



**Verified Carbon  
Standard**

## BIOCHAR PROJECT-1 BY WEACTION



Document Prepared by WeAct Pty Ltd.

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# 1 PROJECT DETAILS

## 1.1 Summary Description of the Project

The project activity is biochar production facility in the Telangana district of India which intends to address the issue of crop residue in the region while addressing the soil carbon improvement with the application of biochar. Biochar is a carbon-rich charcoal-like substance produced from the pyrolysis or heating of biomass materials in a low-oxygen environment. While biochar has a long history of use in various cultures around the world, its adoption and exploration in India have been relatively recent. Thus, the concept of biochar production and utilization needs a reasonable amount of efforts that mainly includes awareness, both technological and financial inclusions, waste collection & handling practice; monitoring etc. which can ensure sustainable production and application of biochar.

In the mid-2010s, the International Biochar Initiative (IBI) and other global organizations actively promoted biochar research and adoption and knowledge exchange programs and international conferences facilitated the dissemination of information about biochar's potential benefits and best practices. The use of charcoal and biochar in agriculture has a traditional history in India, primarily in the form of "terra preta" soils found in the Amazon basin. Research institutions, such as the Indian Council of Agricultural Research (ICAR) and various agricultural universities, initiated studies and trials to investigate the benefits of biochar application in different crops and soil types. While biochar shows promise in various agricultural and environmental applications, its widespread adoption and integration into Indian farming systems are still ongoing processes.

- **A summary description of the technologies/measures to be implemented by the project:**

This project activity is a voluntary initiative in the state of Telangana in India by WeAct Pty Ltd., a carbon asset management and carbon financing entity from Australia who deals in such GHG projects globally to address the concerns of climate change and ensures long term sustainability. The project activity uses Low technology production facilities. The project includes the soil-pit methods and box-kiln method which are two common low-tech approaches that can serve as a starting point for small-scale production, experimentation, and community-level initiatives. This process mainly designed based on limited airflow to ensure the biomass undergoes pyrolysis, a process where it decomposes in the absence of oxygen. The project activity mainly targets to include single type of waste biomass i.e. "Cotton Stalk" used as feedstock to produce biochar and the resulting biochar to be utilized in soil application.

- **About the project how it is expected to generate GHG emission reductions or removals:**

This project activity is a greenfield project, in the baseline scenario at production stage, no biochar is produced for the purpose of the project activity. As per the provision of the applied methodology VM0044, in low technology settings the total organic carbon content of the

produced biochar is the foundation of the GHG calculations. The value is derived from the mass of biochar, its respective organic carbon content, and the decay rate of organic carbon in the biochar taken over a period of 100 years (100-year permanence value).

▪ **Brief description of the scenario existing prior to the implementation of the project:**

The scenario prior to the project activity is that the waste biomass (i.e. cotton stalks) is either left to decay or combusted. However, a survey related to the baseline scenario has been conducted in the project region and it has been established that the waste biomass (i.e. cotton stalks) only have the fate as: combustion of biomass and such burning mostly open burning which is a prevailing practice and a concern in the region.

***An estimate of annual average and total GHG emission reductions and removals.***

The project activity is expected to generate an annual average of 22,376 tCO<sub>2e</sub> emission reductions which is estimated based on a projected generation of biochar from cotton stalks as feedstock during each harvesting season in each year.

The details of validation and verification related timeline are as follows:

Audit Type	Period	Program	VVB Name	Number of years
Joint Validation/ Verification	12-April-2023 to 30-June-2023	VCS	4K Earth Science Private Limited (4KES)	NA
Monitoring	12-April-2023 to 30-June-2023	VCS	4K Earth Science Private Limited (4KES)	03 Months
<b>Total</b>				03 Months

## 1.2 Sectoral Scope and Project Type

Sectoral Scope1 : 13  
 Category : Non-AFOLU  
 Type : Waste Handling and Disposal (WHD)

This project is not a grouped project.

### 1.3 Project Eligibility

The eligibility of the project activity under the scope of the VCS Program has been demonstrated based on the applicability conditions of the applied methodology (VM0044), as follows:

SN	Condition	Justification
1	The project activity must install and operate a new (greenfield) biochar production facility(ies) where the project proponent must 1) source waste biomass, 2) produce biochar and 3) ensure the biochar is utilized in soil or non-soil application. GHG benefits are credited only for the biochar that is utilized in the eligible soil and non-soil applications.	Eligible: <ul style="list-style-type: none"> <li>• The project activity is a greenfield biochar production facility.</li> <li>• The feedstock is cotton stalk, which is a waste biomass.</li> <li>• The produced biochar will be utilized for soil application only.</li> </ul>
2	Technological Scope: <ul style="list-style-type: none"> <li>(i) The methodology is applicable when biochar is produced from eligible waste biomass through a thermochemical process such as pyrolysis, gasification, and biomass boilers and the biochar is subsequently applied to an end-use (soil or non-soil applications). Torrefaction and hydrothermal carbonization as processes of biochar production are excluded from this methodology.</li> <li>(ii) The methodology is applicable to projects using either low or high technology production facilities to produce biochar, as per the definitions of each provided in Section 3 of this methodology.</li> <li>(iii) The biochar producers must have a health and safety program to protect workers from airborne pollutants and other hazards.</li> </ul>	Eligible: <ul style="list-style-type: none"> <li>• The project activity involves pyrolysis process and subsequently applied for soil application only.</li> <li>• The project activity involves low technology production facilities (i.e. pit method and box kiln method) to produce biochar.</li> <li>• There is a proper health &amp; safety procedures proposed under this project to support the workers with safe working environment.</li> </ul>
3	Feedstocks and production scope:  The feedstock used to produce biochar must meet all following conditions to be eligible:	Eligible: <ul style="list-style-type: none"> <li>• The project activity involves only cotton stalk as feedstock, which is a biogenic waste biomass and hence not purpose-grown.</li> </ul>

	<p>a. Feedstock must be purely biogenic waste biomass and not purpose-grown,</p> <p>b. Feedstock must have been otherwise left to decay or combusted for purposes other than energy production. Additional guidance on how to demonstrate fate of waste biomass in the absence of the project activity is provided in Appendix 2,</p> <p>c. Feedstock must not have been imported from other countries,</p> <p>d. Feedstock must meet the sustainability conditions provided in Table 1 of the methodology.</p>	<ul style="list-style-type: none"> <li>• In absence of the project, the feedstock would have been combusted without any energy production or similar purposes. The fate of the biomass feedstock is referred in line with the Appendix 2 of the methodology; a detailed baseline study has been conducted for the same.</li> <li>• The project boundary is limited to the Sangareddy district of Telangana state in India. The feedstock is also sourced within the same region. Hence, there is no import of feedstock.</li> <li>• The feedstock being used under the project activity is cotton stalks, which falls under the Sustainability criteria (a) of the category-1 “agricultural waste biomass”; the project is designed to use cotton stalks directly from fields and not from a centralized biomass processing operation.</li> </ul>
4	<p>Biochar made from a single or mixed eligible feedstock types must comply with the latest version of the IBI Biochar Testing Guidelines or the EBC Production Guidelines.</p>	<p>Eligible:</p> <p>The biochar under this project activity is produced from a single feedstock type, i.e. cotton stalk and follows the requirements of IBI Biochar guideline. More details will be provided during the course of validation &amp; verification.</p>
5	<p>The waste biomass used as feedstock to produce biochar and the resulting biochar to be utilized in soil or non-soil applications may be transported via ships, boats, and vehicles other than road transportation up to a distance of 200 km. However, it must only be transported by vehicles (i.e., road transportation) for distances more than 200 km as defined under CDM Tool 12: Project and leakage emissions from transportation of freight.</p>	<p>Eligible:</p> <p>The biochar under this project activity is produced using waste biomass and shall be utilized only for soil applications in and around the fields where the biomass waste is generated. Hence there is no involvement of dedicated transportation facilities; hence Tool 12 is not applied.</p>
6	<p>Mineral additives such as lime, rock minerals, and ash may comprise up to 10</p>	<p>Not applicable.</p> <p>The production process of biochar</p>

	<p>percent of the mass when added. If the addition exceeds 10 percent on a dry weight basis, the biochar producer must present laboratory tests indicating that the final product meets IBI Biochar Testing Guidelines or EBC Production Guidelines thresholds for organic and inorganic contaminants.</p>	<p>under the project activity does not include any additive.</p>
7	<p>Biochar is eligible to be utilized and accounted for under the methodology if it is being utilized within one year of its production. Biochar is subject to natural decay and the permanence of biochar is calculated for a period of 100 years. To adhere to the decay factor established for 100 years and prevent any decay before application, biochar must be utilized in soil or non-soil applications, as appropriate, within the first year of its production.</p>	<p>Eligible: The biochar produced under the project activity shall be utilized for soil applications within one year of its production.</p>
8	<p>Biochar is eligible to be used as a soil amendment on land other than wetlands. Eligible land types include cropland, grassland, and forest. Biochar is eligible to be applied either to the soil surface or subsurface. For surface application, the biochar must be mixed with other substrates such as compost, manure or digestate from anaerobic digestion. For subsurface application, the biochar may be applied either as a unique soil amendment or mixed with other substrates. For any soil application, the biochar must comply with biochar material standards to avoid the risk of transferring unwanted heavy metals and organic contaminants to soil. Project proponents must meet the IBI Biochar Testing Guidelines or EBC Production Guidelines or relevant national regulations for avoiding soil contamination.</p>	<p>Eligible: The biochar produced under the project activity shall be used for soil applications. Depending on the farmers' requirement it can be used as soil amendment on land both to the soil surface and/or subsurface. In all cases, the biochar application shall meet the requirements of IBI Biochar Testing Guidelines. More details will be provided during the course of validation &amp; verification.</p>

## 1.4 Project Design

Following condition is applicable for the project activity:

**The project includes multiple locations or project activity instances, but is not being developed as a grouped project**

The project has been designed to include multiple options/approaches as biochar production facility. These options are as follows:

**Approach 1:** Multiple biochar production in-situ earth-pits<sup>1</sup> across the project boundary

**Approach 2:** Multiple biochar production moveable Box-Kiln<sup>2</sup> across the project boundary

**Approach 3:** Centralized biochar production pit(s) for different regions across the project boundary

Thus, biochar production may be considered in-situ facilities or in central facilities (as low technology facility) with multiple locations, but within the same project boundary; however these are not be considered as instances and hence not being developed as a grouped project.

### Eligibility Criteria

This section is not applicable as project is not a grouped project.

## 1.5 Project Proponent

<b>Organization name</b>	WeAct Pty Ltd
<b>Contact person</b>	Satish Duvvuru
<b>Title</b>	Director
<b>Address</b>	5/663 Victoria Street, Victoria 3067, Australia.
<b>Telephone</b>	+61-409 135 580
<b>Email</b>	satish@weact.com.au

## 1.6 Other Entities Involved in the Project

Not applicable.

<sup>1</sup> Here “Earth-pit” is considered as a category which may include different types of pits, mainly two types are defined under this project activity such as (i) regular soil pits, (ii) steel-shield soil pits; as referred under the Table 3 in Cornelissen et al. (2016), as referred under the applied Methodology.

<sup>2</sup> Here “box-kiln” is considered as a category of type “shallow steel pyramidal and octagonal” as per Table 3 in Cornelissen et al. (2016), as referred under the Methodology.

## 1.7 Ownership

The project ownership is with WeAct Pty Ltd.

In accordance with the VCS Program specifications on project ownership, the project ownership is meant to be arising by virtue of a statutory, property or contractual right in the biochar production plants/facilities, equipment or process etc. that generates GHG emission reductions and/or removals.

## 1.8 Project Start Date

12-April-2023.

As per the VCS Standard, the project start date of a non-AFOLU project is the date on which the project began generating GHG emission reductions or removals. Therefore, the start date of this project activity is considered as the date of production of first batch of biochar under the project activity which is 12-April-2023.

## 1.9 Project Crediting Period

Type : Renewal Crediting Period

The project crediting period shall be seven (7) years which will be twice renewable for a total of up to 21 years.

Start date of first crediting period : 12-April-2023  
 End date of first crediting period : 11-April-2030

## 1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

20,000 – 100,000 tCO<sub>2</sub>e/year

Project Scale	
Project	√
Large project	

Year	Estimated <sup>3</sup> GHG emission reductions or removals (tCO <sub>2</sub> e)
Year 1 (12 April 2023 to 11 April 2024)	22,376
Year 2 (12 April 2024 to 11 April 2025)	22,376
Year 3 (12 April 2025 to 11 April 2026)	22,376
Year 4 (12 April 2026 to 11 April 2027)	22,376
Year 5 (12 April 2027 to 11 April 2028)	22,376
Year 6 (12 April 2028 to 11 April 2029)	22,376
Year 7 (12 April 2029 to 11 April 2030)	22,376
<b>Total estimated ERs</b>	<b>156,632</b>
<b>Total number of crediting years</b>	<b>7</b>
<b>Average annual ERs</b>	<b>22,376</b>

## 1.11 Description of the Project Activity

The project activity is a non-AFOLU project under VCS, mainly engaged in the process of Biochar production using low technology facilities with the fate of Cotton Stalk as sustainable biomass waste as feedstock. However, the design of the project activity includes multiple methods/approaches for biochar production facility ensuring a practical and sustainable way of producing biochar in the project region. The prescribed methods/approaches are as follows:

**Approach 1:** Multiple biochar production in-situ earth-pits across the project boundary

**Approach 2:** Multiple biochar production moveable Box Kiln across the project boundary

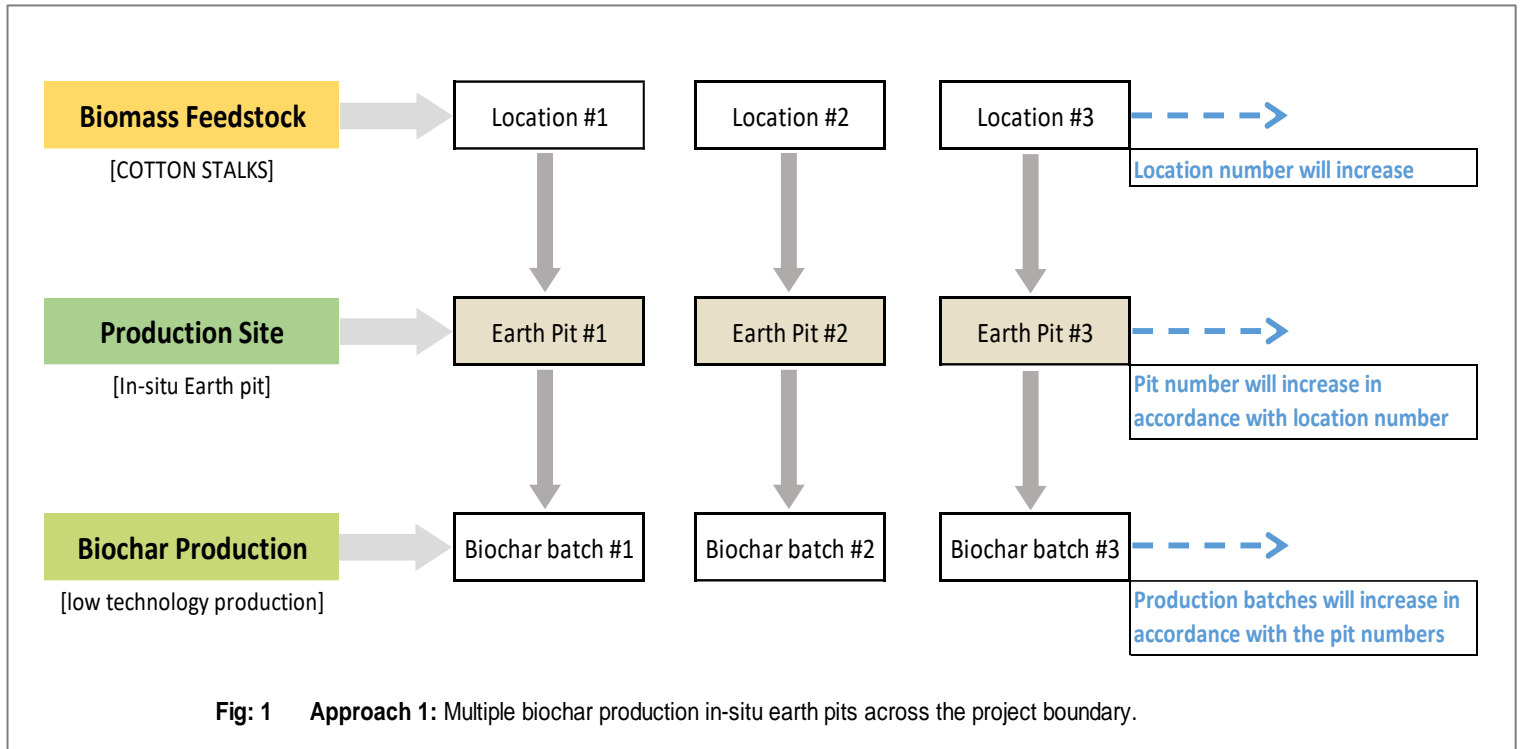
**Approach 3:** Centralized biochar production earth-pit(s) for different regions across the project boundary

**The project proponent may decide to select either of the approaches or combination of two or all three approaches depending on the situations in each season of cotton harvesting that lead to generation of stalk as waste biomass.**

<sup>3</sup> The ex-ante calculations are demonstrated under the section 5.4 of this report, which includes estimations for different types of low-tech facilities being proposed (as defined under the project design below). However, PP has anticipated that actual implementation of project activity will mostly include combination of low-tech facilities such as earth-pits, followed by the box-kiln and/or centralized pits. Therefore, for the purpose of ex-ante calculation summary under this section (1.10) the results are given for combination of low-tech facilities such as 50% of soil pits (where 25% is regular soil pits, 25% is steel-shield soil pits) and 50% of box-kiln. Also, for the purpose of ex-ante estimate an annual avg. projection of 25,000 tons of biochar on dry weight basis is considered under this project activity.

