Preliminary Assessment Public Summary

This *Preliminary Assessment Public Summary*, prepared by Puro.earth, contains general information about the CO_2 Removal Supplier and its project, as evaluated at the time of the Preliminary Assessment (PA). It also includes a *Non-Technical Project Summary* and a *Criteria Assessment Report* detailing: i) key criteria assessed and their associated outcomes, ii) Puro's comments, and iii) evidence provided by the CO_2 Removal Supplier.

The *Preliminary Assessment Public Summary* serves as a transparent communication tool, enabling potential investors, buyers, and stakeholders to quickly understand the supplier's carbon removal capabilities and assessment status.

The supplier has also received an extended *Preliminary Assessment Report*. This confidential document offers in-depth insights, including specific remarks and actionable recommendations to guide the supplier's progression through the certification journey.

1. Supplier and Project Information

CO_2 Removal Supplier	
Company name	CarboHeroes GmgH
Company address	Karl-Liebknecht-Straße 13 10178 Berlin Germany
Business ID	HRB253374B
KYC status	Completed (06/15/2023)
CO_2 Removal Project	
Methodology	**Biochar, Edition 2022, Version 3**
Production Facility name	Costa Rica 1
Facility registration date	02/20/2025
Production Facility ID	420257
Production Facility location	Tejar de El Guarco, Parque Activa, Grecia Cartago 65-7052 Costa Rica
Host Country of removal	Costa Rica
Has this facility been registered in another registry?	☒No ☐Yes, additional information:
Preliminary Assessment Details	
Date of assessment	09/18/2024
Status of assessment	Final
Conclusion of assessment	Passed

2. Non-Technical Project Summary

CarboHeroes will remove 100 million tons of CO2 from the atmosphere by 2050 combining sustainable agriculture with the sequestration of massive amounts of carbon. Our solution is a circular economy model using wood residues to produce biochar by thermal carbonization (pyrolysis). This biochar will be incorporated into the soil, increasing soil health.

Carbon credits will be created, issued, and traded with the permanent fixation of the carbon in the soil. In addition, there are numerous applications for biochar in markets inside and outside agriculture that make processes and products more environmentally friendly and sustainable. The business model is based on the massively growing carbon credit market in the first phase, supplemented by selling into biochar application cases in the second phase. Of course, the usage (& sales) of thermal energy is considered in all phases.

Our long experience in biochar and the Voluntary Carbon Market, paired with our excellent network of farmers and feedstock providers, as well as pyrolysis plant suppliers, and carbon marketplaces, makes our team perfect to develop and scale this business.

3. Criteria Assessment Report

Reminder: Criteria/Sub-criteria assess either the *technical eligibility* of the facility or its *maturity and quality*, determining whether the facility qualifies for CO_2 Removal Certificates (CORCs) and evaluating its development stage and operational quality. There are three types of sub-criteria:

- **Required to be Passed**: These core criteria are crucial for determining the Supplier's facility eligibility as they may be otherwise impossible or costly to change at a later stage. For example, if the supplier is at a such an early stage of development that the *capture technology is not yet identified*, the PA won't be able to provide useful insights regarding the facility's eligibility.

- **Required to be Assessed**: These criteria are important for evaluation, but they do not necessarily determine whether the facility will pass or fail at this stage. Suppliers may be at different stages of development, and some criteria (e.g., demonstrating the necessary permits) may not yet be fully met. In such cases, disclosing the status of permit acquisition is sufficient.

- **Not Required**: These criteria are optional and do not impact the facility's eligibility for listing at this stage. They may provide additional context or information about the facility's maturity but are not essential for passing the preliminary evaluation.

For a facility to be considered eligible for listing, all the sub-criteria that condition eligibility must be met (i.e. passed or assessed), as specified in Table 1. **If any of these critical sub-criteria are not met, the facility will not be eligible for listing in its current development stage.**

Disclaimer: The assessment has been made against the criteria in the current version of the methodology. Puro.earth relied on the CO_2 Removal Supplier for the correctness of the provided information during the time of the PA and will make no representation as to the accuracy or completeness of this report. The CO_2 Removal Supplier must undergo a third-party audit before issuing CO_2 Removal Credits (CORCs). **Passing the PA does not guarantee a success in the third-party audit.**

Overall evaluation: Preliminary Assessment is **passed**.

Table 1. Criteria and sub-criteria assessment by Puro based on the documents submitted in the Audit Package.

