Standards for a Sustainable Future

Methodology for biochar utilization in soil and non-soil applications

Introductory webinar

10 August 2021

Welcome and Introduction

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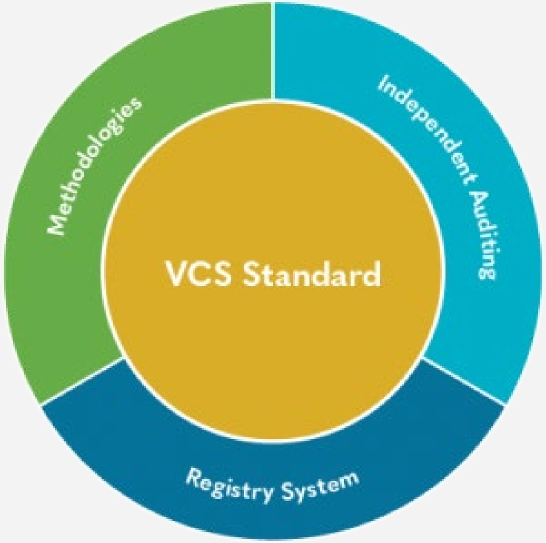
Agenda

- Overview of VCS Program & methodology approval process
- Presentation of the draft biochar methodology
- Q&A

Verified Carbon Standard (VCS) Program

The world's leading voluntary GHG crediting program



Verified Carbon Standard

- Rigorous set of rules and requirements
- Sound accounting methodologies
- Qualified independent assessment
- Central & transparent system to track projects and Verified Carbon Units (VCUs)

VCS Methodology Approval Process

Step 1: Assessment of Methodology Concept Note	RFP for methodology developers Dec 2020
Step 2: 30 Day Public Comment Period	Aug – Sept 2021
Step 3: VVB Assessment	Sept – Oct 2021
Step 4: VCS Final Review & Approval	Q4 2021

TIMELINE

Biochar methodology consortium

- FORLIANCE
- South Pole
- Biochar Works
- Matt Delaney

Biochar methodology overview

- Background
- Applicability
- Additionality and Baselines
- Quantification of GHG removals
- Closing remarks

Introduction and background

- Interest in a GHG accounting methodology for biochar
- Two previous efforts: VCS and ACR
- IPCC Special Report on Global Warming
    - "Method for Estimating the Change in Mineral Soil Organic Carbon Stocks from Biochar Amendments" in the IPCC's 2019 Refinement
- Current biochar credits trading platforms in the voluntary carbon market

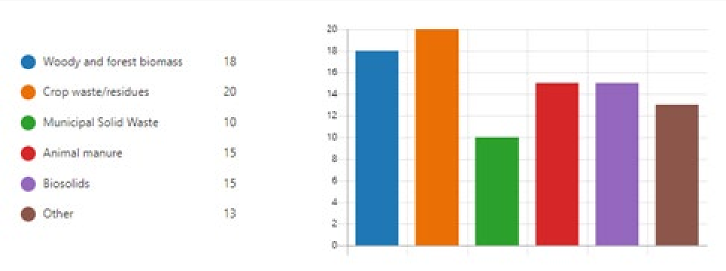
Process for developing the methodology

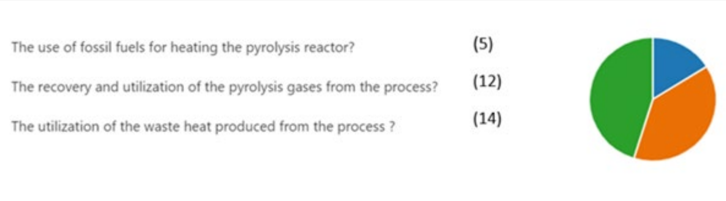
1. Formed an expert group of biochar stakeholders (20+ members from different background such as biochar producer, academia, project developers)
2. Stakeholder consultation through an initial questionnaire about feedstocks, technologies, baseline, boundaries, biochar application, monitoring, and other topics

Goal: to develop a comprehensive methodology for the biochar community that is based on sound science.

Stakeholder group priorities

- Desire for a diverse array of feedstocks
- Technology of all kinds
- Soil and non-soil applications





Key Methodology Innovations

- Globally applicable framework
- Sectoral scope 13: Waste Handling and Disposal (WHD)
- Diverse feedstocks: waste biomass from forestry, agriculture, and others
- Baseline: determination of fate of waste biomass
- Technology agnostic
- Applications: soil and non-soil end uses
- GHG accounting includes utilization of biochar
- Standardized approaches for additionality
- Risk of reversal included in the methodology

Applicability, Additionality, and Baselines

Applicability conditions

1. Geographical scope

Worldwide

2. Technological scope

Pyrolysis, gasification.

