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	Riberalta
Registration date (YYYY-MM-DD)	2024-10-11
Production Facility ID	292788
Location of facility	Riberalta
Host Country of removal	Bolivia
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	Exomad SRL
Supplier address	Av. 4to Anillo entre Centenario y Roca y Coronado "Torre Link" Piso 11, Santa Cruz, Bolivia
Business ID	182932023
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
Methodology edition and version	Edition: 2022 Version: 3
Date of audit completion	2024-12-18
Conclusion of audit	Positive conclusion
Auditing body	Energy Link Services Pty Ltd
Start date of crediting period	2024-07-17
End date of crediting period	2029-07-17
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	At Exomad's production facility, the carbon removal process involves turning organic waste, specifically forestry residues, into a stable form of carbon called biochar. This is done through a method called pyrolysis, which heats the waste in the absence of oxygen. Instead of burning and releasing carbon dioxide into the air, the process locks the carbon into the biochar. The biochar is then either used to improve soil quality or stored, keeping the carbon out of the atmosphere for long periods. This helps reduce the amount of greenhouse gases in the atmosphere, contributing to the fight against climate change.
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: Carretera Riberalta – Santa Rosa, Nro:SN; Zona:E. Riberalta, Bolivia Coordinates (WSG84, decimal format): WWJV+V2W, Riberalta Latitude: -11.067592789853787 Longitude: -66.05693808784213
Additional location(s)	*Specify purpose, location, address, coordinates, to the extent possible, for one or multiple additional locations relevant to the removal activity.* Click or tap here to enter text.
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: Exomad SRL Entity business ID: 182932023 Entity address: Av. 4to Anillo entre Centenario y Roca y Coronado "Torre Link" Piso 11, Santa Cruz, Bolivia Role of entity: Bolivian Contractor for Biochar Operations
Organization 2	*Entity name:* *Entity business ID:* *Entity address:* *Role of entity:*

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

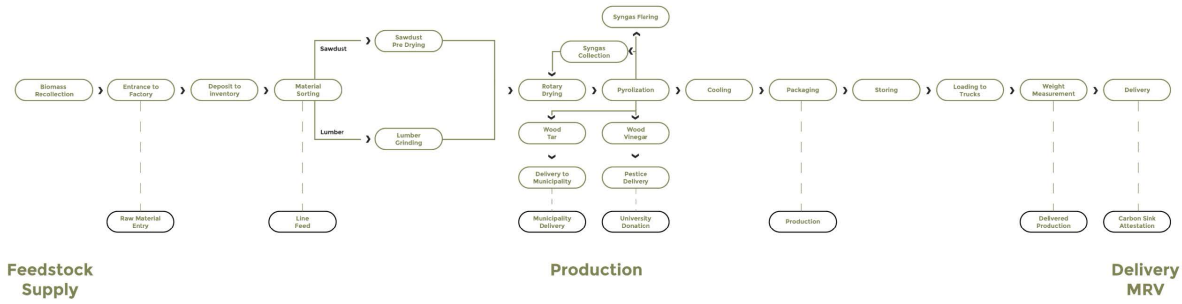
The information in this section provides more technical details about the technologies and processes deployed to achieve carbon dioxide removal.

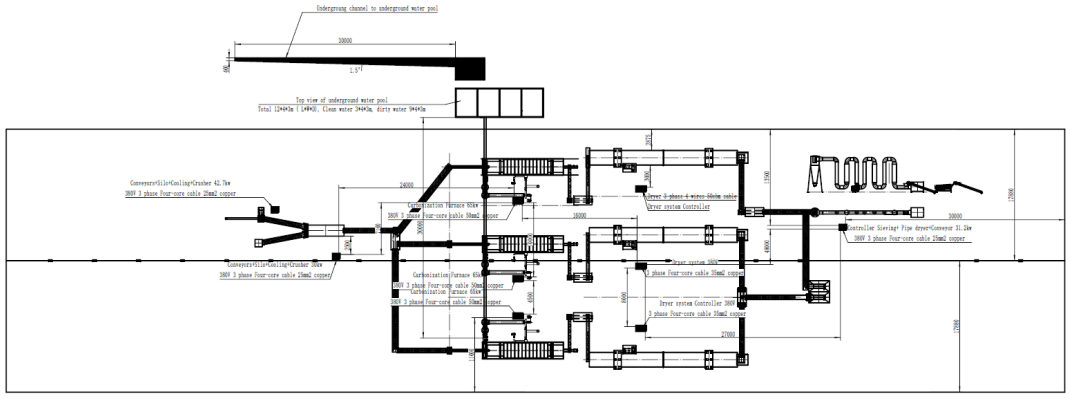
3.1 Technical description

Instructions	*Please provide a technical description of the carbon removal activity taking place at the production facility. Word limit: 500 words.*
Technical description	Exomad's carbon removal activity centers on the production of biochar through a process known as pyrolysis, which involves thermally decomposing biomass feedstock in the absence of oxygen. This process is carried out at high temperatures (typically between 550°C and 750°C), converting hardwood residues sourced from sustainably managed forestry operations, into biochar – a stable form of carbon that can remain sequestered in soil for hundreds to thousands of years.
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	Exomad's carbon removal activity fits within the scope of the Puro Standard Biochar Methodology by adhering to the requirements for biochar production and carbon sequestration. The project boundary includes the entire lifecycle of the biochar production process, starting from sourcing sustainable biomass (forestry residues) to the pyrolysis process, biochar production, and its application. The system boundary aligns with the cradle-to-grave approach, covering biomass sourcing, biochar production, transportation, and final use. Emissions from all stages are accounted for in compliance with life cycle

	assessment (LCA) principles, ensuring that the biochar produced meets the standard's carbon sequestration requirements.
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	
The baseline scenario for Exomad's carbon removal activity involves the disposal of forestry biomass residues through traditional means, such as open burning or decomposition. In this scenario, the biomass would decay or be incinerated, releasing stored carbon back into the atmosphere in the form of CO2 and methane, contributing to greenhouse gas emissions. Without the biochar production process, these emissions would continue to occur, leading to a significant environmental impact. The project baseline assumes no carbon sequestration would take place, and no additional environmental or soil health benefits would be realized from the residues. The shift to biochar production provides a net-positive carbon removal solution by stabilizing carbon in a solid form and avoiding emissions.	
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	The selected baseline scenario for Exomad's carbon removal activity is biomass open burning or natural decomposition. This scenario is explicitly defined in the Puro Standard Biochar Methodology as a common outcome for forestry residues, where the biomass would either decay naturally or be burned, releasing carbon dioxide (CO2) and methane (CH4) into the atmosphere. By choosing biochar production as an alternative, Exomad avoids these emissions, stabilizing the carbon in biochar for long-term sequestration. This baseline aligns with the methodology's requirements for demonstrating additionality through avoided emissions.
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	
Exomad's biochar project demonstrates that the carbon removals achieved are above and beyond what would occur in the baseline scenario. The baseline involves the open burning of forestry residues, which does not result in carbon removal but rather contributes to emissions. The project is not mandated by any legal or regulatory frameworks in Bolivia, confirming regulatory additionality. Financially, the project depends on carbon credits to cover operational costs, as	

biochar market development in Bolivia is still limited. Without carbon finance, the project would not be viable, further proving its financial additionality.
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	Puro Additionality V1.9
	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	
The quantification of net carbon dioxide removal at Exomad is implemented according to the Puro Standard methodology. The calculation follows the CORC equation, which accounts for the carbon sequestered in biochar and deducts emissions from the supply chain and production processes. 1. **Biochar Carbon Storage**: The amount of biochar produced is measured in dry metric tons, and laboratory analyses determine the organic carbon content and hydrogen-to-carbon ratio (H/Corg). These factors are used to calculate the amount of stable carbon sequestered over 100 years (Estored). 2. **Supply Chain Emissions**: Emissions from biomass collection, transport, and biochar production are tracked and included in the calculation. These emissions are derived from fuel usage for transport, machinery, and energy consumed during pyrolysis. 3. **Monitoring**: Continuous monitoring of biochar production ensures accurate reporting of volumes and composition. Biochar properties, such as carbon content and stability, are regularly tested to ensure compliance with Puro's standards. The final net CO_2 removal is calculated by subtracting all supply-chain emissions from the total carbon sequestered, ensuring that the project achieves net-negative carbon removal.	
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

Exomad has established a comprehensive monitoring and reporting plan to ensure the safety, eligibility, and accurate quantification of its carbon removal activities. The plan adheres to the standards outlined by the Puro methodology and is designed to maintain transparency and accountability in biochar production.

i) Safety of the Removal Activity

The monitoring plan incorporates strict safety protocols to mitigate risks associated with the pyrolysis process. These protocols include regular inspections of the pyrolysis equipment to ensure proper functioning and avoid accidents. Safety training is provided to all staff involved in the process, and emergency response plans are in place for handling unforeseen incidents such as equipment malfunctions or fires. Monitoring sensors are installed to track operating temperatures and control emissions, ensuring that the pyrolysis process runs within safe parameters. Additionally, air quality around the facility is monitored to prevent harmful exposure to workers and the surrounding community.

ii) Eligibility of the Removal Activity

The eligibility of the removal activity is maintained through continuous verification of the sustainability of biomass feedstock. Exomad sources biomass from sustainably managed forests, verified by Bolivia's forestry authorities. Regular audits of feedstock suppliers ensure compliance with sustainability criteria, and all biomass must meet the non-hazardous, forestry residue classification required by the Puro Standard.

To further guarantee eligibility, Exomad submits regular reports on feedstock sourcing, biochar production, and emissions tracking. These reports are reviewed by third-party auditors to confirm that the removal activity aligns with the standards set by Puro. The company also adheres to the "no double-counting" principle, ensuring that carbon removal credits are unique and not claimed by other parties.

iii) Precise Quantification of CORCs

Exomad follows a robust monitoring protocol to ensure precise quantification of carbon dioxide removal certificates (CORCs). The biochar produced at the facility is measured in dry metric tons, and laboratory tests are performed to determine the carbon content and the hydrogen-to-carbon ratio (H/Corg), which are essential for calculating stable carbon storage.

The monitoring plan includes:

- **Continuous Measurement**: The facility records the amount of biomass processed, biochar produced, and energy consumed. The data collected is cross-checked against operational logs to ensure accuracy.
- **Laboratory Testing**: Samples of biochar are regularly sent to accredited laboratories to verify carbon content and stability. These tests are critical for determining the long-term sequestration potential of the biochar.
- **Supply Chain Emissions**: Emissions from the collection, transportation, and pyrolysis of biomass are tracked and reported. This includes fuel consumption for transporting biomass and energy use during biochar production. All emissions are deducted from the total carbon sequestration to calculate net CO2 removal.

Reporting

Exomad submits monthly and annual reports documenting the entire process, from biomass sourcing to biochar application. These reports include data on biochar production volumes, carbon content, emissions, and safety compliance. The reports are reviewed by third-party auditors to ensure adherence to Puro's standards and transparency in CORC generation.

This rigorous monitoring and reporting plan ensures that Exomad's carbon removal activity is safe, eligible, and accurately quantified, guaranteeing the integrity of the carbon credits produced.

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: Contains confidential information
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

The Life Cycle Assessment (LCA) of Exomad's biochar production facility in Riberalta, Bolivia, was conducted to quantify the environmental impact and carbon removal potential of the operation. The assessment follows the **Puro.Earth Edition 2022 v3 methodology** and adopts a cradle-to-grave approach. The system boundaries include the collection of biomass from local sawmills, transportation, biochar production, and the transportation and application of biochar.

Key Aspects:

1. **Biomass Collection and Transportation**: The biomass feedstock is sourced from ten nearby sawmills within an average transport distance of 7.84 km. The emissions associated with transportation are calculated using diesel consumption data for trucks, including return trips and loading activities.
2. **Biochar Production**: The pyrolysis process operates continuously with three reactors, using liquefied petroleum gas (LPG) for start-up. The machinery involved, including crushers and dryers, is accounted for from manufacturing to end-of-life. The facility consumes 16.7 kWh per ton of biochar produced and requires minimal fossil fuel inputs during operations.
3. **Supply Chain Emissions**: The emissions generated during the collection, transport, and production phases are calculated using Ecoinvent 3.9.1 datasets. Emissions are recorded from diesel consumption, LPG combustion, and electricity use during biochar production.
4. **Carbon Sequestration**: The organic carbon content of the biochar is analyzed, and the carbon sequestration potential is determined using Puro.earth's CORC calculation method. The biochar produced is confirmed to store carbon stably for over 100 years, with a final CORC ratio of **2.041 tons of CO2 equivalent sequestered per dry ton of biochar**.
5. **End Use**: Biochar is applied to local farmlands within a 50 km radius. The transportation and spreading of biochar are included in the assessment, though no further environmental impacts occur after the application.

Emission Factors and Results:

- **Ebiomass** (biomass transport) and **Eproduction** (biochar production) represent the largest sources of emissions. However, the significant carbon storage (Estored) from biochar outweighs these emissions, resulting in a net-negative carbon footprint.
- The analysis concludes that biochar production at the Riberalta facility achieves a substantial net carbon removal, supporting the generation of **CORCs**.

This LCA provides a detailed breakdown of the environmental performance and carbon sequestration capabilities of Exomad's biochar production facility.
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	Riberalta LCA
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	
The stakeholder engagement process for Exomad's biochar production facility in Riberalta was conducted in accordance with Puro's General Rules and Stakeholder Engagement Requirements. The engagement included various groups such as local residents, farmers, indigenous communities and sawmill operators. **Identified Stakeholders:** • **Local Residents**: Citizens of Riberalta are expected to benefit from job creation and reduced air pollution. • **Farmers and Indigenous Communities**: These groups will receive biochar to improve soil quality, helping reduce slash-and-burn practices and deforestation. • **Sawmill Operators**: They will benefit from free collection of forestry residues, lowering fire risks and disposal costs. **Consultation Activities:** The engagement involved public meetings, verbal invitations, and direct consultations with local stakeholders. Key feedback received included questions on the benefits of biochar, its application rates, and job creation potential. Exomad provided detailed responses and reassured stakeholders that biochar would be distributed for free, creating economic and environmental benefits. **Continued Engagement:** Exomad plans to maintain ongoing engagement through agricultural training, supplier onboarding protocols, educational programs, and health initiatives, ensuring active participation from all stakeholders throughout the project's duration.	
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	

Exomad has implemented a comprehensive set of environmental and social safeguards in line with Puro's General Rules, ensuring compliance with local, national, and international standards. Below is a summary of the key safeguards:

Environmental Safeguards:

1. **Pollution Prevention**: Exomad significantly minimizes air pollution by using pyrolysis to convert biomass into biochar. During this process, harmful gases like methane and volatile organic compounds are captured and reused to power the system, ensuring minimal emissions. The facility also complies with regulations on water, soil, noise, and vibration impacts, maintaining a closed-loop system that minimizes waste and prevents pollution.
2. **Biodiversity Conservation**: The facility is not located near environmentally sensitive areas, and all biomass feedstock is sourced from sustainable forestry operations verified by Bolivian authorities. Exomad adheres to stringent forestry management regulations, ensuring that the surrounding biodiversity and ecosystems remain protected.
3. **Sustainable Biomass Sourcing**: The biomass feedstock consists of hardwood residues from sustainable forestry practices. Exomad follows Bolivia's forestry regulations and performs regular audits to ensure compliance with sustainability standards.
4. **Soil Health and Water Retention**: The application of biochar in agriculture improves soil fertility and water retention, reducing the risk of soil erosion and enhancing long-term soil health. This helps mitigate environmental risks like soil degradation.

Social Safeguards:

1. **Labor Rights and Working Conditions**: Exomad complies with all labor rights requirements, ensuring fair treatment, equal opportunities, and a safe working environment. Policies are in place to prevent forced labor, child labor, and discrimination. Regular audits and compliance checks ensure adherence to these labor standards.
2. **Community Health and Safety**: The company has implemented measures to minimize impacts on community health and safety, particularly from emissions and potential non-routine incidents like equipment malfunctions. Safety protocols, regular maintenance, and emergency response plans are in place to protect both the workforce and nearby communities.
3. **Indigenous and Local Community Engagement**: Exomad actively engages with indigenous and local communities, ensuring they benefit from the project. Indigenous groups receive biochar for agricultural use, improving crop yields and reducing the need for environmentally harmful practices like slash-and-burn agriculture.
4. **Free, Prior, and Informed Consent (FPIC)**: Indigenous communities in the area have given their FPIC for the project. Exomad ensures ongoing engagement and maintains a

grievance mechanism for these communities, allowing for continuous feedback and collaboration throughout the project's life. These safeguards ensure that Exomad's operations are environmentally and socially responsible, aligning with both Puro's standards and broader sustainability goals.
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:

Environmental and social safeguards questionnaire (required)	Filename	Puro Environmental and Social Safeguard
	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: Business License ID of permit: 013509 Issuer of permit: Riberalta Municipality Date of issuance: 30-Aug-2024 Permit file (.pdf): Riberalta Business Licence Permit URL (if available):
	Name of permit: Environmental Permit ID of permit: 0802010285 Issuer of permit: Riberalta Municipality Date of issuance: 30th July 2002 Permit file (.pdf): Environmental permit - Riberalta 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: Environmental Impact Filename of report: Environmental Impact Study 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: Environmental Impact Filename of report: Environmental Impact Study Can the report be published in the Puro Registry: No
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	The climate benefit SDG 13 resulting from carbon removal is quantified and certified as CO2 Removal Certificates (CORCs). Exomad considers providing additional evidence as to the quantifiability of the positive impacts when available.
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	Puro Additionality V1.9	13
2	Riberalta LCA	46
3	Stakeholder Engagement Report	14
4	Puro Environmental and Social Safeguard	11

5		
6		
7		
8		
9		
10		
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.

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Biochar

Carbon Credit Removal Calculation

LCA Report

Version 003 – Nov 29th, 2024

Table of Contents

List of Tables and Figures

Abstract

This environmental life cycle assessment (LCA) aims to cover the production and use of biochar in Riberalta (Bolivia) on a preliminary stage. This study fulfills the Puro.earth Edition 2024 v3 for the calculation of the Carbon CO2 Removal Certificate (CORC). This LCA was performed based on this confirmed description and any deviation qualitative or quantitative would imply deviations with the environmental impact values quantified hereinafter. It is out of responsibility of the LCA practitioner any liability or discrepancy between processes described in this study and the facility and the submission of this LCA to Puro.Earth by EXOMAD implies the full conformity of processes and materials described herein. The biochar facility is under operation and main equipment are depicted in Annex A. Real tests with biochar produced in the facility are provided in Annex B, while the results of test of gases in Annex C.

Table 1-1 describes the CORC ratio obtained in terms of CORCs per ton of biochar.