**Approach 1:** Multiple biochar production in-situ earth-pits across the project boundary.

Following is the representative diagram of the overall project operation under the approach 1. Under this approach main operational element is the “Earth-Pit” (please refer to the footnote #1 for types) and such earth pits will be developed in each season in and around the fields where waste will be generated/collected; hence this is an in-situ project design. Such pits will be created during the biochar production season, recorded properly (such as geo-coordinates, photos, videos etc.) and then shall be filled up post-production is over.



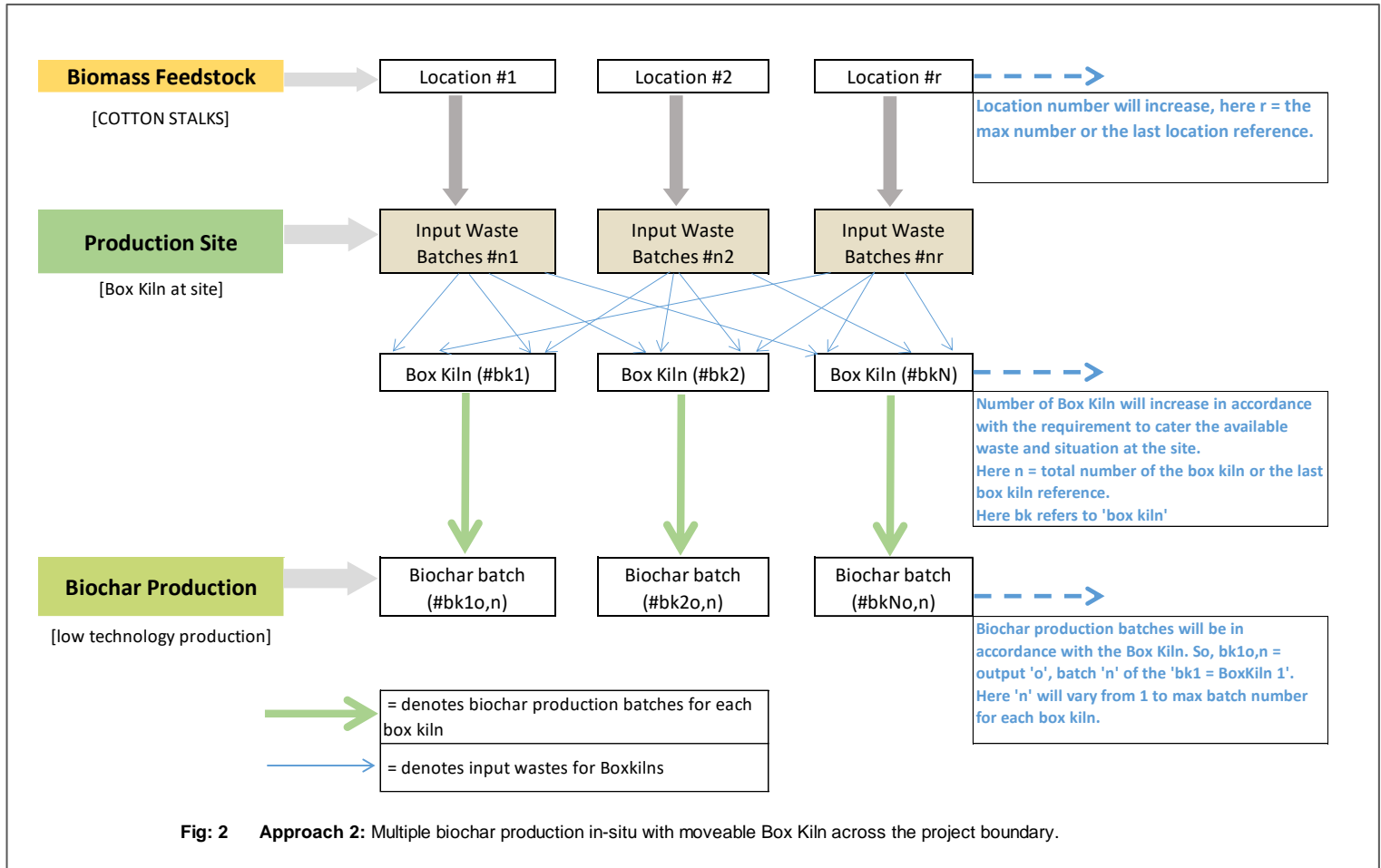
**The specifications of Earth-Pit (regular soil-pits and steel-shield soil-pits):**

- Size : 12’ x 4’ x 3’
- Volume : 4 cubic meter.
- Burning times : 2 hours approx.
- Input : 1300 kgs at 12%-13% moisture.
- Output Biochar : 360-400kgs.
- Fire dousing method : Covered method preferred, alternatively water can also be used

**Approach 2:** Multiple biochar production moveable Box-Kilns across the project boundary.

Following is the representative diagram of the overall project operation under the approach 2.

Under this approach main operational element is moveable “Box-Kiln” (please refer to footnote #2 for more reference); there will be multiple box-kilns to be specifically designed and developed to produce biochar; hence this approach is similar to an in-situ biochar production method where production facility will be portable and can cater to wastes collected at different locations. Each time a batch of biochar is produced using a particular kiln, the input waste batch(s) and output biochar batch(s), geo-coordinates, photos, videos etc. shall be recorded.



**The specifications of Box Kiln:**

Dimensions:

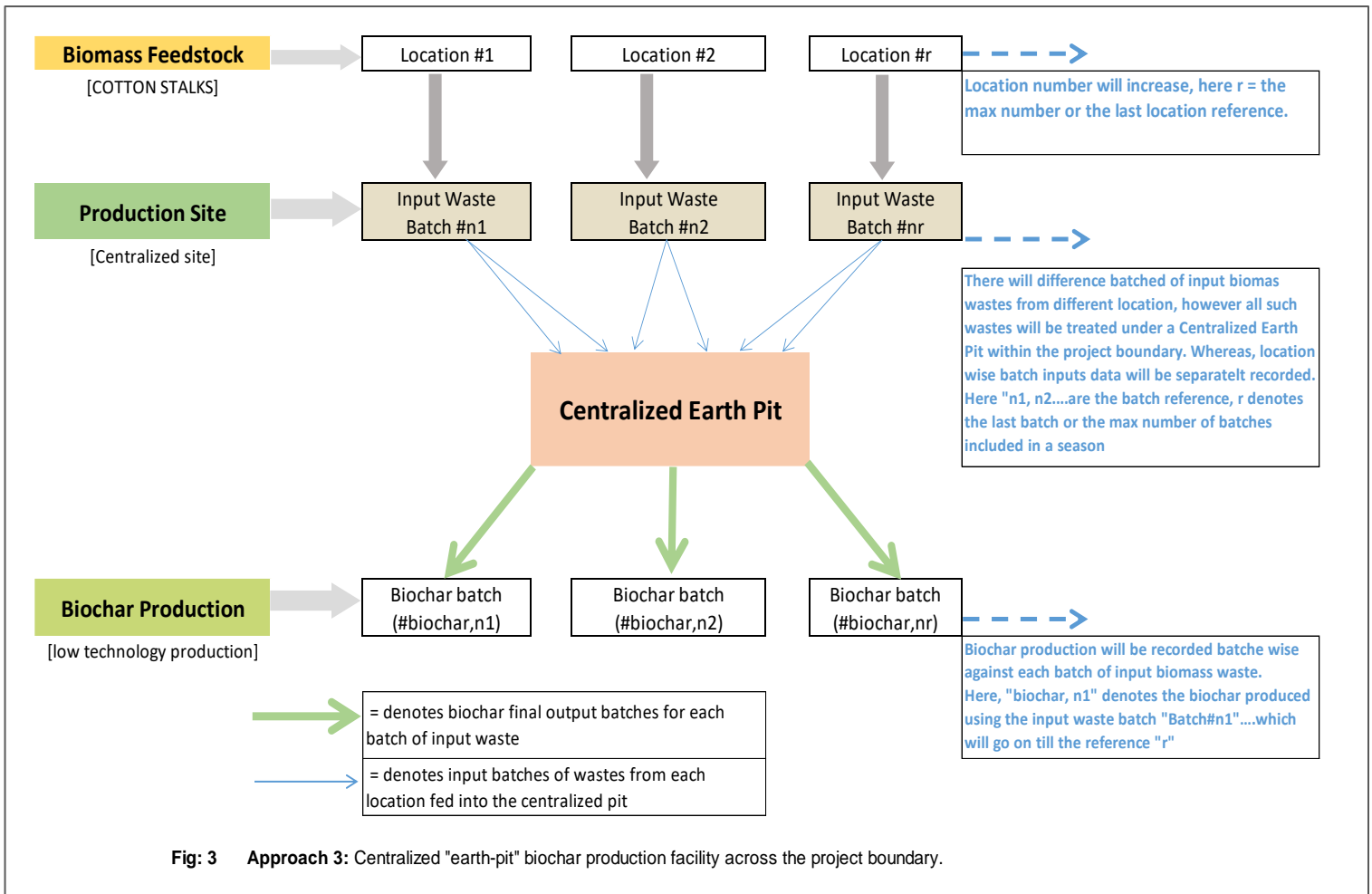
- Top : 12' x 6'
- Height : 4'
- Base : 10' x 4'
- Iron sheet : 2mm, side reinforcement with 50 mm
- "L" angle : 6mm Thick
- Batch capacity : input 2,000kgs @ 12 to 13 % Moisture.
- Output : 28 to 32 %, 560kgs to 640kgs.
- Time : 2hrs to 2:30 mins.

Batch Loading : 10 to 12 time batch loading of approximately 200 kgs of Biomass per top-up.  
 Temperature : 400- 600 degrees centigrade  
 Fire dousing method : Covered method preferred, alternatively water can also be used.

**Approach 3:** Centralized biochar production earth pit(s) for different regions across the project boundary.

Following is the representative diagram of the overall project operation under the approach 3.

Under this approach main operational element is a fixed Earth-pit in a centralized location within the project boundary. The biomass wastes will be collected from different fields and will be diverted to the central production facility where batch wise biochar production shall be performed. However, depending on the point of waste collection and geographical spread, PP may decide to go for more than one centralized Pit. Whereas at present only a single centralized earth-pit is denoted for representation purposes.



**The specifications of Earth Pit (Centralized):**

- Dimensions : 16' x 8' x 3'
- Volume : 10cubic meters.
- Input : 3,000kgs @12-13 % moisture.
- Output : 840 to 960 kgs (approx.)
- Fire dousing method : Covered method preferred, alternatively water can also be used.

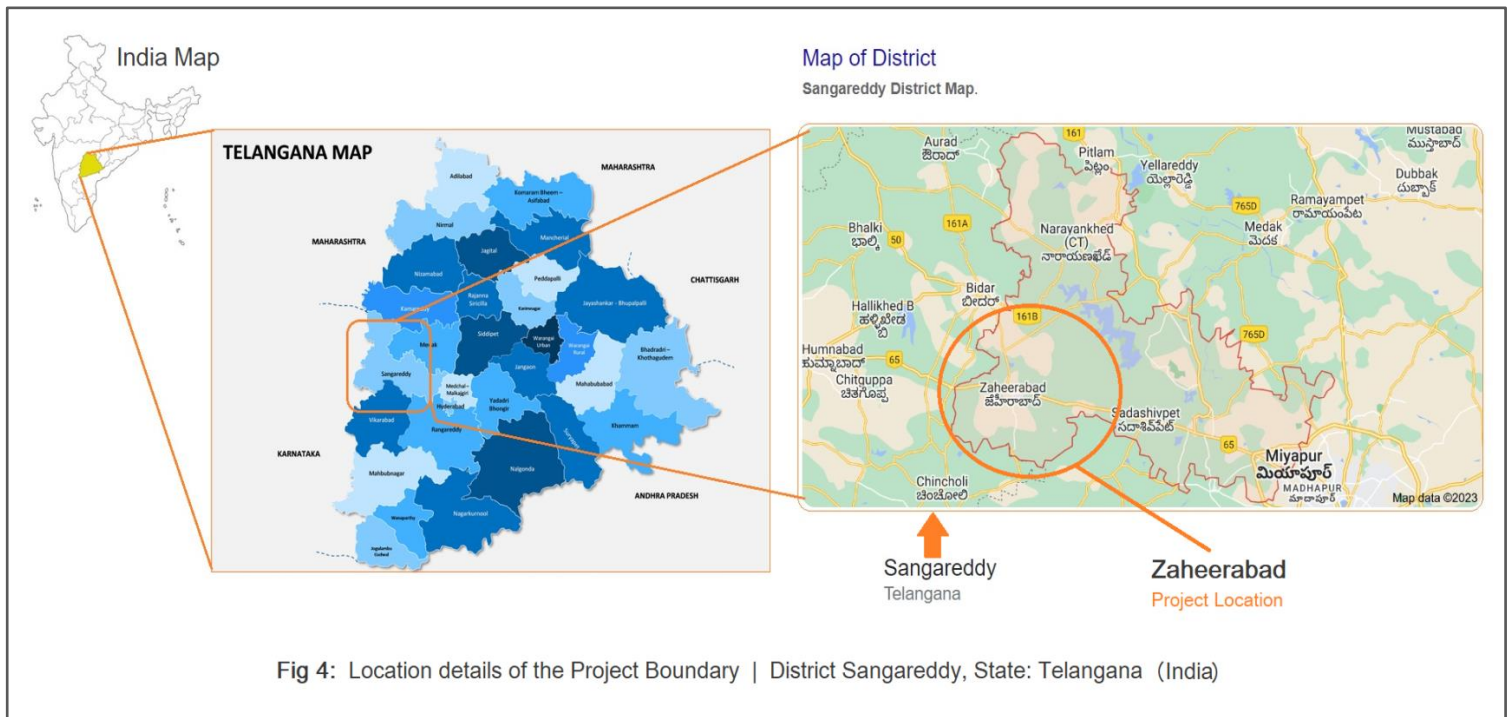
### 1.12 Project Location

The project is designed to cater a wider project boundary (as can be identified from the three approaches prescribed under the project design), but within the district of Sangareddy in the state of Telangana. Thus, the project location is within the territorial boundary as follows:

- Village : multiple villages across three mandalas
- Region : Zaheerabad
- District : Sangareddy
- State : Telangana
- Country : India

Geo-coordinates : Latitude 17° 37' 9.9" N and Longitude 78° 4' 56.31" E

Currently geo-coordinates at the district level mentioned as a project design, whereas actual geo-coordinates of the biochar production facilities will be reported during the actual monitoring of the project.