- High technology production facility
- Low technology production facility

3. Eligible feedstock

- Waste biomass
  - Agricultural biomass
  - Forestry and other wood processing
  - Recycling economy
  - Aquaculture plants
  - Animal manure
  - High carbon fly ash

SUSTAINABLE SOURCING!

4. Eligible end-use

- No energy use
- Soil and non-soil application
- In soils: IBI, EBC, other national regulations

Project boundary - GHG sources

Source	Included?	CO_2	CH_4	N_2O
Feedstock production	No. Waste biomass are considered renewable per eligibility conditions	*Excluded*	*Excluded*	*Excluded*
Combustion and/or decomposition of feedstock	Conditional. Default baseline is zero unless project proponent provides emission factors	*Conditional*	*Conditional*	*Conditional*
Thermochemical conversion (pyrolysis) - high technology systems	No	*Excluded*	*Excluded*	*Excluded*
Thermochemical conversion (pyrolysis) - low technology systems	Yes	*Included*	*Main source*	*Included*
Electricity or fossil fuel	Yes	*Included*	*Included*	*Included*
Transportation (leakage >200 km)	Yes	*Included*	*Included*	*Included*

If a GHG is less than 5% total net project GHG emission reduction/removals source is *de minimis*

Demonstration of Additionality

1. Standardized approach under the VCS Program: Activity Method
2. Positive list: global waste biomass feedstocks
3. Activity Penetration

$$AP_y = OA_y / MAP_y$$

Where:

AP_y = Activity penetration of the project activity in year y

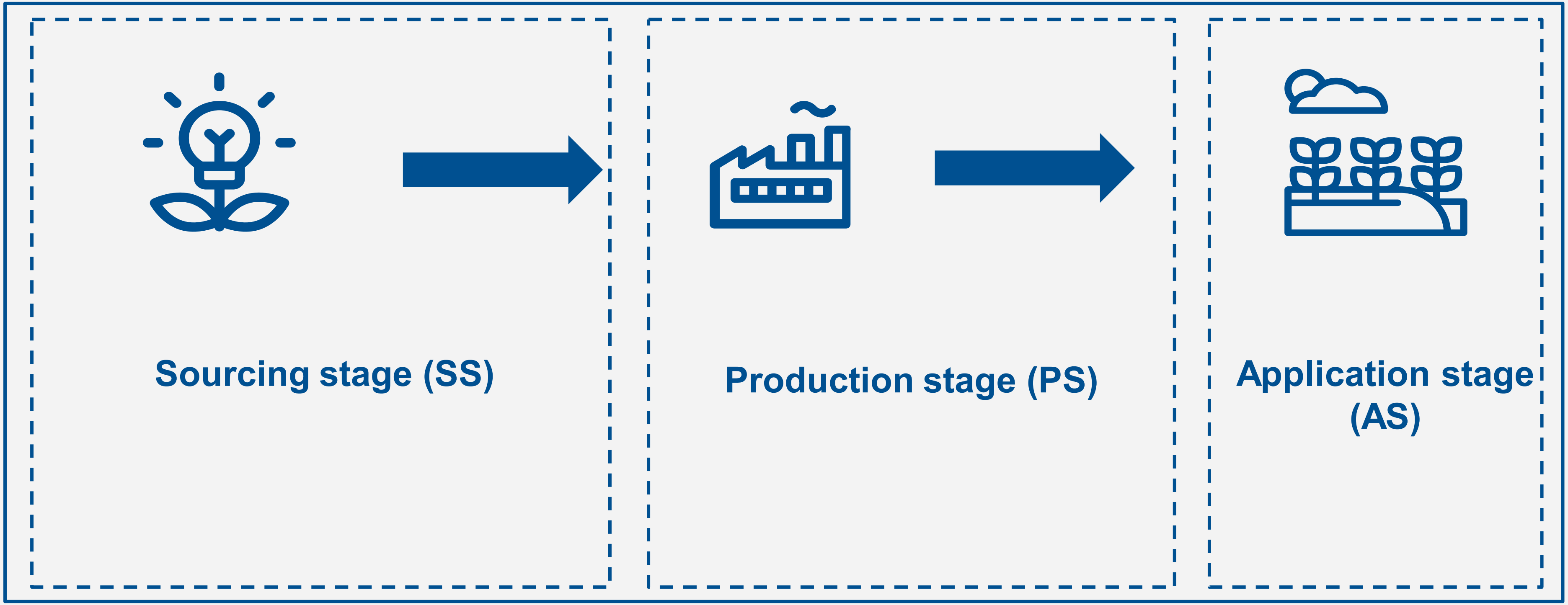
OA_y = Observed adoption of the project activity in year y

MAP_y = Maximum adoption potential of the project activity in year y

Global production of biochar is <5% of total waste biomass feedstocks produced annually. Hence, current biochar production considered additional.

