlsx”.</td></tr>
<tr><td>B5. Are you willing to provide full calculation spreadsheet to be visible in Puro Registry? If yes, please specify the name of the file that has been provided. If not, please ensure that there is sufficient information provided in your answers in this document.</td><td>Yes.</td></tr>
<tr><td>B6. Is the information shared here consistent with information presented to the company’s decision-making management, investors or lenders?</td><td>Yes.</td></tr>
</table>

B7. Is the information shared here consistent with the information in the audit documentation presented to Puro and its verifiers (e.g. LCA model)? If not, please explain why there are differences.	Yes.

3. Investment Analysis

CO_2 Removal Suppliers can be guided by the CDM Methodological Tool 27 of the UNFCCC Clean Development Mechanism "Investment Analysis" to demonstrate financial additionality with Investment Analysis.

C. Financial Additionality – Investment analysis	Project response
C1. Describe the relevant alternative scenarios in terms of investments analysis. **If the only alternative scenario is to carry out the project without CORCs, please answer the following questions:** **Please show your calculations to determine the benchmark rate for either equity IRR or WACC, whichever you are using. Please include documentation of how the rate is suitable for the technology and region. Please specify the currency and whether the rate is nominal or real.**	
C2. Please state how CORC revenues change the expected IRR or NPV of the project.	
C3. Please conduct a sensitivity analysis in relation to the investment analysis and summarize the results here.	
C4. Is the information shared here consistent with information presented to the company's decision-making management, investors, or lenders?	
C5. Is the information shared here consistent with the information in the audit documentation presented to Puro and its verifiers (e.g. LCA model)? If not, please explain why there are differences.	
C6. Are you willing to provide full calculation spreadsheet to be visible in Puro Registry? If yes, please specify the name of the file that has been provided.	
C7. If you are not willing to disclose the full spreadsheet, please provide here a summary of the confidential file that has been provided to the Auditor and Puro.earth. Please include: • **Overall description of the spreadsheet, including type of terms (real/nominal), currency, forecasting periodicity** • **Capital structure, if the measure is based on equity return** • **Information sources on main revenues and costs** • **Expected breakdown of income from the different sources** • **Expected or already received public subsidies** • **Growth assumptions** • **Model duration and a comparison with expected lifetime**	

4. Barrier Analysis

In Barrier Analysis only one barrier needs to be demonstrated but there needs to be clear, objective, and verifiable evidence to demonstrate its existence. If possible, please provide quantitative estimates for the barrier.

D. Barrier Analysis	No/yes	Project response
D1. Are there financial barriers? (e.g., financing is not accessible for the type of activity in the country due to the risks)		
D2. Are there institutional barriers? (e.g., the investor not being the beneficiary of cost savings associated with the investment)		
D3. Are there information barriers? (e.g., lack of awareness of the financial benefits of by-products)		
D4. Please explain how CORC revenues are crucial element in overcoming identified barrier(s)		
D5. Are there subsidies for the carbon removal activity? If yes, please explain how they are not sufficient to overcome the barrier.		
D6. Please attach verifiable evidence for the existence of the barrier and describe the evidence here. If the file can be included publicly in the Puro registry, please specify the name of the file here. If the evidence is not public, please ensure		

that you describe it in sufficient detail.		
D7. Please demonstrate that at least one other alternative in baseline determination (first question) does not face any significant barriers, including the barriers faced by your project.		

I hereby declare that all information provided is truthful and precise to the best of my knowledge.

X 王奇 Qi Wang

Date: 30/09/2024, Place: Beijing
Representative name: Qi Wang, Title: Senior Project Manager,
Organization: Miao Ying Ling Tan Information & Technology Co, Ltd

Life cycle assessment of NANJING NIAN'DA ENVIRONMENTAL & TECHNOLOGY CO., LTD’s biochar production and use for CORC calculation

Report prepared by MioTech

Date: 2024.09.25

Table of Contents

Abstract

Potential greenhouse gas emissions of biochar were studied in a life cycle assessment presented in this report.

The purpose of this study is to calculate the greenhouse gas emissions of biochar produced in Nanjing Nian'da Environmental & Technology Co., Ltd and assess the greenhouse gas compensation potential. The system boundary is set cradle-to-grave and includes emissions from production and supply of the biomass, from biomass conversion to biochar, and from biochar distribution and use.

Data for the study was collected from Nanjing Nian'da Environmental & Technology Co., Ltd. This study is conducted following the LCA methodology described in standards ISO 14040 and 14044, as well as in Puro.Earth's Standard Biochar methodology, which gives requirements and guidelines for the quantification of the carbon footprint of products. It also provides procedures to verify the compliance of CO2 removal activity with the removal method. It specifies the system boundaries, detailed calculation formulas and the proof needed for the issuance of CORCs regarding the LCA.

Based on the LCA, 1472.94 kgCO2eq is removed per tonne of dry weight biochar. The biggest emitter during the life cycle is the production process (219.62 kgCO2eq). The most significant climate change impacts during the production process of biochar are caused by the energy usage (190.41 kgCO2eq), capital goods (12.09 kgCO2eq), residual emissions (13.93 kgCO2eq) and biochar packaging (3.18 kgCO2eq). The major contributor in energy usage on site is caused by the electricity used (162.28 kgCO2eq) and liquefied petroleum gas (28.00 kgCO2eq). The production facilities (12.09 kgCO2eq), of which 9.49 kgCO2eq is caused by medium carbon steel and 2.60 kgCO2eq is caused by SUS 304. The use phase is transport to end-use (5.22 kgCO2eq). The total emissions produced are 228.72 kgCO2eq per tonne of biochar produced. The amount of CO2 stored in biochar for a 100-year period, also known as Estored, is 1701.66 kgCO2eq per tonne of dry weight biochar.

Glossary

Life Cycle: consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal.

Life Cycle Assessment (LCA): compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle.

Raw Materials: primary or secondary material that is used to produce a product.

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

Carbon Dioxide (CO2) Equivalent: unit for comparing the radiative forcing of a GHG to that of carbon dioxide.

Global Warming Potential (GWP): index, based on radiative properties of GHGs, measuring the radiative forcing following a pulse emission of a unit mass of a given GHG in the present-day atmosphere integrated over a chosen time horizon, relative to that of carbon dioxide (CO2) .

Functional or Declared Unit: A CFP study shall clearly specify the functional or declared unit of the system under study. The functional or declared unit shall be consistent with the goal and scope of the CFP study. The primary purpose of a functional or declared unit is to provide a reference to which the inputs and outputs are related. Therefore, the functional or declared unit shall be clearly defined and measurable. The declared unit shall only be used in a partial CFP.

Reference Flow: measure of the inputs to or outputs from processes in a given product system required to fulfil the function expressed by the functional unit.

System Boundary: boundary based on a set of criteria representing which unit processes are a part of the system under study.

Process: set of interrelated or interacting activities that transforms inputs into outputs.

Unit Process: smallest element considered in the life cycle inventory analysis for which input and output data are quantified.

From Cradle to Gate: Evaluation of part of the life cycle process of the product, from the acquisition of raw materials from natural resources to the delivery of the product, excluding the product use or the end of the life cycle.

Cut-off Criteria: specification of the amount of material or energy flow or the level of significance of GHG emissions associated with unit processes or the product system to be excluded from a CFP study.

GHG Emission Factor / Carbon Emission Factor: coefficient relating activity data with the GHG emission.

1. Introduction

Farmers burned their crop residues to add nutrients to the soil for a long time, but this can pollute air quality, so China bans burning stalks and implements pulverizing them to return to the fields. Although this increases the organic matter content of the soil, it also brings a lot of additional environmental pollution, such as pests and diseases, soil acidification, heavy metal activity, and so on. In addition, farmers often overuse chemical fertilizers in order to increase food production, which eventually leads to soil compaction and pollution from agricultural non-point sources. These series of agricultural pollution problems can lead to unhealthy food, and ultimately affect human health. Therefore, the project owner, with the support of the local government and biochar experts, decided to invest in the construction of straw biochar project, trying to improve the soil through the use of biochar, so as to obtain healthy rice. Farmers are reluctant to buy biochar because they do not know it. Therefore, under the coordination of the government, farmers provide straw to factories for free, and the latter produces biochar for free use by farmers, and then increases farmers' income through the improvement of food quality, realizing the "common prosperity" policy that the Chinese government has been implementing.

The project involves five major stakeholders, including factory workers, farmers, government agencies, industry experts and residents. According to the project questionnaire, all of them support the operation of the project, but only a small number of people have a good understanding of biochar. This indicates the urgent need to support the operation of this biochar project, so that more and more farmers can understand the benefits of biochar. Some interviewees pointed out that on the one hand, they hope that the government can introduce more policies to support similar enterprises, and on the other hand, they also hope that the enterprise can further increase investment to help more farmers.

To sum up, the project can not only solve the problem of difficult disposal of waste straw in rural areas, but also solve the problem of agricultural environmental pollution, and finally harvest healthy rice and lead farmers to increase their income, so it is a model of sustainable development.

2. Goal and scope definition

2.1. Goal of the study

- gain information on how the environmental impacts of the biochar are distributed throughout the life cycle, and
- provide material for the customer inquiries related to the environmental performance of the biochar.
- serve as background for the audit process to Puro.Earth CO2 removal marketplace. To be eligible for Puro.Earth's carbon dioxide removal certificates (CORCs) the producer must proof the CO2 removal achieved by the production of biochar with LCA.