### 1.13 Conditions Prior to Project Initiation

The conditions existing prior to project initiation are as follows:

- 1) The cotton wastes in the region are commonly burnt in open fields.
- 2) Sometime some portion of the cotton wastes may be left in the field for open decay.
- 3) There was no treatment process of these cotton wastes; hence no biochar production activity was taken place in the baseline.

Thus, in the absence of the project activity, waste biomass is either combusted or left to decay for purposes other than energy production and is not utilized for producing biochar for soil or non-soil applications.

Also, it is confirmed that the project has not been implemented to generate GHG emissions for the purpose of their subsequent reduction, removal, or destruction. This is being a biochar project activity with an intended soil application; hence GHG emissions are removed through biochar as a long-lived and persistent carbon sink.

### 1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

There is no specific compliance law exclusively dedicated to biochar production in India.

In the host country India, there are various policies and frameworks in each state. Also, there are central level laws and frameworks; however, there are no specific laws, statutes or any regulatory framework on biochar production and utilization. In this regard, PP has reviewed the “Telangana State Pollution Control Board (TSPCB)” and also reviewed compliance with “Solid Waste Management Rules: The Solid Waste Management Rules, 2016 in India. It can be observed that such policies and frameworks provide a comprehensive framework for waste management in India but there is no dedicated regulation or compliance requirement for cotton waste as well as for biochar produced from such waste.

### 1.15 Participation under Other GHG Programs

#### 1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The project has not been registered neither is seeking registration under any other GHG programs other than VCS under VERRA. A declaration shall be provided by PP.

#### 1.15.2 Projects Rejected by Other GHG Programs

The project has never been applied under any other GHG programs other than the current application under VCS of VERRA. Hence it can be confirmed that project is never rejected by any other GHG programs. A declaration shall be provided by PP confirming the same.

## 1.16 Other Forms of Credit

### 1.16.1 Emissions Trading Programs and Other Binding Limits

Does the project reduce GHG emissions from activities that are included in an emission trading program or any other mechanism that includes GHG allowance trading?

Yes  No

The project reduces GHG emissions from activities that are not included in any emissions trading program or any other mechanism that includes GHG allowance trading and include details about any such programs or mechanisms. A declaration shall be provided by PP.

### 1.16.2 Other Forms of Environmental Credit

Has the project sought or received another form of GHG-related credit, including renewable energy certificates?

Yes  No

The project has never sought or received any another form of GHG-related environmental credits including renewable energy certificates. A declaration shall be provided by PP.

### 1.16.3 Supply Chain (Scope 3) Emissions

The project activity does not include a long supply chain network of organizations, instead entire project is locally managed, operated and biochar is produced with the help of a local representative entity<sup>4</sup> using locally manufactured low technology facilities. The entity does not intend to account or offset or notify any scope-3 related activities. Thus, the project does not affect emissions associated with a good or service. Also, a statement/declaration shall be provided from the entities involved in the process confirming no potential risk of such scope-3 emission double claiming.

## 1.17 Sustainable Development Contributions

### 1.17.1 Sustainable Development Contributions Activity Description

The project activity contributes to sustainable development (SD) in various ways. The project being in the category of agricultural wastes management and overall process involves significant resources, the project certainly achieves a high level of SD indicators which can be monitored and reported. A summary of the overall SD contributions are given below:

**Environmental Sustainability:** This project leads to an effective management of cotton waste that helps reduce environmental pollution as in absence of the project cotton wastes would have been degraded via open burning or open decay. Since the project implements biochar production from the cotton wastes, thus the waste is transformed into valuable resources as

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<sup>4</sup> "Aranya Agriculture Alternatives", is a society who is engaged in local agricultural activities with a focus of bringing natural and sustainable practices for the farmers and communities.

soil amendments which reduces the need for chemical fertilizers, mitigates greenhouse gas emissions, and promotes soil health, biodiversity, and water conservation etc.

**Resource Conservation:** This project helps utilizing the biomass wastes for a meaningful purpose rather than being discarded; it leads to significant resource conservation. By efficiently managing and utilizing these waste streams into biochar with soil application, the project reduces the demand for virgin resources, such as synthetic fertilizers. This promotes resource conservation and minimizes the pressure on natural ecosystems.

**Technology & knowledge sharing:** Additionally, the project being first-of-its-kind in the region, it will also create awareness and knowledge transfer related to waste handling, management and production of biochar. Through initial R&D and subsequent field level experiments, testing, training etc. project will also contribute to educational engagement, qualitative and quantitative aspects for the community, beneficiaries, stakeholders etc.

**Good Health & Well-being:** The project certainly improves environmental aspects, as explained above. Especially the baseline scenario of the project is attached to a high level burning of wastes in the region which is now avoided, hence directly benefits to the health of the communities due to reduction in smoke, air-particulate matters etc. Also, the waste management and systematic way of biochar production leads to a dedicated framework both in terms of resources utilization, knowledge sharing, economic upliftment, useful products and improved agricultural activities etc.; hence directly contributes to overall well-being in the region.

**Rural Development and Economic Opportunities:** The project envisages creating local employment and income-generation opportunities in rural areas as project activities are confined in and around the village communities. For example, setting up of biochar production units (via either of the approaches discussed under the project design) has engaged people from local communities and contributed to the local economy by means of adding earning to the households. Such economic-benefits attached to the project are gender un-biased, which means both male and female are getting direct and indirect employment across various functions of the project, leading to gender equality as well. Also, the end product from the project is Biochar which will be targeted for soil-applications; thus the project helps turning agricultural wastes into marketable products or say as much desired organic fertilizers, farmers can generate additional income and improve their livelihoods.

**Soil Health and Fertility:** Biochar has beneficial effects on soil health and fertility. It improves soil structure, water holding capacity, and nutrient retention. By enhancing soil health, biochar can increase agricultural productivity, reduce the need for synthetic fertilizers, and decrease nutrient runoff, which helps prevent water pollution and eutrophication.

Since biochar-amended soils have the potential to improve water quality by reducing nutrient leaching and runoff, it can directly impact life above the ground as well as below water as it can help retain and slowly release nutrients, minimizing their movement into water bodies. This helps protect aquatic ecosystems, prevent water pollution, and maintain water quality for both human consumption and biodiversity conservation.

**Climate Change Mitigation and Adaptation:** The climate change mitigation is one of the key integral benefits attached to this project. Biochar is a stable form of carbon that can be incorporated into soil. By adding biochar to agricultural lands, carbon is sequestered for long-lived periods, effectively removing carbon dioxide from the atmosphere. This process helps mitigate climate change by reducing greenhouse gas emissions and offsetting carbon footprints. Additionally, the sustainable management of agricultural waste can contribute to climate change mitigation by reducing greenhouse gas emissions associated with the baseline

practices such as open burning, open decay etc. Also as already mentioned in the previous para, this sustainable waste management practices improve soil fertility and water management, enhancing resilience to climate change impacts for long term.

**Circular Economy Approach:** This project can be attributed to embrace a circular economy approach by closing the loop in the waste management system. Conventionally, the cotton waste is being considered as a burden, being burnt without the purpose driven approach. Whereas under the project level the waste is now seen/realized as a valuable resource that can be recycled and reused, i.e. production of biochar which goes for soil applications to enable various positive gains. Thus, by integrating waste input into the overall waste management system, the project maximizes resource efficiency to result in a useful product and minimizes waste generation in the region.

Overall, it can be summarized that the project contributes to sustainable development by promoting various aspects including (but not limited to) environmental conservation, resource efficiency, rural development, climate change mitigation, and the transition towards a circular economy. It aligns agricultural practices with the principles of sustainable development, fostering a more resilient and equitable agricultural sector.

Therefore, PP attributes the following SDG indicators in this project activity:



### 1.17.2 Sustainable Development Contributions Activity Monitoring

- **A summary description of project activities implemented during the monitoring period that result in SD contributions:**

During the current monitoring period (i.e. from 12-April-2023 to 30-June-2023), the project activity has been partially implemented (i.e. a pilot run) using the two approaches, viz. Approach 1 (in-situ earth-pits) and Approach 2 (moveable box kiln). These activities were implemented in Jarasangam Mandala, under the region Zaheerabad in the Sangareddy District of Telangana. There were two main cotton waste collection points viz. Kambalpallu and Narsapoor, a total quantity of 696.15 tons of cotton waste collected during the season and about 51.28 tons of cotton wastes were treated during the current monitoring period to produce about 25.35 tons of biochar.

Thus, during the current monitoring period all expected SD contributions such as environmental sustainability, resource conservation, local employment, good health & well-being etc. are resulted.

- **An explanation of how project activities result in the SD contributions described in Table 1 of this report.**

During the current monitoring period (i.e. from 12-April-2023 to 30-June-2023), the project activity was at pilot phase, hence it has partially contributed to certain SDG benefits which are reported under the Table 1. However, during the current monitoring period no specific claims are made except for SDG 1 and 13; whereas SD table 1 is demonstrated for future claim.

- **Identification of which SD contributions described in Table 1 of this report contribute to achieving any nationally stated sustainable development priorities, including any provisions for monitoring and reporting the same.**

As stated in the United Nations and mentioned under NITI Aayog, the Government of India has decided to contribute to various SDGs. There are five SDGs which were identified as nationally stated goals in priority, viz. SDG 1, 3, 5, 13 and 15.

The project activity is designed to have 11 SDGs (as described under the previous section) and these five indicators are part of these eleven goals, thus all indicators were identified under the project activity. More details are discussed under the Table 1 below.

**Table 1: Sustainable Development Contributions**

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	1.1	User defined indicator under SDG 1.1: Strengthen financial conditions of local people to reduce risk of low income vulnerability against the poverty line, according to national definitions	Implemented activities to increase	<p>About 25 people are employed in the project activity during the current monitoring period.</p> <ul style="list-style-type: none"> <li>(i) About 5 direct engagements</li> <li>(ii) About 20 indirect/contractual engagement</li> </ul>	<p>The project has increased the 25 participants' total daily income that directly helps strengthening financial conditions of these beneficiaries.</p> <p>Thus, the total contribution achieved over the project lifetime so far is equal to the contributions monitored and reported as on 30 June 2023,</p>
2)	3.9	3.9. Environmental health By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.	Implemented activities to decrease	<p>Lowered the air born environmental hazards by equivalent to a biomass waste amount of 51,280 kgs of cotton stalks in the project region, which would otherwise have been openly combusted leading to air contamination that can directly affects the health.</p>	<p>Lowered environmental air pollution by removing open combustion of cotton wastes amounting to 51,280 kgs during the period.</p> <p>Thus, the total contribution achieved over the project lifetime so far is equal to the contributions monitored and reported as on 30 June 2023,</p>

3)	4.4	4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship	Implemented activities to increase	<p>About 25 resources are engaged under this project will get regular training, technological know-how, etc. which enhances their skills and giving direct and indirect job opportunities.</p> <p>Additionally, each and every farmer who will be part of this project either by means of contributor of waste or by means of user of biochar, will be substantially receive relevant skills and entrepreneurship opportunities.</p>	The total contribution achieved over the project lifetime so far is equal to the contributions monitored and reported as on 30 June 2023.
4)	5.0	User defined indicator under SDG 5.1:  Promote and achieve gender equality and empower all women and girls	Implemented activities to increase	Currently around 20% of the local resources engaged in the project is from female gender. And this ratio is expected to grow as the project proceeds	The total contribution achieved over the project lifetime so far is equal to the contributions monitored and reported as on 30 June 2023.
5)	8.6	8.6.1. Substantially reduce the proportion of youth (aged 15-24 years) not in employment, education or training	Implemented activities to decrease	Currently project includes youths who were not in employment. 3 such beneficiaries are added during the current monitoring period, which is expected to grow as the project proceeds.	The total contribution achieved over the project lifetime so far is equal to the contributions monitored and reported as on 30 June 2023.
6)	8.8	8.8.1 fatal and non-fatal occupational injuries per 100,000 workers, by sex and migrant status	Implemented activities to decrease	<p>Zero occupational injuries, zero mortality achieved during the monitoring period.</p> <p>Project activity deployed required health &amp; safety measures (such as safety gears, handling tools etc.) as part of regular operating practices</p>	The total contribution achieved over the project lifetime so far is equal to the contributions monitored and reported as on 30 June 2023.

7)	9.1	<p>User defined indicator under SDG 9.1:</p> <p>Develop quality, reliable, sustainable and resilient infrastructure, to support economic development and human well-being,</p>	<p>Implemented activities to increase</p>	<p>The project activity has deployed biochar production facilities and addressed the concern of crop residue open burning., Also, the application of biochar into the soil brings a sustainable practice via economic development, human well-being and a climate resilient infrastructure in the region.</p> <p>During the current monitoring period 1 box-kiln is developed for biochar production which is included into the GHG accounting. Also 6 soil-pits were developed to pilot run cotton wastes for biochar conversion, however measurements were not recorded hence they are excluded from the current period.</p>	<p>The total contribution achieved over the project lifetime so far is equal to the contributions monitored and reported as on 30 June 2023.</p>
8)	12.4	<p>12.4.2</p> <p>Hazardous waste generated per capita; and proportion of hazardous waste treated, by type of treatment</p>	<p>Implemented activities to decrease.</p> <p>(Achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.)</p>	<p>During the current monitoring period a measured quantity of 51,280 kgs of hazardous waste (i.e. cotton stalks) treated under the project and converted to biochar of quantity 12,460 kgs for soil application.</p> <p>This has contributed to sustainable consumption of waste in the region and also sustainable production patterns of biochar for a meaning output.</p>	<p>The total contribution achieved over the project lifetime so far is equal to the contributions monitored and reported as on 30 June 2023.</p>
9)	13.0	<p>Tonnes of greenhouse gas emissions avoided or removed</p>	<p>Implemented activities to increase</p>	<p>By converting 51,280 tons of cotton waste into biochar of quantity around 12,460 the Project has prevented the release of or removal of 10,000 kgs of carbon into the atmosphere during the monitoring period.</p>	<p>The total contribution achieved over the project lifetime so far is equal to the contributions monitored and reported as on 30 June 2023.</p>
10	<p>The other indicators, viz. SDG 14, 15 and 17 are currently not monitored and hence not attributed, The same will be included during next monitoring period.</p>				

## 1.18 Additional Information Relevant to the Project

### Leakage Management

As per the applied methodology and per the project design, there is no specific risk of any leakage. Hence no leakage management is required.

### Commercially Sensitive Information

There is no such information which is considered as commercially sensitive that has been excluded from the public version of the project description.

### Further Information

There is no other information that relates to any additional relevant legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and/or temporal information that may have a bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

## 2 SAFEGUARDS

### 2.1 No Net Harm

There is no negative or adverse impact and harm associated with the project activity. PP has observed that while biochar production has several potential positive environmental and socio-economic impacts (as discussed under the previous sections), it is important to consider and mitigate any potential negative effects if arises. In this regard, a detailed stakeholders' consultation was conducted on 07-April-2023 and feedback and inputs were taken from the stakeholders. However, no negative remark or no specific harm was realized in the project activity. Hence, currently no mitigation action plan is required.

### 2.2 Local Stakeholder Consultation

As per the requirements of the VCS standard, a detailed stakeholders' consultation was conducted on 7<sup>th</sup> April 2023 in the project region. The details of the stakeholders' consultation are as follows:

<b>Date of the Local Stakeholder Consultation</b>	: 07-April-2023
<b>Venue of the consultation</b>	: Aranya Permaculture Farm, Bidakanne Village, Jharasangam Mandal, Sangareddy District, Telangana (India).
<b>Mode of consultation</b>	: Physical meeting

**Further details are as follows:**

**The procedures or methods used for engaging local stakeholders:**

For the purpose of inviting and engaging local stakeholders, PP has identified the relevant stakeholders across the project region and then identified a suitable date and venue for the meeting. To have a wider coverage of the invitation, PP has notified about this meeting on a state level newspaper on 17-March-2023 which was 3 weeks prior to meeting date. This notification was served both in English and vernacular language.