ID	Criteria / Sub-criteria	Outcome	Comment	Evidence reviewed	Requirement for listing	Purpose of criteria
C1	**Planned biomass feedstock(s) is(are) eligible**	**Passed**			*Passed if required sub-criteria are met*	
C1.1	*Biomass feedstocks are identified and compatible with EBC positive list*	Passed	Biomass feedstocks identified are sawmill leftovers from forestry and include F-01: Bark, F-02: Wood chips only from mechanical	Biomass types and origins list.xlsx Biomass types and origins list_CarboHeroes_1	Required to be passed	Technical eligibility

			treatment, F-03: wood residues, F-04: sawdust. The biomass sources are eligible and compatible with the EBC positive list.			
c1.2	*Biomass feedstock sustainability and chain-of-custody can be demonstrated, if applicable*	Passed	The biomass feedstocks are planned to be sourced from forests in Costa Rica that are under FSC certification. The country's regulations and certifications further supports that its wood products are sourced and produced in a responsible manner Evidence will need to be supplied for the output audits.	Biomass types and origins list.xlsx Biomass types and origins list_CarboHeroes_1	Required to be passed	Technical eligibility
c1.3	*Bioenergy leakage related to feedstock use is minimal*	Assessed	There are alternative uses for the biomass selected, which could entail energy production (e.g. woodchip combustion) but also large amounts of biomass left to decay in the project area according to the supplier. Here, the facility is not planned to produce bioenergy for other uses. This situation could represent a risk for bioenergy leakage, if biomass feedstock would become limited in the project area.	Puro additionality questions to suppliers v1.8_CarboHeroes_1.docx Biochar production equipment questionnaire_CarboHeroes_1.xlsx	Required to be assessed	Technical eligibility
c1.4	*Land use change related to feedstock use is minimal*	Assessed	The feedstocks selected and their sources are deemed to have minimal to no effects on land use change, due to forest management certification.	Biomass types and origins list.xlsx Biomass types and origins list_CarboHeroes_1	Required to be assessed	Technical eligibility
c1.5	*Sourcing of biomass is secured (e.g. letters of intent, contracts)*	Assessed	Biomass suppliers have been identified and non-binding letters of intent have already been signed.	LoI Feedstock - GRUPO EMPRESARIAL EL ALMENDRO.pdf LoI Feedstock - Okama MB Corporación S.A	Not required	Maturity & Quality
c2	**Planned biochar production equipment is technically sound**	**Passed**			*Passed if required sub-criteria are met*	
c2.1	*Several options of reactor design have been identified*	Passed	The supplier engaged with multiple pyrolysis plant manufacturers in Europe and China, which were assessed against the requirements of carbon credit methodologies.	Biochar production equipment questionnaire_CarboHeroes_1.docx	Required to be passed	Technical eligibility
c2.2	*Reactor design has been decided, contracted, or purchased*	Assessed	The supplier has opted to use a Puro-vetted equipment. Haiqi's CNBC1000 and CNBC500 continuous pyrolysis screw reactor	Biochar production equipment questionnaire_CarboHeroes_1.docx Puro Assessment - CarboHeroes 20240408.pdf	Required to be assessed	Maturity & Quality

			configurations have been decided but have not yet been purchased.			
c2.3	*Reactor design is vetted, regarding production of biochar with H/C ratio below 0.7*	Passed	The equipment and feedstock selected are deemed possible to produce biochar with H/C below 0.7. Laboratory analyses were provided by HaiQi during its vetting.	Biochar production equipment questionnaire_CarboHeroes_1.docx	Required to be passed	Technical eligibility
c2.4	*Reactor design is vetted, regarding risk for CH_4 emissions*	Passed	If operated according to specifications, the reactor should have negligible methane emissions. Methane emissions tests were provided by HaiQi during its vetting.	Biochar production equipment questionnaire_CarboHeroes_1.docx Environmental Evaluation Report_CarboHeroes_1.docx	Required to be passed	Technical eligibility
c2.5	*Reactor design is vetted, regarding air pollutant emissions in line with local regulation*	Passed	The required regulation has been identified and the monitoring and testing of facility emissions are required to obtain the required permit in Costa Rica. Various flue gas treatment options can be installed that reduce air pollutants sufficiently for the forestry-based feedstock, but no decision was yet made. Air pollution emissions tests were provided by HaiQi during its vetting and results were able to comply with regulation in the country of manufacturing (China).	Biochar production equipment questionnaire_CarboHeroes_1.docx	Required to be passed	Technical eligibility
c2.6	*Facility design is vetted, regarding disposal of waste streams, including any liquid streams (wastewater, oil, tars)*	Passed	The process is expected to produce some small amount of wood vinegar and tar, due to syngas cleaning prior to combustion. It is expected that every ton of carbonized raw material will produce 5-10 kg of wood vinegar and 2-3 kg of tar. Wood vinegar and tar are planned to be retired every month. Wood vinegar and tar products are planned to be sold in the future as raw materials to other industries; but alternative disposal routes remain to be identified by the supplier. Ashes and sludge are planned to be removed every 3 months. A disposal route remains to be identified by the supplier.	Biochar production equipment questionnaire_CarboHeroes_1.docx Environmental Evaluation Report_CarboHeroes_1.docx	Required to be passed	Technical eligibility