The reason for carrying out the study is to be able to respond to the customer inquiries about the environmental performance of biochar and to acquire information on LCA results for Puro CO2 Removal marketplace. By conducting the study, Nanjing Nian'da Environmental & Technology Co., Ltd prepares for the continuously growing demand for environmental information required by the customers and other key stakeholders.

The results of the study are primarily presented internally at Nanjing Nian'da Environmental & Technology Co., Ltd. The results of the study are not intended for comparative assertions to be disclosed to the public.

2.2. Scope of the study

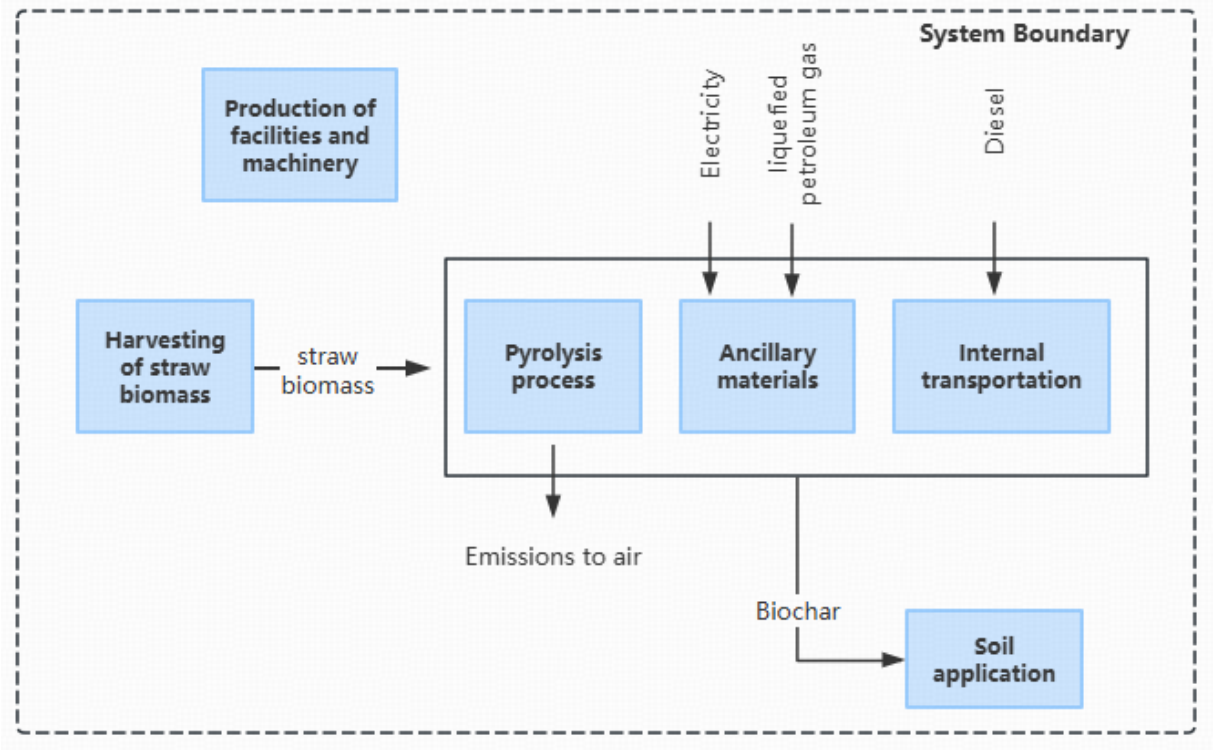
2.2.1. Product-systems considered

The scope of this study was to develop a cradle-to-grave life cycle assessment for biochar processing including a life cycle impact assessment (LCIA) to evaluate the environmental impacts from raw material supply to the thermochemical conversion of biomass into biochar (product manufacturing). Biochar is produced by Nanjing Nian'da Environmental & Technology Co., Ltd. Energy produced by the system include pyrolysis oil and district heat.

Biochar is produced from straws biomass through pyrolysis process. The straw biomass is dried and chipped prior to the pyrolysis process. Pyrolysis produces an extremely stable solid form of carbon that can withstand in soil for thousands of years, making it an ideal approach for carbon removal.

The Nanjing Nian'da Environmental & Technology Co., Ltd pyrolysis process heats the straw biomass to approximately 600 °C. The outputs from the pyrolysis process include biochar, biomass combustible gas and wood vinegar solution. The pyrolysis gas is reused in the process of firing the pyrolysis process. Light fuel oil is used in heating the pyrolysis process. The high firing temperature of the pyrolysis gas results to very accurate carbonization and low emission in the flue gas.

Figure 1. System Boundary.



2.2.2. Functional unit(s) and reference flow(s)

The main function of the whole system is the production of biochar for soil amendment, and the functional unit of the study is therefore 1 t of dry biochar stored in soil for 100 years. The reference flow is then 1 dry metric tonne of biochar.

2.2.3. Impact categories and impact assessment methods

This study assessed one environmental impact category parameter: global warming potential (GWP) - IPCC2021. The GWP results are expressed as kg CO2 eq. Biogenic and fossil CO2 emissions are treated equally in the model.

2.2.4. System boundaries

The product system to be studied consist of biochar. The system boundary of the life cycle assessment was set to cradle-to-grave, or, more specifically, the system is studied from raw material supply to biochar soil amendment. The life cycle stages include emissions from production and supply of the biomass, from biomass conversion to biochar, and from biochar distribution and use. The materials and manufacturing of the pyrolysis and other machinery are included in the life cycle assessment.

The quality requirements for the LCA were set according to the EN ISO 14044 standard (4.2.3.6). The used data is as up-to-date as possible and at most five years old for producer-specific data and at most ten years old for generic data.

The datasets described in this LCA report, and the datasets inserted into the biochar model are based on data for 10 months of a production (2023.08.01-2024.05.31) and 1 ton as functional unit. The choice of data presentation ensures consistency and comparability of the data with the biochar production.
Geographically, the production of the biochar concerns conditions in China. The data corresponds to modern technology and the physical properties of the product.

Specific data collected in plant from Nanjing Nian'da Environmental & Technology Co., Ltd were used for the production processes. For upstream and downstream processed generic data was used. Generic data is from 2024 (Ecoinvent 3.10).

The accuracy of the data was assessed when creating the life cycle model. Clear deviations and suspicious values were checked. When entering the values into the model, they were critically examined, and possible misspellings were detected and corrected.

In the information categories, all the gathered data were used without excluding categories in advance but following the boundaries of the system set earlier. The data used are primarily gathered from the actual unit processes.

They are produced specifically for the model complying with the general principles of the life cycle assessment standard, and in the way that the assessment can be re-conducted by an external party. No statistical limits are set to the uncertainty of the source information.

2.2.5. Multi-functionality and allocation procedures

There are grounds for allocation concerning biochar production. Biochar is always product of a multi-output product. These include biomass combustible gas and wood vinegar solution in addition to biochar.

However, in the production process of biochar, biomass combustible gas and wood vinegar are not sold but participate in the production, so the distribution between the two is ignored.

2.2.6. Assumptions and limitations

Restrictions and/or limitations, which can influence the extent of the LCA, the interpretation and application of the results, are described in this chapter.

Simulate the transportation process of straw from farmers to biochar processing facilities after receiving it through online maps.

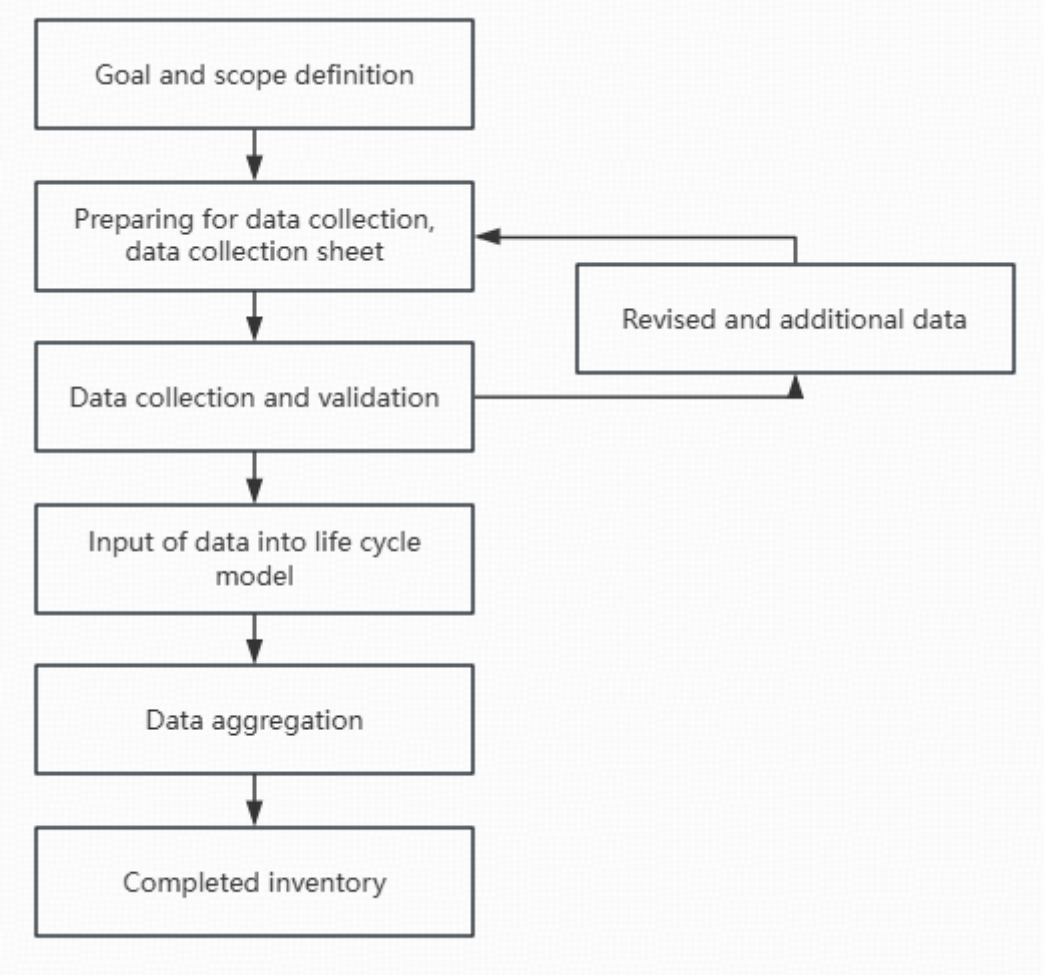
Biomass is dried in the hands of farmers before being transported to biochar processing facilities. It is then stored for a very short period of time before production. Therefore, it is assumed that there is no methane production during the storage period.