Additionally, personal invitation letters were submitted to the nearby concern authorities such as Gram Panchayat, Head of the govt. schools, authorities at Mandal level functions etc. Also, some posters and bills were published in and around the project region to inform all local beneficiaries in the communities.

The procedures or methods used for documenting the outcomes of the local stakeholder consultation.

**Summary of the meeting:** On the day of the meeting, a proper arrangement was done for all the invitees so that they can easily reach the venue. The meeting was started with a welcome note from Mrs. Padmavathi Kappola, the Permaculture Specialist from “Aranya Agriculture Alternatives” who is a known personality among the communities due to her extensive work in the agriculture practices across the region. She put forwarded the objectives of the consultation and also gave a short description of the project activity.

The meeting was further addressed by Mr. Satish Reddy, Director of WeAct Pty Ltd., explained the background of the project from the perspective of carbon revenue. Mr. Uday Dodi, acting as the Biochar Technical Expert from WeAct addressed the gathering and responded to few project specific understanding amongst the attendees.

During the meeting Mrs. Padma demonstrated the preparation of soil with Biochar and its application. All possible types of comments, queries, know-how etc. were invited from all the attendees and properly responded by PP. In order to record the outcomes of the consultation, a dedicated questionnaire was designed by PP prior to the meeting and feedback/suggestions/inputs etc. were taken directly from all the attendees. Thus the method of documenting outcomes of the meeting was transparent, open, based on real-time inputs. These feedback forms were considered as the primary records of the outcomes of the consultation.

From the overall feedback, it can be concluded that there is no negative remark or there was no suggestion that relates to project design change or overall approach of the project.

### **The mechanism for on-going communication with local stakeholders.**

In order to establish an on-going continuous communication and feedback mechanism with the local stakeholders, an opinion poll was taken during the feedback round of the consultation. The stakeholders were open for all types of communication protocol such as telephonic, feedback register at site office etc. Based on the common suggestions received from majority of the respondent, it has been concluded that one Feedback/Input Register shall be prepared and kept at the office of Aranya such that local stakeholders can access any point of time and input their suggestions/concerns/grievances etc. Additionally, there is one local point of contact assigned on behalf of PP to whom stakeholders can directly communicate in case of any emergency.

How due account of all and any input received during the consultation has been taken. Include details on any updates to the project design or justify why updates are not appropriate.

As verified from the stakeholders feedback forms and the minutes of the meetings, there was no negative comment or any specific inputs that needs any immediate action. Also, the overall outcome of the consultation was positive and stakeholders displayed a great level of support and willingness towards this project. Hence, there is no requirement of any update in the project design or any part of the project activity.

## 2.3 Environmental Impact

The project does not encounter with any negative environmental impacts. Rather, due to the inherent nature of the project (i.e. handling biomass waste and conversion to biochar for further application in soil), project contributes positively towards the environment, such as avoidance of waste burning, avoidance of any open decay, reduction in chemical fertilizer usages, increase in productivity via improvement in soil, water, etc.

## 2.4 Public Comments

The project is currently submitted for Public Commenting period. More details will be provided under this section once the Public Commenting period is concluded.

## 2.5 AFOLU-Specific Safeguards

This is a non-AFOLU project, hence this section is not applicable.

## 3 APPLICATION OF METHODOLOGY

### 3.1 Title and Reference of Methodology

Title : Methodology for Biochar utilization in soil and non-soil applications  
 Reference : VM0044, Sectoral Scope 13  
 Version : 1.0, 12 August 2022

### 3.2 Applicability of Methodology

SN	Condition	Justification
1	The project activity must install and operate a new (greenfield) biochar production facility(ies) where the project proponent must 1) source waste biomass, 2) produce biochar and 3) ensure the biochar is utilized in soil or non-soil application. GHG benefits are credited only for the biochar that is utilized in the eligible soil and non-soil applications.	Eligible: <ul style="list-style-type: none"> <li>• The project activity is a greenfield biochar production facility.</li> <li>• The feedstock is cotton stalk, which is a waste biomass.</li> <li>• The produced biochar will be utilized for soil application only.</li> </ul>
2	Technological Scope: <p>(i) The methodology is applicable when biochar is produced from eligible waste biomass through a thermochemical process such as pyrolysis, gasification, and biomass boilers and the biochar is subsequently applied to an end-use (soil or non-soil applications). Torrefaction and hydrothermal carbonization as processes of biochar production are excluded from this methodology.</p> <p>(ii) The methodology is applicable to projects using either low or high technology production facilities to produce biochar, as per the definitions of each provided in Section 3 of this methodology.</p> <p>(iii) The biochar producers must have a health and safety program to protect workers from airborne pollutants and other hazards.</p>	Eligible: <ul style="list-style-type: none"> <li>• The project activity involves pyrolysis process and subsequently applied for soil application only.</li> <li>• The project activity involves low technology production facilities (i.e. pit method and box kiln method) to produce biochar.</li> <li>• There is a proper health &amp; safety procedures proposed under this project to support the workers with safe working environment.</li> </ul>

<p>3</p>	<p><b>Feedstocks and production scope:</b></p> <p>The feedstock used to produce biochar must meet all following conditions to be eligible:</p> <ol style="list-style-type: none"> <li>Feedstock must be purely biogenic waste biomass and not purpose-grown,</li> <li>Feedstock must have been otherwise left to decay or combusted for purposes other than energy production. Additional guidance on how to demonstrate fate of waste biomass in the absence of the project activity is provided in Appendix 2,</li> <li>Feedstock must not have been imported from other countries,</li> <li>Feedstock must meet the sustainability conditions provided in Table 1 of the methodology.</li> </ol>	<p><b>Eligible:</b></p> <ul style="list-style-type: none"> <li>The project activity involves only cotton stalk as feedstock, which is a biogenic waste biomass and hence not purpose-grown.</li> <li>In absence of the project, the feedstock would have been combusted without any energy production or similar purposes. The fate of the biomass feedstock is referred in line with the Appendix 2 of the methodology; a detailed baseline study has been conducted for the same.</li> <li>The project boundary is limited to the Sangareddy district of Telangana state in India. The feedstock is also sourced within the same region. Hence, there is no import of feedstock.</li> <li>The feedstock being used under the project activity is cotton stalks, which falls under the Sustainability criteria (a) of the category-1 “agricultural waste biomass”; the project is designed to use cotton stalks directly from fields and not from a centralized biomass processing operation.</li> </ul>
<p>4</p>	<p>Biochar made from a single or mixed eligible feedstock types must comply with the latest version of the IBI Biochar Testing Guidelines or the EBC Production Guidelines.</p>	<p><b>Eligible:</b></p> <p>The biochar under this project activity is produced from a single feedstock type, i.e. cotton stalk and follows the requirements of IBI Biochar guideline. More details will be provided during the course of validation &amp; verification.</p>
<p>5</p>	<p>The waste biomass used as feedstock to produce biochar and the resulting biochar to be utilized in soil or non-soil applications may be transported via ships, boats, and vehicles other than road transportation up to a distance of 200 km. However, it must only be transported by</p>	<p><b>Eligible:</b></p> <p>The biochar under this project activity is produced using waste biomass and shall be utilized only for soil applications in and around the fields where the biomass waste is generated.</p>

	vehicles (i.e., road transportation) for distances more than 200 km as defined under CDM Tool 12: Project and leakage emissions from transportation of freight.	Hence there is no involvement of dedicated transportation facilities; hence Tool 12 is not applied.
6	Mineral additives such as lime, rock minerals, and ash may comprise up to 10 percent of the mass when added. If the addition exceeds 10 percent on a dry weight basis, the biochar producer must present laboratory tests indicating that the final product meets IBI Biochar Testing Guidelines or EBC Production Guidelines thresholds for organic and inorganic contaminants.	Not applicable.  The production process of biochar under the project activity does not include any additive.
7	Biochar is eligible to be utilized and accounted for under the methodology if it is being utilized within one year of its production. Biochar is subject to natural decay and the permanence of biochar is calculated for a period of 100 years. To adhere to the decay factor established for 100 years and prevent any decay before application, biochar must be utilized in soil or non-soil applications, as appropriate, within the first year of its production.	Eligible:  The biochar produced under the project activity shall be utilized for soil applications within one year of its production.
8	Biochar is eligible to be used as a soil amendment on land other than wetlands. Eligible land types include cropland, grassland, and forest. Biochar is eligible to be applied either to the soil surface or subsurface. For surface application, the biochar must be mixed with other substrates such as compost, manure or digestate from anaerobic digestion. For subsurface application, the biochar may be applied either as a unique soil amendment or mixed with other substrates. For any soil application, the biochar must comply with biochar material standards to avoid the risk of transferring unwanted heavy metals and organic contaminants to soil. Project proponents must meet the IBI Biochar Testing Guidelines or EBC Production Guidelines or relevant national regulations for avoiding soil contamination.	Eligible:  The biochar produced under the project activity shall be used for soil applications. Depending on the farmers' requirement it can be used as soil amendment on land both to the soil surface and/or subsurface. In all cases, the biochar application shall meet the requirements of IBI Biochar Testing Guidelines. More details will be provided during the course of validation & verification.

### 3.3 Project Boundary

Following table defines the project boundary and identifies the relevant GHG sources, sinks and reservoirs for the project and baseline scenarios:

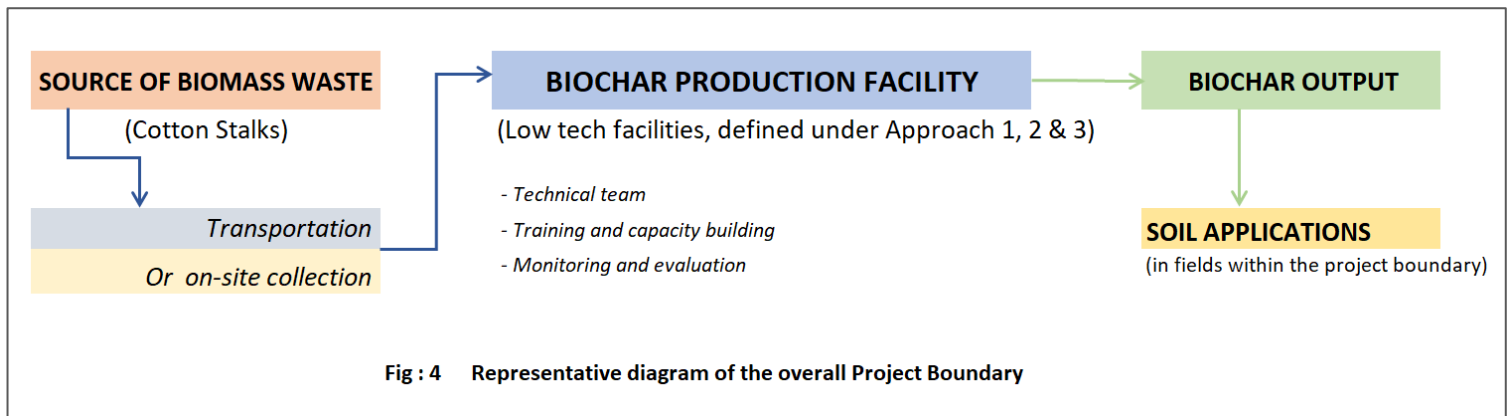
Source		Gas	Included?	Justification/Explanation
Baseline	Feedstock production	CO <sub>2</sub>	NO	Excluded. Waste biomass is considered renewable per eligibility CH4 No conditions.
		CH <sub>4</sub>	NO	
		N <sub>2</sub> O	NO	
		Other	NO	
	Feedstock transportation	CO <sub>2</sub>	NO	Expected to be de minimis if distance between sourcing sites and production facility is less than 200 kilometers.
		CH <sub>4</sub>	NO	
		N <sub>2</sub> O	NO	
		Other	NO	
	Combustion, aerobic and anaerobic decomposition of feedstocks	CO <sub>2</sub>	NO	Possible emissions from decay or combustion of biomass in the absence of project activity are excluded. Baseline emissions are assumed to be zero (a conservative assumption).
		CH <sub>4</sub>	NO	
		N <sub>2</sub> O	NO	
		Other	NO	
Project <sup>5</sup>	Feedstock Production	CO <sub>2</sub>	NO	Purpose-grown crops are ineligible, hence there are no emissions from feedstock production. Waste biomass is also considered renewable per the CDM renewable biomass definition (EB23 Annex 18) and applicability conditions (see Table 1).
		CH <sub>4</sub>	NO	
		N <sub>2</sub> O	NO	
		Other	NO	
	Pyrolysis, or thermochemical conversion (low technology systems)	CO <sub>2</sub>	NO	Low technology systems are provided a default emission value based on published literature (Cornelissen et al., 2016).
		CH <sub>4</sub>	YES	
		N <sub>2</sub> O	NO	
		Other	NO	
	Electricity and/or fossil fuels consumed during eligible thermochemical process	CO <sub>2</sub>	YES	Included. Emissions associated directly with project activity due to use of fossil fuel. However, there is no use of electricity in the process.
		CH <sub>4</sub>	NO	
		N <sub>2</sub> O	NO	
		Other	NO	
	Biochar transportation	CO <sub>2</sub>	NO	Expected to be de minimis if distance between production facility and end-use destination is less than 200 kilometers.
		CH <sub>4</sub>	NO	
		N <sub>2</sub> O	NO	
		Other	NO	
	Pre-treatment of feedstocks (e.g., grinding, drying)	CO <sub>2</sub>	NO	Excluded as there is no such pre-treatment occurs at project level.
		CH <sub>4</sub>	NO	
		N <sub>2</sub> O	NO	
		Other	NO	

<sup>5</sup> Additionally, H\* (i.e. High-carbon fly ash diversion) could be a parameter under project emission. However, as per the provision of the methodology the applicability conditions state that qualifying biomass facilities that divert a portion of their biomass away from renewable energy production to biochar (high-carbon fly ash) must divert less than 5 percent of the total biomass used on an annual basis. In addition, the biomass facility must demonstrate that they are not replacing the biomass lost with fossil fuel sources. Since, in the current project activity both the conditions are not applicable, hence biomass-based heat or electrical production loss can be considered de minimis. Hence it's excluded.

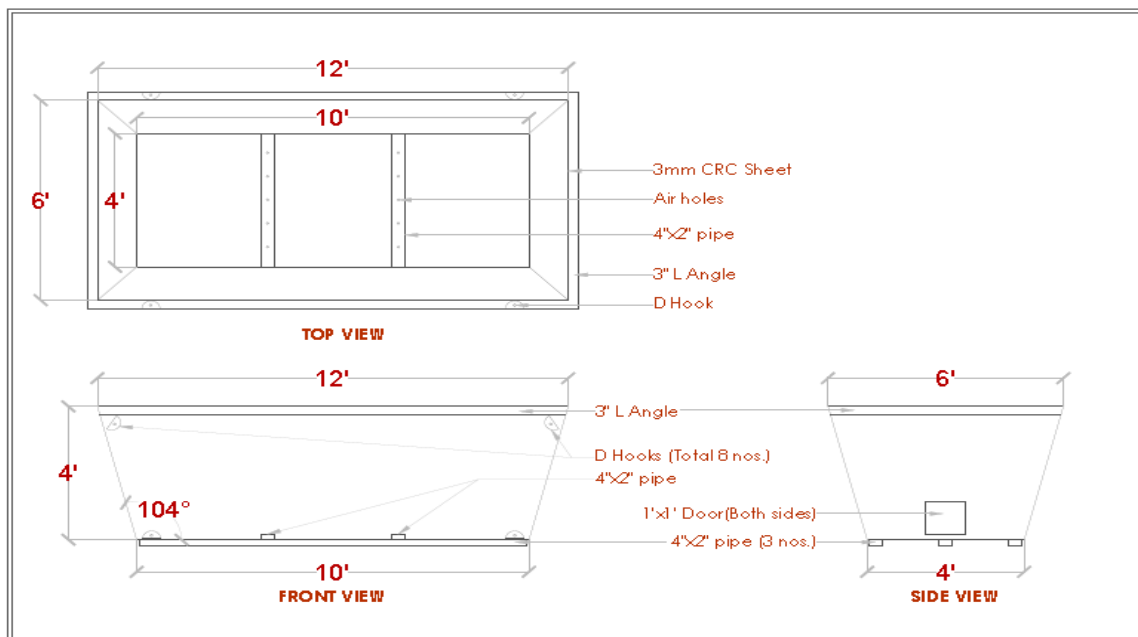
Source	Gas	Included?	Justification/Explanation
Biochar application (e.g., preparation of biochar for final use)	CO <sub>2</sub>	NO	No direct or indirect emission is anticipated in the process.
	CH <sub>4</sub>	NO	
	N <sub>2</sub> O	NO	
	Other	NO	

The spatial extent of the project boundary is demonstrated below, it encompasses the geographic area including:

- 1) Initial waste biomass (i.e. cotton stalks) is sourced;
- 2) Waste biomass is treated for the purpose of biochar production using one or more of the given Approaches (i.e. Approach 1, 2 and/or 3) defined under the project design;
- 3) The final application of biochar into soils.