Table 1-1: CORC ratio (tCO2e-sequestered/dry.ton.biochar)

Parameter	Unit	Value
CORC ratio	tCO_2e/ dry.ton.biochar	2.322

1. Goal of the Study

The objective of this Life Cycle Assessment (LCA) is to evaluate the environmental impact and carbon sequestration potential associated with biochar production and utilization. This assessment employs attributional LCA modeling and is intended to inform financial planning and Carbon Removal Certificate (CORC) issuance under Puro.Earth v.2. The trial period for this assessment spans from July 8th to September 6th, 2024.

The primary audience for this LCA includes reviewers and verifiers involved in the CORC issuance process within Puro.Earth. This preliminary LCA aims to outline the CORC potential of the Riberalta biochar project, providing a foundational analysis that will be refined with more extensive data and a more established learning curve in future updates.

2. Scope of the Study

The subsequent sections outline the comprehensive scope of the project aimed at achieving the stated objectives. This encompasses, but is not limited to, the following elements:

- **Identification of Specific Product Systems: Detailed assessment of the product systems involved.**
- **Product Function(s): Clarification of the functions served by the products.**
- **Functional Unit and Reference Flows: Definition of the functional unit and the associated reference flows.**
- **System Boundary: Establishment of the boundaries within which the system operates.**
- **Allocation Procedures: Description of the procedures for allocating inputs and outputs.**
- **Cut-off Criteria: Specification of the criteria for including or excluding certain data or processes from the study.**

2.1. Product System(s)

This declaration covers the biochar production from cradle-to-grave. The product activity considered in this study is as follows:

- **Collection & Transportation of Waste Biomass to Biochar Facility**
- **Biochar Production**
- **Biochar Transportation to Final point.**

This LCA is based on primary information recorded and provided by Exomad and real test on biochar generated in between July 8th to September 6th 2024.

2.2. Application

This study serves to generate quantitative results for CORC generation within the Puro.Earth v3 methodology.

2.3. Functional Unit

The functional unit considered was 1 ton of biochar produced and used.

2.4. System Boundaries

The system boundaries were considered as per Puro.earth methodology following a cradle-to-grave approach, this is considering waste biomass burden free at the farm site and accounting for the collection, transportation, manufacturing processes and biochar use. Thus, it is included the collection and transportation of waste biomass to the biochar facitility (A2), the biochar production (A3), the transportation of biochar to point of final use (A4) and use of biochar (B1), as described in Figure 2-1 -depicted in the Puro.earth Edition 2024 v3 methodology. The A3 system diagram is described with detail in Annex B.

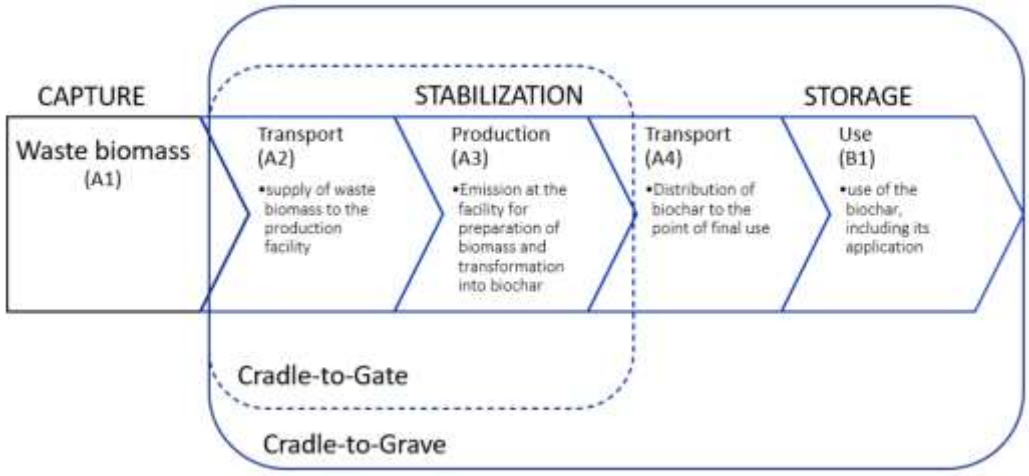


Figure 2-1 System boundaries as per Puro.earth Edition 2024 v3 (Puro.earth, 2024)

2.4.1. Time Coverage

The data is intended to represent the period of July 8th to September 6th, (biomass collection started in July 8th, while pyrolysis July 17th) created based on the testing period.

2.4.2. Technology Coverage

This study is intended to be representative of the existing biochar production in the site. All foreground data was collected by Exomad in 2024.

2.4.3. Geographical Coverage

This background LCA represents construction testing operation and the background data is

representative of this operation without exception.

2.5. Allocation

2.5.1. Multi-output Allocation

No co-product or multi- input allocation occurs in the product foreground system.

2.5.2. End-of-Life Allocation

Cut-off approach was considered within the gate-to-gate boundaries of this study.

2.6. Cut-off Criteria

No cut-off criteria is defined for this study, although it could be stablished that 99% of the input mass flows were considered.

2.7. Selection of LCIA Methodology and Impact Categories

The increasing awareness of the importance of sustainability and the potential environmental consequences associated with products and services has sparked the innovation of methods to better understand, measure and reduce this impact. The leading tool for achieving this – and the only tool that can make a full evaluation of all sources and types of impact over the entire life cycle of a product – is LCA, a methodology defined by the International Organization for Standardization (ISO) 14040-14044:2006 standards.

LCA is an internationally recognized approach that evaluates the potential environmental and human health impact associated with products and services throughout their life cycle, beginning with raw material extraction and including transportation, production, use, and end-of-life treatment. Among other uses, LCA can identify opportunities to improve the environmental performance of products at various points in their life cycle, inform decision-making, and support marketing and communication efforts.

This LCA was performed on openLCA 1.11.0 using Ecoinvent 3.9.1 (Wernet et al., 2016).

The IPCC AR6 greenhouse gases was considered as per Table 2-1.

Table 2-1 Greenhouse gases potential of different gases

Parameter	Description	Unit	Source
Carbon dioxide, fossil	1	kg CO_2 eq.	IPCC AR6
Methane, fossil	29	kg CO_2 eq.	IPCC AR6
Methane, biogenic	27	kg CO_2 eq.	IPCC AR6
Dinitrogen monoxide	273	kg CO_2 eq.	IPCC AR6

2.8. Interpretation to be Used

The interpretation discusses the relevant findings and the data quality. No grouping or further quantitative cross- category weighting of impact categories has been applied. Instead, each impact is discussed in isolation, with- out reference to other impact categories before final conclusions and recommendations are made.

2.9. Data Quality Requirements

The data utilized for the inventory model must be as precise, complete, consistent, and representative as possible, considering the study's goal and scope within the given time and budget constraints.

- **Precision: Measured primary data are prioritized for their high precision, followed by calculated data, literature data, and estimated data. The objective is to model all relevant foreground processes using measured or calculated primary data.**

- **Completeness: This is evaluated based on the thoroughness of inputs and outputs per unit process and the completeness of the unit processes themselves. The aim is to capture all pertinent data.**

- **Consistency: Ensuring that differences in results reflect actual differences between product systems, not inconsistencies in modeling choices, data sources, emission factors, or other artifacts, is crucial.**

- **Reproducibility: The study should provide sufficient transparency to allow third parties to approximate the reported results, though this may be limited by the exclusion of confidential primary data and access to the same background data sources.**

- **Representativeness: The data should align with the geographical, temporal, and technological requirements defined in the study's goal and scope. The goal is to use the most representative primary data for all foreground processes and the most representative industry-average data for all background processes. When such data are unavailable, the best-available proxy data are employed.**

2.10. Software and Database

The LCA model was created using the openLCA 1.11.0 coupled with the ecoinvent 3.9.1 database.

2.11. Scenario analysis

No sensitivity study was performed.

2.12. Critical Review

No critical third-party review was performed.

3. Life Cycle Inventory Analysis

3.1. Data Collection Procedure

All primary data was collected during the testing operation.

3.2. Product System

3.2.1. Overview of Product System

The product life cycle modules (system boundary) was considered cradle-to-grave to fully comply with the Puro.Earth v3 methodology.

Table 3-1 Inputs from Questionnaire

Concept	Unit	Value	Phase
Testing period		July 8th – September 6th. Biomass collection started July 8th, while pyrolysis July 17th.	
Biomass consumption (wet basis)	ton	6941	A2
Diesel consumption for biomass collection (Riberalta – sawmill- Riberalta)	litre	6860 (4260 in dumptrucks and 2600 in loaders)	A2
Diesel consumption for machinery in Riberalta site (management of biomass and biochar)	litre	5260 (1160 forklifts, 2600 loaders and 1500 others)	A3
Electricity consumption in Riberalta	kWh	39315 (July 19th-Sept 18th)	A3
Liquified Petroleum Gas (LPG) for pyrolysis switch on	kg	1440	A3
Biochar production (wet basis)	ton	1550 (18%)	A3
Biochar production (dry basis)	ton	1271	A3
Share of CH4 (methane) in syngas	%	15%	A3
Methane content after flaring	%	0%	A3
Diesel consumption for biochar transportation to final point	litre	1420	A4

Table 3-2 Distances of sawmills and coordinates

Site	Coordinates (lat, lon)	Distance (km)
ASERRADERO LEOVEL SRL	(-11.063781°, -66.057541°)	0.9
ASERRADERO INDUSTRIA MADERERA MARTINEZ S.R.L. INDUSMAR S.R.L.	(-11.035334°, -66.049852°)	4.4
IMPORT EXPORT CONCIENCIA FORESTAL S.R.L.	(-11.030818°, -66.033274°)	6.3
ASERRADERO FAMABU	(-11.116361°, -66.092841°)	6.7
ASERRADERO EMPRESA FORESTAL Y AGRICOLA BOLITAL LTDA	(-10.994608°, -66.062353°)	9.5
ASERRADERO MABET	(-11.0403727°, 66.0478745°)	3.5
ASERRADERO DON LUIS Y PACHAMAMA S.R.L.	(-10.988357°, -66.055723°)	10.5
ASERRADERO OURO VERDE WOOD SRL	(-10.978994°, -66.052406°)	11.7
ASERRADERO MADERERA JORONOMA	(-10.972271°, -66.049428°)	12.5
ASERRADERO MANORBOL SRL	(-10.972836°, -66.049916°)	12.4
RIBERALTA BIOCHAR SITE	(-11.0690742°, -66.057043°)	-

Table 3-3 Species considered for biochar production

Local Name	Share (%)
Garapa (almendrillo amarillo)	10
Cumarú (Almendrillo negro)	15
Ipe	15
Aliso	20
Roble	15
Otros	25

3.2.2 Assumptions

Apart from the information provided through the Questionnaire, this LCA was performed considering the following assumptions, which try to cover those inputs without information at the moment of developing this LCA.

- Sustainable biomass sourced. According to Puro.earth it is required that biomass is

sourced from sustainable sources, which is described as the Positive List Feedstock of the European Biochar Certificate1. Thus, according to this list the waste biomass corresponds to the process F-03, this is wood and wood residues from mechanical processing (waste wood A1), which states that this wood should come from "only from certified, sustainable forestry. Approved are the FSC and the PEFC labels, others on request. For EBC-Feed: only from defined, well documented sources, biomass from municipal collection not allowed". Thus, it is responsibility of EXOMAD to ensure sustainability of biomass from FSC, PEFC or other methods, on request.

- **No detailed information regarding maintenance neither refrigerants (if any) was provided. To account for the use of industrial lubricant 320 and grease #3, it was assumed a consumption of 100 kg of unspecified industrial lubricating oil per year.**
- **The pyrolizers were considered to be shipped from Qingdao (China) to Iquique (Chile) by international ship at a distance of 18,427 km and from Iquique to Riberalta by truck at a distance of 1,628 km.**
- **Bio-oil produced at 10 liters per ton of biochar with density of 0.85kg/liter.**
- **The factory building was estimated to have a 50-year lifespan.**
- **Electricity consumption was considered from the national grid in Bolivia at medium voltage.**
- **1.73 liters of diesel per ton of biochar for use phase. This is a conservative figure corresponding to manure spread.**

3.3. Background Data

3.3.1. Life cycle inventories

Documentation for all life cycle inventories was obtained from ecoinvent 3.9.1 as depicted in Table 3-4.

Table 3-4: Key datasets used in inventory analysis.

Process	Unit	Description
Truck transportation	ton.km	market for transport, freight, lorry 7.5-16 metric ton, EURO5 | transport, freight, lorry 7.5-16 metric ton, EURO5 | cut-off, U GLO
National electricity	kWh	market for electricity, medium voltage | electricity, medium voltage | cut-off, U BO
Liquified petroleum gas manufacturing & distribution	kg	market for liquefied petroleum gas | liquefied petroleum gas | cut-off, U RoW
Burning of LPG	MJ (0.02266 kg of LPG)	heat production, propane, at industrial furnace >100kW | heat, district or industrial, other than natural gas | cut-off, U
Machine steel	kg	industrial machine production, heavy, unspecified | industrial machine, heavy, unspecified | Cutoff, S

[1] Positive list of biomass feedstock https://www.european-biochar.org/en/ct/2-EBC-guidelines-documents-for-the-certification [Accessed May 29th, 2023]

Factory facility	**item**	**wood pellet factory production | wood pellet factory | Cutoff, S**
Diesel	**MJ (0.02643 liter of diesel)**	**diesel, burned in agricultural machinery | diesel, burned in agricultural machinery | Cutoff, S**
Lubricant	**kg**	**lubricating oil production | lubricating oil | Cutoff, S RoW**
Truck long distance	**ton.km**	**market for transport, freight, lorry 16-32 metric ton, EURO5 | transport, freight, lorry 16-32 metric ton, EURO5 | Cutoff, S Glo**
Ship	**ton.km**	**market for transport, freight, sea, container ship | transport, freight, sea, container ship | Cutoff, S Glo**
Crusher manufacturing	**1 item of 2500 kg including concrete foundation**	**market for chipper, stationary, electric | chipper, stationary, electric | Cutoff, S Glo**
Auxiliary machinery	**MJ (0.02643 liter of diesel)**	**market for diesel, burned in agricultural machinery | diesel, burned in agricultural machinery | Cutoff, S**
Airborne emissions through stack	**1 kg of biochar**	**modelled based on-Exomad biochar site**

3.3.2. Puro.Earth 2.0 application

The Puro.Earth methodology provides a detailed methodology for computing the carbon reduction, which is based on the following expression.

$$CORCs = E_{stored} - E_{biomass} - E_{production} - E_{use}$$

Where CORCs stands for carbon dioxide removal certificates as the amount of net CO_2eq removed over 100-year period by the biochar production activity, E_{stored} for the amount of CO_2 sequestered over a 100-year time horizon by the amount of biochar produced over the reporting period, $E_{biomass}$ the life cycle greenhouse gas emissions arising from the production and supply of biomass to the production facility, including land use changes, $E_{production}$ the lifecycle greenhouse gas emissions arising from the transformation of the biomass into biochar at the producing facility for and E_{use} for the life cycle greenhouse gas emissions arising from the use of the biochar, including its distribution up to the point of final use. Units for all these components are tonnes of CO_2eq.

For the final results it is referred to Table 3-9.

3.3.3. E_{stored} calculation

The E_{stored} was computed considering the methodology of Puro.earth as follows.

$$E_{stored} = Q_{biochar} \cdot C_{org} \cdot F_p^{TH,Ts} \cdot \frac{44}{12}$$

Where $Q_{biochar}$ stands for the amount of biochar produced over the reporting period. It is expressed in dry metric tonnes of biochar. Care must be taken to exclude any moisture, as including water would lead to an overestimation of the carbon actually sequestered. C_{org} is the organic carbon content of the biochar produced. It is expressed in dry weight of organic carbon over dry weight of

biochar, $F_p^{TH,Ts}$ is the performance factor of biochar organic carbon over a given time horizon, TH, in a given soil at temperature T_s.

The $F_p^{TH,Ts}$ can be calculated as follows:

$$F_p^{TH,Ts} = c + m \cdot \frac{H}{C_{org}}$$

$$\frac{H}{C_{org}} = \frac{m_H(\%)}{m_c(\%)} \cdot \frac{12}{1.0}$$

The regressions coefficients c and m are a function of the time horizon TH of 100 years, and the soil temperature Ts as per Table 3-5. m_H and m_c stand for the hydrogen mass content by the organic carbon mass content of the biochar from the laboratory analysis.

Table 3-5 Regression coefficients for performance factor of biochar according to Puro.earth

Soil temperature	c	m
5ºC	1.13	-0.46
10ºC	1.1	-0.59
15ºC	1.04	-0.64
20ºC	1.01	-0.65
25ºC	0.98	-0.66

The Ts was obtained from Lembrechts et al (2021)2 for the region of interest (longitude: -66º to -67º; latitude: -12º to -11º) obtaining a value of Ts of 25.3ºC. Thus, according to this it implies a c and m of 0.9782 (obtained with linear proportion for 25.3ºC between 20ºC and 25ºC) and -0.6606 (obtained with linear proportion for 25.3ºC between 20ºC and 25ºC), respectively. Then, the $F_p^{TH,Ts}$ is estimated with the expression below.

$$F_p^{TH,Ts} = 0.9782 - 0.6606 \cdot \frac{m_H(\%)}{m_c(\%)} \cdot \frac{12}{1.0}$$

2 Lembrechts et al., 2021. URL: https://doi.org/10.1111/gcb.16060 [Accessed May 19th, 2023]

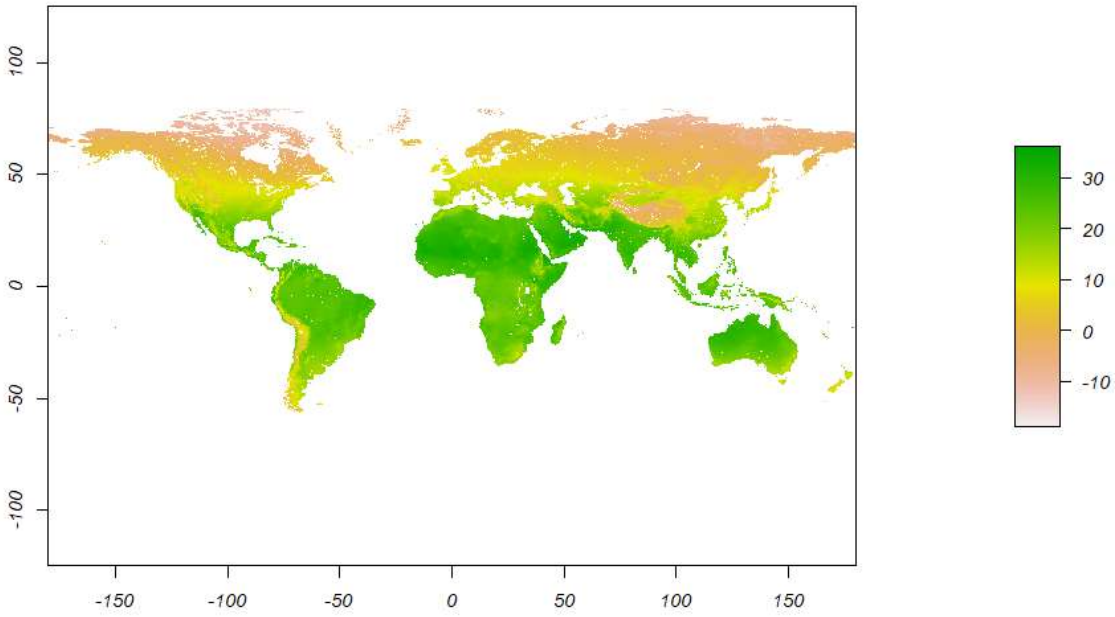


Figure 3-1Global soil temperature zones recommended by Puro.earth methodology. Source: Lembrechts et al. (2021) and own elaboration figure

Thus, considering the results obtained from biochar on-site produced (Test results in Annex B) it is calculated the E_{stored} as depicted in Table 3-6.