3. Life cycle inventory analysis

3.1. Software, databases, and other data sources

The life cycle inventory analysis (LCI) includes the collection of the data necessary to meet the goals of an LCA study as well as analysis of the life cycle inventory. The life cycle model used for the inventory analysis was created with Excel software. The structure of the life cycle inventory analysis is presented in Figure 2.

Figure 2. The structure of life cycle inventory analysis (LCI).



As a result of the inventory analysis, a life cycle inventory is obtained, which is the material and energy balance for the studied product system. This is used as a base for the life cycle impact assessment (LCIA).

In this chapter, the essential method and data used for the life cycle inventory analysis is described.

3.2. Missing data disclosure

The input data used in the study should correspond to the actual practice of the studied product system as far as possible. In an ideal situation, each unit process can be described with data based on measurements or annual material and energy balances. In an ideal situation, the supplier should also be able to provide the life cycle inventory data for their share of the life cycle (e.g., from raw material supply to the factory gate). Relatively few material suppliers can provide this life cycle inventory data, hence the input data must be collected from alternative sources.

In this study the following principles have been followed when collecting and treating missing data:

- collecting LCI-data from the manufacturer
- collecting LCI-data from the supplier
- collecting LCI-data from an industry organization
- collecting LCI-data from the literature
- collecting data from other commercially available databases (only if the missing data is assumed to have a major impact on the overall impact assessment)
- theoretical calculation of LCI-data on a rough level (only if the missing data is assumed to have a major impact on the overall impact assessment)
- replacement of the data with data for a similar material
- pointing out and documenting that the data is missing

In this LCA, no data was collected from other sources than the manufacturer, supplier databases (Ecoinvent 3.10).

3.3. Inventory data

Data collection for the biochar system encompasses a cradle-to-grave system boundary. No material losses were considered in the data collection, as it was estimated that materials are not lost during the life cycle, but the yield is 100 %.

The total dry weight of biochar produced in this study is 229.4 tons (dry mass), with a raw material input of 734.1 tons (wet mass). Biomass combustible gas and wood vinegar are both used in the production process. All straws were considered waste and therefore harvesting were excluded from this LCA.

All raw material transportation is included, including the transportation of straw from farmers to production facilities, transportation of raw materials for biochar processing facilities, and energy consumption for biochar use.

Production consumes energy in the form of electricity and liquefied petroleum gas. Electricity is 100% provided by the State Grid. Electricity is mainly used for driving motors in production facilities, while liquefied petroleum gas is used for ignition.

The capital goods must be considered in LCA. In this study, capital goods mainly refer to production facilities The production facilities mainly include the main kiln, front and rear covers, main kiln support, cooling kiln, shell, front and rear covers, incinerator, water tank, pipeline, and operation platform guardrail a total of 21.09 tons of steel were used. Thus, the lifecycle of the plant is 20 years. Therefore, when calculating the carbon emissions of capital goods, only 4.17% is taken.

Due to the direct use of biochar products in farmland on site after production, packaging and transportation of the products were considered.

Table 1. Data used for determining the GHG emissions of the capital goods.

	Input	Unit
Life cycle of the production plant	20	years
Climate change impact over the entire 20-year life cycle	66.55740	tCO2e
Climate change impact per one ton of biochar	0.01209	tCO2e
Climate change impact	2.77322	tCO2e

Table 2. Datasets used in life cycle model of biochar production.

Input/Output	Dataset	Year (dataset)	Amount	Unit
Product output	Biochar	-	229.4	t
Raw material supply				
Rapeseed straw	waste as raw material	-	453.4	t
Wheat stalk	waste as raw material	-	40.9	t
Corn stalks	waste as raw material	-	256	t
Bean straw	waste as raw material	-	66.9	t
Production equipment				
304 Steel - Raw materials	steel production, electric, chromium steel 18/8 - Rest-of-World - steel, chromium steel 18/8 - ecoinvent 3.10 - cutoff	2024	2.58	t
A3 Steel - Raw materials	steel production, low-alloyed, hot rolled - Rest-of-World - steel, low-alloyed, hot rolled - ecoinvent 3.10 - cutoff	2024	18.51	t
304 Steel - Processing	sheet rolling, steel - Rest-of-World - sheet rolling, steel - ecoinvent 3.10 - cutoff	2024	2.58	t
A3 Steel - Processing	sheet rolling, steel - Rest-of-World - sheet rolling, steel - ecoinvent 3.10 - cutoff	2024	18.51	t
Biochar production process				

Electricity – China, East Grid	market for electricity, low voltage - China, East Grid - electricity, low voltage - ecoinvent 3.10 - cutoff	2024	42135	kwh
Liquefied petroleum gas	liquefied petroleum gas production, petroleum refinery operation - Rest-of-World - liquefied petroleum gas - ecoinvent 3.10 - cutoff	2024	1550	Kg
Residual emissions-N2O	dinitrogen monoxide emissions, as N2O	2024	10.1	Kg
Residual emissions-CH4	methane emissions, as CH4	2024	17.6	Kg
Biochar packaging-material	market for polypropylene, granulate - Global - polypropylene, granulate- ecoinvent 3.10 - cutoff	2024	375	kg
Biochar packaging-processing	market for extrusion, co-extrusion - Global - extrusion, co-extrusion- ecoinvent 3.10 - cutoff	2024	375	kg
Biochar packaging-end of life	market for waste plastic, mixture - Rest-of-World - waste plastic, mixture- ecoinvent 3.10 - cutoff	2024	375	kg
Use				
Diesel oil	market for diesel - Rest-of-World - diesel - ecoinvent 3.10 - cutoff	2024	352	L

4. Life cycle impact assessment and interpretation

4.1. Methodology of LCIA and interpretation

The life cycle impact assessment (LCIA) is made based on the inventory analysis (LCI). The impact assessment is applied to evaluate the product system from an environment's perspective by using impact categories and impact category indicators, which are connected to the results of the inventory analysis (see section 3).

Calculations for the impact assessment were conducted using the Ecoinvent and the impact category parameters set by the EN 15804:2012+A2:2019 standard. The LCIA method is described in the section 4.1.2.

Interpretations, which are based on the LCIA methods, are made based on the characterization phase according to the instructions of the life cycle assessment standard.

4.1.1. Structure, concept and nomenclature of the impact assessment

According to the ISO 14040 standard series, the LCIA includes both mandatory and voluntary parts. The mandatory parts of the LCIA are presented in Figure 3. Interpretation and conclusions of the impact assessment should be made based on their actual result, which is the LCIA profile. The LCIA profile is also the outcome of the mandatory phase of the impact assessment. In the LCIA profile, the indicator result in each impact category should be expressed using specific quantitative impact category related indicators. This calculation of the impact categories' indicator results is called characterization.

Voluntary parts of the impact assessment include normalization, grouping and weighting. Voluntary parts of the impact assessment were not used in this life cycle assessment.

Normalization is proportioning of the LCIA results with respect to other relevant measures. For example, life cycle emissions of a specific product system could be compared in proportion to equivalent China emissions within the same time period.

Grouping means classification and ranking of the impact categories, for example with respect to their characteristics. Ranking is based on the value choices, and thus subjective.

Weighting is the most subjective part of the life cycle impact assessment, and its main function is to proportion every impact category with respect to each other. As an outcome, there is one index figure. For this measurement, many alternative methods have been developed, however, subjectivity is present in all of them. Back-grounds of the weighting methods should be well known when evaluating results related to them. Even at their best, weighting methods only give guidelines of proportional significance of the environmental impacts.

4.1.2. Environmental impact categories

Climate change – total (GWP-total, Global Warming Potential total): informs the total potential effect of greenhouse gases, such as carbon dioxide (CO2), to change the climate. Greenhouse gases block a part of the sun's infrared radiation to exit the atmosphere, causing the temperature at the earth's surface to rise. The effects of different greenhouse gases are converted into comparable form by proportioning them to carbon dioxide units. GWP-total is the sum of global warming potential of fossil, biogenic and land use and land use change emissions. Unit: kg CO2-eq.