Following section includes some representative diagram (Fig 5) the box-kiln equipment involved in the biochar production facility under the project:



### 3.4 Baseline Scenario

The baseline scenario is that in which, in the absence of the project activity, the cotton waste (i.e. stalks) biomass is mainly combusted without any utilization for purposes and is not utilized for producing biochar for either soil or non-soil application.

As per the applicability conditions of the methodology, the waste biomass must only have the following fates: decay (aerobic or anaerobic) or combustion of biomass for purposes other than energy production. The resulting emission avoidance potential for the project activity feedstock has been excluded (a conservative assumption).

In this regard, a baseline survey was conducted and it has been confirmed that the baseline scenario has the fate as “combustion of biomass for the purposes other than energy production”. Also, the emissions avoidance associated with the feedstock at baseline is excluded; hence baseline scenario of the project is in line with the requirement of the applied methodology.

### 3.5 Additionality

The additionality of the project is demonstrated in accordance with the applied methodology taking into account the following parameters:

Project activities must not be mandated by any law, statute, or other regulatory framework, or for UNFCCC non-Annex I countries, any systematically enforced law, statute, or other regulatory framework.

The project is a biochar production activity by utilizing waste biomass (i.e. cotton wastes) which fate in absence of the project activity would have been open burning without production of biochar or similar products. Thus, from the existing or baseline scenario of the project it's evident that the project activities are not mandated by law, statute or any regulatory framework in the host country.

Additionality based on an activity method for the demonstration, as follows:

#### **Step 1: Regulatory Surplus**

The regulatory surplus scenario is demonstrated below in accordance with the rules and requirements regarding regulatory surplus set out in the latest version of the VCS Standard and VCS Methodology Requirements. As per VCS Standard, v4.4 *“Regulatory surplus means that project activities are not mandated by any law, statute, or other regulatory framework, or for UNFCCC non-Annex I countries, any systematically enforced law, statute, or other regulatory framework.”*

As demonstrated under the previous section the biochar production in the state of Telangana or even in any state in the host country India is not a mandatory requirement. The Indian government has been promoting sustainable agriculture practices, including the use of organic amendments like biochar, through initiatives such as the National Mission for Sustainable Agriculture (NMSA) and the National Biochar Initiative. These initiatives aim to enhance soil fertility, improve crop yields, and promote sustainable agricultural practices but not a mandatory regulation or enforced law in the country.

**Step 2: Positive List**

As per the appendix 1 of the Methodology, it uses an activity method for demonstrating additionality with the processing of waste biomass to biochar as the basis for a positive list. This approach stipulates that the total waste biomass converted to biochar amounts to less than five percent of the total waste biomass available worldwide.

Five percent is the activity penetration threshold set by the VCS Methodology Requirements and is determined by taking the “Observed Activity (OA)” divided by the “Maximum Adoption Potential (MAP)”. Where the result of this equation is less than five percent, the project activity may be considered additional.

Activity penetration is calculated as:

$$AP_y = \frac{OA_y}{MAP_y} \times 100$$

Where:

AP<sub>y</sub> = Activity penetration of the project activity in year y (percent)

OA<sub>y</sub> = Observed adoption of the project activity in year y

MAP<sub>y</sub> = Maximum adoption potential of the project activity in year y

As per the baseline survey, the total observed adoption of the project activity in a year is about 100,000 tons. Thus, OA<sub>y</sub> = 100,000 tons/y

For the purposes of this methodology, the maximum adoption potential of this activity is the number of **tons** of waste biomass that could be converted to biochar worldwide. As per the demonstration under the Appendix 1 of the methodology, the maximum adoption potential of this activity is limited to MAP<sub>y</sub> = **1.369 billion tons**.

Thus, the calculated activity penetration rate is  
 AP<sub>y</sub> = [(0.1 million tons)/(1,300 million tons)] X 100 = 0.0077%, which is < 5%.

Thus, the project activity is deemed additional under the positive list.

### 3.6 Methodology Deviations

Not applicable.

## 4 IMPLEMENTATION STATUS

### 4.1 Implementation Status of the Project Activity

The implementation status of the project activity is demonstrated as per the following information:

- **The operation of the project activity(s) during this monitoring period, including any information on events that may impact the GHG emission reductions or removals and monitoring.**

The project activity has been designed and developed in the recent time and the initial pilot run and data recording activities were started from 12-April-2023. Therefore, the start date of the current monitoring period is also the start date of the project activity. During this period, the project activity undergone a pilot run as per the designed specification under the Approach 1 (i.e. earth-pits) and 2 (box-kiln). There was no event that may impact the GHG emissions reduction or removals and its monitoring. However, the production of biochar is seasonal as it's based on cotton stalks as feedstock which is a seasonal waste biomass.

- **Leakage and non-permanence risk factors are being monitored and managed:**  
Since the project activity is a non-AFOLU project, hence this is not required.
- **Important dates of the overall implementation of the project activity:**  
The chronological events of the project activity are as follows:

Event	Date	Remarks
MoU between WeAct Pty Ltd. & Aranya Agriculture Alternatives	03-Feb-2022	Objective of this MoU was to conduct a feasibility study of the biochar and bio-compost related project from crop residues, to evaluate the baseline scenarios of such biomass waste, availability, issues etc. in the target regions. Thereby to establish a pilot project.
Awareness and sensitization of the communities, farmers, etc.	April 2022 and onward	Objective was to create awareness about importance of sustainable agriculture, mainly with the help of soil improvement using Biochar, Bio-Compost etc. Also to understand the situation crop residue burning and then to inform about the possible way of avoiding such practice, etc.
Evaluation of biochar production technologies, possible options of production etc.	July 2022 and continuous process	Objective was to evaluate all technical know-how related to biochar product in accordance with the local conditions, to understand effective utilization etc.
Clarifications taken from VERRA on the New Biochar Methodology, its application, monitoring parameters etc.	Aug 2022 to April 2023	Objective was to understand requirements of different monitoring parameters under various project scenarios. Understand various

		intricacies of low and high-tech facilities, series of follow up clarifications prior to the project design
Baseline Survey for the project	Jan 2023	Detailed study of the biomass waste, availability, accessibility, prevailing practice, etc.
Pilot run of the biochar production	April 2023	Initial batches of biochar produced in the project boundary
Stakeholders' Consultation	07 April 2023	Local stakeholders' consultation to receive feedback on the overall project activity and way forward. It also includes assessment of environmental safeguards, socio-economic aspects of the project etc.

# 5 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

## 5.1 Baseline Emissions

The procedure for quantification of baseline emissions removals is considered in accordance with the applied methodology. The relevant choices for this project activity are as follows:

Net GHG emission reductions and removals are calculated as per the equation 15, as follows:

$$ER_y = (ER_{SS,y} - ER_{PS,y} - ER_{AS,y}) - LE_y \quad (15)$$

Where:

- $ER_y$  = Net GHG emissions removals in year  $y$  (tCO<sub>2</sub>e)
- $ER_{SS,y}$  = GHG emissions reduction at sourcing stage in year  $y$  (tCO<sub>2</sub>e)
- $ER_{PS,y}$  = GHG emissions removals at production stage in year  $y$  (tCO<sub>2</sub>e)
- $ER_{AS,y}$  = GHG emissions at application stage in year  $y$  (tCO<sub>2</sub>e)
- $LE_y$  = Total leakage emissions in year  $y$  (tCO<sub>2</sub>e)

### Sourcing Stage:

Emission reductions at the sourcing stage are calculated using equation 14, as follows:

$$ER_{SS,y} = \sum_y (BE_{SS,y} - PE_{SS,y}) \quad (14)$$

Where:

- $ER_{SS,y}$  = GHG emissions reduction at sourcing stage in year  $y$  (tCO<sub>2</sub>e)
- $BE_{SS,y}$  = Baseline emissions at sourcing stage in year  $y$ , conservatively assumed default value of zero (tCO<sub>2</sub>e)
- $PE_{SS,y}$  = Project emissions at sourcing stage in year  $y$ , conservatively assumed to be zero (waste biogenic source material is considered as renewable biomass) (tCO<sub>2</sub>e)

As per para 8.1.1 of the methodology, “Following the CDM EB23 Annex 18: Definition of renewable biomass, waste biomass may be classified as renewable. As the decay rate pathway of diverse feedstock types varies by region and time, the methodology defines the default net baseline emission avoidance as zero following a conservative scenario ( $ER_{SS,y}$ ).

Thus,  $ER_{SS,y} = 0$ .

### Production Stage:

In the baseline scenario at production stage, no biochar is produced for the purpose of the project activity and therefore no GHG removals or related emissions are considered.

### Application Stage:

Emissions at application stage refer to GHG emissions associated with the post-production and end-use application of biochar. In the baseline scenario at application stage, since no biochar was produced, no GHG removals or related emissions are considered.

## 5.2 Project Emissions

### Sourcing Stage:

At the sourcing stage, the methodology relies on the collection of waste biomass. Therefore, the emissions at the sourcing stage ( $PE_{SS,y}$ ) are set to zero.

### Production Stage:

In the project scenario, the net GHG balance depends on the organic carbon content at the biochar production stage. Equation 1 below summarizes the carbon balance at the production stage by comparing the difference between the stabilized carbon content in the biochar and the resulting project emissions from feedstock pre-treatment (where applicable) and from conversion of waste biomass into biochar. However, in this project activity the pre-treatment process is not involved, hence the latter includes other relevant emissions from the production facilities.

The project emission removals during production at the biochar facility are as follows:

$$ER_{PS,y} = \sum_t \sum_k \sum_p \left( CC_{t,k,y} \times \frac{44}{12} \right) - PE_{PS,t,p,y} \quad (1)$$

Where:

- $ER_{PS,y}$  = GHG emissions removals at production stage in year y (tCO<sub>2</sub>e)
- $CC_{t,k,y}$  = Organic carbon content on a dry weight basis for biochar type t used for application type k in year y (tonnes)
- $PE_{PS,t,p,y}$  = Project emissions at production stage for production of biochar type t at production facility p in year y (tCO<sub>2</sub>e)
- $\frac{44}{12}$  = Coefficient to convert organic carbon to tCO<sub>2</sub>e

The project activity is designed to adopt low-technology<sup>6</sup> biochar production facility. Hence, as per the para 8.2.2.2 of the methodology, following steps are adopted:

<sup>6</sup> Low technology production facilities are all production facilities that do not meet the conditions defined under high technology production. The project includes earth-pits and box-kiln, which are categorized as low-tech facilities.

### Step 1: Estimate organic carbon content ( $CC_{t,k,y}$ ) of biochar for low technology facilities

In low technology settings the total organic carbon content of the produced biochar is the foundation of the GHG calculations. The value is derived from the mass of biochar, its respective organic carbon content, and the decay rate of organic carbon in the biochar taken over a period of 100 years (100-year permanence value).

For low technology production facilities, a conservative approach has been selected, related to the organic carbon content of biochar ( $F_{Cp}$ ), based on feedstock type and heating temperature as provided in Table 4 which draws from IPCC Method for Estimating the Change in Mineral Soil Organic Carbon Stocks from Biochar Amendments: Basis for Future Methodological Development. In Equation 6 below, permanence (the fraction of carbon in the biochar remaining after 100 years) is included.

$$CC_{t,k,y} = M_{t,k,p,y} \times F_{Cp,t,p} \times PR_{de,k} \quad (6)$$

Where:

$CC_{t,k,y}$  = Organic carbon content on a dry weight basis for biochar type t used for application type k in year y (tonnes). Biochar type is based on the feedstock used to produce the biochar.

$M_{t,k,p,y}$  = Mass on a dry weight basis of biochar type t for application type k produced at production facility p in year y (tonnes)

$F_{Cp,t,p}$  = Organic carbon content of biochar type t produced in production facility p per tonne of biochar, taken on a dry weight basis (percent).  $F_{Cp}$  for low technology production facilities is determined through laboratory material analysis of biochar where possible. Otherwise,  $F_{Cp}$  values are obtained from Table 4 per type of feedstock. Where feedstocks are mixed, the most conservative  $F_{Cp}$  value of the relevant feedstocks must be used.

$PR_{de,k}$  = Permanence adjustment factor due to decay of biochar to be defined for application type k (dimensionless). Biochar is subject to natural decay rate when used in soil applications such as in agriculture, forests, croplands, or grasslands. Many low technology production facilities do not measure the temperature at biochar production. A default value of 0.56<sup>22</sup> must be used where pyrolysis temperature is unknown. This follows a conservative approach for carbon permanence.

#### Determining $F_{Cp}$ : Values for organic carbon content per tonne of biochar per production type

As per the provision of the methodology, project proponents using low technology production facilities may adopt values from IPCC (2019) for different feedstocks and production types (Table 4). Further, project proponents may also refer to other scientific literature such as Woolf et al. (2021).

PP has followed the default value as per the Table 4 of the methodology. Since the feedstock type is Cotton stalks and process follows pyrolysis method, it is considered to be in the category of woody biomass Feedstock and value considered as 0.77 for  $F_{Cp}$ .

**Step 2: Estimate project emissions  $PE_{PS,t,p,y}$  for low technology facilities:**

Emissions under the project scenario are determined using the following equation (7):

$$PE_{PS,t,p,y} = \sum_t [(P_{ED,p,y} + P_{EP,p,y} + P_{EC,p,y})] \quad (7)$$

Where:

- $PE_{PS,t,p,y}$  = Project emissions at the production stage for production of biochar t at production facility p in year y (tCO<sub>2e</sub>)
- $P_{ED,p,y}$  = Emissions associated with the pre-treatment of waste biomass at production facility p in year y (tCO<sub>2e</sub>)
- $P_{EP,p,y}$  = Emissions associated with the conversion of waste biomass into biochar at production facility p in year y (tCO<sub>2e</sub>)
- $P_{EC,p,y}$  = Emissions due to the utilization of auxiliary energy for the purpose of pyrolysis at production facility p in year y (tCO<sub>2e</sub>)

**Determining  $P_{ED,p,y}$ :**
**Emissions associated with the pre-treatment of feedstock at production facility p in year y for low technology facilities**

Energy consumption for necessary pre-treatment of waste biomass must be accounted for. This may include feedstock preparation (e.g., feedstock agglomeration, homogenization, pelletizing) either inside the production facility or in field preparation, drying of wet biomass, or other processes. If the energy source is renewable,  $P_{ED,p,y}$  must be zero. Otherwise, it must be calculated using the equation 8, as follows:

$$P_{ED,p,y} = P_{EDE,p,y} + P_{EDF,p,y} \quad (8)$$

Where:

- $P_{ED,p,y}$  = Emissions associated with pre-treatment of feedstock at production facility p in year y (tCO<sub>2e</sub>)
- $P_{EDE,p,y}$  = Emissions associated with grid-connected electricity utilized for pre-treatment of waste biomass at production facility p in year y (tCO<sub>2e</sub>).  $P_{EDE,p,y}$  must be calculated as per the provisions of CDM *Methodological Tool 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*.<sup>23</sup>
- $P_{EDF,p,y}$  = Emissions associated with combustion of fossil fuels utilized for pre-treatment of waste biomass at production facility p in year y (tCO<sub>2e</sub>).  $P_{EDF,p,y}$  must be calculated as per the provisions of CDM *Tool 03: Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion*.<sup>24</sup>

Since there is no pre-treatment involved in the current project design, hence **this equation shall not be applied for any calculation.**

**Determining  $P_{EP,p,y}$ :**
**Emissions associated with the thermochemical process (pyrolysis) at production facility p in year y for low technology facilities**

In the absence of direct emission measurements that can reliably measure and report project emissions, data from peer-reviewed literature must be used in the following equation 9, as follows:

$$P_{EP,p,y} = \sum_k \sum_t (F_e \times GWP_{CH_4} \times M_{t,k,p,y}) \quad (9)$$

Where:

- $P_{EP,p,y}$  = Emissions associated with the conversion of waste biomass into biochar at production facility p in year y (tCO<sub>2</sub>e)
- $F_e$  = Average methane emissions from producing one tonne of biochar in year y (tCH<sub>4</sub>/tonne). Values from Table 3 in Cornelissen et al. (2016)<sup>25</sup> may be used based on the corresponding kiln type (i.e., low technology production facility type). Where the kiln type is not listed a default average emission factor of 0.049 t CH<sub>4</sub>/tonne may be conservatively used based on the value for traditional kilns since simple low-cost technologies are known to emit higher levels of CH<sub>4</sub><sup>26</sup>. Project proponent may propose more appropriate values based on scientific studies, research papers or any other credible documentation and/or information related to the utilized production technology.