Table 3-6 Carbon stored with Puro.earth

$Q_{biochar}$ (dry tonnes)	C_{org} (%)	H/C_{org}	E_{stored} (tCO_2e)
1,271	83.3	0.25	2,546

3.3.4. $E_{biomass}$ calculation

The $E_{biomass}$ considers the boundaries of Figure 2-1, which only account for the biomass transport (including the emissions arising from transport of the biomass from the collection points), in this case the load and transportation from sawmills to the biochar production facility. $E_{biomass}$ was based on the diesel consumption considering the use of machinery on a cradle-to-gate perspective.
No particular infrastructures (roads, dirt roads, bridges, etc.) were built with the special purpose of transportation waste biomass from sawmills to the biochar production facility. Indeed, most of the sawmills were located very near (in the same city) of the biochar production facility. This explains the strikingly low distances described in Table 3-2.

3.3.5. $E_{production}$ calculation

Regarding the $E_{production}$, it accounts for all the activities within the biochar production process considering the handling processes, drying, chipping, operation of the pyrolysis reactor, post-processing operations and biochar handling on site including packaging. Machines were

considered from cradle-to-grave, this is considering manufacturing, transportation, use and end-of-life.

Figure 3-2 depicts the biochar production process with the machines involved. Technical datasheets of these machines are provided in Table 3-6 and also provided as a full document in Annex A.

Received biomass is loaded with truck lifters into the crusher, which can be modeled considering the ecoinvent 3.9 inventory corresponding to "market for chipper, stationary, electric | chipper, stationary, electric | Cutoff, S GLO" corresponding to a 2,500 kg electric crusher (attributional modeling). The crusher has an electric power capacity of 37 kW and requires no other fossil fuel. Then, the crushed waste biomass is introduced with belt conveyors into the rotary drier, whose full process is depicted in Figure 3-3. No source of fossil fuel is required for the rotary drier since it gets advantage of the heat generated in the rotary carbonization furnace. The rotary drier requires 38 kW of electricity. The rotating drier was modeled considering the ecoinvent 3.9 inventory of "industrial machine production, heavy, unspecified | industrial machine, heavy, unspecified | Cutoff, S".

The impact of electricity was considered accounting for the life cycle impact assessment (LCIA) of electricity at medium voltage in Bolivia from ecoinvent 3.9.1. It must be noted that the electricity consumption corresponds to full months, while the pyrolysis period comprised July 17th-September 6th. A lifespan of 10 years for components and 50 years for the factory building was considered with an end-of-life process assumed be equivalent to the machine manufacturing and transportation processes.

Figure 3-2 Biochar production process selected. Source: Gongyi Xiaoyi Mingyang (2022)

Table 3-7 Technical details of equipments

Machine	Power	Weight
Crusher	37 kW	1 tons

Rotary drier	38 kW	12 tons
Rotary Carbonization Furnace	38 kW + 15 kW (preheating)	7 tons
	75 kW + 15 kW (preheating)	20 tons

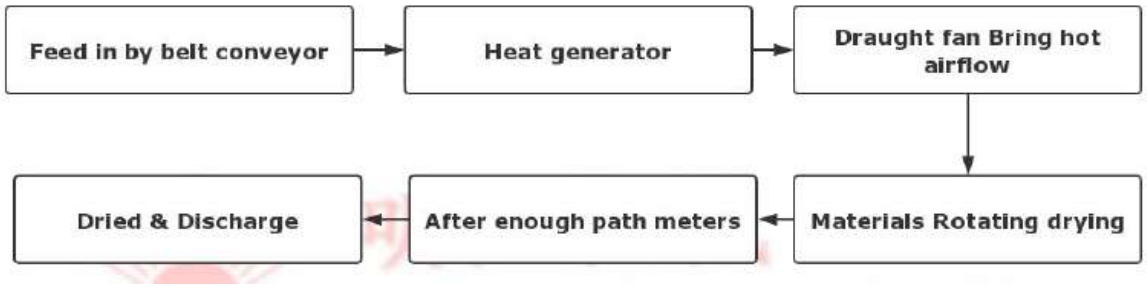


Figure 3-3 Drying process considered. Source: Gongyi Xiaoyi Mingyang (2024)

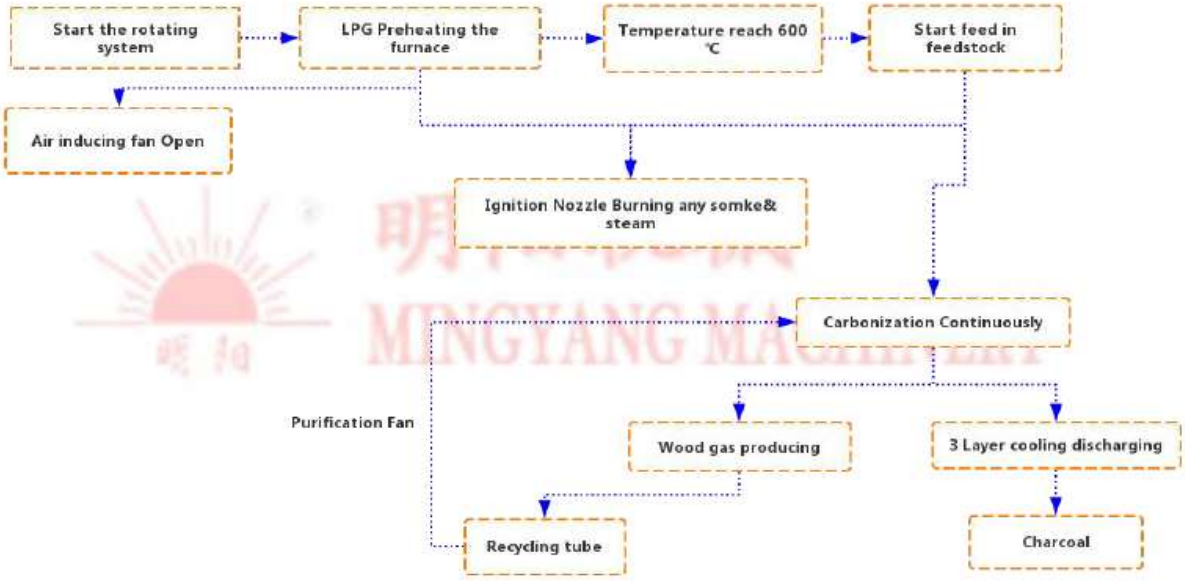


Figure 3-4 Rotating carbonization furnace process. Source: Gongyi Xiaoyi Mingyang (2024)

An estimated weight of 20 ton per line (there will be 3) was considered based on the Questionnaire, including this weight the biomass dryer.

Regarding maintenance no detailed information was provided apart from requiring lubricating oil for moving components (assumed to require 100 kg per year and the proportional value for the testing period).

Thus, the $E_{production}$ was calculated as follows:

$$E_{production} = E_{el} + E_{sw} + E_{m\,\&\,f,cradle-to-grave} + E_{st} + E_{aux}$$

Where E_{el} stands for the impact of electricity use, E_{sw} for the impact of LPG required for switch on, $E_{m\,\&\,f,cradle\text{-}to\text{-}grave}$ for the impact of machines and building from cradle-to-grave (excluding the use to

avoid double counting with E_{el} and E_{sw}), E_{aux} for the auxiliary consumption (machines requiring fossil fuel within the factory installation).

E_{el} was calculated considering the inventory "market for electricity, medium voltage | electricity, medium voltage | cut-off Bo", with an emission factor of 0.459 kgCO2eq/kWh.

The impact of producing and burning LPG was accounted considering "market for liquefied petroleum gas | liquefied petroleum gas | cut-off, U RoW" and "heat production, propane, at industrial furnace >100kW | heat, district or industrial, other than natural gas | cut-off, U", respectively.

$E_{m\ \&\ f,\ cradle\text{-}to\text{-}grave}$ was considered accounting for the impact of crusher, rotary drier, rotary carbonization furnace and factory, independently, for manufacturing, transportation and end-of-life. In order to absorb the uncertainty of installation and end-of-life impact: both manufacturing and transportation impacts were corrected with a factor of 1.2.

Following IPCC (2021) NOx were disregarded. It must be noted that emissions due to the LPG oxidation were already accounted within $E_{production}$.

The excess of syngas generated within the pyrolysis are burned using an open-flaring system at very high efficiency, given the lack of methane registered after flaring with onsite measurements. As a conservative figure it was estimated a residual methane release into atmosphere estimated at 4e-6 kg of biogenic methane per kg of biochar.

Table 3-8 Airborne emissions from pyrolizer during pyrolysis, in kg per kg of biochar output

Parameter	Value (kg of the corresponding gas)	Source
Methane, biogenic, (10% syngas excess in open fire flaring)	4E-6	Conservative proxy derived from no methane registered in tests out of flaring system

For the final results of $E_{production}$ it is referred to Table 3-9.

3.3.6. E_{use} calculation

The term E_{use} includes all greenhouse gas emissions from the transportation and handling of biochar until it is spread out on the soil on top of the same fields from where the wood is being collected: primary forest in the surroundings of Riberalta, Bolivia

Once spread at the point of final use no other processes were confirmed to be required along a 100-year period.

$$E_{use} = E_{use,transportation} + E_{use,spread}$$

where $E_{use,\ transportation}$ corresponds to the impact of transporting the biochar in 15 ton trucks and $E_{use,\ spread}$ corresponds to the environmental impact of using specific and undefined machinery for spreading the biochar.

3.3.7. CORCs calculation

The Puro.earth methodology provides a detailed methodology for computing the carbon reduction, which is based on the following expression.

$$CORCs = E_{stored} - E_{biomass} - E_{production} - E_{use}$$

Thus, the CORC is depicted in Table 3-9.

Table 3-9 CORC as per Puro.Earth

E_{stored} ($mtCO_2e$)	$E_{biomass}$ ($mtCO_2e$)	$E_{production}$ ($mtCO_2e$)	E_{use} ($mtCO_2e$)	CORCs ($mtCO_2e$)	Ratio of CORC to biochar (dry)
2,546.5	27.7	180.8	16.5	2,321.5	2.322

4. LCIA Results

This chapter presents the results for the impact categories and additional metrics as defined in section 2.7. It is important to emphasize that the reported impact categories represent potential impacts. These are approximations of environmental impacts that could occur if the emissions follow the underlying impact pathway and meet certain conditions in the receiving environment. Additionally, the inventory captures only the fraction of the total environmental load that corresponds to the chosen functional unit, following a relative approach. Therefore, the Life Cycle Impact Assessment (LCIA) results are relative expressions and do not predict actual impacts, exceedance of thresholds, safety margins, or risks.

4.1. LCIA Results

In the study, the GWP impact categories were analyzed.

4.1.1. Cradle-to-grave results

Tables 4-1 depict the cradle-to-grave results disaggregated per impact category.

Table 4-1 Global warming potential in kgCO2e per functional unit

Process	Level-2	Level-3	Climate impact in kg CO2-eq	kg-CO2 fossil	kg CH4 as CO2-eq	kg N2O as CO2-eq	kg oGHG as CO2-eq
Ebiomass	Collection & Transportation	RoW / litre / market for diesel, burned in agricultural machinery	27.65	24.42	2.86	0.24	0.13

Eproduction	Biomass pre-processing and biochar management in facility	RoW / litre / market for diesel, burned in agricultural machinery	21.20	18.73	2.20	0.18	0.10
Eproduction	Pyrolyzer operation	RoW / kg / heat production, propane, at industrial furnace >100kW | heat, district or industrial, other than natural gas	4.78	4.28	0.50	0.01	0.00
Eproduction	Pyrolyzer operation	BO / kWh / market for electricity medium voltage grid mix	14.21	12.31	1.64	0.12	0.14
Eproduction	Pyrolyzer operation	RoW / item / wood pellet factory production	113.15	97.24	13.17	1.52	1.22
Eproduction	Pyrolyzer operation	RoW / kg / lubricating oil production	0.02	0.02	0.01	0.00	0.00
Eproduction	Pyrolyzer operation lubricating oil	RoW / kg / treatment of refinery sludge, sanitary landfill	0.01	0.00	0.01	0.00	0.00
Eproduction	Pyrolyzer operation bio-oil	RoW / kg / treatment of refinery sludge, sanitary landfill	9.01	1.54	7.46	0.01	0.00
Eproduction	Pyrolyzer operation	RoW / kg / industrial machine production, heavy, unspecified	14.20	12.37	1.68	0.08	0.06
Eproduction	Pyrolyzer operation	GLO / ton.km / market for transport, freight, lorry 16-32 metric ton, EURO5	1.81	1.60	0.18	0.02	0.00
Eproduction	Pyrolyzer operation	GLO / ton.km / market for transport, freight, sea, container ship	1.08	0.97	0.09	0.01	0.00
Eproduction	Pyrolyzer operation	GLO / kg / Airborne emissions through flaring per kg of biochar	1.32	0.00	1.32	0.00	0.00
Euse	Transportation to use place	RoW / litre / market for diesel, burned in agricultural machinery	5.72	5.06	0.59	0.05	0.03
Euse	Use of biochar in use place	RoW / litre / market for diesel, burned in agricultural machinery	10.81	9.55	1.12	0.09	0.05
Estored	Estored	Estored	-2546.53	0.00	0.00	0.00	0.00

5. Interpretation

This section aims to cover the discussion and interpretation of results described in previous section.

5.1. Identification of Relevant Findings

Figure 5-1 and 5-2 describe the CORC factor calculation.

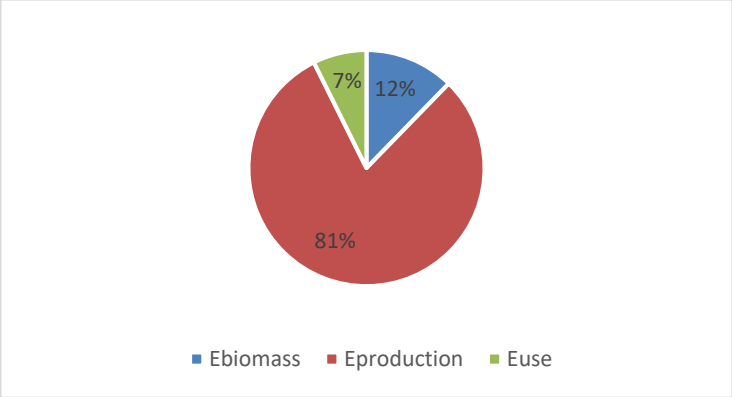


Figure 5-1: Share of GWP100 (global warming potential total) per source of impact

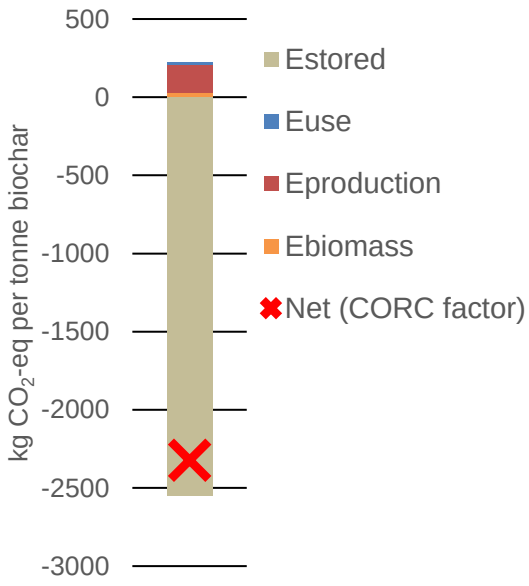


Figure 5-2: CORC calculation

5.2. Assumptions and Limitations

The scope of this study is limited to the information provided by Exomad. Any deviation from this information would require an update of this study. The electricity consumption was obtained from invoices from July 17th to September 18th, while the pyrolizer operated from July 17th to September 6th, this implies that electricity considered is conservative. The analysis of considering 15% less electricity was assessed finding a CORC ratio increase lower than 0.1%. For this reason, it was considered the electricity consumption from July 17th to September 18th, without any reduction or assumption associated to the production period. Probably the main source of potential CORC improvement is the estimation of soil temperature, herein considered at 25.3ºC based on the recommended maps at 0-5cm depth by Puro.earth.

5.3. Data Quality Assessment

The quality of inventory data is assessed based on several criteria:

- **Precision: This includes measured, calculated, or estimated data.**
- **Completeness: Ensuring all relevant emissions are reported.**
- **Consistency: The uniformity of the applied methodology.**
- **Representativeness: This covers geographical, temporal, and technological aspects.**

These datasets are widely used in Life Cycle Assessment (LCA) models globally, both in industrial and scientific contexts. They have been incorporated into numerous critically reviewed and published studies. During the provision process, these datasets are cross-checked with other databases and validated against industry and scientific values.

5.3.1. Precision and Completeness

- ✓ **Precision: precision is considered to be high.**
- ✓ **Completeness of foreground unit process data is considered to be high.**

5.3.2. Consistency and Reproducibility

- ✓ **Consistency: To ensure data consistency, all primary data were collected with the same level of detail.**
- ✓ **Reproducibility: This study aims to support reproducibility by thoroughly disclosing input-output data, dataset choices, and modeling approaches. With this information, third parties should be able to approximate the results of this study using the same data and modeling methodologies.**

5.3.3. Representativeness

- ✓ **Temporal: All primary data were collected during July 8th to September 6th, 2024.**
- ✓ **Geographical: All primary and secondary data were collected specific to the countries or regions under study.**
- ✓ **Technological: All primary and secondary data were modeled to be specific to the technologies or technology mixes under study.**

5.3.4. Key inputs to track

- **Organic carbon content**
- **HC ratio**
- **Humidity of biochar**
- **LPG use for pyrolizer switch-on**
- **Electricity use**
- **Soil temperature**

5.4. Model Completeness and Consistency

5.4.1. Completeness

All relevant process steps for each product system have been considered and modeled to accurately represent each specific situation. The process chain is deemed sufficiently complete and detailed in alignment with the goal and scope of this study.