Climate change – fossil (GWP-fossil, Global Warming Potential fossil): accounts the greenhouse gas emissions and removals originating the oxidisation, for example combustion or landfilling, of fossil fuels or materials containing fossil carbon. Unit: kg CO2-eq.

Climate change – biogenic (GWP-biogenic, Global Warming Potential biogenic): accounts the greenhouse gas emissions and removals originating the oxidisation, for example combustion or landfilling, of biofuels or materials containing biogenic carbon. GWP-biogenic covers biogenic greenhouse gas emissions and removals from all sources except native forests. Unit: kg CO2-eq.

Climate change – land use and land use change (GWP-luluc, Global Warming Potential land use and land use change): accounts for greenhouse gas emissions and removals of carbon stocks which includes also biogenic carbon content from native forests. Unit: kg CO2-eq.

4.1.3. Used impact assessment methods

Environmental impact assessment factors set in the EN 15804 standard were applied in the assessment. Characterization factors according to EN 15804:2012+A2:2019 Annex C (EC-JRC) were used. The method uses the characterization factors as developed by the Intergovernmental Panel on Climate Change (IPCC) based on IPCC 2013, expressed as GWP for time horizon 100 years (GWP100). According to Puro Standard Biochar methodology, the CORC value is based on the product's biogenic carbon storage and fossil emissions. Biogenic or LULUC CO2eq emissions are not considered in the CORC calculation, and thus, do not have any impact to the CORC value.

4.2. Results of the life cycle impact assessment

The result consists of the LCIA profile. The LCIA profile was obtained at the characterization phase of the impact assessment. The results include all assessed life cycle phases. Table 3 presents the potential environmental impacts (GWP) of the life cycle of biochar using one ton of biochar as the functional unit and 100% of the impacts are allocated to the biochar in raw material supply, and biochar production process.

Figure 3. LCA results for 1 t of dry biochar (kg CO2eq).

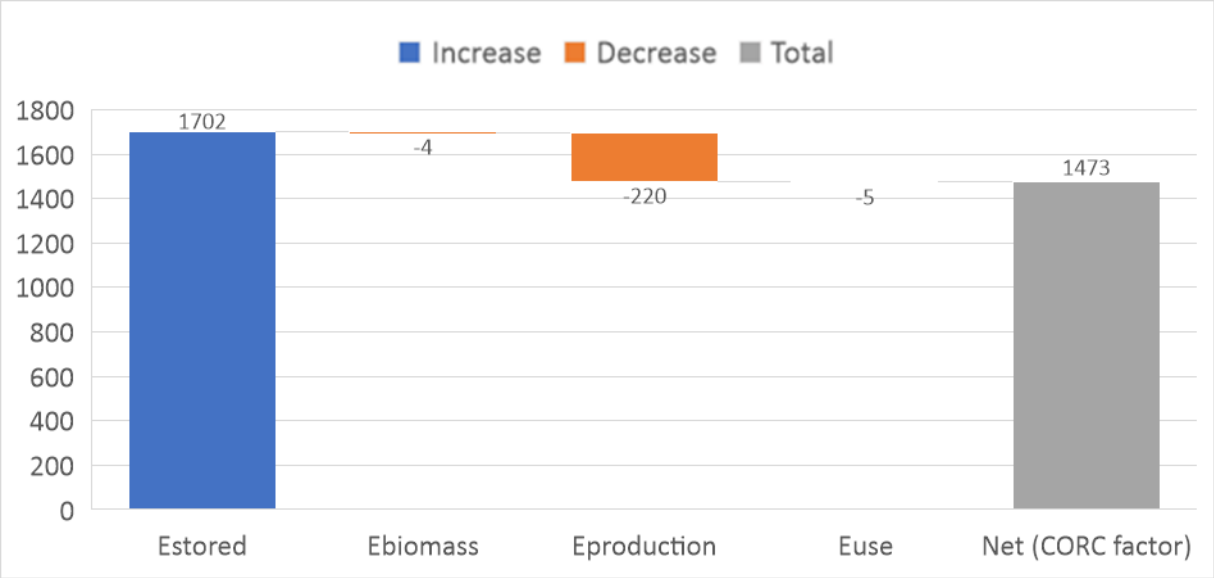

Increase
Decrease
Total
1800
1600
1400
1200
1000
800
600
400
200
0
1702
-4
-220
-5
1473
Estored
Ebiomass
Eproduction
Euse
Net (CORC factor)

Table 3. LCA results for 1 t of dry biochar.

Contribution levels			Per tonne of biochar produced and used						
Level-1	Level-2	Level-3	CC in kg CO2-eq	kg-CO2 fossil	kg CH4 as CO2-eq	kg N2O as CO2-eq	kg oGHG as CO2-eq	kg CO2 biogenic captured	kg CO2 biogenic emitted
$E_{biomass}$	Supply	RoW / metric ton*km / transport, tractor and trailer, agricultural	3.88	3.87	0.00	0.00	0.01	3.88	3.87
$E_{production}$	Biomass pre-processing & Energy consumption	RoW / kg / liquefied petroleum gas production, petroleum refinery operation	6.61	6.61	0.00	0.00	0.00	6.61	6.61
$E_{production}$	Biomass pre-processing & Energy consumption	CN / kg / liquefied petroleum gas direct emission factor	21.41	21.40	0.01	0.00	0.00	21.41	21.40
$E_{production}$	Biomass pre-processing & Energy consumption	CN / kWh / market for electricity, low voltage	162.40	162.28	0.00	0.00	0.09	162.40	162.28
$E_{production}$	Biochar packaging	GLO / kg / market for polypropylene, granulate	2.40	2.39	0.00	0.00	0.00	2.40	2.39
$E_{production}$	Biochar packaging	GLO / kg / market for extrusion, co-extrusion	0.37	0.37	0.00	0.00	0.00	0.37	0.37
$E_{production}$	Biochar packaging	RoW / kg / market for waste plastic, mixture	0.42	0.42	0.00	0.00	0.00	0.42	0.42
$E_{production}$	Residual emissions	GLO / kilogram / dinitrogen monoxide emission from pyrolysis flue gas (as kg N2O)	11.65	0.00	0.00	11.65	0.00	0.00	0.00
$E_{production}$	Residual emissions	GLO / kilogram / methane emission from pyrolysis flue gas (as kg CH4)	2.27	0.00	2.27	0.00	0.00	0.00	0.00
$E_{production}$	Embodied infrastructure emissions	RoW / kg / steel production, electric, chromium steel 18/8	2.40	2.39	0.00	0.00	0.00	2.40	2.39
$E_{production}$	Embodied infrastructure emissions	RoW / kg / steel production, low-alloyed, hot rolled	8.08	8.07	0.00	0.00	0.00	8.08	8.07
$E_{production}$	Embodied infrastructure emissions	RoW / kg / sheet rolling, steel	0.19	0.19	0.00	0.00	0.00	0.19	0.19
$E_{production}$	Embodied infrastructure emissions	RoW / kg / sheet rolling, steel	1.39	1.39	0.00	0.00	0.00	1.39	1.39
$E_{production}$	Embodied infrastructure emissions	RoW / metric ton*km / transport, freight, lorry, all sizes, EURO6 to generic market for transport, freight, lorry, unspecified	0.03	0.03	0.00	0.00	0.00	0.03	0.03
E_{use}	Biochar usage	RoW / kg / market for diesel	1.09	1.09	0.00	0.00	0.00	1.09	1.09
E_{use}	Biochar usage	CN / kg / diesel direct emission factor	4.14	4.07	0.01	0.06	0.00	4.14	4.07
E_{stored}		-	1701.66	-	-1701.66	-	-	-	-
Total (CORCs)		-	1472.94	-	-	-	-	-	-

4.3. Interpretation

Results are reported according to the ISO 14044 -standard.

4.3.1. Identification of significant issues

Based on the LCA, 1469.99 kgCO2eq is removed per tonne of dry weight biochar. The biggest emitter during the life cycle is the production process (222.57 kgCO2eq). The most significant climate change impacts during the production process of biochar are caused by the energy usage (190.41 kgCO2eq), capital goods (12.09 kgCO2eq), residual emissions (16.88 kgCO2eq) and biochar packaging (3.18 kgCO2eq). The major contributor in energy usage on site is caused by the electricity used (162.28 kgCO2eq) and liquefied petroleum gas (28.00 kgCO2eq). The production facilities (12.09 kgCO2eq), of which 9.49 kgCO2eq is caused by medium carbon steel and 2.60 kgCO2eq is caused by SUS 304. The use phase is transport to end-use (5.22 kgCO2eq). The total emissions produced are 231.67 kgCO2eq per tonne of biochar produced. The amount of CO2 stored in biochar for a 100-year period, also known as Estored, is 1701.66 kgCO2eq per tonne of dry weight biochar.

4.3.2. Completeness check

To assess the environmental impacts of the product stage, it is important to have accurate information on the material content and the manufacturing processes. The production of the studied product includes a limited number of raw materials, and their accurate consumption was known. The accurate electricity and fuel consumption of the manufacturing process was known.