$GWP_{CH_4}$  = Global warming potential of methane. Use value referenced in the latest version of the *VCS Standard*

$M_{t,k,p,y}$  = Mass on a dry weight basis of biochar type t and application type k produced at production facility p in year y (tonnes)

**Determining  $P_{EC,p,y}$ :**
**Emissions due to the utilization of auxiliary energy for the purpose of pyrolysis**

When external energy is required to initiate and maintain the pyrolysis reactor, it must be accounted as project emissions. If the source of auxiliary energy is renewable,  $P_{EC,p,y}$  must be zero. Otherwise, it must be calculated using the equation 10, as follows:

$$P_{EC,p,y} = P_{ECE,p,y} + P_{ECF,p,y} \quad (10)$$

Where:

$P_{EC,p,y}$  = Emissions due to the utilization of auxiliary energy for the purpose of pyrolysis at production facility p in year y (tCO<sub>2</sub>e)

$P_{ECE,p,y}$  = Emissions associated with use of grid-connected electricity utilized for starting the reactor at production facility p in year y (tCO<sub>2</sub>e).  $P_{ECE,p,y}$  must be calculated as per CDM *Methodological Tool 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*.<sup>27</sup>

$P_{ECF,p,y}$  = Emissions associated with combustion of fossil fuels utilized for starting the reactor at production facility p in year y (tCO<sub>2</sub>e).  $P_{ECF,p,y}$  must be calculated as per the provisions of CDM *Tool 03: Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion*.<sup>28</sup>

**Application Stage:**

As per para 8.2.3 of the methodology, in the project scenario, emissions associated with processing and utilizing biochar after its production will have a potential impact on the overall emission removal potential. Equation 11 below determines the GHG emissions at the application stage.

$$ER_{AS,y} = \sum_k \sum_t [(-1) \times (E_{p,t,k,y} + E_{ap,t,k,y})] \quad (11)$$

Where:

$ER_{AS,y}$  = GHG emissions at application stage in year y (tCO<sub>2</sub>e)

$E_{p,t,k,y}$  = Emissions from processing of biochar type t for application type k in year y (tCO<sub>2</sub>e)

$E_{ap,t,k,y}$  = Emissions from utilization of biochar type t for application type k in year y (tCO<sub>2</sub>e)

However, biochar produced in the project activity is not processed using any energy application such as grid electricity, fossil fuel etc. **Hence,  $E_{p,t,k,y}$  is Zero.**

GHG emissions resulting from fossil fuel combustion or mixing of biochar with fertilizer products are considered negligible. **Thus,  $E_{ap,k,y}$  is zero.**

### 5.3 Leakage

In the case of biochar use, leakage emissions are primarily attributed to transport emissions at various stages of the biochar life cycle. Emissions due to activity-shifting leakage or biomass diversion are considered zero, as currently only waste biomass is eligible for biochar production. Quantification of leakage emissions are considered using equation 13, as follows:

$$LE_y = LE_{as,y} + LE_{bd,y} + LE_{ts,y} + LE_{tap,y} \quad (13)$$

Where:

$LE_y$  = Total leakage emissions in year y (tCO<sub>2</sub>e)

$LE_{as,y}$  = Leakage due to activity shift in year y (tCO<sub>2</sub>e). Leakage due to activity shift is zero as use of purposely grown biomass for production of biochar is currently not allowed.

$LE_{bd,y}$  = Leakage due to biomass diversion in year y (tCO<sub>2</sub>e). Leakage due to biomass (waste/residue) diversion is considered negligible since only biomass which would have been combusted or left to decay is utilized for biochar production.

$LE_{ts,y}$  = Leakage emissions due to transport of waste biomass from sourcing to biochar production facility in year y (tCO<sub>2</sub>e). As per CDM *Methodological Tool 16: Project and leakage emissions from biomass*,<sup>32</sup> GHG emissions must be accounted for only if transportation distance is more than 200 km. Project proponent must use CDM *Methodological Tool 12: Project and leakage emissions from transportation of freight*<sup>33</sup> to calculate  $LE_{ts,y}$ .

$LE_{tap,y}$  = Leakage emissions from transportation of biochar from the production facility to the site of end application in year y (tCO<sub>2</sub>e). As per CDM *Methodological Tool 16: Project and leakage emissions from biomass*,<sup>34</sup> GHG emissions must be accounted for only if transportation distance is more than 200 km. Project proponent must use CDM *Methodological Tool 12: Project and leakage emissions from transportation of freight*<sup>35</sup> to calculate  $LE_{tap,y}$ .

#### **Determining $LE_{ts,y}$ : Emissions related to leakage from transportation of biochar from sourcing to biochar production facility:**

Project emissions from transportation of biochar from the place of origin of the waste biomass to the production site may have the following components:

##### **(i) Transport emissions from field to the production facility**

**$LE_{ts,y}$  is considered zero** if transportation distance (to and from—round trip) is less than 200 km. Project emissions from transportation of biochar shall be calculated as per the latest version of “CDM Tool 12: Project and leakage emissions from transportation of freight”.

**Determining  $LE_{tap,y}$ : Emissions related to leakage from transportation of biochar from production facility to site of end-use application**

Project emissions from transportation of biochar from facility to end-use application may have the following components:

- Transport emissions from biochar facility to processing facility; AND
- Transport emissions from processing facility to end-use site; OR
- Transport emissions from biochar facility to end-use site.

$LE_{tap,y}$  is considered zero if transportation distance (to and from—round trip) is less than 200 km. Project emissions from transportation of biochar must be calculated as per the latest version of CDM Tool 12: Project and leakage emissions from transportation of freight.

## 5.4 Estimated Net GHG Emission Reductions and Removals

The procedure for estimation of net GHG emission reductions and removals include all relevant equations described under the previous section 5.3.

The ex-ante calculation (estimate<sup>7</sup>) of baseline emissions/removals, project emissions/removals, leakage emissions and net GHG emission reductions and removals in the table(s) below for the project crediting period, separately presented for different low-tech facilities proposed under the project design.

For Approach 1 (i.e. for low-tech facility with different Earth-pits):

**Table A: For regular soil-pits:**

Year	Estimated baseline emissions or removals (tCO <sub>2e</sub> )	Estimated project emissions or removals (tCO <sub>2e</sub> )	Estimated leakage emissions (tCO <sub>2e</sub> )	Estimated net GHG emission reductions or removals (tCO <sub>2e</sub> )
Year 1 (12 April 2023 to 11 April 2024)	39,527	22,400	0	17,126
Year 2 (12 April 2024 to 11 April 2025)	39,527	22,400	0	17,126
Year 3 (12 April 2025 to 11 April 2026)	39,527	22,400	0	17,126
Year 4 (12 April 2026 to 11 April 2027)	39,527	22,400	0	17,126
Year 5 (12 April 2027 to 11 April 2028)	39,527	22,400	0	17,126

<sup>7</sup> The ex-ante calculation will vary depending on the type of low-tech facility being used. PP has already proposed three different approaches under the project design, therefore ex-ante estimates are done for each type of facility. However, PP has anticipated that approach 1 (i.e. earth-pits) may become more suitable followed by the approach 2 and 3. Therefore, final calculation will be based on type of low-tech facilities (or combination) and may vary significantly as compared to the ex-ante estimate. Also, for the purpose of ex-ante estimate an annual projection of 100,000 tons of biomass waste is considered under this project activity which may lead to an annual avg. generation of about 25,000 tons of biochar on dry weight basis.

Year 6 (12 April 2028 to 11 April 2029)	39,527	22,400	0	17,126
Year 7 (12 April 2029 to 11 April 2030)	39,527	22,400	0	17,126
<b>Total</b>	<b>276,687</b>	<b>156,800</b>	<b>0</b>	<b>119,882</b>

**Table B: For steel-shield soil-pits:**

Year	Estimated baseline emissions or removals (tCO <sub>2</sub> e)	Estimated project emissions or removals (tCO <sub>2</sub> e)	Estimated leakage emissions (tCO <sub>2</sub> e)	Estimated net GHG emission reductions or removals (tCO <sub>2</sub> e)
Year 1 (12 April 2023 to 11 April 2024)	39,527	9,800	0	29,726
Year 2 (12 April 2024 to 11 April 2025)	39,527	9,800	0	29,726
Year 3 (12 April 2025 to 11 April 2026)	39,527	9,800	0	29,726
Year 4 (12 April 2026 to 11 April 2027)	39,527	9,800	0	29,726
Year 5 (12 April 2027 to 11 April 2028)	39,527	9,800	0	29,726
Year 6 (12 April 2028 to 11 April 2029)	39,527	9,800	0	29,726
Year 7 (12 April 2029 to 11 April 2030)	39,527	9,800	0	29,726
<b>Total</b>	<b>276,687</b>	<b>68,600</b>	<b>0</b>	<b>208,082</b>

For Approach 2 (i.e. for low-tech facility with box-kiln):

**Table C: For box-kiln (i.e. shallow steel octagonal kiln):**

Year	Estimated baseline emissions or removals (tCO <sub>2</sub> e)	Estimated project emissions or removals (tCO <sub>2</sub> e)	Estimated leakage emissions (tCO <sub>2</sub> e)	Estimated net GHG emission reductions or removals (tCO <sub>2</sub> e)
Year 1 (12 April 2023 to 11 April 2024)	39,527	18,200	0	21,326
Year 2 (12 April 2024 to 11 April 2025)	39,527	18,200	0	21,326
Year 3 (12 April 2025 to 11 April 2026)	39,527	18,200	0	21,326
Year 4 (12 April 2026 to 11 April 2027)	39,527	18,200	0	21,326

Year 5 (12 April 2027 to 11 April 2028)	39,527	18,200	0	21,326
Year 6 (12 April 2028 to 11 April 2029)	39,527	18,200	0	21,326
Year 7 (12 April 2029 to 11 April 2030)	39,527	18,200	0	21,326
<b>Total</b>	<b>276,687</b>	<b>127,400</b>	<b>0</b>	<b>149,282</b>

## 6 MONITORING

### 6.1 Data and Parameters Available at Validation

<b>Data / Parameter</b>	$FC_{p,t,p}$
<b>Data unit</b>	Percent (%)
<b>Description</b>	Organic carbon content of biochar for each biochar type t produced in production facility p per ton of biochar, on a dry weight basis (%)
<b>Source of data</b>	Default value provided in Table 4 of the methodology: “values for Organic Carbon Content in Biochar from Table 4AP.1 of IPCC (2019)”.
<b>Value applied:</b>	0.77
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	<p>The project is designed based on single feedstock, i.e. Cotton Stalks as biomass waste. Therefore, the value has been considered for the category “wood” and for the pyrolysis process.</p> <p>Default value considered using IPCC (2019) states global estimates of organic carbon content of biochar as a function of feedstock and heating temperature.</p>
<b>Purpose of Data</b>	Calculation of project emissions
<b>Comments</b>	Fixed for the entire crediting period.

<b>Data / Parameter</b>	$PR_{de,k}$
<b>Data unit</b>	Dimensionless
<b>Description</b>	Permanence adjustment factor due to decay of biochar (dimensionless) to be defined for application type k
<b>Source of data</b>	Default Values from Table 4AP.2 of IPCC (2019), as prescribed under the methodology
<b>Value applied:</b>	0.56
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	<p>As per methodological choice, for low technology production facilities, project proponents must use a conservative default value of 0.56 (Figure 4Ap.1 in IPCC, 2019)</p> <p>Biochar is a stable material that may be used for soil and non-soil applications. As a material, it has a decay rate that must be accounted for. This parameter considers how much of the original carbon will remain in the biochar and may be accounted as a carbon</p>

	sink after its final application.  IPCC and EBC are internationally recognized, and the data provided in the guidelines are peer reviewed.
<b>Purpose of Data</b>	Calculation of project emissions
<b>Comments</b>	Fixed for the entire crediting period.

<b>Data / Parameter</b>	GWP <sub>CH4</sub>
<b>Data unit</b>	tonnes CO2e per tonne CH4 (t CO2e/t CH4)
<b>Description</b>	Global warming potential of methane
<b>Source of data</b>	IPCC Fifth Assessment Report
<b>Value applied:</b>	28
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	The VCS Standard requires that CH4 is converted to CO2e using the 100-year global warming potential derived from the most recent IPCC Assessment Report.
<b>Purpose of Data</b>	Calculation of project emissions
<b>Comments</b>	Fixed for the entire crediting period.

<b>Data / Parameter</b>	F <sub>e</sub>
<b>Data unit</b>	tonnes CH4 per tonne biochar (t CH4/t)
<b>Description</b>	Average methane emissions from producing one tonne of biochar in year y in a low technology production facility
<b>Source of data</b>	Table 3 in Cornelissen et al. (2016)
<b>Value applied:</b>	For earth-pit type (a) Soil Pit: 0.032 For earth-pit type (b) Steel-shield Soil Pit: 0.014 For box-kiln (shallow steel type octagonal): 0.026
<b>Justification of choice of data or description of measurement methods</b>	As per the methodological choice, it is prescribed that if kiln type is known and represented in Table 3, corresponding values may be used for F <sub>e</sub> . Here, the project includes both soil-pits and steel-shield soil pits and also box-kiln is another type. The value for these two soil-pits are

<b>and procedures applied</b>	mentioned in the Table 3. Also, the box kiln is considered as a traditional shallow steel type octagonal kiln. Hence, these values are considered from the Table 3.
<b>Purpose of Data</b>	Calculation of project emissions
<b>Comments</b>	Fixed for the entire crediting period.