5.4.2. Consistency

All assumptions, methods and data are consistent with each other and with the study's goal and scope.

5.5. Conclusions, Limitations, and Recommendations

5.5.1. Conclusions

This LCA covers the testing period comprising July 8th to September 6th of 2024. was performed for the cradle-to-gate analysis of the operational facility of Exomad in Riberalta (Bolivia) under the Puro.earth v3 2024 methodology. This study aims to provide insights regarding the CORCs potential based on facility-produced biochar using real biochar and also considering primary data provided by Exomad and real test results seeking to describe all processes involved within the Puro.earth boundaries. This LCA study is pending of third-party verification of the results herein provided. Besides, any modification of the conditions described in this LCA will imply the consequent variation in the results.

References

Huijbregts, M.A.J., Steinmann, Z.J.N., Elsshout, P.M.F., Stam, G., Verones, F., Vieira, M., Zijps, M., Hollanders, A., van Zelm, R., 2017. ReCiPe2016: a harmonised life cycle impact assessment method at midpoint and endpoint level. Int J Life Cycle Assess 22:138–147.

Puro.earth, 2024. Puro.earth biochar methodology Edition 2024, v3.

Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, 21(9), pp.1218–1230

openLCA, 2023. OpenLCA 1.11.0 available at URL: https://openlca.org

Gongyi Xiaoyi Mingyang, 2024. Gongyi Xiaoyi Mingyang Machinery Plant Datasheet. Version 2024.

Cornelissen, G., Pandit, N. R., Taylor, P., Pandit, B. H., Sparrevik, M., Schmidt, H. P., 2016. Emissions and Char Quality of Flame-Curtain “Kon Tiki” Kilns for Farmer-Scale Charcoal/Biochar Production. PLoS One 11 (5), e0154617.

Sparrevik, M., Cornelissen, G., Sparrevik, M., Adam, C., Martinsen, V., Cornelissen, G., Cornelissen, G., 2015, Emissions of gases and particles from charcoal/biochar production in rural areas using medium-sized traditional and improved “retort” kilns. Biomass and Bioenergy 72 (806), 65–73.

Owsianiak, M., Cornelissen, G., Hale, S.E., Lindhjem, H., Sparrevik, M., 2018. Influence of spatial differentiation in impact assessment for LCA-based decision support: Implementation of biochar technology in Indonesia. Journal of Cleaner Production 200, 259-268.

Akagi, S. K., Yokelson, R. J., Wiedinmyer, C., Alvarado, M. J., Reid, J. S., Karl, T., Crounse, J. D., 2011. Emission factors for open and domestic biomass burning for use in atmospheric models. Atmos. Chem. Phys. 11, 4039–4072.

Annex A: Datasheet of equipment

Gongyi Xiaoyi Mingyang Machinery Plant

Date: 2024/1/3

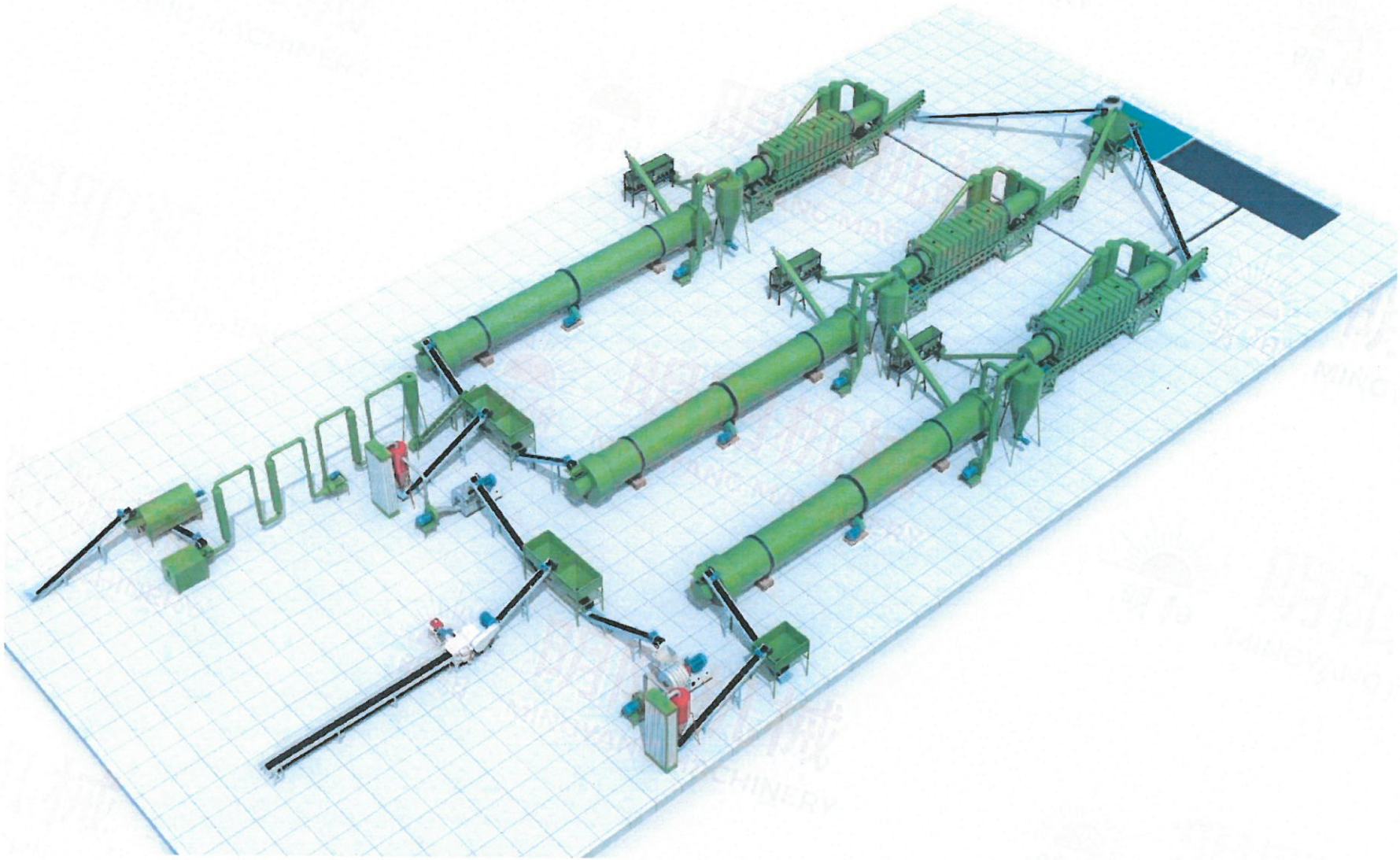
Charcoal Production Line Continuous Rotary Carbonization Equipment Solution

Gongyi Xiaoyi Mingyang Machinery is located in zhengzhou city, henan province,china. Started designing and manufacturing charcoal making equipment since year 1988. Which is one of the first companies in charcoal equipment field. Owning factory land more than 7000 square meters. Contains primary manufacturing workshop, finishing workshop, welding workshop, testing workshop which for different range machines. We have R&D team, engineer team, technician team, marketing team, domestic& oversea sales team, logistics team. Finished machines widely used for Energy, biomass projects applied to Government, Organization, Big, medium, small scale charcoal business partners.

With plenty of experience in manufacturing machinery and equipment Mingyang Machinery has Obtained many national patents, has independent import and export rights for products, and has passed the ISO-9001 national quality system certification. Mingyang Machinery is a comprehensive company of design, manufacturing, sales. Through years of management and development, the scale continues to expand, and the products have been sold to more than 20 provinces national wide and have been exported to Germany, Algeria, Mexico, Kenya, Spain, Chile, Ukraine, Indonesia, Malaysia, Thailand, Sri Lanka, Kenya, Russia and other countries.Main star machines includes, all kinds of carbonization furnace, hammer mill crusher, pipe dryer, rotary dryer, briquette machine, charcoal production line and related auxiliary accessories.

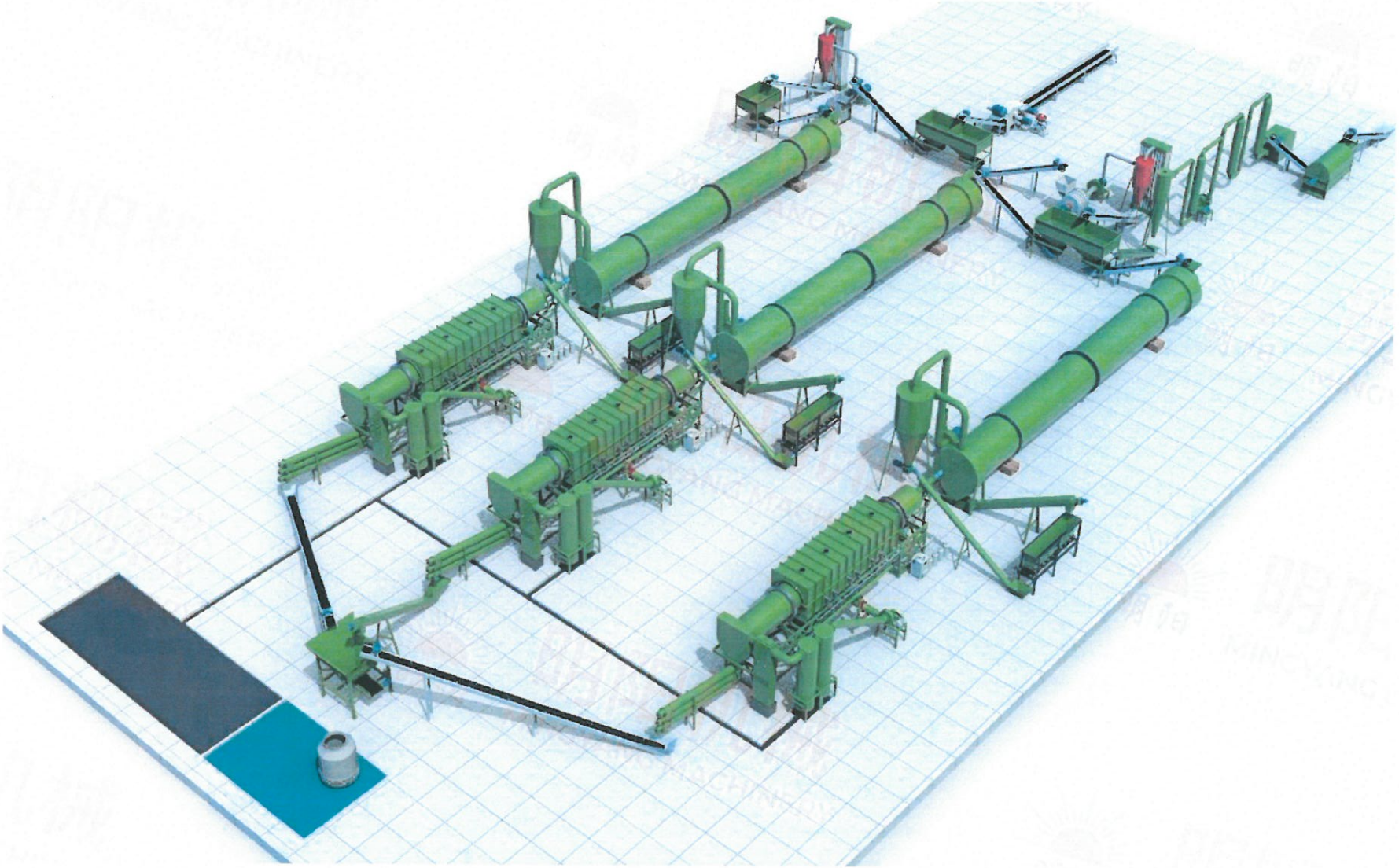
Gongyi Xiaoyi Mingyang Machinery Plant

Date: 2024/1/3



Gongyi Xiaoyi Mingyang Machinery Plant

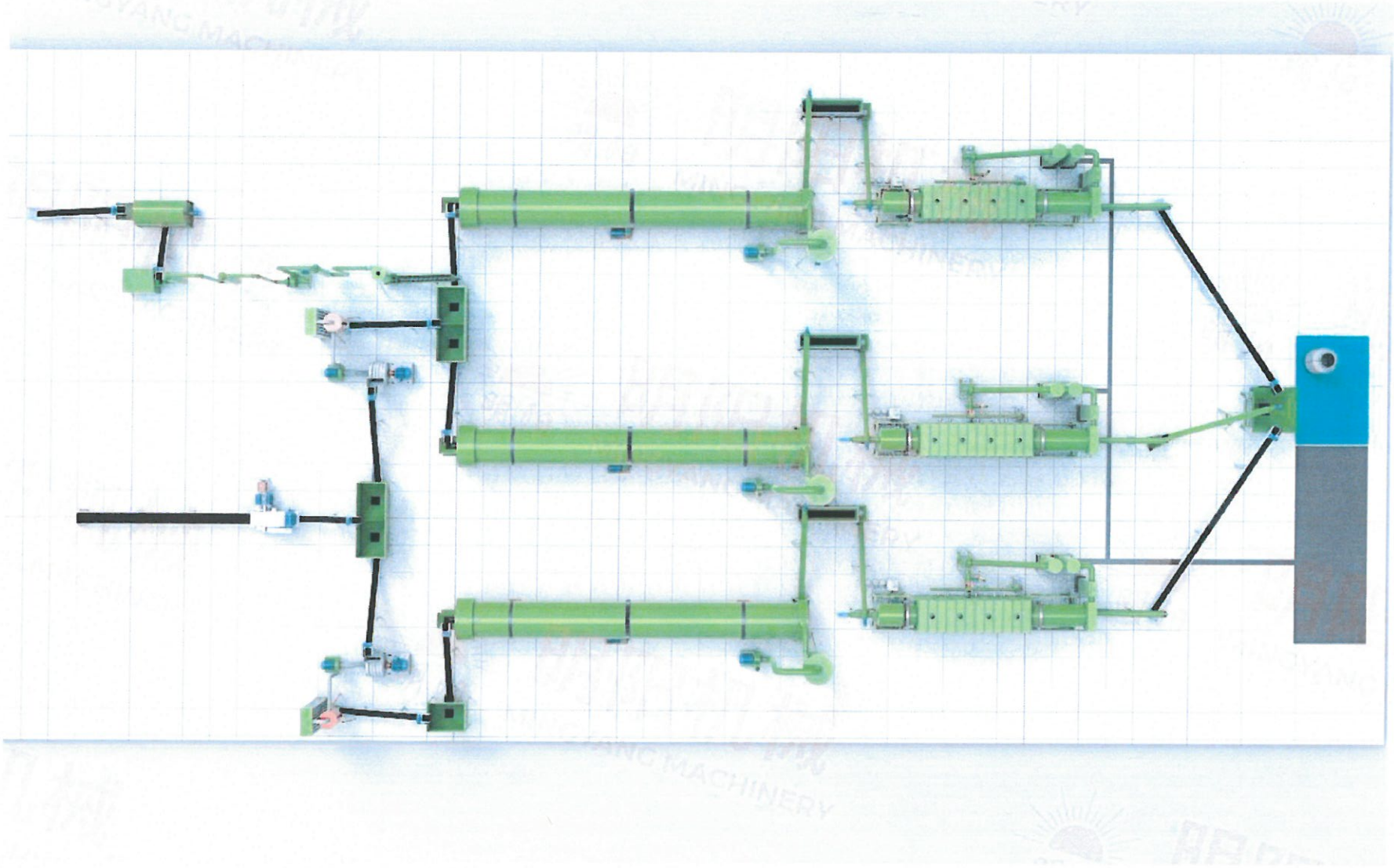
Date: 2024/1/3



Web: mingyangmachinery.com | Add: Waigou indurstrial block, Nanhuan road, Gongyi Zhengzhou city, Henan, China.
E-mail: kim@zgmingyang.com | Mob: +86-13949068666

Gongyi Xiaoyi Mingyang Machinery Plant

Date: 2024/1/3



Web: mingyangmachinery.com | Add: Waigou indurstrial block, Nanhuan road, Gongyi Zhengzhou city, Henan, China.
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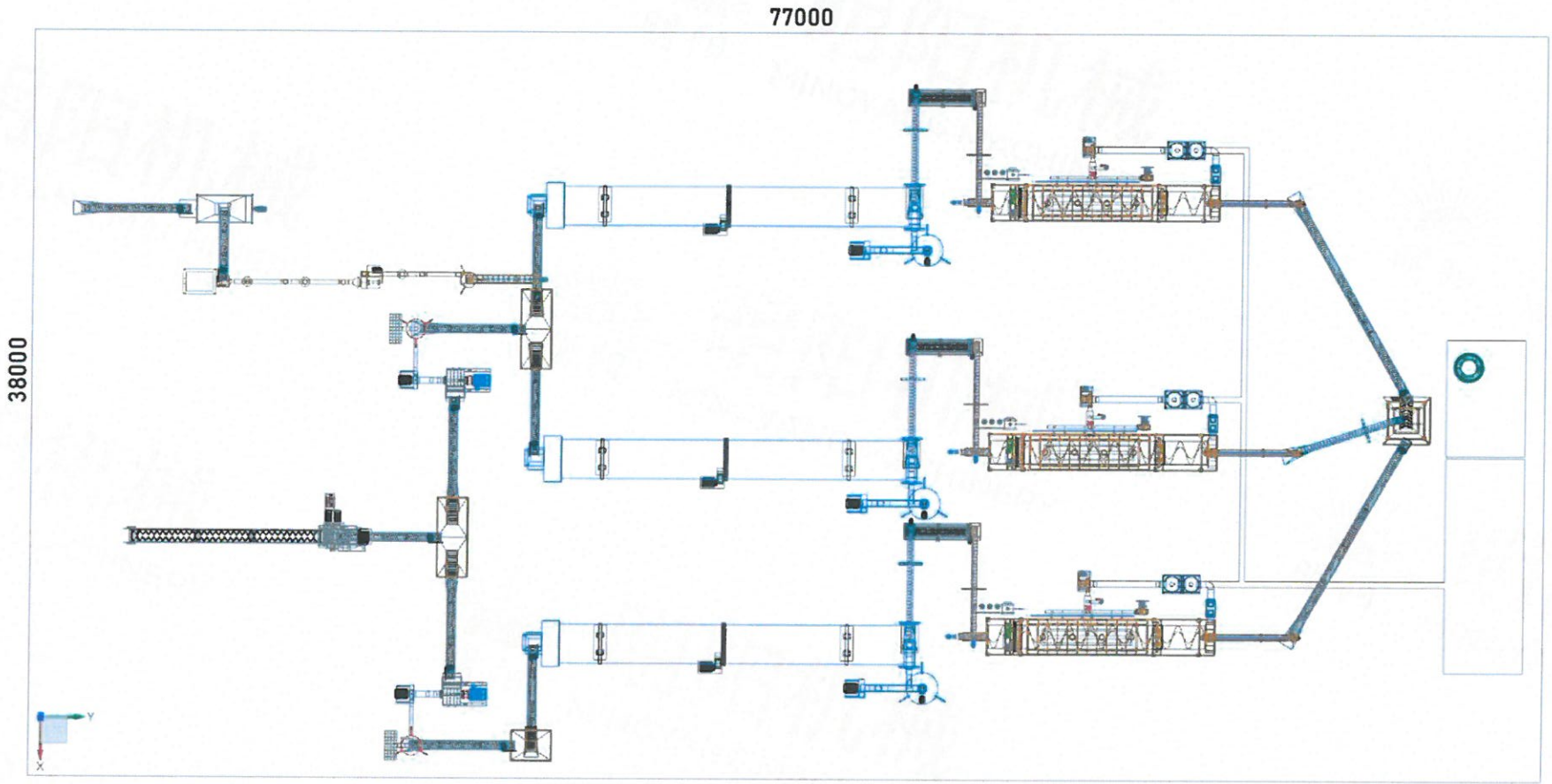
Gongyi Xiaoyi Mingyang Machinery Plant