4.3.3. Consistency check

Same sources of input data have been used to assure consistency in information describing the life cycle phases. For most of the input data, database (Ecoinvent 3.10) was used. The database information describes the production with average geographical data. If the production differs from the average, it can influence the results when assessing largest raw material amounts.

Same impact categories and impact assessment method has been utilized when assessing different life cycle phases to assure consistency in the impact assessment.

5. Discussion, conclusions, and recommendations

Potential greenhouse gas emissions of biochar were studied in this LCA. The system boundary of the LCA was set to cradle-to-grave. Data for the life cycle assessment were collected regarding the material and energy inputs and outputs of the included life cycle stages: the raw material supply, transport to the production facility, the production process of biochar and the distribution to the point of final use. The conclusions of the impact assessment are made based on the results of the characterization phase.

Based on the LCA, 1472.94 kgCO2eq is removed per tonne of dry weight biochar. The biggest emitter during the life cycle is the production process (219.62 kgCO2eq). The most significant climate change impacts during the production process of biochar are caused by the energy usage (190.41 kgCO2eq), capital goods (12.09 kgCO2eq), residual emissions (13.93 kgCO2eq) and biochar packaging (3.18 kgCO2eq). The major contributor in energy usage on site is caused by the electricity used (162.28 kgCO2eq) and liquefied petroleum gas (28.00 kgCO2eq). The production facilities (12.09 kgCO2eq), of which 9.49 kgCO2eq is caused by medium carbon steel and 2.60 kgCO2eq is caused by SUS 304. The use phase is transport to end-use (5.22 kgCO2eq). The total emissions produced are 228.72 kgCO2eq per tonne of biochar produced. The amount of CO2 stored in biochar for a 100-year period, also known as Estored, is 1701.66 kgCO2eq per tonne of dry weight biochar.

6. References

Puro.Earth. CO2 Removal Marketplace. General Rules. 2019.

Puro.Earth. Puro Standard Biochar Methodology. Edition 2022

ISO 14040:2006. Environmental management. Life cycle assessment. Principles and framework.

ISO 14044:2006 Environmental management. Life cycle assessment. Requirements and guidelines.

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Stakeholder Engagement Report

CO_2 Removal Supplier	**Nanjing Nian'da**
Production Facility	**Nian'da Biochar Facility**
Production Facility ID	**577494**
Date of report last update (YYYY-MM-DD)	2024-09-23

Stakeholder Engagement Report

The purpose of this document is to gather results of the Stakeholder Engagement that has been conducted by the CO_2 Removal Supplier, for its Production Facility, in line with Section 6.4 of the Puro General Rules 4.0 and the Puro Stakeholder Engagement Requirements.

This report is divided in the following sections:

1 Identified stakeholders
2 Consultation activities and outcomes
3 Plans for continued consultation during crediting period
4 Summary

This report will be made **publicly available** in the Puro Registry. It shall not contain information about private individuals (e.g. name, personal address) for privacy reasons. Such information shall be provided separately (e.g. list of participants to consultation activity, as an appendix to the report).

1 Identified stakeholders

Provide an overview of the stakeholders that have been identified as relevant to include in the stakeholder engagement process, following the categories defined below:

Stakeholder categories	Identified stakeholders
Local Stakeholders, i.e. stakeholders in the immediate environment of the facility of the CO2 Removal Supplier, and most prone to experience direct or indirect effects of the respective carbon removal activity.	Workers, villagers
Stakeholders with **land-tenure rights** within the vicinity of the project boundary	Villagers
Representatives of relevant **local authorities** and relevant **local politicians**	Environmental Protection Department of Longtan Street, municipal Environmental Bureau
Local **non-governmental organizations** (NGOs) or international NGOs who are active in the region and relevant to the topic	There is no relevant organization around the project site.
Representatives of relevant **working groups** or **vulnerable** and **marginalized** groups within the vicinity of the project boundary	There is no relevant organization around the project site.
Relevant **industry experts,** given there are any in the near environment	Professors of Nanjing Forest University and Nanjing Science and Technology
Other, please specify:	Street residents
Answers are to be written in the second column without disclosing private information. For instance, instead of the name of a specific resident, use terminology like "local residents". Likewise, instead of naming specific public employees, prefer to mention the roles and departments. *In case there are no identified stakeholders in a given category, provide a brief justification instead.*	

Activity directly or indirectly impacting indigenous peoples or their livelihoods, ancestral knowledge or cultural heritage:

Question	Answer
Does the list of identified stakeholders include any indigenous peoples or communities?	☐ Yes ☒ No
If answer is "Yes" to the question above, has the free, prior and informed consent (FPIC) been obtained from those indigenous peoples or communities?	☐ Yes. Please provide evidence of the obtention of the FPIC in a separate document.
As per rule 2.1.6 in the Puro Stakeholder Engagement Requirements, note that "FPIC is distinct from stakeholder engagement in that it is derived from indigenous peoples' right to self-determination. While stakeholder engagement involves consultation and collaboration with all parties affected by a project, FPIC goes a step further by requiring the explicit consent of indigenous peoples before proceeding with activities that impact them."	

2 Consultation activities and outcomes

Provide an exhaustive list of all the **stakeholder consultation activities** that have been conducted. Add as many rows as necessary. The activity categories can for instance be one of the followings (but not limited to these ones): public meeting, online webinar, paper questionnaire, electronic questionnaire, interviews, focus group, site visit, door-to-door visits, etc.

Activity categories	Activity name	Activity date (YYYY-MM-DD)
paper questionnaire	Biochar project questionnaire of Nanjing Nianda Environmental Technology Co., LTD	2024-07-28

Provide a list of all the **stakeholder invitations** that have been sent out, grouping whenever relevant the invitations (e.g., for all local residents as one row). Add as many rows as necessary. The invitation format can be one of the followings (but not limited to these ones): postal letters, email, social media publication, public board information, telephone calls, verbal communication, etc.

Invitation format	Invitation name	Invitation date (YYYY-MM-DD)
public board information	Project survey invitation	2024-07-22

As **supporting evidence** to this report, please provide in a separate subfolder, the following:

- Example of invitations sent out, for different consultation activities (e.g. letters, emails, website announcements).
- Lists of all stakeholders invited to the consultation activities and stakeholders participating in the consultation activities. The lists will not be made public, as they can contain private information.

In case identified relevant stakeholders (section 1) were not invited to the consultation activities, please provide clear **reasons for not inviting** them. Add as many row as necessary. Leave blank if not applicable.

Identified stakeholders	Reasons for not inviting

Provide an extensive summary of i) the **information that was provided to stakeholders** during the consultation activities, ii) the **feedback received** during the consultation activities (with a particular focus on concerns, potential issues and critiques), and iii) the **responses provided to stakeholders** about their feedback.

Summary of the feedback received during the consultation activities

Information provided to stakeholders:
The invitation letter for the project investigation briefly describes the basic situation of the project. For example, the project uses waste straw generated from the surrounding farmland to obtain biochar after high temperature anaerobic pyrolysis. Because of the unique properties of biochar itself, it can effectively improve farmland and improve the yield and quality of food. At the same time, the syngas is redirected back into the combustion chamber, thus avoiding greenhouse gas emissions such as methane.
Through the implementation of the project, it not only solves the problem of straw treatment, but also improves the health of agriculture and food, while improving the biodiversity of the ecosystem, but also increases jobs and promotes the sustainable development of society.
The questionnaire consists of 10 questions, including 9 multiple choice questions and 1 essay question. The contents include what impact the project will have on the surrounding environment and society, and whether the rights of workers are guaranteed. Do you know about biochar and carbon credits? Etc. The final question invites participants to submit any suggestions or comments on the project.

Feedback received from stakeholders:
A total of 30 questionnaires were sent out and all were recalled. All the respondents said they were aware of the project; more than 83% of respondents believe that the project will bring positive benefits to the surrounding environment and society; 90% believe that the legitimate rights and interests of workers are fully protected during the operation of the project; 87% of the respondents supported the construction and operation of the project, and the remaining four expressed no concern about it. However, only 9 people were very aware of the value of biochar, the majority said only a general understanding, and even 2 people did not know about biochar.
Another 3 people put forward suggestions for the project. 1. suggested that the company increase investment to solve the local straw and make more biochar to improve the local soil structure; 2. invest more in environmental protection to benefit local people; 3. it is suggested that the government should introduce corresponding policies to encourage such enterprises and promote the development of this type of project.
Overall, the vast majority of respondents supported the project, while a minority did not care about it because they did not know much about biochar. We believe that with the operation of the project, fewer and fewer people will not know about biochar.

Responses provided to stakeholders:
As no one raised objections to the operation of the project, there was no response for the time being.

In case any relevant stakeholders **could not take part** in the consultation activities due to reasons such as lack of mobile access or physical disability, please describe and summarize how you engaged with them, what their specific feedback was, and how it was answered. Leave blank if not applicable.

Consultation of stakeholders that could not take part in the scheduled consultation activities

As **supporting evidence** to this report, please provide in a separate subfolder, the following:

- Materials presented during the consultation activities (e.g. presentations)
- Documentation of the feedback received (e.g. meeting notes, questionnaire answers)
- Documentation of the responses provided to stakeholders (e.g. consultation reports)

Provide an extensive description of the **changes made to the project** plans to address the concerns and issues raised during the consultation activities.