## 6.2 Data and Parameters Monitored

<b>Data / Parameter</b>	$M_{t,k,p,y}$
<b>Data unit</b>	tonnes (t)
<b>Description</b>	Mass on dry weight basis of biochar type t and application type k produced at production facility p in year y
<b>Source of data</b>	On-site measurements
<b>Description of measurement methods and procedures applied</b>	Use weighing tools (such as weighing scales and weighbridge). The moisture content is to be adjusted in order to determine quantity of dry weight biomass.
<b>Frequency of monitoring/recording</b>	Monitored continuously, recorded at least monthly
<b>Value applied:</b>	To be applied on actual
<b>Monitoring equipment</b>	Weighing scales and/or Weighbridge
<b>QA/QC procedures applied</b>	<p>Calibrate weighing scales and/or weighbridge as per manufacturer's specifications or at least every three years. In case public weighbridges, the status of calibration can be verified from the operator.</p> <p>Amount of biochar applied must be cross checked with sales records or distribution records kept by the local representative.</p>
<b>Purpose of data</b>	Calculation of project emissions
<b>Calculation method</b>	NA
<b>Comments</b>	<p>Each biochar quantity shall be weighed separately for each biochar type t and each biochar production facility p. Moisture content shall be monitored for each batch of biochar type t. The weighted average value shall be calculated for each monitoring period.</p> <p>However, the current project activity design is based on biochar produced using a single type of biomass waste, i.e. Cotton Stalk, Hence, biochar type "t" remains the same across the project.</p>

<b>Data / Parameter</b>	H:C <sub>org</sub>
<b>Data unit</b>	Dimensionless
<b>Description</b>	Ratio of hydrogen to organic carbon
<b>Source of data</b>	Laboratory Analysis
<b>Description of measurement methods and procedures applied</b>	Laboratory analysis following IBI Biochar Testing Guidelines or EBC Production Guidelines.
<b>Frequency of monitoring/recording</b>	To be taken samples from random batches of biochar produced at the production facility (please refer to “comments” below for more details)
<b>Value applied:</b>	To be applied on actual
<b>Monitoring equipment</b>	-
<b>QA/QC procedures applied</b>	Laboratory must be accredited and/or approved by the relevant national agency to conduct required material analysis.
<b>Purpose of data</b>	Calculation of project emissions
<b>Calculation method</b>	NA
<b>Comments</b>	<p>The methodology provisions this value for each batch of biochar produced in the facility, However, the current project activity is designed based on monotype feedstock and hence biochar type is also same/uniform across the project. Additionally, the feedstock (i.e. Cotton stalk) is seasonal and hence biochar production is also seasonal. Therefore, it is proposed that the value of H:C shall be evaluated using laboratory analysis once in each seasonal production as characteristics of the biochar output is expected to be uniform.</p> <p>Additionally, this is only a reporting parameter and value is not used in the ER calculation. Therefore, for the initial validation and verification value can also be derived from published literature,</p>

<b>Data / Parameter</b>	Biomass categories and quantities used for selection of the baseline scenario and production of biochar utilized in the project activity
<b>Data unit</b>	tonnes (t) on dry basis
<b>Description</b>	<p><b>Category:</b> Agriculture waste (cotton stalks)</p> <p><b>Source:</b> produced on-site during the season by the farmers, obtained from the farmers during the production phase</p> <p><b>Fate in absence of the project activity:</b> in absence of the project activity the cotton stalks would have been openly combusted without further utilization.</p> <p><b>Sustainability criteria compliance for respective category as indicated in Table 1:</b>                      In line with the table 1, the sustainability criteria are referred for the feedstock category “agricultural waste biomass”. Here, the project proponent is using agricultural waste biomass directly from fields and not from a centralized biomass-processing operation. In the baseline agriculture waste biomass was burned without energy production (e.g., open burning of stubble). A baseline survey is referred in this regard.</p> <p>For selection of the baseline scenario, at validation, an ex-ante estimation of these quantities shall be provided.</p>
<b>Source of data</b>	On-site assessment of biomass categories and quantities
<b>Description of measurement methods and procedures applied</b>	<p>Use weigh bridge or an equivalent measuring method.</p> <p>Adjust by moisture content in order to determine the quantity of dry biomass.</p>
<b>Frequency of monitoring/recording</b>	Data monitored continuously and aggregated at least monthly.
<b>Value applied:</b>	To be applied on actual
<b>Monitoring equipment</b>	-
<b>QA/QC procedures applied</b>	The biomass weighing data shall be recorded at the point of weighing and records shall be available during monitoring & verification. If required annual energy balance that is based on recorded quantities and quantities converted to biochar in a season can be referred.
<b>Purpose of data</b>	Monitoring of eligible biomass categories and quantities used as feedstock for production of biochar
<b>Calculation method</b>	NA
<b>Comments</b>	NA

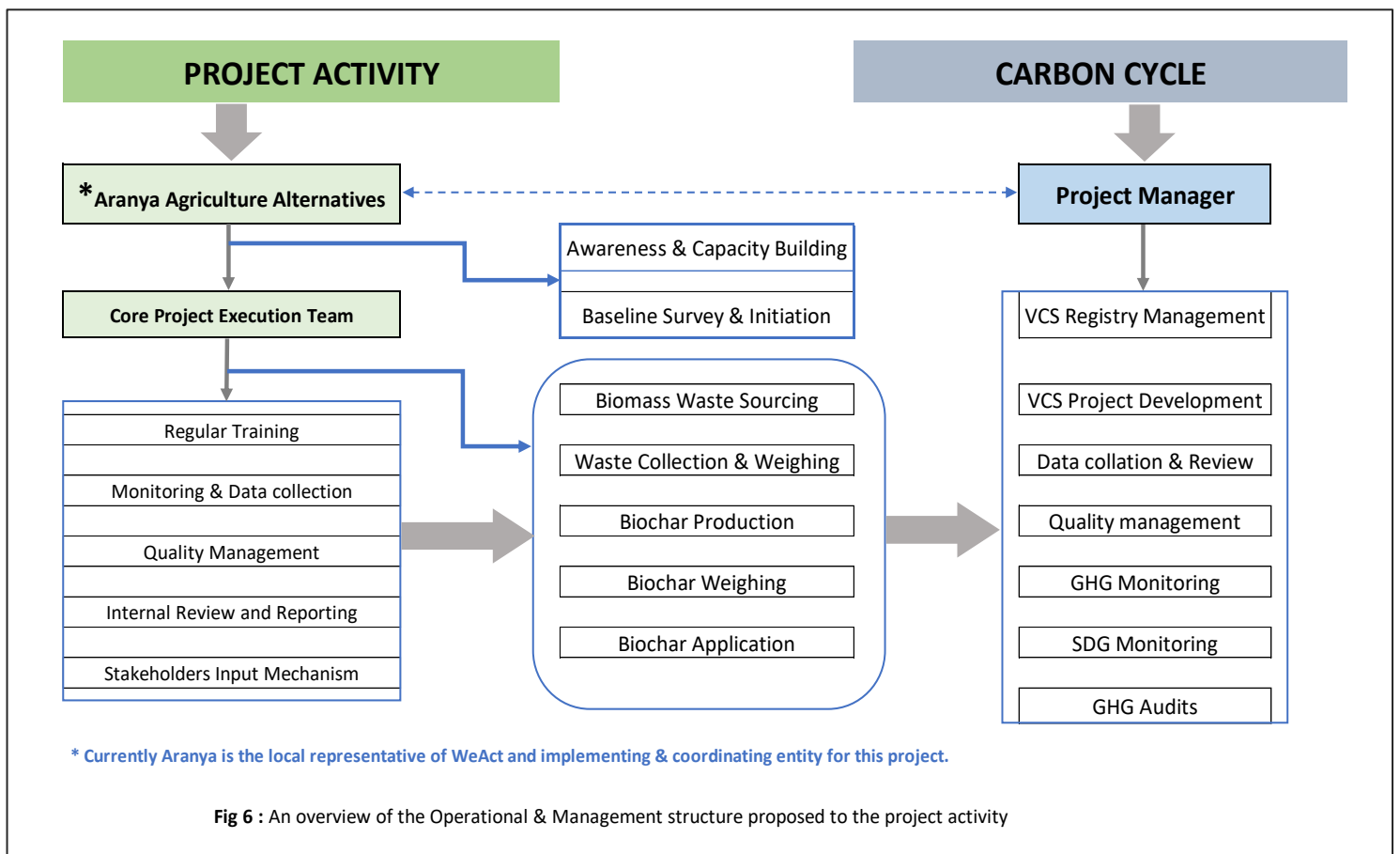
### 6.3 Monitoring Plan

The monitoring plan for the project activity is designed to capture all required monitoring parameters for an accurate recording of GHG data, estimation of GHG emission reduction results and overall management of the project.

**Objective:** The main objective of the monitoring is to prove the carbon sink from the final application of biochar and to quantify the emissions resulting from the project scenario during the project crediting period, prior to each verification. To achieve transparency and accuracy that allows the quantification and proof of GHG emissions at the three stages covered by this methodology: sourcing, production, and application.

**Operation and Management system:**

Following is the representative flow chart to demonstrate the organizational structure for GHG data collection and overall management system. This structure may be revised on time-to-time basis depending on the project requirement and for continuous improvement in the monitoring process.



The key aspects of the monitoring plan are as follows:

#### **Data Management Practice:**

Following are the main aspects of data management:

- Data for each of the prescribed parameters (i.e. Section 6.2 above) shall be monitored individually and will constitute the main database
- Primary Data shall be collected/recorded/kept by the core project team.
- Primary mode of data recording will be either hard copies (e.g. receipts, invoices, log books etc.) or digital data (e.g. excel entries) or both.
- Internal data review, quality check etc. to be performed by project manager(s).
- For the purpose of Carbon accounting, the data shall be periodically collated and to be submitted to the Carbon team.
- As per the requirement of the project, various data collection, data recording and data management tools can be adopted by PP; however at present only manual practice followed by digital records are provisioned under the management plan.

Additionally, the following elements will be included in the main database:

#### **For Sourcing stage :**

- Village Name
- Farmer Reference and details
- Geo-coordinates of farmers field locations and distance to the production facility
- Date of collection
- Vehicle type and details
- Number of trips
- Vehicle Load in each trip

#### **For Production stage :**

- Identification of method/kiln type (i.e. earth-pit or Box-kiln or others)
- Location references of the production facilities
- Batch wise recording of biochar production data for each location
- Date references

#### **For Application stage :**

- Identification of beneficiaries for soil application
- Details of the beneficiaries
- Quantity of biochar given to beneficiaries
- Location reference of the fields where biochar to be applied
- Date references

#### **Monitoring tools:**

Following are the main monitoring tools proposed under the current project activity:

- Public weigh bridge – for input biomass waste weighing
- Weighing scales – for biochar weighing
- Moisture meters – for measure moisture content of biomass & biochar

### Internal Auditing and QA/QC procedure:

As part of continuous improvement and to ensure qualitative implementation and monitoring of the entire process, PP has proposed an internal QA/QC procedure and an internal audit practice at team level. The key elements of these practices are as follows:

- Regular trainings to be conducted (say at least one training every quarter in a calendar year)– both technical and non-technical.
- There will be one Project manager at execution team level, he/she will review the database entries every month and provide a conformity report to Carbon Team on quarterly basis.
- To ensure testing/calibration of the monitoring equipment (wherever applicable) as per manufacturers' specification or at least once in five years
- Project Manager to conduct one internal audit of all the monitoring data once in every six months. Any non-conformance identified to be reported to the carbon team and necessary actions to be taken under the supervision of the Carbon Project Manager. The internal audit report can be practiced annually which will include details of both the half yearly audits.
- Any finding/observation/non-conformity etc. identified during the internal audits shall be addressed by the Carbon team before preparing for any periodic verification of the GHG data.

### Uncertainty Situations :

- During the project operation, uncertain situations may arise such as loss of primary data, emergency shut down situations, natural calamities etc.  
During such events, PP may decide to follow one of the following measures:

- (i) In case of primary data sources are lost, PP may decide to forego the claim of Emission Reduction for that particular period as a conservative approach, OR
- (ii) PP may refer to any backup data, duplicate data, reference information etc. which are credible to establish the data sources and shall not double account any emission reduction results.

### Other Practices:

In order to establish a reliable, transparent and accurate monitoring practice, following provisions are prescribed as part of the monitoring plan:

### Batch Definition :

- For the purpose of batch wise monitoring of input biomass waste data and output biochar data, a batch is defined as follows:
  - (i) **For input biomass waste:** a batch of biomass waste is a full load vehicle (i.e. truck load, tractor load etc.) which is weighed and recorded before going into the biochar production facility.
  - (ii) **For output biochar produced:** a batch of biochar is the produced quantity of biochar via one-time conversion of total input biomass wastes (i.e. single or multiple batches of biomass waste) fed into a particular production facility (e.g. into a box-kiln). Thus, total quantity of biochar coming out of one full capacity of box-kiln is one batch.

**Note:** Thus, it is to be noted that one batch of biochar may or may not be equal to one batch of biomass waste; generally multiple batches of biomass waste will lead to one batch of biochar output.

A representative diagram is given below to establish the batch definitions:

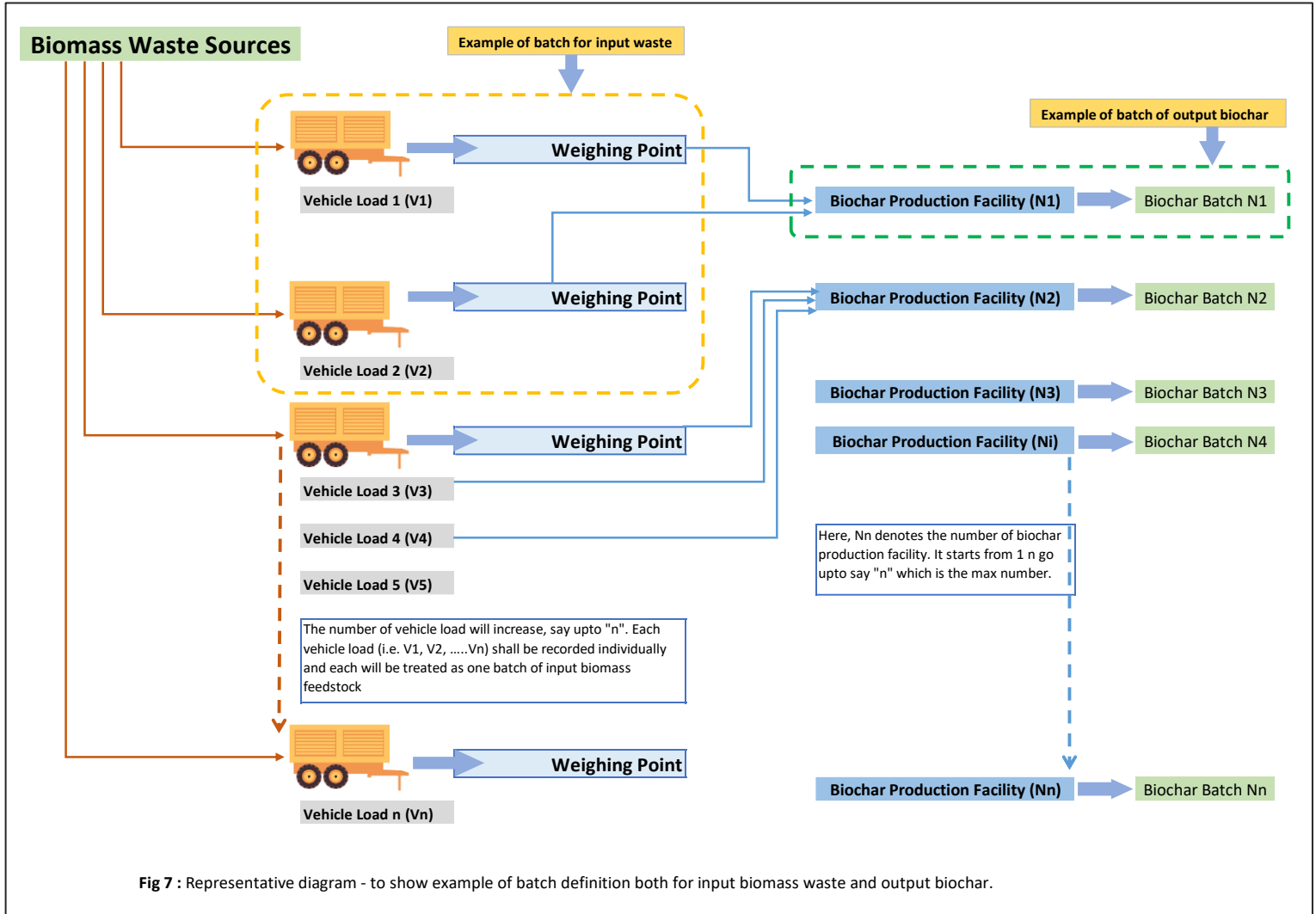


Fig 7 : Representative diagram - to show example of batch definition both for input biomass waste and output biochar.

As can be observed in the representative diagram above, each vehicle load (i.e. denoted as Vn, where V refers to vehicle type (e.g. truck, tractor etc.) and n refers to number) will be recorded for weight & moisture as single batch. Similarly, each time there is a production of biochar from a particular facility (say Nn, where N is the facility reference no. and n is the batch number) will be recorded for weight & moisture and will be a single batch.

Thus, as per this batch definition a batch of single output of biochar can be converted from a single or multiple batches of input biomass waste. Hence,

**1 Biochar Batch =  $\sum$  Batch(s) of input biomass waste (Vn),**

where weight of input biomass waste will be based on vehicle loads (V), n will be the reference number of each batch. Thus, n can be as low as 1 or can be multiple in numbers.