Date: 2024/1/3



1， Crusher System

Gongyi Xiaoyi Mingyang Machinery Plant

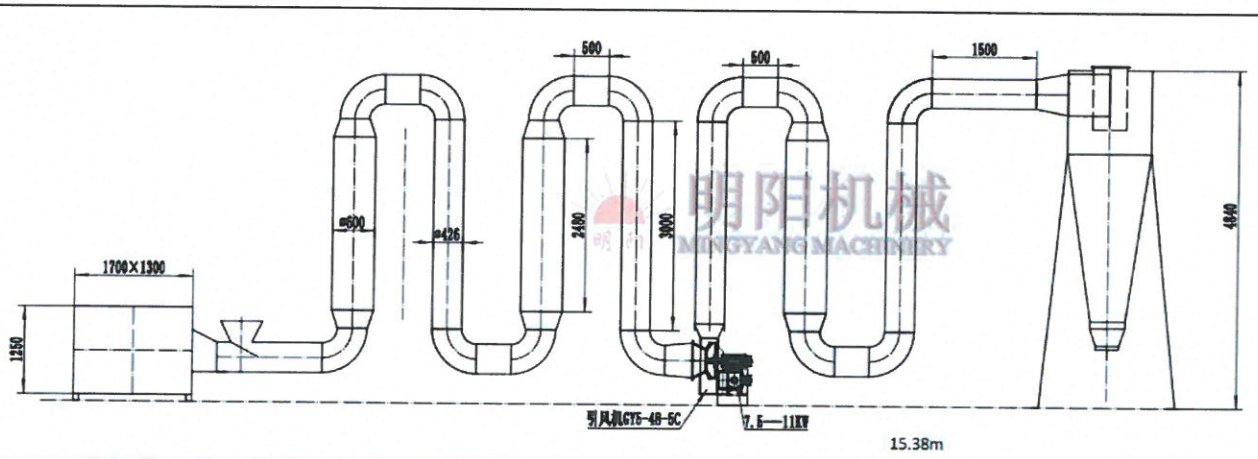
Date: 2024/1/3

1, Drying Equipment

① Impulse pipe type hot airflow dryer

Customized for sawdust

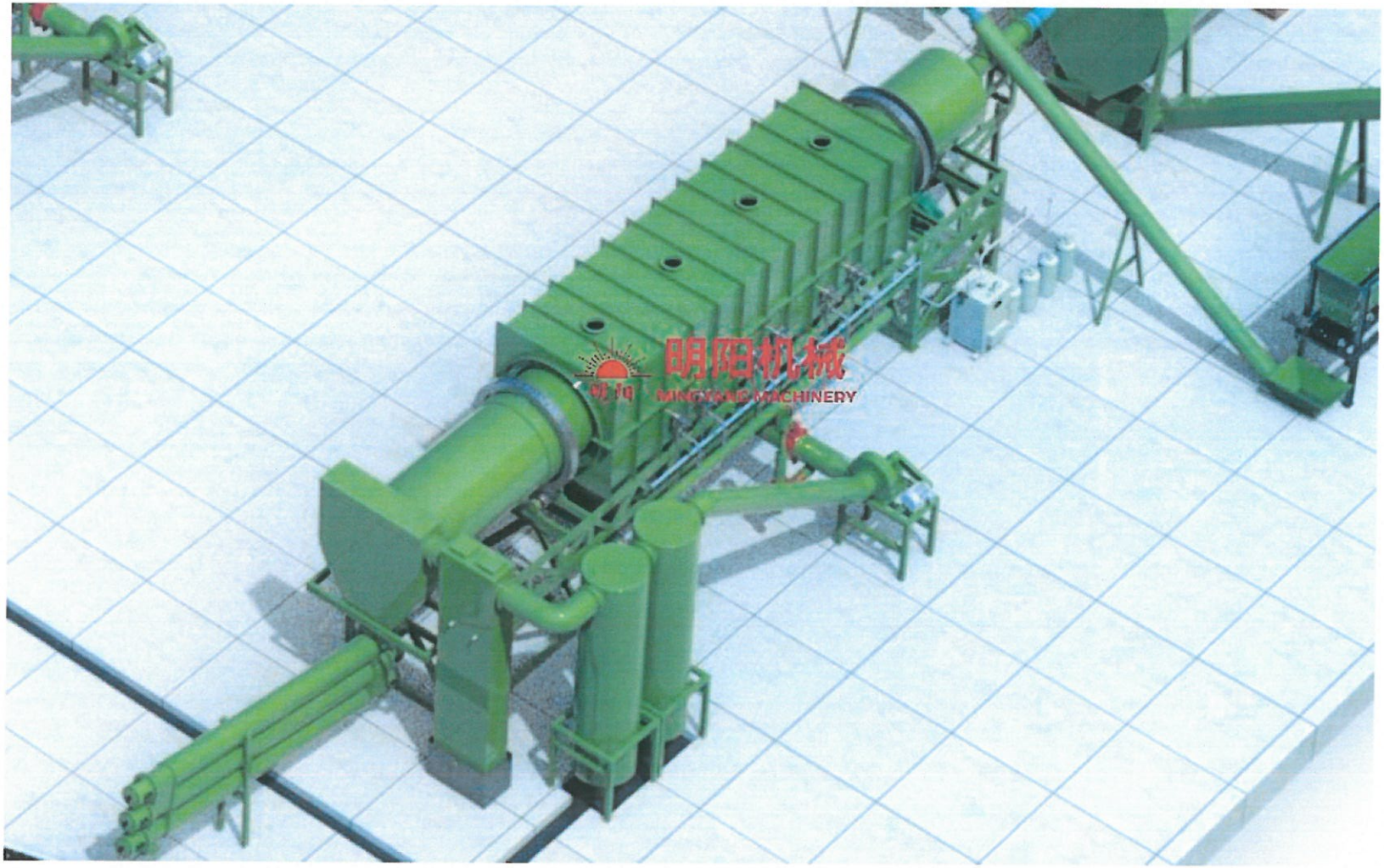
1, Impulse tube: Φ600mm
2, Pipe: Φ426mm
3, Height of dryer: 4.8m
4, Total length: 15.38m
5, Motor: 11kw
6, Includes Heat burning stove



② Rotary Drum type dryer

1, Drum: Φ2*20m
2, Motor: 22(fan)+ 22(drum)+1.5kw(airlock)
3, Height of cyclone separator: 6m
4, Height of feeding hopper: 3.2m
5, Heating method: extra heat& gas from furnace
6, Customized inner design

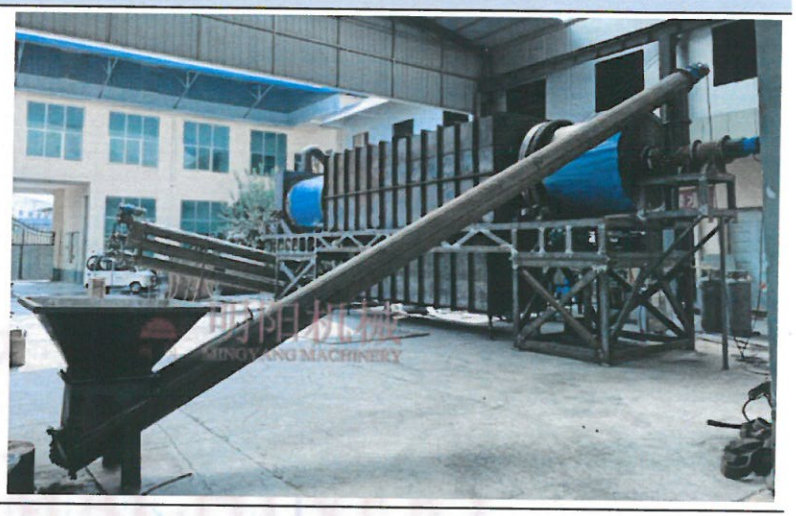
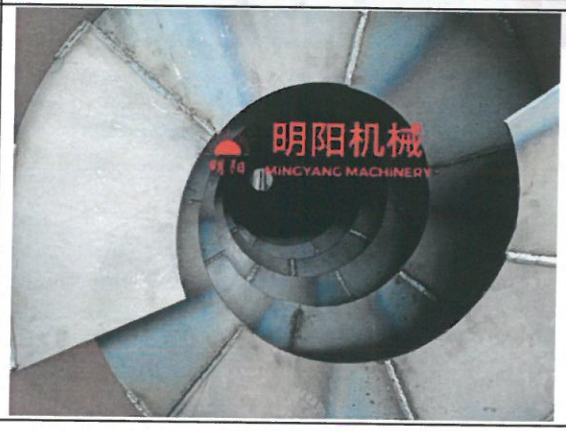
2, Carbonization Furnace



Gongyi Xiaoyi Mingyang Machinery Plant

Date: 2024/1/3

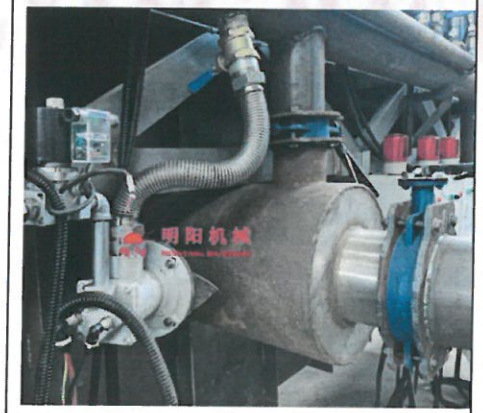
Core parts with photos:

Items	Photo	Items	Photo
Upper Part		Feeding conveyors	
Inner Screw		Discharge conveyor with cooling	

Web: mingyangmachinery.com | Add: Waigou indurstrial block, Nanhuan road, Gongyi Zhengzhou city, Henan, China.
E-mail: kim@zgmingyang.com | Mob: +86-13949068666

Gongyi Xiaoyi Mingyang Machinery Plant

Date: 2024/1/3

Bottom burning chamber		Preheating electri-ignition			
Insulation Layer		Wood gas ignition nozzle		Labyrinth Sealing	

Gongyi Xiaoyi Mingyang Machinery Plant

Date: 2024/1/3

Sprayer		Condensation		Gasifier	

Details of Carbonization Furnace System

No.	Item	Specification	Qty	Unit	Power	Notes
1	Quantified feeding and conveying	Ø325*9000mm ~~Φ300*5000mm~~	1	Pc	4kw	①The size of feed port can be adjusted ②Feeding frequency conversion speed regulation
2	Forced feeder	Ø325	1	Pc	2.2kw	
3	Furnace	Ø1500*11000	1	Pc	5.5kw	10mm thick 310S stainless steel/304 ~~12mm boiler grade 245R carbon steel~~
4	Air distribution draught fan	/	2	sets	4kw	Air blower
5	Cooling Conveyor 3 layers 18m path	InnerØ219*6000 ExternalØ420*4300	1	Pc	4kw	Double layer cooling discharge

Gongyi Xiaoyi Mingyang Machinery Plant

Date: 2024/1/3

Size: ① 4.5*1.5m ② 3*2m ③ 2*2m ④ 3*1.3m **Motor: 2.2kw** ① "U" shaped screw conveyor ② Half-closed conveyor to avoid dust			

4, Cooling and Charcoal particle crusher

Charocal Cooling Size: Φ1.2*3m Inner structure: screws Customized, photo just for reference Rotating speed with inverter		**Multi-function particle crusher** Motor: 37kw Final output: 3-5mm particle(optional) Hammers qty: 70pcs Size of grinding chamber: 600mm Machine size: 2175×1340×1455mm Includes 5m discharging conveyor	

6	Sprayer Container with water tank ~~Cyclone separator~~	500*800mm	1	sets	/	Stainless steel 201 ~~Normal steel Q235~~
7	Condensation with ball valve	Φ0.8*3m	2	sets	/	Stainless steel 201
8	Purification draught fan	/	1	Pc	18.5kw	high pressure positive blower
9	Synthesis gas combustion pipe	/	1	sets	/	Stainless steel 201
10	Gasifier	100kg/h	1	sets	15kw	LPG Gasification system
11	Igniter burner,Electric Ignition	/	8	sets	/	Preheating burning
12	wood gas combustion ignition burner	/	2	pcs	/	Syngas gas special burner, Stainless steel 201
13	Ignition and alarm control system	/	8	sets	/	One button ignition, air leakage, flameout alarm system
14	Fire-resistant insulation	/	/	/	/	Good heat preservation effect and fuel saving
Supporting Total Power		**38kw + 15kw(Preheating), 3phase, 50Hz, 380V**				
Capacity(sawdust)		**3000kg/h (input) & 900-1100kg/h (output)**				
Area Suggested		**Length 12m * Width 5m * Height 5-7m**				

3, Storage buffering silo

Annex B: Biochar properties

Eurofins Umwelt Ost GmbH - Lindenstraße 11 - Gewerbegebiet Freiberg Ost -
D-09627 Bobritzsch-Hilbersdorf

Exomad Green
Avenue 4to anillo
10260 Santa Cruz De La Sierra
BOLIVIA

Title :	**Analytical Report for Order 12437779**
EOL Order Code:	**006-10544-71139**
Test report number :	**AR-24-FR-051586-01**
Project name :	**Exomad Green 1.2**
Number of samples :	**1**
Sample type:	**coal**
Date of sample taking :	**2024-08-20**
Sample Taker:	**not specified, sample(s) were delivered to lab**
Sample reception date :	**2024-09-02**
Sample processing time :	**2024-09-02 - 2024-09-20**

The test results solely refer to the analysed test specimen. Unless the sampling was done by our laboratory or in our sub-order the responsibility for the correctness of the sampling is disclaimed. This analytical report is electronically signed and may only be further published completely and unchanged. Extracts or changes require the authorisation of the EUROFINS UMWELT in each individual case.

Our General Terms & Conditions of Sale (GTCS) are applicable, as far as no specific agreements do exist. The GTCS are available on http://www.eurofins.de/umwelt/avb.aspx.

Accredited test laboratory according to DIN EN ISO/IEC 17025:2018 DAkkS notification under the DAkkS German Accreditation System for Testing. The laboratory is according (D-PL-14081-01-00) accredited.

Attachments
XML_Export_AR-24-FR-051586-01.xml

Katja Schulze
Analytical Service Manager

+49 3731 2076 583

Digitally signed 9/20/2024
Stefan Seifert
Analytical Service Manager

DAkkS Deutsche Akkreditierungsstelle D-PL-14081-01-00

							Description		Sample 1.2	
							Date and time of sample taking		2024-08-20	
							EOL Sample Code		005-10544-277741	
				Limit values			Sample number		124135670	
Parameter	**Lab**	**Accr.**	**Method**	WBC-Premium	WBC-Agro	WBC-Material	**LOQ**	**Unit**	**ar**	**db**
Biochar properties										
Bulk density < 3 mm	FR		based on VDLUFA-Methode A 13.2.1					kg/m³	-	240
water holding capacity (WHC) < 2 mm	FR		DIN EN ISO 14238, A: 2014-03					%	-	158.8
Moisture	FR	F5	DIN 51718: 2002-06				0.1	% (w/w)	40.5	-
Ash content (550°C)	FR	F5	DIN 51719: 1997-07				0.1	% (w/w)	5.6	9.4
Total carbon	FR	F5	DIN 51732: 2014-07				0.2	% (w/w)	50.3	84.5
carbon (organic)	FR		Calculation					% (w/w)	49.6	83.3
Hydrogen	FR	F5	DIN 51732: 2014-07				0.1	% (w/w)	1.0	1.7
Total nitrogen	FR	F5	DIN 51732: 2014-07				0.05	% (w/w)	0.50	0.84
Sulphur (S), total	FR	F5	DIN 51724-3: 2012-07				0.03	% (w/w)	< 0.03	< 0.03
Oxygen	FR	F5	DIN 51733: 2016-04					% (w/w)	4.9	8.2
Total inorganic carbon (TIC)	FR	F5	DIN 51726: 2004-06				0.1	% (w/w)	0.7	1.2
carbonate-CO2	FR	F5	DIN 51726: 2004-06				0.4	% (w/w)	2.5	4.2
H/C ratio (molar)	FR		Calculation						0.25	0.25
H/Corg ratio (molar)	FR		Calculation	< 0.4	< 0.7	< 0.7			0.25	0.25
O/C ratio (molar)	FR		Calculation						0.073	0.073
pH in CaCl2	FR		DIN ISO 10390: 2005-12						8.2	-
salt content	FR		BGK III. C2: 2006-09				0.005	g/kg	3.34	-
salt content	FR		BGK III. C2: 2006-09				0.005	g/l	0.801	-
Conductivity at 1,2 t pressure	FR		Internal Method SAA-H-Lf-Pflanzen-kohle.040				0.01	mS/cm	-	0.62
Conductivity at 2 t pressure	FR		Internal Method SAA-H-Lf-Pflanzen-kohle.040				0.01	mS/cm	-	0.96