Description of the changes made to the project for addressing concerns and issues
As no one raised objections to the operation of the project, there was no response for the time being.

3 Plans for continued consultation during crediting period

Provide a description of the current plans for maintaining a continued engagement of the stakeholders during the crediting period.

Description of the plans for continued consultation of stakeholders during the crediting period
At present, the operation of the project is losing money. We hope to realize the profit of the project through the support of carbon finance, so as to drive more enterprises to join us.

4 Summary

Based on all the information provided above and the evidence provided separately, write an overall summary of the stakeholder engagement. This summary must follow the structure of this report, tackling identified stakeholders, consultation activities and outcome, and plans for continued consultation. This summary is limited to 500 words. This summary must be re-used in the Project Description.

Overall summary (500-word limit)
Through the survey, we identified five types of local stakeholders directly or indirectly related to the project, such as workers, villagers, street residents, local environmental protection authorities, and related industry experts. We then posted invitations to the project survey on the public board and sent paper versions of 30 questionnaires to the identified stakeholders. Finally, within 21 days of validity, we recovered all the questionnaires, and the recovery rate reached 100%. By analyzing all the questionnaires, we found that the vast majority of respondents supported the construction and operation of the project because they believed that the project brought many positive benefits to the local

community. In addition, perfect rules and regulations have been formulated during the operation of the project, and the rights and interests of workers have been fully protected. While the vast majority of respondents said they knew about biochar, only 30% said they knew a lot about biochar, indicating that more publicity is still needed to get people to truly understand biochar. In addition, 80% of people expressed interest in the price of biochar carbon credits, far more than the demand, indicating that a favorable price of biochar carbon credits will encourage more people to learn about biochar and join the ranks of biochar production and use. In addition, three of them suggested that the government should introduce measures to encourage similar enterprises, and that the company should continue to increase construction and produce more biochar to help improve the local soil condition.

Since no one opposes the construction and operation of the project, no response has been made for the time being. The project operator will continue to open feedback channels and welcome suggestions or comments from stakeholders at any time, whether agree or against. We will try our best to answer all the doubts and seek the support of more people.

Environmental and social safeguards questionnaire

CO_2 Removal Supplier	**Nanjing Nian'da**
Production Facility	**Nian'da Biochar Facility**
Production Facility ID	**577494**
Date of report last update (YYYY-MM-DD)	2024-09-23

Environmental and Social Safeguards Questionnaire

The purpose of this document is to provide a summary of how the CO_2 Removal Supplier complies with the environmental and social safeguards, as defined in Section 6.4 of the Puro General Rules 4.0. The responses from the supplier are expected to be commensurate with the identified impacts and risks.

This document consists of five sections, noting that the fifth section does not apply to all suppliers:

1. General overview and compliance
2. Labor practices and rights
3. Environmental impact and management
4. Social impact and community relations
5. Biomass sustainability

This document forms part of the evidence needed for the Production Facility Audit. It is corroborated by other documents and evidence provided by the supplier to Puro.earth and the 3rd-party auditors, demonstrating environmental and social safeguards. This questionnaire will be made **publicly available** in the Puro Registry.

1 General overview and compliance

Provide a description of your operations and the context where you are operating in, as relevant for environmental and social safeguards.
First of all, this project uses straw to produce biochar, and uses it to improve the soil, so it is not classified as an industrial production project. Second, the construction site of this project is 10.6km away from the nearest ecological protection red line -- Longtan Drinking Water Source Protection Area, so it is not within the scope of ecological protection red line and ecological control space. Third, the waste water, waste gas and solid waste generated by this project will be disposed of reasonably, and all kinds of pollutants can meet the corresponding emission limits after operation, and will not cause significant impact on the regional ecological environment. Fourth, the project has complete infrastructure and sufficient water and electricity supply, and will not reach the upper limit of resource utilization.

Provide an overview of the material environmental and social impacts and risks in your operations, and how they were determined.
According to the environmental impact assessment report, the project of making biochar from straw only produces ash dust and domestic waste, and does not produce toxic and harmful pollutants, which is not in the negative list of environmental access of China, so it will not have a significant impact on the environment and society and risk. **Note:** China's negative list for environmental access is a management system implemented by China to protect the ecological environment and promote green development. This system mainly through the setting of a series of prohibited or restricted industrial projects, production activities and pollutant emission behaviour, clear in a specific area is not allowed to build, expansion or reconstruction of serious pollution projects and industries.

Requirement: Abide by national and local laws, objectives, programs, and regulations and, where relevant, international conventions and agreements.	**Rule** 6.4.1.1.i
Do you comply with the requirement?	☒ Yes ☐ No
If not, how and why do you not comply? If yes, how do you know that you comply with the requirement? Please provide details considering the laws and regulations that are most relevant to your operations. Also, include any regulations that are specifically related to your carbon removal activities.	
After comparing a series of regulatory documents issued by the Chinese government, *Negative List of Market Access (2022 edition), Guidance Catalogue of Industrial Organization Adjustment (2019 edition), List of restricted land Use Projects (2012 edition)* and *List of prohibited land use Projects (2012 edition)*, I confirm that the project complies with national and local laws, objectives, plans and regulations. And these carbon removal activities are certified under the Puros' Biochar Methodology, which ensures compliance with international carbon sequestration standards, and are verified through regular third-party audit.	
Identify any documents or other records that you rely upon to verify compliance.	
See the Environmental Impact Assessment report for details	

Requirement: Respect for **human rights** and avoiding discrimination; abiding by the International Bill of Human Rights and universal instruments ratified by the host country.	**Rule** 6.4.1.1.ii
Do you comply with the requirement? Motivate below.	☒ Yes ☐ No
We are committed to abide by Chinese laws, respect employees' human rights, gender equality and non-discrimination; and abide by the International Bill of Rights.	

Requirement: Recognize, respect, and promote the protection of the rights of IPs & LCs (**indigenous peoples and local communities**) in line with applicable international human rights law, and the United Nations Declaration on the Rights of Indigenous Peoples and International Labor Organization (ILO) Convention 169 on Indigenous and Tribal Peoples.	**Rule** 6.4.1.1.iii
Do you comply with the requirement? Motivate below.	☒ Yes ☐ No
We are committed to recognize, respect, and promote the protection of the rights of IPs & LCs (indigenous peoples and local communities). However, it should be noted that there are no indigenous people on the project site.	

Note that there is an additional question on free, prior, informed consent below (section 4), and there is a requirement to publish a separate stakeholder engagement report based on a Puro template.

2 Labor practices and rights

Requirement: Labor rights and working conditions, including prohibiting forced labor, child labor or trafficked persons whether in own operations or employed by third parties, fair treatment of employees.	**Rule** 6.4.1.1.iv
Do you comply with the requirement?	☒ Yes ☐ No
If not, how and why do you not comply? If yes, how do you know that you comply with the requirement?	
We strictly abide by China's labor law, treat every employee fairly, and there is absolutely no forced labor, child labor or human trafficking. Human trafficking in China will trigger China's criminal law, and formal enterprises are afraid to do such behaviors.	
Identify any documents or other records that you rely upon to verify compliance.	
Labor Law of the People's Republic of China, Criminal Law of the People's Republic of China	

Requirement: Ensuring a safe working environment and mitigating occupational health and safety hazards.	**Rule** 6.4.1.1.iv
Describe occupational health and safety hazards that you have identified.	
The two substances produced by this project - dust and noise will lead to occupational hazards. 1. When the dust inhaled by the operators who have been exposed to production dust for a long time reaches a certain level, lung disease will be caused, rhinitis, pharyngitis, bronchitis, rash, eye conjunctival damage, etc. 2, noise can damage human hearing, causing hearing loss. Long-term exposure to noise and cause headache, tinnitus, panic, memory loss, and even cause neurosis. It may also lead to rapid heartbeat, vasospasm, hypertension, coronary heart disease, loss of appetite and so on.	
Describe the measures undertaken to mitigate the hazards.	
We have developed comprehensive measures to deal with these two types of hazards, workers must wear N95 masks, dust masks and earplugs when working, regular maintenance and overhaul of dust removal facilities to ensure their normal operation, and regular organization of staff medical check-ups.	