**Method of Weighing of Biomass Waste (i.e. Cotton Stalks):**

With the help of weigh bridge, to be measured based on vehicle load (such as truck load, tractor load etc.)

Alternative methods can be used in line with the provision of the methodology and VCS guidelines.

**Method of Weighing of Biochar Waste (i.e. output product):**

With the help of weighing scales.

Such scales can be fixed and/or portable/moveable; details to be included into the database.

Alternative methods can be used in line with the provision of the methodology and VCS guidelines.

**Method of measuring moisture contents of biomass & biochar:**

With the help of moisture meters.

Data to be logged into register and/or excel file. Also, photographs (random samples) of such readings shall be kept for cross referencing purposes.

**Method of monitoring SDG parameters:**

- Direct monitoring based on records (such as employment agreement, work contracts, training records, etc.)
- Based on primary records such as direct sampling survey with beneficiaries
- Based on third party reports such as NGO statistics, survey reports etc.
- Any other method which can allow SDG claims to be recorded and verified, etc.

# 7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

## 7.1 Data and Parameters Monitored

All data and parameters monitored during the current monitoring period (12-April-2023 to 30-June-2023). The data and parameters determined or available at validation which remain fixed throughout the project crediting period are included in Section 6.1 (Data and Parameters Available at Validation) above.

<b>Data / Parameter</b>	$M_{t,k,p,y}$																
<b>Data unit</b>	tonnes (t)																
<b>Description</b>	Mass on dry weight basis of biochar type t and application type k produced at production facility p in year y																
<b>Source of data</b>	On-site measurements																
<b>Description of measurement methods and procedures applied</b>	Use weighing scales. The moisture content has been adjusted in order to determine quantity of dry weight biomass.																
<b>Frequency of monitoring/recording</b>	Monitored continuously, recorded both daily and monthly																
<b>Value applied:</b>	12.46																
<b>Monitoring equipment</b>	<p>(i) <b>Weighing Scale:</b></p> <table border="1"> <tr> <td>Make</td> <td>Hindustan Scale Company</td> </tr> <tr> <td>Serial number</td> <td>47421</td> </tr> <tr> <td>Accuracy class</td> <td>0.02</td> </tr> <tr> <td>Date of last calibration</td> <td>05 March 2023</td> </tr> </table> <p>(ii) <b>Weighbridge:</b></p> <table border="1"> <tr> <td>Make</td> <td>SRK Industries</td> </tr> <tr> <td>Serial number</td> <td>SP22UB50T031</td> </tr> <tr> <td>Accuracy class</td> <td>III, verification scale interval 10</td> </tr> <tr> <td>Date of last calibration</td> <td>15 January 2023</td> </tr> </table>	Make	Hindustan Scale Company	Serial number	47421	Accuracy class	0.02	Date of last calibration	05 March 2023	Make	SRK Industries	Serial number	SP22UB50T031	Accuracy class	III, verification scale interval 10	Date of last calibration	15 January 2023
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Serial number	SP22UB50T031																
Accuracy class	III, verification scale interval 10																
Date of last calibration	15 January 2023																
<b>QA/QC procedures applied</b>	<p>Calibration of the weighing scale and/or weighbridge is as per manufacturer's specifications or at least every three years. Currently public weighbridge was used for measuring.</p> <p>Amount of biochar produced and applied are available in logbooks for further cross checking.</p>																

<b>Purpose of data</b>	Calculation of project emissions
<b>Calculation method</b>	NA
<b>Comments</b>	<p>The current project activity design is based on biochar produced using a single type of biomass waste, i.e. Cotton Stalk, Hence, biochar type “t” remains the same across the project and usage is considered for soil-application only hence “k” = soil application. Also, production facility considered for this entire period was box-kiln, hence “p” = box-kiln.</p> <p>The moisture content values are recorded using moisture meter and to be included in the ER sheet.</p> <p>Both the monitoring equipment are available in the project. However, during the current monitoring period biochar weights were recorded using weighbridge only.</p>

<b>Data / Parameter</b>	H:C <sub>org</sub>
<b>Data unit</b>	Dimensionless
<b>Description</b>	Ratio of hydrogen to organic carbon
<b>Source of data</b>	Laboratory Analysis (see below “comments” section for details)
<b>Description of measurement methods and procedures applied</b>	Laboratory analysis following IBI Biochar Testing Guidelines or EBC Production Guidelines.
<b>Frequency of monitoring/recording</b>	To be taken samples from random batches of biochar produced at the production facility (please refer to “comments” below for more details)
<b>Value applied:</b>	0.23~0.76
<b>Monitoring equipment</b>	-
<b>QA/QC procedures applied</b>	Laboratory must be accredited and/or approved by the relevant national agency to conduct required material analysis.
<b>Purpose of data</b>	Calculation of project emissions
<b>Calculation method</b>	NA
<b>Comments</b>	<p>Currently value from literature review is considered.                      Source: Scientific Report, Published: 04 March 2016  <a href="https://www.nature.com/articles/srep22644">https://www.nature.com/articles/srep22644</a></p> <p>However, the current project activity it is proposed that the value of H:C shall be evaluated using laboratory analysis once in each seasonal production as characteristics of the biochar output is expected to be uniform. Also, this is only a reporting parameter and value is not used in the ER calculation.</p>

<b>Data / Parameter</b>	Biomass categories and quantities used for selection of the baseline scenario and production of biochar utilized in the project activity
<b>Data unit</b>	tonnes (t) on dry basis
<b>Description</b>	<p><b>Category:</b> Agriculture waste (cotton stalks)</p> <p><b>Source:</b> produced on-site during the season by the farmers, obtained from the farmers during the production phase</p> <p><b>Fate in absence of the project activity:</b> in absence of the project activity the cotton stalks would have been openly combusted without further utilization.</p> <p><b>Sustainability criteria compliance for respective category as indicated in Table 1:</b>                      In line with the table 1, the sustainability criteria are referred for the feedstock category “agricultural waste biomass”. Here, the project proponent is using agricultural waste biomass directly from fields and not from a centralized biomass-processing operation. In the baseline agriculture waste biomass was burned without energy production (e.g., open burning of stubble). A baseline survey is referred in this regard.</p> <p>For selection of the baseline scenario, at validation, an ex-ante estimation of these quantities shall be provided.</p>
<b>Source of data</b>	On-site assessment of biomass wastes
<b>Description of measurement methods and procedures applied</b>	<p>Quantity measured using public weighbridge.</p> <p>Adjust by moisture content in order to determine the quantity of dry biomass.</p>
<b>Frequency of monitoring/recording</b>	Data monitored continuously (for each trip) and aggregated monthly.
<b>Value applied:</b>	51.28
<b>Monitoring equipment</b>	Manual method, and use of weighbridge for measuring biomass quantity
<b>QA/QC procedures applied</b>	The biomass weighing data was recorded at the point of weighbridge and records are available for verification.
<b>Purpose of data</b>	Monitoring of eligible biomass categories and quantities used as feedstock for production of biochar
<b>Calculation method</b>	NA
<b>Comments</b>	The moisture content values are recorded and to be included in the ER sheet.

## 7.2 Monitoring Plan

The monitoring plan is referred to under the section 6.4 above. The same monitoring structure and practices are followed.

## 7.3 Baseline Emissions

### Sourcing Stage

As per the section 5.1 of this report, the Baseline emissions at sourcing stage in year  $y$ ; conservatively assumed default value of zero (tCO<sub>2</sub>e).

### Production Stage:

In the baseline scenario at production stage, no biochar is produced for the purpose of the project activity and therefore no GHG removals or related emissions are considered.

### Application Stage:

In the baseline scenario at application stage, since no biochar was produced, no GHG removals or related emissions are considered.

## 7.4 Project Emissions

### Sourcing Stage

As per the section 5.2 of this report, at the sourcing stage, the methodology relies on the collection of waste biomass (i.e. cotton stalks). Therefore, the emissions at the sourcing stage (PE<sub>ss,y</sub>) are set to zero.

### Production Stage:

In the project scenario, the net GHG balance depends on the organic carbon content at the biochar production stage. The equation 1 is referred, in this project activity the pre-treatment process is not involved, hence the latter includes other relevant emissions from the production facilities only. Thus, The project emission removals during production at the biochar facility are as follows:

$$ER_{PS,y} = \sum_t \sum_k \sum_p \left( CC_{t,k,y} \times \frac{44}{12} \right) - PE_{PS,t,p,y} \quad (1)$$

Where:

ER<sub>PS,y</sub> = GHG emissions removals at production stage in year  $y$  (tCO<sub>2</sub>e)

CC<sub>t,k,y</sub> = Organic carbon content on a dry weight basis for biochar type  $t$  used for application type  $k$  in year  $y$  (tonnes)

PE<sub>PS,t,p,y</sub> = Project emissions at production stage for production of biochar type  $t$  at production facility  $p$  in year  $y$  (tCO<sub>2</sub>e)

$\frac{44}{12}$  = Coefficient to convert organic carbon to tCO<sub>2</sub>e

The project activity has adopted low-technology<sup>8</sup> biochar production facility. Hence, as per the para 8.2.2.2 of the methodology, following steps are adopted:

### Step 1: Estimate organic carbon content ( $CC_{t,k,y}$ ) of biochar for low technology facilities

Equation 6 of the methodology applied:

$$CC_{t,k,y} = M_{t,k,p,y} \times F_{Cp,t,p} \times PR_{de,k} \quad (6)$$

Where:

$CC_{t,k,y}$  = Organic carbon content on a dry weight basis for biochar type t used for application type k in year y (tonnes). Biochar type is based on the feedstock used to produce the biochar.

$M_{t,k,p,y}$  = Mass on a dry weight basis of biochar type t for application type k produced at production facility p in year y (tonnes)

$F_{Cp,tp}$  = Organic carbon content of biochar type t produced in production facility p per tonne of biochar, taken on a dry weight basis (percent).  $F_{Cp}$  for low technology production facilities is determined through laboratory material analysis of biochar where possible. Otherwise,  $F_{Cp}$  values are obtained from Table 4 per type of feedstock. Where feedstocks are mixed, the most conservative  $F_{Cp}$  value of the relevant feedstocks must be used.

$PR_{de,k}$  = Permanence adjustment factor due to decay of biochar to be defined for application type k (dimensionless). Biochar is subject to natural decay rate when used in soil applications such as in agriculture, forests, croplands, or grasslands. Many low technology production facilities do not measure the temperature at biochar production. A default value of 0.56<sup>22</sup> must be used where pyrolysis temperature is unknown. This follows a conservative approach for carbon permanence.

The value calculated for  $CC_{t,k,y}$  for the current monitoring period as follows:

Parameter	Values	Units
$M_{t,k,p,y}$	12.46	Tons
$F_{Cp,tp}$	0.77	-
$PR_{de,k}$	0.56	-

Thus,  $CC_{t,k,y} = 5.4$  tons

### Step 2: Estimate project emissions $PE_{PS,t,p,y}$ for low technology facilities:

Emissions under the project scenario are determined using the following equation (7):

<sup>8</sup> The project design includes earth-pits and box-kiln, which are categorized as low-tech facilities. During the current monitoring period only box-kiln was utilized.

$$PE_{PS,t,p,y} = \sum_t [(PE_{D,p,y} + PE_{P,p,y} + PE_{C,p,y})] \quad (7)$$

Where:

$PE_{PS,t,p,y}$  = Project emissions at the production stage for production of biochar  $t$  at production facility  $p$  in year  $y$  (tCO<sub>2e</sub>)

$PE_{D,p,y}$  = Emissions associated with the pre-treatment of waste biomass at production facility  $p$  in year  $y$  (tCO<sub>2e</sub>)

$PE_{P,p,y}$  = Emissions associated with the conversion of waste biomass into biochar at production facility  $p$  in year  $y$  (tCO<sub>2e</sub>)

$PE_{C,p,y}$  = Emissions due to the utilization of auxiliary energy for the purpose of pyrolysis at production facility  $p$  in year  $y$  (tCO<sub>2e</sub>)

**Here,**

$$PE_{D,p,y} = 0$$

(Since there is no pre-treatment involved in the current project design, hence **this equation shall not be applied for any calculation**)

$$PE_{C,p,y} = 0$$

(Biochar produced in the project activity is not processed using any energy application such as grid electricity, fossil fuel etc. Also, GHG emissions resulting from fossil fuel combustion or mixing of biochar with fertilizer products are considered negligible.)

**$PE_{P,p,y}$ :**

In the absence of direct emission measurements that can reliably measure and report project emissions, data from peer-reviewed literature must be used in the following equation 9, as follows:

$$PE_{P,p,y} = \sum_k \sum_t (F_e \times GWP_{CH_4} \times M_{t,k,p,y}) \quad (9)$$

Where:

$PE_{P,p,y}$  = Emissions associated with the conversion of waste biomass into biochar at production facility  $p$  in year  $y$  (tCO<sub>2e</sub>)

$F_e$  = Average methane emissions from producing one tonne of biochar in year  $y$  (tCH<sub>4</sub>/tonne). Values from Table 3 in Cornelissen et al. (2016)<sup>25</sup> may be used based on the corresponding kiln type (i.e., low technology production facility type). Where the kiln type is not listed a default average emission factor of 0.049 t CH<sub>4</sub>/tonne may be conservatively used based on the value for traditional kilns since simple low-cost technologies are known to emit higher levels of CH<sub>4</sub><sup>26</sup>. Project proponent may propose more appropriate values based on scientific studies, research papers or any other credible documentation and/or information related to the utilized production technology.

$GWP_{CH_4}$	= Global warming potential of methane. Use value referenced in the latest version of the <i>VCS Standard</i>
$M_{t,k,p,y}$	= Mass on a dry weight basis of biochar type t and application type k produced at production facility p in year y (tonnes)

The value calculated for  $P_{EP,p,y}$  for the current monitoring period as follows:

Parameter	Values	Units
$F_e$	0.026	tCH <sub>4</sub> /ton of biochar
$GHG_{CH_4}$	28	-
$M_{t,k,p,y}$	12.46	Tons

Thus,  $P_{EP,p,y} = 9.07 \text{ tCO}_2\text{e}$

## 7.5 Leakage

As per the provision of the section 5.3 of the report, the Leakage emission is Zero.

(The transportation distance (to and from—round trip) for both biomass collection and the biochar application site is less than 200 km. Additionally, feedstock is not purposely grown and there is no diversion of biomass for the biochar production in the project)

## 7.6 Net GHG Emission Reductions and Removals

The net GHG emission reductions and removals achieved for this monitoring period is as follows:

$$ER_{PS,y} = \sum_t \sum_k \sum_p \left( CC_{t,k,y} \times \frac{44}{12} \right) - PE_{PS,t,p,y} \quad (1)$$

$$ER_{PS,y} = (5.4 \times 44/12) - 9.07 = 10 \text{ tCO}_2\text{e (rounded down value)}$$

Year	Baseline emissions or removals (tCO <sub>2</sub> e)	Project emissions or removals (tCO <sub>2</sub> e)	Leakage emissions (tCO <sub>2</sub> e)	Net GHG emission reductions or removals (tCO <sub>2</sub> e)
Year 1 (12-April-2023-- 30-June-2023)	19.70	9.07	0	10
<b>Total</b>	<b>19.70</b>	<b>9.07</b>	<b>0</b>	<b>10</b>

The comparison of estimated ex-ante GHG emission reductions and removals and the achieved emission reductions and removals for this monitoring period:

<u>Ex-ante emissions reductions/removals</u>	<u>Achieved emissions reductions/removals</u>	<u>Percent difference</u>	<u>Justification for the difference</u>
4,674 tCO <sub>2</sub> e	10 tCO <sub>2</sub> e	-99.79%	This is because during the current monitoring period only a very small portion of biomass was considered for biochar conversion as part of an initial pilot run. As per ex-ante estimate it was expected to have about 21,900 tons of biomass to be treated amounting to an estimated production of about 5,480 tons of biochar production during this monitoring period. Whereas total biochar produced (measured quantity) during this period was only 12.46 tons.