							Description		Sample 1.2	
							Date and time of sample taking		2024-08-20	
							EOL Sample Code		005-10544-277741	
				Limit values			Sample number		124135670	
Parameter	**Lab**	**Accr.**	**Method**	WBC-Premium	WBC-Agro	WBC-Material	**LOQ**	**Unit**	**ar**	**db**
Conductivity at 3 t pressure	FR		Internal Method SAA-H-Lf-Pflanzen-kohle.040				0.01	mS/cm	-	1.2
Conductivity at 4 t pressure	FR		Internal Method SAA-H-Lf-Pflanzen-kohle.040				0.01	mS/cm	-	1.3
Conductivity at 5 t pressure	FR		Internal Method SAA-H-Lf-Pflanzen-kohle.040				0.01	mS/cm	-	1.6
Elements from the micro wave pressure digestion acc. to DIN 22022-1: 2014-07										
Arsenic (As)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01	13	20		0.8	mg/kg	-	1.1
Lead (Pb)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01	120	300		2	mg/kg	-	< 2
Cadmium (Cd)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01	1.5	5		0.2	mg/kg	-	< 0.2
Copper (Cu)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01	140	200		1	mg/kg	-	9
Nickel (Ni)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01	50	100		1	mg/kg	-	< 1
Mercury (Hg)	FR	F5	DIN 22022-4: 2001-02	1	2		0.07	mg/kg	-	< 0.07
Zinc (Zn)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01	420	1000		1	mg/kg	-	13
Chromium (Cr)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01	100	200		1	mg/kg	-	9
Boron (B)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01				1	mg/kg	-	112
Manganese (Mn)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01				1	mg/kg	-	68
Selenium (Se)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01				1	mg/kg	-	< 1
Silver (Ag)	FR	F5	DIN EN ISO 17294-2 (E29): 2017-01				5	mg/kg	-	< 5

							Description		Sample 1.2	
							Date and time of sample taking		2024-08-20	
							EOL Sample Code		005-10544-277741	
				Limit values			Sample number		124135670	
Parameter	**Lab**	**Accr.**	**Method**	WBC-Premium	WBC-Agro	WBC-Material	**LOQ**	**Unit**	**ar**	**db**
Elements fr. the borate digestion of ash 550 °C acc. to DIN 51729-11:1998-11(AR)										
Calcium as CaO	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	% (w/w)	-	49.0
Iron as Fe2O3	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	% (w/w)	-	0.4
Potassium as K2O	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	% (w/w)	-	2.1
Magnesium as MgO	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	% (w/w)	-	2.2
Sodium as Na2O	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	% (w/w)	-	0.1
Phosphorus as P2O5	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	% (w/w)	-	1.5
sulphur as SO3	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	% (w/w)	-	0.6
Silicon as SiO2	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	% (w/w)	-	1.6
Macronutrients										
Total nitrogen	FR	F5	DIN 51732: 2014-07				0.5	g/kg	5.0	8.4
Macronutrients-LiBO2/Li2B4O7/LiBr-melt of ash 550°C [DIN 51729-11:1998-11] (OS)										
Phosphorus as P2O5	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	g/kg	-	1.4
Potassium as K2O	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	g/kg	-	2.0
Calcium as CaO	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	g/kg	-	46.1
Magnesium as MgO	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	g/kg	-	2.1
Sodium as Na2O	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	g/kg	-	0.1
sulphur as SO3	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	g/kg	-	0.6
Elements fr. the borate digestion of ash 550°C acc. to DIN 51729-11:1998-11(OS)										
Iron (Fe)	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	g/kg	-	0.3
Silicon (Si)	FR	F5	DIN EN ISO 11885 (E22): 2009-09				0.1	g/kg	-	0.7

							Description		Sample 1.2	
							Date and time of sample taking		2024-08-20	
							EOL Sample Code		005-10544-277741	
				Limit values			Sample number		124135670	
Parameter	**Lab**	**Accr.**	**Method**	WBC-Premium	WBC-Agro	WBC-Material	**LOQ**	**Unit**	**ar**	**db**
Organic contaminants from toluene extraction acc. to EN 17503 (method 10.2.3)										
Naphthalene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	16
Acenaphthylene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1
Acenaphthene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1
Fluorene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1
Phenanthrene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	0.9
Anthracene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	0.3
Fluoranthene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	0.1
Pyrene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	0.1
Benz(a)anthracene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	0.1
Chrysene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1
Benzo(b)fluoranthene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1
Benzo(k)fluoranthene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1
Benzo(a)pyrene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1
Indeno(1,2,3-cd)pyrene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1
Dibenz(a,h)anthracene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1
Benzo(g,h,i)perylene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1
Total 8 EFSA-PAH excl. LOQ	FR		calculated	1	1	4		mg/kg	-	0.1
Total 16 EPA-PAH excl. LOQ	FR		calculated	6				mg/kg	-	17.5
Benzo(e)pyrene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1

							Description		Sample 1.2	
							Date and time of sample taking		2024-08-20	
							EOL Sample Code		005-10544-277741	
				Limit values			Sample number		124135670	
Parameter	**Lab**	**Accr.**	**Method**	WBC-Premium	WBC-Agro	WBC-Material	**LOQ**	**Unit**	**ar**	**db**
Benzo-(j)-fluoranthen	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08				0.1	mg/kg	-	< 0.1

Explanations

LOQ - Limit of quantification

ar - as received

db - dry basis

Lab - Abbreviation of the performing laboratory

Accr. - Abbreviation of the accreditation of the performing laboratory

The parameters identified by FR have been performed by the laboratory Eurofins Umwelt Ost GmbH (Lindenstraße 11, Gewerbegebiet Freiberg Ost, Bobritzsch-Hilbersdorf). The accreditation code F5 identifies the parameters accredited according to DIN EN ISO/IEC 17025:2018 DAkkS D-PL-14081-01-00 .

Explanations regarding Limits

Analysis performed according to guidelines for a sustainable production of biochar - WBC, Version 1.0 - of 09/15/2023.

AR: related to ash

OS: related to original substance

The presentation of comparative values in the analytical report is a service provided by EUROFINS UMWELT. The cited comparative values (limit, guideline or other allocation values) are partially simplified and do not take into account all comments, ancillary provisions and/or exemptions of the corresponding regulations.

Annex C: Study of Syngas

SERVOLAB
Services & Oil Laboratories Srl

INFORME DE ENSAYO DE LABORATORIO

1.0 DATOS.-

CLIENTE:	EXOMAD GREEN
TIPO DE MUESTRA:	Biogas
PUNTO DE MUESTREO:	Reactor 2
MUESTREADO POR:	Augusto Raldes (SERVOLAB)
FECHA TOMA DE MUESTRA:	19-09-24
FECHA RECEPCION:	20-09-24
FECHA DE INFORME:	05-10-24
NUMERO DE PAGINAS:	Pag. 1 de 1
NUMERO DE INFORME:	LFQ-053-24

2.0 ENSAYO DE CROMATOGRAFIA .-

COMPONENTES	PORCIENTO MOLAR
Nitrógeno	31.5600
Dióxido de Carbono	53.2362
Metano	15.2038
Etano	0.0000
Propano	0.0000
Iso-Butano	0.0000
Normal-Butano	0.0000
Iso-Pentano	0.0000
Normal-Pentano	0.0000
Hexano	0.0000
Heptano +	0.0000
TOTAL	**100.0000**

** Los resultados de este informe se refieren unicamente a la muestra ensayada.*
** La firma (s) de los responsables de este informe confirman los resultados finales.*

Igor Cornejo Góngora
Resp. de Calidad Laboratorio

FIN DEL INFORME

Av. Eucaliptos N°30
Telf: 3581798 Telefax: 3528614
e-mail: info@servolab.net
www.servolab.net
Santa Cruz de la Sierra - Bolivia

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: *Burning of forestry*	*The current practice of biomass disposal at Riberalta sawmills, involves incineration of forestry residues. Sawmills, as an integral part of their operations, generate significant quantities of residues such as bark, branches, and sawdust. Due to limited economically viable alternatives, the most common and affordable method of disposing of these residues is through combustion, leading to their complete oxidation. In the absence of the biochar project, this practice of burning forestry residues at sawmills will persist. The economic viability of the sawmills heavily influences their waste management practices, and the cost-effective nature of burning residues incentivizes the continuation of this disposal method. The absence of a financially feasible alternative for residue utilization necessitates the ongoing implementation of the current biomass burning practice.*	None	None
Project activity: *Exomad Green Riberalta Biochar Facility*	*The implementation of the EXOMAD GREEN Riberalta biochar facility, with an annual production capacity of 30,000 tons of biochar, plays a crucial role in removing CO2 and other greenhouse gases from the environment. By utilizing forestry residues instead of resorting to burning , the facility serves as a carbon sink, effectively capturing and storing carbon in the biochar it produces. It is worth noting that biochar has a significant carbon sequestration potential. Approximately 1 ton of biochar is equivalent to around 2.5 tons of CO2 removed from the atmosphere. This demonstrates the substantial carbon-negative impact of the EXOMAD GREEN facility, as each ton of*	60.000 Tons per year	None / Some *(please quantify)*

	biochar produced contributes to the removal and offset of greenhouse gas emissions. In addition to its carbon removal capabilities, the biochar produced by the facility offers numerous benefits when applied to the soil. It enhances soil fertility, improves water retention, and increases nutrient availability for plants. These soil-enhancing properties make biochar a valuable tool for sustainable agriculture, horticulture, and land restoration practices. *The establishment of the EXOMAD GREEN biochar facility not only provides an environmentally friendly alternative to the traditional burning of forestry residues but also drives local economic growth. The facility creates employment opportunities within the community and supports sustainable waste management practices.* *Overall, the annual production of 30,000 tons of biochar by the EXOMAD GREEN facility makes a significant contribution to carbon removal efforts. By actively removing and offsetting Co2 and other greenhouse gases, the facility plays a vital role in mitigating climate change and fostering sustainable development in the region.*		
Alternative scenarios	*(Other likely activities in this market that can replace the baseline activity, if none leave blank)*	None / Some *(please quantify)*	None / Some *(please quantify)*

A2. Does the project lead to higher volumes of durable carbon removal than the baseline?	**Yes / No**
Baseline has no carbon removal	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**
Project aids in net zero transition	Yes

A4. Is the project required by existing laws, regulations, or other binding obligations?	**Yes / No**
The EXOMAD GREEN Riberalta biochar facility is not mandated by Bolivian laws, regulations, or other binding obligations. However, it represents a voluntary initiative driven by a commitment to responsible waste management and sustainable practices. By choosing to implement the facility, the project demonstrates a proactive approach to address environmental concerns, even in the absence of legal requirements. This voluntary commitment showcases a dedication to environmental stewardship and sets an example for others to ado t sustainable ractices	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
October 2023	10/2023

A6. Is the Technological Readiness Level of the Methodology 8 or 9?	Yes/No
Biochar is a proven methodology with an accepted Technological readiness level TRL 9	Yes

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.
Riberalta - Bolivia

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.**
Centralized Technology (Plants): Projects Meeting the Criteria in Additionality Assessment Requirements (Clause 3.2.6): Exomad Green has identified a limited number of projects in Bolivia that could meet the criteria outlined in clause 3.2.6. Specifically: a) Output Range: Exomad Green's new plant in Riberalta will have a production capacity of over 2,000 tons of carbon-sequestering biochar per month. We estimate that projects with a comparable output range of +/- 50% in Bolivia are none existant due to the nascent state of biochar production in the region. b) Location: No existing large-scale biochar projects have been identified in the region surrounding Riberalta that meet the outlined criteria. This city is located in a relatively undeveloped part of the country in terms of biochar production. c) Same Measure: Exomad Green's biochar production is focused on high-carbon-content biochar (84% carbon content) with an H

ratio of 0.24, aimed at carbon sequestration and soil enhancement. We have not found any projects in the region applying identical measures with the same focus on these specific parameters.

d) Comparable Goods or Services: While there are smaller-scale charcoal production activities in Bolivia, they do not produce biochar. The high standard of our biochar is aimed at premium markets for carbon removal and agricultural enhancement, which is distinct from any existing operations in the region.

e) Start Date: There are no identified projects in the region that have started commercial operation before our proposed start date and meet the aforementioned criteria.

f) Carbon Crediting Programs: To our knowledge, there are no other biochar projects in Bolivia that are currently registered in any carbon crediting programs, which underscores the uniqueness of our operation in terms of additionality.

Market Constraints and Growth Potential:

Constraints: The primary constraint to market size growth in Bolivia is the limited infrastructure for large-scale biochar production and the lack of awareness and adoption of biochar among local farmers. Additionally, the logistical challenges associated with transportation in and out of Riberalta pose potential constraints.
Growth Potential: Despite these constraints, the market size for biochar in Bolivia is promising due to the country's large agricultural sector, which can benefit significantly from biochar's soil enhancement properties. Furthermore, the increasing global demand for carbon removal solutions positions Exomad Green to tap into both domestic and international markets.
Technology Comparison:

Exomad Green's technology is unique in the region for its focus on high-quality biochar with a specific H ratio and carbon content tailored for carbon sequestration and soil improvement. We have not identified any other projects in Bolivia using the same or a directly comparable technology.
Sources:

- Internal market research conducted by Exomad Green.
- Regional agricultural and industrial data from Bolivia's Ministry of Agriculture.
- Carbon market analyses from industry reports.

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**.**

Market Penetration Rate:

Centralized Technology (Plants):

Calculation of Market Penetration Rate:

According to the formula provided in clause 3.2.6 of the Additionality Assessment Requirements, the market penetration rate (MPR) is calculated as:

MPR
=
Total production capacity of similar activities already operational in the region
Total market potential for the activity in the region

×
100
MPR=
Total market potential for the activity in the region
Total production capacity of similar activities already operational in the region

×100
Total Production Capacity of Similar Activities:

Based on our research and industry data, there are no large-scale biochar production plants currently operational in the region surrounding Riberalta that meet the criteria for "similar activities" (i.e., same output range, applying the same measure, and producing comparable goods).
Therefore, the total production capacity of similar activities in the region is estimated to be 0 tons per year.
Total Market Potential:

Bolivia's agricultural sector is substantial, with a significant portion of the land potentially benefiting from biochar application. Based on our analysis, the total market potential for biochar in Bolivia, considering agricultural land and the potential for carbon sequestration, is estimated at 50,000 tons per year.
This figure accounts for the potential biochar demand from both agricultural enhancement and carbon removal markets.

Market Penetration Rate:
The market penetration rate for biochar production in the region is currently 0%, indicating that Exomad Green's new plant in Riberalta will be a pioneer in the region's biochar market.
Trend of Adoption Over Time:

The adoption of biochar technology in Bolivia has been limited so far, with no significant market penetration in the region. However, the global trend towards carbon removal and sustainable agriculture practices suggests that there is substantial potential for growth in the biochar market.
As awareness of biochar's benefits increases, and as Exomad Green's operations demonstrate the value of high-quality biochar, we anticipate a gradual increase in adoption rates in Bolivia and the broader region.
Conclusion:

Exomad Green's project in Riberalta is positioned to establish a new market for biochar in Bolivia, with a current market penetration rate of 0%. This underlines the additionality of our project, as it will be the first of its kind in the region, setting the stage for future growth and adoption.

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**
The successful implementation of the EXOMAD GREEN biochar facility is dependent on carbon finance. As a voluntary initiative, the project requires financial support to cover its operational costs and realize its environmental objectives. Carbon finance, through mechanisms such as carbon credit trading, provides a means to generate revenue for the biochar facility. By monetizing the carbon removal and sequestration achieved by the project, carbon finance enables its sustainability and viability, allowing for the continued removal of Co2 and other greenhouse gases from the environment.	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
Exomad Green's biochar factory in Riberalta is designed primarily for carbon sequestration, with carbon finance being the main revenue stream. The project has limited alternative income sources, as the local market for biochar in agriculture is still underdeveloped. **1. Reliance on Carbon Finance:** • The project's economic viability depends entirely on carbon credits. Without this income, the project would not be financially feasible. **2. Capex Compared to Opex:** • Initial capital expenditure for the plant is high, with even more significant ongoing operational costs, including biomass sourcing, labor, and logistics. These recurring expenses are substantial compared to the initial investment. Given the project's dependency on carbon finance and capex relative to opex, simple cost analysis is applicable. The project's additionality is clear, as it would not be viable without the revenue from carbon credits.

B Simple cost analysis	**Project response**

B2. Please describe your cost structure here and include evidence in attachment.	Exomad Green's cost structure for the Riberalta biochar factory includes the following key components:
	• **Capital Expenditure (Capex):** Initial costs include purchasing and installing pyrolysis units, site preparation, and basic infrastructure. The total Capex is estimated at [Insert Amount].
	• **Operating Expenditure (Opex):**
	  ○ **Raw Materials:** Biomass sourcing, transportation, and storage costs.
	  ○ **Labor:** Wages for plant operators, maintenance staff, and administrative personnel.
	  ○ **Energy Costs:** Electricity and fuel expenses for operating the pyrolysis units.
	  ○ **Logistics:** Costs associated with transporting the finished biochar to markets.
	  ○ **Maintenance:** Regular maintenance of equipment and infrastructure.

B3. Please summarize the simple cost analysis here. Please include any public subsidies received or expected. Compare with alternative scenarios, if relevant.	**Simple Cost Analysis Summary:** The simple cost analysis highlights the following points:

	• **Primary Revenue Stream:** Carbon credits are the main source of income, as the local biochar market is underdeveloped. Without this, the project is not financially viable. • **Public Subsidies:** Exomad Green has not received any public subsidies and does not expect any in the near future. • **Alternative Scenarios:** Without carbon finance, the project would operate at a loss. The comparison with alternative scenarios (e.g., traditional farming without biochar application) underscores the project's dependency on carbon credits.
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.	No alternative scenario
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.	
B6. Is the information shared here consistent with information presented to the company's decision-making management, investors or lenders?	
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.	

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.**	In determining the benchmark rate for equity IRR or WACC for the Exomad Green biochar facility, we have conducted a detailed analysis considering several key factors. The project requires a total capital xpenditure (CAPEX) of $5,000,000 and has annual operational expenditures (OPEX) of $7 ,500,000. The financing structure is designed with 50% equity and 50% debt. After careful consideration of the project's objectives and financial requirements, we have opted to utilize an equity Internal Rate of Return (IRR) of 22% as the benchmark rate. This rate is derived from a comprehensive assessment of the project's expected cash flows and represents the minimum rate of return required by equity investors to justify their investment. Taking into account the technology aspect, it is acknowledged that the appropriate biochar technology may not be currently available in Bolivia. However, the project benefits from a region abundant in forestry residues, ensuring a consistent and reliable feedstock supply. Moreover, the global market for carbon removals is witnessing substantial growth, with increasing demand for carbon offsets. This market trend, coupled with the project's focus on environmental cleanliness, positions the Exomad Green biochar facility favourably within the industry. Many prominent companies demonstrate a strong interest in offsetting their carbon emissions through carbon removal credits, further enhancing the revenue potential for the project. Based on these considerations, it is evident that carbon finance plays a pivotal role in the financial sustainability and success of the Exomad Green biochar facility. The absence of an existing biochar market in Bolivia, combined with the environmental benefits offered by the project, emphasizes the project's dependence on carbon finance as a primary source of income. The anticipated financial returns derived from carbon finance mechanisms are essential for the project's economic viability, ensuring long-term profitability and facilitating the realization of carbon removal goals.
C2. Please state how CORC revenues change the expected IRR or NPV of the project.	Including CORC (Carbon Offset Revenue Credit) revenues in the financial projections of the project can have a significant impact on the expected IRR (Internal Rate of Return) or NPV (Net Present Value).