c2.7	*Facility is co-producing bioenergy (e.g. heat, power) for internal use*	Assessed	Part of the thermal energy generated from combustion of pyrolysis gas is used to sustain the pyrolysis and dry the biomass.	Biochar production equipment questionnaire_CarboHeroes_1.docx	Required to be assessed	Maturity & Quality
c2.8	*Facility is co-producing bioenergy (e.g. heat, power, fuel) for external use*	Assessed	The facility will not produce bioenergy for any external use; the excel thermal energy will be dissipated. However, a small amount of tar and wood vinegar may be sold as a raw material to be used by other industries.	Environmental Evaluation Report_CarboHeroes_1.docx	Required to be assessed	Maturity & Quality
c3	**Biochar planned end-use(s) is(are) eligible**	**Passed**			*Passed if required sub-criteria are met*	
c3.1	*Biochar end-uses are eligible*	Passed	The biochar will be used for soil application for agricultural, reforestation and ecological activities. The biochar will also be mixed with additional natural products such as manure or crop residues depending on the specific application locations.	06. Biochar end-use types_CarboHeroes_1.docx LoI Café M&M Pura Vida - Soil Incorporation.pdf LoI Cafetalera Aquiaris - Soil Incorporation.pdf MoU Soil Incorporation - Agroecologica Sustentable.pdf Puro Assessment - CarboHeroes 20240408.pdf	Required to be passed	Technical eligibility
c3.2	*Plans of biochar end-uses are tangible*	Assessed	There are already letters of intention with several farmers for biochar offtake and soil application.	LoI Café M&M Pura Vida - Soil Incorporation.pdf LoI Cafetalera Aquiaris - Soil Incorporation.pdf MoU Soil Incorporation - Agroecologica Sustentable.pdf	Required to be assessed	Maturity & Quality
c3.3	*Biochar environmental quality thresholds are known for the identified end-uses*	Assessed	The thresholds for the intended end-use has not been identified at this stage. But, based on the feedstock and pyrolysis unit, and if operated correctly, the biochar is expected to be below the required thresholds.	Puro Assessment - CarboHeroes 20240408.pdf	Required to be assessed	Maturity & Quality
c4	**Additionality is demonstrated**	**Passed**			*Passed if required sub-criteria are met*	
c4.1	*Carbon storage additionality to baseline*	Passed	Without this project, the leftovers from the sawmills are either incinerated or left to decompose.	Puro additionality questions to suppliers v1.8_CarboHeroes_1.docx Puro Assessment - CarboHeroes 20240408.pdf	Required to be passed	Technical eligibility
c4.2	*Financial additionality of facility*	Passed	The supplier has provided a facility-specific cash flow model demonstrating that CORC revenues are required to achieve a positive IRR.	Puro additionality questions to suppliers v1.8_CarboHeroes_1.docx 301024_CarboHeroes_BP_1_UNIT_excl_CORC.xlsx 301024_CarboHeroes_BP_1_UNIT_incl_CORC.xlsx	Required to be passed	Technical eligibility