Requirement: Providing for equal opportunities in the context of gender; providing equal pay for equal work and protecting against and appropriately responding to violence against women and girls.	**Rule** 6.4.1.1.v
Do you comply with the requirement?	☒ Yes ☐ No

If not, how and why do you not comply? If yes, how do you know that you comply with the requirement?
Article 46 of China's Labor Law stipulates that the distribution of wages shall follow the principle of distribution according to work and implement "equal pay for equal work" without distinction of gender, age, ethnicity, disability or region. Therefore, enterprises must strictly abide by such regulations, otherwise they will be subjected to complaints from employees who are treated unfairly.
Identify any documents or other records that you rely upon to verify compliance.
Labor Law of the People's Republic of China

3 Environmental impact and management

Requirement: Pollution prevention, including pollutant emissions to air, water, and soil as well as noise and vibration, and generation of waste and release of hazardous materials, chemical pesticides, and fertilizers.	**Rule** 6.4.1.1.vi
Does the carbon removal activity result in the following impacts? For **each potential impact**, please provide detailed information about its extent and the current measures in place to mitigate these negative impacts.	
a. Pollutant discharges to air	
1, straw shredding process will produce dust, according to theoretical calculations can produce 2.4084t of dust per year. Therefore, a gas collector is set in the straw shredding process, and the collection efficiency is 80%; Then the waste gas is collected and introduced into the bag dust collector, the treatment efficiency can reach 95%; Finally, only 0.3322t/a of dust will eventually be discharged to air through 15m exhaust pipe. 2, the combustion of fuel and pyrolysis gas will produce exhaust fumes, including particulate matter and SO2 and NOx, which are sequentially passed through the cyclone dust collector and water bath dust collector, and the treatment efficiency can reach 95%; Finally, it is discharged through 15m exhaust pipe. 3, since the synthesis gas, tar and wood vinegar are directly burned in the carbonization furnace after they are produced, the remaining part will be led back to the combustion chamber for secondary combustion, so there is almost no emission of CH4, CO, VOCs. After taking these measures, the waste gas of the project meets the standard limits of Table 1 in the *Emission Standard of Air Pollutants from Industrial Furnaces (DB32/3728-2020)*, and has little impact on the surrounding atmospheric environment.	
b. Pollutant discharges to water	
This project generates only two types of waste water, namely domestic sewage and circulating cooling water for cooling kilns. 1. The project has 10 workers without room and board, and the total domestic water consumption is 125t/a based on the corresponding standard of 50L water per person per day and 250 days of annual work. The pollution production coefficient is recorded as 80%, so the domestic sewage production is 100t/a. 2. The cooling kiln of this project adopts circulating water for indirect cooling, and the circulating water is replenished regularly and does not discharge outwards. The annual consumption of circulating water is 4,800t, and the loss is recorded as 5%, so the annual water supply is 240t.As	

the domestic sewage produced in this project is used to produce organic fertilizer for returning to the field, the project will not have an impact on the surface water environment.
c. Pollutant discharges to soil
During the operation of the project, no waste water and solid waste containing toxins are produced, so it will not cause harm to the soil. In contrast, the project's product, biochar, adsorbs heavy metals from the soil and therefore has a beneficial effect on the soil.
d. Noise
The equipment will produce mechanical noise during operation, the noise can reach 70~85dB, through the installation of shock absorption base, reasonable arrangement of the location of the equipment, doors and windows closed and other measures, the noise can be reduced by 25dB, so whether during the day or at night, the factory boundary noise can meet the relevant provisions, will not have a significant impact on the lives of surrounding residents.
e. Vibration
The equipment will produce mechanical vibration during operation, and its impact on the lives of surrounding residents can be effectively reduced by installing shock-absorbing base and other measures.
f. Waste
In addition to the above mentioned waste gas, waste water, solid waste, noise, the project does not produce other waste or pollutants.
g. Release of hazardous materials
In addition to the above mentioned waste gas, waste water, solid waste, noise, the project does not produce other waste or pollutants.
h. Chemical pesticides and fertilizers
In addition to the above mentioned waste gas, waste water, solid waste, noise, the project does not produce chemical pesticide and fertilizers.

Requirement: Biodiversity conservation and sustainable management of natural resources, including avoiding or minimizing negative impacts on terrestrial and marine biodiversity and ecosystems; protecting the habitats of rare, threatened, and endangered species, including areas needed for habitat connectivity.	**Rule** 6.4.1.1.viii
Is the activity taking place in or near environmentally sensitive areas, including protected areas (e.g. nature reserve or national park), or other areas included in a conservation plan? Describe where the nearest such areas are.	
The project is located in Dapeng Village, Longtan Street, Qixia District, Nanjing. According to the environmental impact assessment, the project is not within the scope of the core area and buffer zone of the nature reserve. Not within the scope of scenic spots; It is not within the scope of the National Wetland Park and is 10.6km away from the nearest drinking water source protection area.	
Describe impacts and risks that you have identified	
The project is not harmful to biodiversity and natural resources, but has been proven to lead to healthier farmland ecosystems and increased biodiversity through soil restoration.	

Describe the measures undertaken to minimize and address the impacts and the risks.
As mentioned earlier, this project does not pose a risk to biodiversity and natural resources, so no precautionary measures need to be taken.

Requirement: Minimizing soil degradation and soil erosion.	**Rule 6.4.1.1.viii**
Describe impacts and risks to soil that you have identified.	
As mentioned earlier, this project does not pose a hazard to soil degradation and soil erosion, so there is no need to take relevant precautions. On the contrary, the biochar produced in this project has a very good effect on the remediation of contaminated soil.	
Describe the measures undertaken to minimize and address the impacts and the risks.	
Not applicable.	

Requirement: Minimizing water consumption and stress.		**Rule** 6.4.1.1.viii
Are you located in an area impacted with water stress?	☐ Yes ☒ No	
If yes, describe local conditions in terms of water stress and any risk analysis done on the impacts of the CO_2 removal activity on water stress		
The area where the project is located is near the Yangtze River, so there is no water pressure. And the operation of the project consumes only the water needed by the workers to live, so it does not put pressure on the local water supply.		
Describe any agreements and/or regulations relating to water sourcing.		
Not applicable.		
Describe the measures undertaken to minimize water consumption.		
Not applicable.		

Requirement: The CO_2 Removal Supplier shall not convert **natural forests or high conservation value habitats.**		**Rule** 6.4.1.1.viii
Do you comply with the requirement?	☒ Yes ☐ No	

If not, how and why do you not comply? If yes, how do you know that you comply with the requirement?
Yes. The project is located in a farmland ecosystem, so there will be no impact on natural forests or high conservation value habitats.
Identify any documents or other records that you rely upon to verify compliance.
The project filing certificate and environmental impact assessment can prove it.

4 Social impact and community relations

Requirement: Avoiding or minimizing adverse impacts **to community health and safety**.	**Rule** 6.4.1.1.vii
Describe potential sources of impact, taking into account all relevant factors in the given context. Consider both routine and non-routine circumstances.	
First, the project is located in a sparsely populated rural area. Secondly, the project produces almost no polluting waste gas, wastewater, solid waste, etc., and will not adversely affect the surrounding communities. Finally, the production of biochar requires the use of electricity, combustible gases, and the presence of dust in the workshop, which are often faced with adverse factors in daily production. In special cases, the equipment may fail to operate, resulting in extreme adverse effects such as fire and explosion.	
Describe the measures undertaken to minimize and address the impacts and the risks.	
We have developed a response plan for both conventional and unconventional situations. For example, under normal circumstances, we will check the power supply, equipment safety valve, dust filtration system, etc., to confirm that it is safe before starting production; Train employees in safe practices, including how to control dust, how to use fire fighting equipment, and how to evacuate in an emergency. In unconventional circumstances, such as sudden equipment failure, which may cause explosion, fire, leakage and other risks, workers will cut off the power and gas source, start the fire extinguishing system, evacuate in accordance with the pre-rehearsed route, and call the alarm phone to explain the location and situation of the fire, and seek support.	

Requirement: Preserves and protects **cultural heritage** and cultural and religious sites.	**Rule** 6.4.1.1.ix
Describe the impacts and the risks to cultural heritage and cultural and religious sites that you have identified.	
The project will have no impact or risk on cultural heritage, cultural and religious sites.	
Describe the measures undertaken to minimize and address the impacts and the risks.	
Not applicable.	

Requirement: Avoiding **forced physical** and/or **economic displacement**. If avoidance is not feasible, CO_2 Removal Suppliers shall minimize physical and/or economic displacement. This applies also to any access restrictions to lands, territories, or resources, and any customary rights of local right holders.	**Rule** 6.4.1.1.x
Did/does the activity result either in forced physical or economic displacement?	☐ Yes ☒ No
If yes, describe the impact to local communities and how it was assessed?	
No. The project was started with the consent of the local government and local villagers, so none of these conditions existed.	
Provide a comprehensive description of the process that was undertaken, compensation arrangements and measures to mitigate the negative impacts.	
Not applicable.	
Also describe in detail how you minimized forced physical or economic displacement.	
Not applicable.	

Requirement: When the activity directly or indirectly impacts **indigenous peoples** or their livelihoods, ancestral knowledge or cultural heritage, the CO_2 Removal supplier shall develop the Production Facility with free, prior, informed consent (FPIC).	**Rule** 6.4.2
Is the CO_2 removal activity taking place in an area inhabited by or claimed by indigenous people, or does it influence such an area?	☐ Yes ☒ No
If yes: does the activity directly or indirectly impact indigenous peoples or their livelihoods, ancestral knowledge or cultural heritage? How was that determined?	
No. There is no indigenous people on the project site.	
If there is a direct or indirect impact:	
a. Provide a description of the impact and the measures that were taken to minimize the impact.	
Not applicable.	
b. Describe how and when the indigenous communities were identified and approached for the FPIC process.	

Not applicable.
c. Describe the mutually agreed process for the negotiations.
Not applicable.
d. Describe how the indigenous communities were informed about the potential impacts of the activity on their livelihoods, ancestral knowledge, or cultural heritage.
Not applicable.
e. Describe the outcome of the negotiations.
Not applicable.
f. Describe how the ongoing consent process is managed to ensure that the indigenous communities continue to agree with the activity as it progresses.
Not applicable.
g. Describe grievance mechanisms that are in place for the indigenous communities.
Not applicable.
h. Describe how the impacts on the indigenous communities are monitored and addressed during the operation of the Production Facility.
Not applicable.