	Based on industry data, the average price range for CORCs is estimated to be between $100 and $150 USD per credit. The inclusion of CORC revenues introduces an additional revenue stream derived from the sale of carbon offsets. These offsets represent the carbon removal or emission reduction achieved by the Exomad Green biochar facility. By monetizing the project's environmental benefits, the sale of CORCs provides a valuable source of income. The potential financial impact of CORC revenues on the expected IRR or NPV depends on several factors such as the quantity of offsets generated, the timing of revenue realization, and the prevailing market prices. With the average price range of CORCs between $100 and $150 USO per credit, the project stands to generate substantial revenue from the sale of these credits. By incorporating CORC revenues, the project's cash inflows increase, leading to improved financial returns. The expected IRR, representing the rate of return required by equity investors, is positively influenced by the additional cash inflows from the sale of carbon offsets. Moreover, the inclusion of CORC revenues enhances the project's NPV by increasing the overall cash inflows over the project's lifespan.
C3. Please conduct a sensitivity analysis in relation to the investment analysis and summarize the results here.	The sensitivity analysis conducted for the investment analysis of the Exomad Green biochar facility considered several key variables. Here is a summary of the results: 1. Carbon Offset Prices: The analysis considered the range of $100 to $150 USO per carbon offset credit. Higher prices within this range positively impacted the project's financial metrics, including the expected IRR and NPV. Lower prices had the potential to decrease the financial 8 performance. It is crucial to monitor market dynamics to optimize revenue projections and financial strategies. 2. Operational Costs: The analysis factored in operational costs such as labor and maintenance. Labor costs were projected to increase by approximately 4% annually, and maintenance costs were expected to rise over time. Higher operational costs could potentially decrease the expected IRR and NPV. Implementing cost-control measures and efficient maintenance practices can mitigate their impact. 3. Biomass Feedstock Availability and Cost: The project benefited from an excess of biomass feedstock, which was currently available , with implied collection costs of around $5 USO per metric ton. However, there was a possibility that suppliers might start charging for it, with the project aiming not to pay more than $3 USD per metric ton. Ensuring a stable and cost-effective supply of biomass

	feedstock is crucial for financial performance. 4. Carbon Offset Demand: The analysis indicated a positive trend of increasing carbon offset demand, with expectations that it would continue to rise. This qrowinq demand creates a v9 favorable market environment for the project, enhancing revenue potential from the sale of carbon removal credits
C4. Is the information shared here consistent with information presented to the company's decision-making management, investors, or lenders?	Yes
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.	Yes
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.	Yes
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)	Yes	In Bolivia, financing for innovative projects like biochar production is difficult to secure due to perceived risks, especially in regions like Riberalta. Traditional financial institutions are hesitant to invest in emerging technologies and regions with underdeveloped infrastructure. This makes it challenging for Exomad Green to access the necessary capital without relying on carbon finance.
D2. Are there institutional barriers? (e.g., the investor not being the beneficiary of cost savings associated with the investment)	Yes	There are institutional barriers related to the alignment of incentives. For example, investors in the project may not directly benefit from the cost savings associated with the long-term benefits of biochar (e.g., soil enhancement, carbon sequestration), as these benefits primarily accrue to farmers and the environment, rather than to the investors themselves.
D3. Are there information barriers? (e.g., lack of awareness of the financial benefits of by-products)	Yes	There is a significant lack of awareness in the region about the financial and environmental benefits of biochar. Many local stakeholders, including potential customers, are not familiar with biochar's advantages, which makes market penetration more challenging and underscores the need for additional revenue streams like CORC (Carbon Removal Certificate) revenues.
D4. Please explain how CORC revenues are crucial element in overcoming identified barrier(s)	Yes	CORC revenues are crucial in overcoming these barriers. They provide a stable and predictable income stream that compensates for the financial risks, lack of institutional alignment, and information gaps. Without CORC revenues, the project would struggle to achieve financial viability, as other income sources (e.g., from selling biochar locally) are either uncertain or insufficient
D5. Are there subsidies for the carbon removal activity? If yes, please explain how they are not sufficient to overcome the barrier.	No	Exomad Green has not received any subsidies for carbon removal activities.
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	No	

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.		An alternative scenario, such as traditional farming without biochar, does not face significant barriers like those encountered by our project. Traditional farming methods are well-established, have easier access to financing, and do not require additional awareness-building efforts. This contrast highlights the unique challenges that our biochar project faces, reinforcing the need for CORC revenues.

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

X _____

Date, Place:
Representative name, title, organization

puro · earth

Stakeholder Engagement Report

Riberalta

PURO.EARTH Puro.earth Oy, Lapinlahdenkatu 16, 00180 Helsinki, Finland

The purpose of this document is to gather results of the Stakeholder Engagement that has been conducted by potential CO_2 Removal Suppliers of Puro.earth. It is subdivided into the three following sections:

- 1 – Stakeholder invitations
- 2 – Verbal consultation
- 3 – Text-based consultation

Please fill in section one in any case, and, depending on your selected means of Stakeholder Engagement, either section two or section three.

contact@puro.earth Puro.earth Oy, Lapinlahdenkatu 16, 00180 Helsinki, Finland https://puro.earth

1 – Stakeholder invitations

1.1. Invitation table

Name of invitee	Organization / Stakeholder type	Gender (m/f/d/no information)	Date of invitation	Method of invitation
MAX RODRIGO HUANCA BUSTAMANTE	SAWMILL FAMABU	M	01/15/2024	Verbal
ALFONSO VELASCO FONG	SAWMILL LEOVEL SRL	M	01/15/2024	Verbal
FELIX MARTINEZ SALGUERO	SAWMILL INDUSMAR SRL	M	01/15/2024	Verbal
JOSE LUIS CALIZAYA CONDORI	SAWMILL IMPOR EXPORT CONCIENCIA FORESTAL SRL	M	01/15/2024	Verbal
HEIDY MARIA SONNESCHEIN ANTELO	SAWMILL EMPRESA FORESTAL Y AGRICOLA BOLITAL LTDA	F	01/15/2024	Verbal
ZULEMA RODRIGUEZ CARTAGENA	SAWMILL DON LUIS Y PACHAMAMA SRL	F	01/15/2024	Verbal
DELMAR FRANCISCO BURG	SAWMILL OURO VERDE WOOD SRL	M	01/15/2024	Verbal
HECTOR ROLANDO MENDOZA MONTAÑO	SAWMILL MADERERA JORONOMA	M	01/15/2024	Verbal
LUIS MARTIN LOROÑO ALCOREZA	SAWMILL MABET	M	01/15/2024	Verbal
LUIS MARCELO JUSTIANO RIVAS	SAWMILL MANORBOL SRL	M	01/15/2024	Verbal
ELOY CARTAGENA	CIRABO INDIGENOUS PEOPLES ASSOCIATION	M	01/15/2024	Verbal
LORENZO ORTIZ CHAO	TACNA CABINEÑO	M	01/15/2024	Verbal
SANDRO VACA CARTAGENA	TACNA CABINEÑO	M	01/15/2024	Verbal
MARO ORTIZ ALVAREZ	CHACOBO PACAGUARA INDIGENOUS TERRITORY	F	01/15/2024	Verbal
EDUARDO VELASCO	LOCAL FARMER	M	01/15/2024	Verbal

			01/15/2024	Verbal
OSCAR DESDRE	LOCAL FARMER	M	01/15/2024	Verbal

(To add rows, right-click the lowest click "insert" and click "insert below")

1.2. Sample invitation (may also be inserted as a screenshot):

Your answer here

1.3. Were any stakeholders not invited although they are listed in para 3.1 of the Stakeholder Engagement Requirements and so relevant that they should clearly have been invited? If so, please provide justification:

Your answer here

2 – Verbal consultation

Please fill in this template if your Stakeholder Engagement was based on verbal feedback (e.g., webinar or physical meeting)

2.1 Date or period of consultation: January 22nd, 2023

2.2. Table of hosts:

Name of host	Organization	E-mail address
Marcelo Pereira	Exomad Green	mpereira@exomad.com
Michel Peralta	Exomad Green	mperalta@exomad.com

2.3. Table of participants:

Name of participant	Organization / Stakeholder type	Gender (m/f/d/prefer not to say)	E-mail address
MAX RODRIGO HUANCA BUSTAMANTE	SAWMILL FAMABU	M	
ALFONSO VELASCO FONG	SAWMILL LEOVEL SRL	M	
FELIX MARTINEZ SALGUERO	SAWMILL INDUSMAR SRL	M	
JOSE LUIS CALIZAYA CONDORI	SAWMILL IMPOR EXPORT CONCIENCIA FORESTAL SRL	M	
HEIDY MARIA SONNESCHEIN ANTELO	SAWMILL EMPRESA FORESTAL Y AGRICOLA BOLITAL LTDA	F	
ZULEMA RODRIGUEZ CARTAGENA	SAWMILL DON LUIS Y PACHAMAMA SRL	F	
DELMAR FRANCISCO BURG	SAWMILL OURO VERDE WOOD SRL	M	
HECTOR ROLANDO MENDOZA MONTAÑO	SAWMILL MADERERA JORONOMA	M	
LUIS MARTIN LOROÑO ALCOREZA	SAWMILL MABET	M	
LUIS MARCELO JUSTIANO RIVAS	SAWMILL MANORBOL SRL	M	
ELOY CARTAGENA	CIRABO INDIGENOUS PEOPLES ASSOCIATION	M	
LORENZO ORTIZ CHAO	TACNA CABINEÑO	M	
SANDRO VACA CARTAGENA	TACNA CABINEÑO	M	
MARO ORTIZ ALVAREZ	CHACOBO PACAGUARA INDIGENOUS TERRITORY	F	
EDUARDO VELASCO	LOCAL FARMER	M	

OSCAR DESDRE	LOCAL FARMER	M

2.4. Duration of meeting (in minutes): 60 minutes

2.5. List of received live-feedback and live-answers during meeting (bullet points are sufficient if they accurately reflect true content):

Comment (stakeholder)	Gender of stakeholder	Answer (CO_2 removal supplier)
What a are the benefits of biochar for the soil	M	Biochar improves soil in several ways, including increasing nutrient retention, enhancing water-holding capacity, and raising pH levels in acidic soils. It supports microbial activity, which boosts soil fertility and structure, reducing erosion. As a highly stable form of carbon, biochar also plays a significant role in long-term carbon sequestration, helping to mitigate climate change. These benefits make biochar especially useful in agricultural systems and for land restoration in degraded areas.
What concentration of biochar is toxic for the soil	F	Biochar is generally safe for soils at concentrations up to 10%, but higher levels, typically above 50% by volume, can lead to nutrient imbalances, reduced plant growth, and excessive increases in soil pH, particularly in alkaline soils.
What are the differences between biochar and charcoal	M	Biochar and charcoal differ primarily in their intended use and production methods. Biochar is produced for soil enhancement and carbon sequestration, using slow pyrolysis at lower temperatures to preserve carbon in a stable form. Charcoal, on the other hand, is made for fuel or heating, produced at higher temperatures for maximum energy release. Additionally, biochar is more porous and tailored for improving soil properties, while charcoal is denser and less effective for agricultural purposes.
How much is it going to cost	M	Biochar will be distributed for free to the community
Are the sawmills going to pay to have their residues picked up	F	No, it will be a service free of charge
How many jobs you estimate to create	M	We will create more than 200 direct jobs and another 200 indirect

2.6. In case the feedback indicates that alterations must be made to the project's design, please summarize the content of those comments and how you will address them. If you decide not to alter project design despite the feedback, please provide a justification:

2.7. In case any relevant stakeholders could not take part in the public comment period due to reasons such as lack of mobile access or physical disability, please describe and summarize how you engaged with them, what their feedback was, and how you will react to it. If you decide to not alter project design although the comments indicate so, please provide a justification:

Your answer here

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ACTA DE REUNIÓN Y ACUERDO

En la ciudad de Riberalta, Departamento del Beni, Estado Plurinacional de Bolivia, a los 14 días del mes de febrero del año 2024, se llevó a cabo una reunión entre representantes de Exomad Green y La Central Indígena de la Región Amazónica de Bolivia (CIRABO), con el objetivo de discutir y llegar a un acuerdo en relación con el proyecto de establecimiento de una planta de producción de biochar en Riberalta, Bolivia.

En calidad de asistentes a esta reunión, estuvieron presentes:

Por parte de Exomad Green:
Marcelo Pereira Holters Cargo: Gerente de Proyecto

La Central Indígena de la Región Amazónica de Bolivia (CIRABO), como máxima instancia de los Pueblos Indígenas de la Región Amazónica de Bolivia, con la ratificación del convenio 169 de la OIT, sobre los pueblos Indígenas y Tribales a través de las diferentes atribuciones reconocidas a sus autoridades tradicionales, en coordinación con sus diferentes secretarías y capitanías de los Pueblos: Tacana-Cavineño, Cavineño, Chacobo-Pacahuara, Araona, Esse-Ejja, Joaquimano y TIM II

La reunión fue conducida por el representante de Exomad Green, quien presentó los detalles y beneficios del proyecto de establecimiento de la planta de producción de biochar en Riberalta. Durante la reunión, se discutieron los siguientes puntos:

1. Se explicaron los beneficios que el biochar puede ofrecer en términos de mejora de la salud del suelo, retención de agua, disponibilidad de nutrientes y mitigación del cambio climático mediante la captura de carbono.
2. Se destacó la importancia de utilizar los residuos generados en las industrias madereras y aserraderos de la zona como materia prima para la producción de

1. Se explicaron los beneficios que el biochar puede ofrecer en términos de mejora de la salud del suelo, retención de agua, disponibilidad de nutrientes y mitigación del cambio climático mediante la captura de carbono.
2. Se destacó la importancia de utilizar los residuos generados en las industrias madereras y aserraderos de la zona como materia prima para la producción de biochar, con el fin de evitar la quema de dichos residuos y los riesgos asociados para la salud y el medio ambiente.
3. Se resaltó el potencial impacto económico positivo del proyecto, en términos de generación de empleo local tanto en la producción como en la distribución y aplicación del biochar en las tierras agrícolas de la región.
4. Se reafirmó el compromiso de Exomad Green de respetar y valorar el conocimiento y las prácticas agrícolas tradicionales de la comunidad indígena, trabajando en colaboración con La Central Indígena de la Región Amazónica de Bolivia (CIRABO), para integrar el uso de biochar de manera compatible con dichas prácticas.

Tras un intercambio de opiniones y consultas, se llegó al siguiente acuerdo:
La Central Indígena de la Región Amazónica de Bolivia (CIRABO), manifiesta su conformidad y apoyo al proyecto de establecimiento de la planta de producción de biochar propuesto por Exomad Green. Reconoce los beneficios potenciales que el biochar puede ofrecer a la comunidad y la región en términos de mejora de la salud del suelo, oportunidades económicas y preservación del medio ambiente.

Exomad Green se compromete a mantener una comunicación abierta y transparente con La Central Indígena de la Región Amazónica de Bolivia (CIRABO), así como a involucrarlos activamente en el proceso de toma de decisiones y desarrollo del proyecto. Ambas partes acuerdan trabajar de manera conjunta y colaborativa para implementar el proyecto de manera responsable y sostenible.

En testimonio de conformidad, se firma esta Acta de Reunión y Acuerdo por los representantes de ambas partes presentes.

Representante de Exomad Green

Representante de La Central Indígena de la Región Amazónica de Bolivia (CIRABO)

Eloy Cartagena Yoamona
PDTE DE LA CIRABO
C.I.1913862 BN.
2021 - 2026
Riberalta-Beni-Bolivia

Mario Chavez Duran
STRIO. DE ECONOMIA
T.C.O. CHACONIO - RECAUDERA TAPAYA

Lourdes Ramara Libert
SECRETARIA DE GENERO Y ASUNTOS GENERACIONALES
CIRABO

Jorge Chamuro Cartagena
C.I. 5595747 SN.
STRIO. T.T.P.N.-CIRABO

Autoridad de Fiscalización y Control Social de Bosques y Tierra

ESTADO PLURINACIONAL DE BOLIVIA

MINISTERIO DE MEDIO AMBIENTE Y AGUA

ACUERDO DE COLABORACIÓN PARA EL MANEJO DE RESIDUOS FORESTALES ENTRE LA INSTITUCIÓN PÚBLICA AUTORIDAD DE BOSQUES Y TIERRAS (ABT), LA EMPRESA PRIVADA EXOMAD GREEN Y LA ASOCIACIÓN DE EMPRESARIOS MADEREROS DE LA AMAZONIA BOLIVIA MUNICIPIO RIBERALTA

Conste por el presente convenio de cooperación interinstitucional entre la (UOBTN) Unidad Operativa de Bosque y Tierra Núcleo Riberalta de la Autoridad de Fiscalización y Control Social de Bosques y Tierra (ABT), la empresa EXOMAD GREEN y la Asociación de Empresarios Madereros de la Amazonia Boliviana ASAMAB; quienes celebran al tenor de las cláusulas y condiciones siguientes:

PRIMERA. - DE LAS PARTES INTERVINENTES:

- la **Autoridad de Fiscalización y Control Social de Bosques y Tierra (ABT)**, en adelante denominada "La Institución", representada por la Ing. Elina Consuelo Torrico Nishihara Responsable de la (UOBTN) Unidad Operativa de Bosque y Tierra Núcleo Riberalta.
- La empresa **EXOMAD GREEN** con registro ante la ABT ABT-RUEF-00218, en adelante denominada "La Empresa", representada por Marcelo Pereira Holters, Gerente de Exomad Green.
- La **Asociación de Empresarios Madereros de la Amazonia Boliviana "ASAMAB"** con Personería Jurídica aprobada mediante Resolución de Gobernación N° 134/2021, en adelante denominada "La Asociación", representada por José Destre Álvarez.

SEGUNDA. – ANTECEDENTES

Los bosques han sido parte importante de la vida social, cultural, económica e incluso espiritual de las culturas bolivianas durante siglos. En la actualidad, la mitad del territorio de Bolivia se encuentra cubierto por diferentes formaciones boscosas, que van desde la región altoandina, hasta las amazónicas. Estos bosques son importantes por sus funciones ambientales, esenciales para el bienestar humano, que incluyen la regulación del clima regional y local, el mantenimiento del carbono, la seguridad hídrica y la prevención de riesgos, la formación del suelo y la seguridad alimentaria, el mantenimiento de la biodiversidad.