c4.3	*Regulatory additionality*	Passed	Statements from the supplier indicate that production of biochar from the identified feedstocks is not required by any law.	Puro additionality questions to suppliers v1.8_CarboHeroes_1.docx	Required to be passed	Technical eligibility
c4.4	*Production equipment is newly built (i.e. not an existing facility or a retrofit of existing facility)*	Assessed	The project requires the construction of a new pyrolysis plant.	05 Biochar production facility_CarboHeroes_1	Required to be assessed	Maturity & Quality
c5	**Facility has monitoring, reporting, and LCA capabilities or tangible plans**	**Passed**			*Passed if required sub-criteria are met*	
c5.1	*Protocol for biomass and biochar record keeping is prepared*	Assessed	The supplier has an agreement with Cula Technologies who provides MRV software solutions that tracks each step of the carbon removal process. Demonstrations and excerpts of the MRV software have not yet been provided, and operational protocols need to be described.	07 MRV Procedures_CarboHeroes_1.docx Tracking Solution - Partner - Cula Technologies.pdf	Required to be assessed	Maturity & Quality
c5.2	*Protocol for dry mass determination of biochar is prepared*	Assessed	A protocol to determine the dry mass of the biochar needs to be prepared.	No information provided.	Required to be assessed	Maturity & Quality
c5.3	*Protocol for biochar sampling and laboratory analysis is prepared (permanence and environmental quality)*	Assessed	Precise information has not been provided at this stage.	No information provided.	Required to be assessed	Maturity & Quality
c5.4	*Monitoring and reporting plan of facility emissions is prepared*	Assessed	Monitoring and reporting plans have not yet been developed, but the supplier has partnered with Cula Technologies who will provide MRV software.	Tracking Solution - Partner - Cula Technologies.pdf	Required to be assessed	Maturity & Quality
c5.5	*An LCA model specific to the facility's operation is prepared*	Assessed	The LCA model is parameterized and can be updated based on data monitoring. There are aspects of the model that could be improved to ensure that the full scope of the project boundary is included in the LCA.	pLCA _Puro_CarboHeroes_1.xlsm	Not required	Maturity & Quality
c6	**Facility has likely co-benefits and positive SDG impacts**	**Passed**			*Passed if required sub-criteria are met*	
c6.1	*Facility-specific co-benefits have been identified*	Assessed	The supplier has identified positive impacts for providers of biomass as the project will increase their income.	Puro Assessment - CarboHeroes 20240408.pdf	Required to be assessed	Maturity & Quality
c6.2	*Facility-specific SDG targets or indicators have been identified*	Assessed	Multiple relevant SDG targets were identified, and specifically linked to the	Puro Assessment - CarboHeroes 20240408.pdf	Required to be assessed	Maturity & Quality

			project activity, within SDG 2, SDG 3, SDG 7, SDG 8, SDG 9, SDG 12, SDG 13, SDG 15 and SDG 17.			
c7	**Facility team has access to relevant knowledge and skills**	**Passed**			*Passed if required sub-criteria are met*	
c7.1	*Relating to biomass sourcing, handling, processing*	Assessed	The team and biomass suppliers, have relevant knowledge and experience from parallel operations related to coffee production and reforestation activities.	CarboHeroes - Team 20240308.pdf	Not required	Maturity & Quality
c7.2	*Relating to thermochemical processes*	Assessed	The team consist of biochar experts, demonstrated by collaborations with recognized scientific partners.	CarboHeroes - Team 20240308.pdf	Not required	Maturity & Quality
c7.3	*Relating to biochar use*	Assessed	The team is made up of experts in biochar production and application.	CarboHeroes - Team 20240308.pdf	Not required	Maturity & Quality
c7.4	*Relating to monitoring and carbon accounting*	Assessed	The team is made up of individuals with experience in the voluntary carbon market and sustainability. An LCA has already been produced for this facility.	CarboHeroes - Team 20240308.pdf	Not required	Maturity & Quality
c8	**Environmental and social safeguards**	**Passed**			*Passed if required sub-criteria are met*	
c8.1	*Stakeholder consultations have been planned or conducted*	Assessed	There are LOIs signed with suppliers and a written intent to perform stakeholder engagement sessions. The stakeholder engagement report will need to be filled out for audit.	Stakeholder Engagement Report_CarboHeroes_1.docx	Required to be assessed	Maturity & Quality
c8.2	*Regulation applicable to facility has been identified*	Assessed	There is a timetable for obtaining permits from local authorities in Costa Rica and the relevant regulation has been identified.	Local Permits - Agency Presentation (Siel Siel).pdf Local Permits - Agency Proposal (Siel Siel).pdf Biochar production equipment questionnaire_CarboHeroes_1.docx	Required to be assessed	Maturity & Quality
c8.3	*Procedures to acquire relevant permits have been identified, started, or completed*	Assessed	The supplier has shared a timetable for acquiring the permits and is in contact with government authorities, semi-state organizations, environmental law firms and farmer associations.	Local Permits - Agency Presentation (Siel Siel).pdf Puro Assessment - CarboHeroes 20240408.pdf	Required to be assessed	Maturity & Quality