5 Biomass sustainability

Puro methodologies require that whenever biomass feedstock is used in the carbon removal activity, it must be sourced in a sustainable manner.	
Is your carbon removal activity based on using biomass feedstock?	☒ Yes ☐ No

Describe how you ensure that it is sourced sustainably.
For more than a decade, the local government has promoted straw crushing to return to the field, which has effectively increased the content of soil organic matter, but also caused soil acidification and "yellow water" phenomenon, seriously affecting food security and terrestrial biodiversity. Based on this, the project received strong support from the local government and local villagers, and was successfully run with the technical assistance of university professors. At present, the street office where the project is located has coordinated the project owner and the surrounding villagers to reach an agreement that the villagers will provide straw free of charge and return it to the farmers after making it into biochar, so that the source of raw materials for the project can be guaranteed to be sustainable.

Note that additional evidence will be required to demonstrate adequate biomass sourcing as per the Puro Biomass Sourcing Criteria, where applicable.

Environmental evaluation report

Document description and purpose:

A report prepared by the supplier summarizing the main negative environmental impacts entailed by the biochar production activity (e.g. emissions of pollutants to air, water, and soil, generation of solid and liquid waste, accumulation of materials in stock).

The report shall demonstrate the knowledge of the project regarding the negative impacts arising from the activity. The report shall be factual, scientific, and concise, listing sources of impacts, quantifying whenever possible the relevant emissions and waste streams on a yearly basis, and identifying measures for improvement of the environmental performance.

This report is prepared for the following Production Facility:

- **Nian'da Biochar Facility**, managed by **Nanjing Nian'da**

1. Identification of sources of environmental impacts

For the biochar production activity at the given production facility, list all potential sources of negative environmental impacts for each category listed below, and provide a brief description. Whenever possible provide details on the applicable regulation and yearly quantification of emissions.

Emissions to air

- **Dust particles (including PM10 and PM2.5)**: 1, straw shredding process will produce dust, according to the pollution coefficient of $6.69*10^{-4}$ and straw raw material 3,600t/a calculation, it can produce 2.4084t of dust per year; 2, the equipment start-up stage is powered by liquefied natural gas, which produces $2*10^{-6}$t of particles per year (negligible); 3, the exhaust gas generated during the pyrolysis process will return to the combustion chamber, so the process produces 0.864t of dust particles per year. In summary, the equipment emits dust particles 3.2724t/a, of which only 10% is discharged through 15m exhaust pipe.
- **SO_2**: The start-up phase of the plant is powered by liquefied natural gas, so it can produce 0.0073 tons of SO_2 per year.
- **NOx**: The start-up phase of the plant is powered by liquefied natural gas, so it can produce 0.0578 tons of NOx per year.
- **CH_4, CO, VOCs**: In addition, since the synthesis gas, tar and wood vinegar are directly burned in the carbonization furnace after they are produced, the remaining part will be led back to the combustion chamber for secondary combustion, so there is almost no emission of CH_4, CO, VOCs.

Emissions to water

- This project has 10 employees without accommodation and meals. According to the *Jiangsu Service Industry and Domestic Water Quota (revised in 2019)*, the water consumption is calculated as 50L per person per day, and the annual work is 250 days, then the domestic water consumption is 125t/a, the pollution production coefficient is 80%, and the domestic

sewage is 100t/a. Therefore, the annual domestic sewage produced by this project contains **COD** (0.0500t/a), **SS** (0.0400t/a), **ammonia nitrogen** (0.0045t/a), **TN** (0.0070t/a), **TP** (0.0008t/a). Because ammonia nitrogen is a fertilizer for farmland, there is no local regulation on the concentration of ammonia nitrogen in sewage return farmland.

- The water bath dust collector recycles 4800t of water per year, of which about 5% of the water will evaporate into the atmosphere through flue gas emissions, so it will replenish 240t of water per year.
- In the production process, water is used to cool the hot biochar that has just come out of the oven and prevent it from burning when it contacts with the air, which then slowly evaporates into the air.
- In any case, the project will not cause any pollution to the water body.

Emissions to soil

- The project does not involve the use of heavy metals, does not involve the discharge of toxic and harmful substances, no hazardous waste is produced, and the settlement of atmospheric pollutants has little impact on the soil.

Generation of solid waste

- The solid waste generated in this project is **dust collection of dust collector** (1.8304t/a), **water bath dust removal waste residue** (0.8208t/a), **waste cloth bag** (0.1t/a) and **household waste** (1.5t/a).

Generation of liquid waste

- Liquid waste such as wood vinegar and tar produced during the pyrolysis of biomass raw materials (which are actually gaseous at high temperatures) will be immediately burned in the main kiln of the carbonization furnace, and the unburned liquid will be led back to the combustion chamber for re-combustion, and the final project will not discharge liquid waste. So, the liquid waste provides heat for the production of biochar by incineration.

Accumulation of materials in stock at the facility

- Biomass raw materials will be packed with tons of bags, neatly placed in the plant to prevent rain wet. These do not pollute the environment.

2. Measures currently in place to mitigate negative environmental impacts

For the biochar production activity at the given production facility, list all measures that are currently implemented to mitigate any negative environmental impacts or associated risks.

Emissions to air

- **Dust particles**: 1, straw shredding process can produce 2.4084t of dust per year; 80% of them are collected by the collecting hood, treated by the bag dust collector (treatment efficiency 95%), and the other 20% is controlled by the enclosure (treatment efficiency 60%), so the process emits dust particles 0.2890t/a. 2, the combustion of exhaust gases in the combustion chamber produces 0.864t of dust particles per year, which are treated by cyclone dust removal and water bath dust removal (treatment efficiency 95%), so the process emits dust particles 0.0432t/a. In summary, the equipment emits 0.3322t of dust particles into the atmosphere every year.
- After the flue gas discharged by the facility is purified by cyclone dust collector and water bath dust collector, the maximum values of SO_2 and NO_x are 0.0604 mg/m^3 and 0.4813 mg/m^3, respectively. The administrative region where the project is located has issued the

Industrial Furnace Air Pollutant Emission Standard (DB32/3728-2020), which stipulates that the emission limits of SO_2 and NO_x are 80 mg/m^3 and 180 mg/m^3 respectively. This is sufficient to prove that the emissions of SO_2 and NO_x comply with relevant regulations.

Emissions to water

- The sewage generated by the project is mainly excrement from workers, which is collected in septic tanks. It is processed on site according to the operation process of composting, and the organic fertilizer is eventually obtained and added to the field. Therefore, there will be no pollution to the water body.

Emissions to soil

- As the heavy metal elements and organic pollution content of the produced biochar are lower than the relevant national standards, so the biochar will not pollute the soil.

Generation of solid waste

- The dust particles and waste residue collected are actually organic matter, so they are all applied to the farmland to increase the organic matter of the soil.
- After the collection of household waste, it is incinerated by the waste disposal company in accordance with local regulations.
- Waste bags are replaced every two years and handed over to the manufacturer for recycling.

Generation of liquid waste

- Due to the high temperature combustion of the carbonization furnace and combustion chamber, the equipment does not produce liquid waste.

Accumulation of materials in stock at the facility

- The raw materials are stacked in the warehouse after drying and are quickly consumed in production, so there is little pollution. We have enhanced the ventilation and repair of the warehouse to prevent the anaerobic fermentation of raw materials, so as to prevent the production of CH_4 as much as possible.

3. Measures possible to implement for improving environmental performance

For the biochar production activity at the given production facility, list measures that are not yet implemented but have been identified as possible ways to improve the environmental performance of the production facility.

Emissions to air

- Current measures are sufficient to meet the relevant criteria and no additional measures are required.

Emissions to water

- Current measures are sufficient to meet the relevant criteria and no additional measures are required.

Emissions to soil

- Current measures are sufficient to meet the relevant criteria and no additional measures are required.

Generation of solid waste

- Current measures are sufficient to meet the relevant criteria and no additional measures are required.

Generation of liquid waste

- Current measures are sufficient to meet the relevant criteria and no additional measures are required.

Accumulation of materials in stock at the facility

- Current measures are sufficient to meet the relevant criteria and no additional measures are required.

CO_2 Removal Supplier

Date: **23 / 09 / 2024**

Signature: 

Name: Shengnian Tao

Title: Legal person, Executive director

Statement of understanding of physical product decoupling

The following statement of understanding is signed by NANJING NIAN'DA ENVIRONMENTAL & TECHNOLOGY CO., LTD , with business ID 91320113MA20K7Q12L, a company duly organised and existing under the laws of China and having its registered place of business at No.6, Qimin Road, Xianlin Street, Qixia District, Nanjing , acting as CO_2 Removal Supplier.

The CO_2 Removal Supplier acknowledges and guarantees that, together with any associated subsidiaries or partners,

they have always refrained, and will continue to refrain, from marketing the biochar they produce and commercialise as "climate positive", "carbon negative", or any similar terminology,

to the exception of biochar sold to clients who are also clients of the associated CO_2 removal certificates, being in this case the rightful owners of this climate benefit,

in line with the requirements set out in the Puro General Rules, the Biochar Methodology Edition 2022, and the Platform Agreement.

CO_2 Removal Supplier

Date 23/09/2024

Location Nanjing, China

Signature

Name Shengnian Tao

Title Legal person, Executive director