El Gobierno Boliviano está tomando medidas más firmes para reprimir la tala ilegal y fortalecer el sector forestal.

El estado Plurinacional de Bolivia, reconoce la necesidad de fortalecer las instituciones dependientes del mismo en el cumplimiento de sus objetivos institucionales a efectos de ser un autentico instrumento de servicio público, una administración eficiente y transparente. Asimismo, reconoce que con la implementación de alianzas estratégicas se satisficieron grandes necesidades de la sociedad civil, en especial, de los mas desprotegidos de la población.

La recolección y venta de madera sostenible puede proporcionar una importante fuente de ingresos a las comunidades locales. Cerca de la mitad de los bosques de

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Autoridad de Fiscalización y Control Social de Bosques y Tierra

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Bolivia se encuentran en manos de comunidades indígenas, y el respeto por el bosque está profundamente arraigado en su cultura.

En la presenta gestión se realizaron reuniones con actores de la cadena productiva a fin de ralizar un convenio para con el objetivo de minimizar impactos ambientales y promover prácticas eco-amigables.

TERCERA. - MARCO NORMATIVO

Los artículos 3 Inc. c), 4, y 27 del Decreto Supremo N° 071/2009 de fecha 09 de Abril del 2009, establecen la creación de la AUTORIDAD DE FISCALIZACION Y CONTROL SOCIAL DE BOSQUES Y TIERRAS (ABT), asimismo determinan que las atribuciones, competencias, derechos y obligaciones de las ex Superintendencia Forestal y Agraria, serán asumidas por las Autoridades de Fiscalización y Control Social de Bosques y Tierras, en consecuencia controla, supervisa y regula el sector Forestal y Agrario dando cumplimiento a los mandatos de la Ley N° 1700 del 12 de Julio de 1996, Ley N° 1715 del 18 de octubre de 1996 del Servicio Nacional de Reforma Agraria, Ley N° 3545 del 28 de noviembre de 2006 de modificación de la Ley N° 1715; quien goza de independencia administrativa, financiera, legal y técnica, bajo la dependencia y/o tuición del Ministerio de Medio ambiente y agua

CUARTA. - OBJETO DEL CONVENIO

Implementación de un sistema eficiente de manejo de residuos forestales provenientes de los aserraderos, con el propósito de mitigar riesgos de incendio, promover la sostenibilidad ambiental y contribuir al bienestar de la comunidad.

QUINTA. - COMPROMISO DE LAS PARTES

La ABT:

Es responsable de la regulación y supervisión de las actividades forestales en la región, incluido el manejo de residuos forestales generados por procesos de aserrado.

UOBTN RIBERALTA

La Empresa EXOMAD GREEN:

Es especializada en la gestión y aprovechamiento sostenible de residuos forestales, con el objetivo de minimizar impactos ambientales y promover prácticas eco-amigables, mediante:

1. Identificación de Residuos: La Empresa se compromete a identificar y clasificar los residuos forestales generados por el proceso de aserrado de troncos en los aserraderos, priorizando aquellos con mayor riesgo de combustión.

2. Transporte Seguro: La Empresa será responsable del transporte seguro de los residuos forestales desde los aserraderos hasta sus instalaciones, cumpliendo con todas las normativas y regulaciones pertinentes.

3. Procesamiento y Aprovechamiento para Biochar: La Empresa llevará a cabo procesos adecuados para la transformación de los residuos forestales en biochar,

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utilizando la biomasa generada en los aserraderos de la zona del municipio de Riberalta, provincia Vaca Diez, Beni, Bolivia.

La Asociación de Empresarios Madereros de la Amazonia Boliviana "ASAMAB":

Los aserraderos, representados por la Asociación de Aserraderos, se comprometen a entregar el material residual del aserrío para evitar o al menos reducir la quema de los mismos, en línea con el objetivo de mitigar riesgos de incendio y promover la sostenibilidad ambiental.

SEXTA. - BENEFICIARIOS:

En el Anexo 1, adjunto al acuerdo, se encuentra una lista de los aserraderos que serán beneficiados con el acuerdo de colaboración de residuos, en el detalle adjunto estará la Razón Social y número de registro RUEF otorgado por la ABT a las empresas.

SEPTIMA. - VIGENCIA Y MODIFICACIONES:

Este acuerdo tendrá una vigencia de cinco (5) años calendario a partir de la fecha de firma por las partes. Cualquier modificación deberá ser acordada por todas las partes involucradas y formalizada por escrito.

OCTAVA. – CONFORMIDAD

Nosotros, Ing. Elina Consuelo Torrico Nishihara **Responsable de la UOBTN Riberalta de la ABT**, Sr. Marcelo Pereira Holters representante de la empresa **EXOMAD GREEN** con registro ante la ABT ABT-RUEF-00218 y Sr. José Destre Álvarez Representante de la **Asociación de Empresarios Madereros de la Amazonia Boliviana "ASAMAB"** declaramos nuestra total conformidad con todas y cada una de las clausulas declaradas en el presente convenio, firmando en triple ejemplar de un mismo tenor a los cinco días del mes de enero del año 2024.

Ing. Marcelo Pereira Holters
Gerente Exomad Green

Ing. Elina Consuelo Torrico Nishihara
Responsable de la UOBTN Riberalta ABT

Sr. José Destre Álvarez
Presidente Asociación de Empresarios Madereros de la Amazonia Boliviana

3 – Text-based consultation

Please fill in this template if your Stakeholder Engagement was based on written feedback (e.g., comments on a website or emails).

3.1. Date or period of consultation:

3.2. Number of comments submitted:

3.3. Table of addressed public comments

Comment of stakeholder	Answer from CO_2 removal supplier	Name of stakeholder	Organization	E-mail address

3.4. In case the feedback indicates that alterations must be made to the project's design, please summarize the content of those comments and how you will address them. If you decide not to alter project design despite the feedback, please provide a justification:

Your answer here

3.5. In case any relevant stakeholders could not take part in the public comment period due to reasons such as lack of mobile access or physical disability, please describe and summarize how you engaged with them, what their feedback was, and how you will react to it. If you decide to not alter project design although the comments indicate so, please provide a justification:

Your answer here

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Environmental and social safeguards questionnaire

CO_2 Removal Supplier	Exomad Green
Production Facility	Riberalta
Production Facility ID	Not Yet Assigned
Date of report last update (YYYY-MM-DD)	2024/09/13

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.
Exomad Green operates in Bolivia, producing hardwood biochar from sustainable forestry residues to address both environmental and social challenges. By transforming biomass waste into biochar through pyrolysis, the company sequesters significant amounts of CO2, helping mitigate climate change and improving soil health for sustainable agriculture. Exomad Green follows strict environmental safeguards, including sustainable sourcing and recycling of resources, while also fostering local economic growth by creating green jobs and supporting indigenous communities. Their operations improve air quality for over 250,000 people and contribute to sustainable land management by preventing deforestation and reducing fire risks.

Provide an overview of the material environmental and social impacts and risks in your operations, and how they were determined.
Exomad Green's operations focus on producing biochar from sustainable hardwood forestry residues, leading to both environmental and social impacts. Environmentally, the company mitigates climate change by sequestering carbon, reducing CO2 emissions by preventing the incineration of biomass, and enhancing soil fertility for sustainable agriculture. Socially, Exomad Green creates green jobs, improves air quality for 250,000 people, and supports local communities by freely distributing biochar to farmers. Risks, such as potential water pollution or air emissions, are mitigated through strict adherence to national and international environmental regulations, sustainable sourcing, and internal recycling systems. These impacts and risks were determined through environmental audits, certifications, and community engagement strategies.

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.	
Exomad Green complies with all relevant Bolivian laws, regulations, and international standards, holding the necessary permits and environmental licenses to operate, including those from the Agencia Boliviana de Bosques y Tierras (ABT). Our biomass is sourced legally and sustainably under Bolivia's forestry management laws, designed to prevent deforestation. We adhere to local environmental regulations on air and water pollution and have the required business licenses, environmental permits, and the Industrial Environmental Registry Permit. Additionally, our carbon removal activities are certified under the Puro.earth biochar methodology, ensuring compliance with international carbon sequestration standards, and are verified through regular third-party audits	
Identify any documents or other records that you rely upon to verify compliance.	
Business Licence, Environmental Permit, Third party Laboratory results for Biochar	

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
Yes. We have policies in place for this	

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
Yes, Exomad Green complies with the requirement to recognize, respect, and promote the rights of Indigenous Peoples (IPs) and Local Communities (LCs) in accordance with international human rights laws, including the United Nations Declaration on the Rights of Indigenous Peoples and ILO Convention 169 on Indigenous and Tribal Peoples. Exomad Green actively engages with local	

indigenous communities around its operations in Bolivia, particularly through open dialogue, community meetings, and informational materials in local languages. We ensure that indigenous groups are fully informed and involved in our biochar projects, which bring tangible benefits such as improved soil health, job creation, and reduced air pollution. Our operations strictly follow national labor laws that protect workers' rights, offering dignified employment, fair wages, and social benefits to local and indigenous workers. Moreover, Exomad Green's free distribution of biochar to farmers, many of whom are from indigenous communities, directly supports their agricultural activities, contributing to food security and economic empowerment.

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 labour, child labour 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?	
Exomad Green complies with labor rights and working condition requirements by implementing strict internal policies that prohibit forced labor, child labor, and discrimination while promoting fair treatment and equal opportunities for all employees. These policies are extended to our suppliers, who are selected based on stringent ethical standards, with protocols in place to verify compliance with child labor laws throughout the supply chain. Our operations adhere to robust health, safety, and environmental standards, regularly audited to ensure compliance with both local and international regulations.	
Identify any documents or other records that you rely upon to verify compliance.	
Policies and checklists	

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.	
Exomad Green has identified key occupational health and safety hazards, including fire risks from wood residue accumulation, air pollution from previous biomass incineration, and potential physical injuries in production processes.	
Describe the measures undertaken to mitigate the hazards.	
To mitigate these risks, the company has implemented robust safety protocols, including repurposing wood residues for biochar to reduce fire hazards, transitioning to cleaner production methods to improve air quality, and enforcing regular safety training and emergency response	

plans. These measures are part of Exomad Green's comprehensive Health, Safety, and Environment (HSE) Program, which exceeds local regulatory standards.

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?	
Yes, Exomad Green complies with the requirement of providing equal opportunities in the context of gender, ensuring equal pay for equal work, and protecting against violence towards women and girls. The company maintains a strict policy of equal employment opportunities, valuing diversity and inclusion across its workforce. This policy guarantees that all employees, regardless of gender, receive equal pay for equal work. Exomad Green also enforces a zero-tolerance approach to harassment and discrimination, creating a safe, respectful work environment. Compliance with these standards is ensured through regular audits, adherence to labor regulations, and clear internal policies that promote gender equality and protect against violence.	
Identify any documents or other records that you rely upon to verify compliance.	
Policies and payroll	

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	
Exomad Green takes significant measures to prevent pollutant discharges to the air during its carbon removal activities. The company's process of transforming biomass residues into biochar through pyrolysis minimizes harmful emissions. During pyrolysis, gases such as methane (CH_4) and volatile organic compounds (VOCs) are generated, but 70% of these are reused to power the drying process, and the remaining 30% is burned off in a controlled manner, converting them into less harmful substances like CO_2 and water vapor. This method reduces air pollution significantly, particularly compared to traditional biomass burning, which would have released large amounts of pollutants into the atmosphere.	
b. Pollutant discharges to water	

It's a closed loop system which does not use any water from the grid.
c. Pollutant discharges to soil
None
d. Noise
Exomad Green complies with the noise pollution requirements through its operational setup. The company's biochar production facilities are strategically located far from residential areas, minimizing the impact of noise on the local population. Additionally, the nature of the biochar production process does not generate significant levels of noise pollution. Exomad Green ensures compliance by continuously monitoring its operations and adhering to local environmental regulations to mitigate any potential disturbances related to noise.
e. Vibration
Exomad Green complies with noise and vibration control standards, as the production facilities are located in remote areas, far from residential zones, minimizing the impact on local populations. The machinery used in biochar production generates low levels of noise and vibration, and operations are regularly monitored to ensure compliance with local environmental regulations. Additionally, measures are in place to control any minimal vibrations caused during the process.
f. Waste
Exomad Green's production process generates minimal waste because the primary focus is on converting biomass residues, which are considered waste from the forestry industry, into biochar. However, some waste is produced during the biochar production process, such as ash and non-biochar residues. To manage this, Exomad Green implements strict protocols to minimize and properly handle any byproducts. The company ensures that all waste is treated and disposed of according to local environmental regulations, prioritizing recycling and reuse wherever possible. Additionally, the gases produced during the pyrolysis process are largely reused, reducing both emissions and waste generation.
g. Release of hazardous materials
Exomad Green takes significant measures to prevent the release of hazardous materials during its carbon removal activities. The biochar production process involves pyrolysis, which transforms organic materials into biochar without generating significant hazardous by-products. The gases produced during this process, such as methane and volatile organic compounds, are mostly reused within the operation, with the remaining gases being safely combusted to minimize their impact. Exomad Green adheres to strict environmental regulations, ensuring that no hazardous chemicals, materials, or residues are released into the environment during its operations
h. Chemical pesticides and fertilizers
Exomad Green does not use chemical pesticides or fertilizers in its biochar production process. Instead, the company focuses on utilizing biomass residues, specifically from sustainably managed forestry operations, and transforms them into biochar, which itself is a natural soil amendment. This process avoids the use of any harmful chemicals, thus preventing the release of chemical pesticides or fertilizers into the environment.

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.	
Exomad Green's biochar production facilities are not located in or near environmentally sensitive areas, such as nature reserves or national parks. The company ensures that its operations take place in areas already designated for sustainable forestry activities, particularly around Concepción, Bolivia, which is known for its responsible forest management practices. Exomad Green's activities adhere to Bolivia's forestry regulations, under the supervision of the Authority for the Supervision and Social Control of Forests and Land (ABT), ensuring that the biodiversity and ecosystems in surrounding areas are protected.	
Describe impacts and risks that you have identified	
none	
Describe the measures undertaken to minimize and address the impacts and the risks.	
none	

Requirement: Minimizing soil degradation and soil erosion.	**Rule** 6.4.1.1.viii
Describe impacts and risks to soil that you have identified.	
By applying biochar to agricultural soils, Exomad Green improves soil fertility and increases its capacity to retain water, which reduces the risk of erosion and helps maintain soil health. Additionally, biochar's porous structure promotes soil carbon sequestration, mitigating long-term degradation. These practices are part of Exomad Green’s sustainable land management efforts.	
Describe the measures undertaken to minimize and address the impacts and the risks.	
None	

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
Concepción, located in the Santa Cruz region of Bolivia, is not identified as an area facing significant water stress. The region, characterized by a tropical climate, has a marked wet season from November to March, during which soil moisture content can range from 20% to 40% or higher due to frequent rainfall. However, in the dry season, which runs from April to October, moisture levels can drop significantly, leading to drier soil conditions. Although not classified as severely water-stressed, Concepción experiences seasonal variations in water availability. CO_2 removal has no impact on the water availability of the region. Quite the opposite, biochar in agricultural application improves water retention
Describe any agreements and/or regulations relating to water sourcing.
None
Describe the measures undertaken to minimize water consumption.
We use a closed system cooling for biochar, no additional consumption of water from the grid is done

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?	
We transform forestry residues into biochar. We verify that the residues are sourced from Sustainable Forest Management Areas and that they are extracted according to regulation.	
Identify any documents or other records that you rely upon to verify compliance.	
Sawmill List with Approved RUEF Licences, Supplier selection protocol	

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.	
Exomad Green identifies and mitigates potential impacts to community health and safety by addressing both routine and non-routine circumstances. During routine operations, the pyrolysis process used to convert biomass into biochar is closely managed to control emissions like	

methane and volatile organic compounds (VOCs). Most of these emissions are reused within the system, and any remaining gases are safely flared to minimize harmful effects. Non-routine circumstances, such as equipment malfunctions, pose risks like pollutant release or fire, which are mitigated through robust safety protocols, regular equipment maintenance, and emergency response plans. Additionally, Exomad Green's facilities are located away from residential areas, reducing exposure to noise, vibration, and other potential hazards.
Describe the measures undertaken to minimize and address the impacts and the risks.
Exomad Green has implemented several measures to minimize and address potential impacts on community health and safety. Firstly, the company uses pyrolysis to transform biomass residues into biochar, which significantly reduces air pollution compared to traditional burning methods. Emissions such as methane and volatile organic compounds are captured and reused, minimizing the release of harmful pollutants into the environment. In addition, Exomad Green has established emergency response protocols and safety training programs to address potential non-routine incidents, such as equipment failures or accidental emissions. These measures ensure the health and safety of both the workforce and nearby communities. Furthermore, the facilities are located in remote areas, reducing the exposure of residential communities to noise, vibration, and other operational impacts.

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.	
None	
Describe the measures undertaken to minimize and address the impacts and the risks.	
None	

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?		
Click or tap here to enter text.		

Provide a comprehensive description of the process that was undertaken, compensation arrangements and measures to mitigate the negative impacts.
Click or tap here to enter text.
Also describe in detail how you minimized forced physical or economic displacement.
Click or tap here to enter text.

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?	
Click or tap here to enter text.	
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.	
The will receive biochar for free for their crops	
b. Describe how and when the indigenous communities were identified and approached for the FPIC process.	
Through their leaders with verbal invitation	
c. Describe the mutually agreed process for the negotiations.	
No negotiation needed as they accepted to receive the free biochar	
d. Describe how the indigenous communities were informed about the potential impacts of the activity on their livelihoods, ancestral knowledge, or cultural heritage.	
They were informed in a meeting	

e. Describe the outcome of the negotiations.
Positive, they decided to accept the biochar donations
f. Describe how the ongoing consent process is managed to ensure that the indigenous communities continue to agree with the activity as it progresses.
They will be contacted periodically to follow up on the improvement of their soils
g. Describe grievance mechanisms that are in place for the indigenous communities.
Direct communication line to the regional project manager
h. Describe how the impacts on the indigenous communities are monitored and addressed during the operation of the Production Facility.
Through quarterly reports

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.	
Yes, Exomad Green's carbon removal activity is based on using biomass feedstock, specifically hardwood residues from the sustainable forestry industry.To ensure that this biomass is sourced sustainably, Exomad Green follows stringent guidelines established by Bolivia's forest management authorities. All biomass feedstock is sourced from suppliers certified by the Bolivian Authority of Forests and Land (ABT), ensuring that the wood residues come from legally and sustainably managed forests. Regular audits and inspections are carried out to ensure ongoing compliance with these sustainability standards	

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