Quantification of GHG emissions and removals

Quantification Framework



Net GHG balance

Each stage has its own GHG balance:

$$ERy = (ER_{PS} + ER_{SS} - ER_{AS}) - LE_y$$

ER_y	Net GHG emissions reduction and removals in year *y* (tCO_2e)
$ER_{PS,y}$	GHG removals at production stage in year *y* (tCO_2e)
$ER_{SS,y}$	GHG emissions reductions at sourcing stage in year *y* (tCO_2e)
$ER_{AS,y}$	GHG emissions at application stage in year *y* (tCO_2e)
LE_y	Total leakage emissions in year *y* (tCO_2e)

Calculation: Sourcing stage

Baseline scenario considerations:

- Default: baseline = 0
- Waste biomass left to decay or combusted

- Project proponent can include baseline emissions if they provide emission factors for waste biomass decomposition and/or combustion

Calculation: Production stage

High technology

(a) ability to combust or recover pyrolysis gases;
(b) pollution controls that meet international emission thresholds;
(c) ability to utilize at least 70% of the waste heat during biochar production;
(d) production temperature is measured and reported.

If any of the above criterias is not met, the production type is categorized as low technology production facility

Low technology

(a) pyrolytic gases are mainly combusted in the flame front;
(b) emissions are not capture from the pyrolysis process;
(c) less than 70% of the produced heat energy is recovered;
(d) production temperature is not measured or reported.

Calculation: Production stage

1. High technology (including High Carbon Fly Ash)
   - Carbon content of biochar is measured through lab analysis → fixed carbon content (CC)

1. Low technology
   - Default values for CC (IPCC)
   - Production emissions: based on Cornelissen *et al.* for methane emissions

Project emissions are either measured or default value

Calculation: Application stage

The application determines the decay factor (PR_{de}) for the biochar in the end-use.

1. Soil application:
   - High technology: 0.74 (EBC)
   - Low technology: 0.56 (IPCC)

1. Non-soil application
   - Do not lead to the loss of >50% of the original carbon material.
   - Default value: 0.74 (soil)

Project proponents can use less conservative decay factors for non-soil applications. If not available, soil degradation factor shall be used.

Risk of reversal

1. Risks:
    - Natural risks
    - Non-natural risks

      → can be considered *de minimis.*

1. Monitoring: Proof that the biochar has an end-use (priority)
    - Tracking record, GPS use location coordinates, tracking software
        - Signed attestation from the end-user
            - Receipt, invoices, purchase agreement from sales that secure end-use application

Closing remarks

Closing remarks

1. This methodology provides a scalable framework that can be adapted to diverse feedstocks and biochar applications → adaptable for future modules/tools
2. Biochar industry, research, and applications are growing globally and biochar carbon removal has been proven scientifically (e.g., IPCC values and other sources)
3. Our team would welcome any feedback or input you wish to provide

Public comment period

- Available at https://verra.org/methodology/methodology-for-biochar-utilization-in-soil-and-non-soil-applications/
- Note the accompanying Request for Input
- Open for public comment from **10 Aug - 9 Sept**
- Submit comments to secretariat@verra.org and eguinessey@verra.org

Questions and Answers

- Verra
- FORLIANCE
- South Pole
- Biochar Works
- Delaney Forestry

Thank you!

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Additional slides

Demonstration of Additionality

APy = OAy/MAPy

Where:

APy = Activity penetration of the project activity in year y

OAy = Observed adoption of the project activity in year y

MAPy = Maximum adoption potential of the project activity in year y

OAy: total tonnes of biochar produced per year is approximately 773,787 tonnes

MAPy: FAO data indicates 1.5 billion tons of biomass residues produced per year (agriculture and forestry residues)

APy of biochar 0.05% , which is well below the <5% criteria

Leakage

The following leakage options have been considered

1. Leakage due to activity shift and diversion = 0
   Exclusion of purposely grown biomass
2. Leakage emissions due to transport: If <200 km = 0, individually for each transport between stages
3. Leakage due to loss of biomass: Should be 0 based on reporting structure, if >5% deduct respective amount of stable carbon content.

ER Calculation at production stage

$$ER_{PS,y} = SUM\left(CC_{y,t} * \frac{44}{12}\right) - PE_{PS} -$$

$$CC_{y,t} = M_{y,t} * F_{Cp} * PR_{de} \quad (8)$$

Where:

$CC_{y,t}$ Fixed carbon content in year *y* for biochar based on feedstock and application type *t* (tCO_2e)

$M_{y,t}$ Mass of biochar of type *t* applied to the respective end-use in the year *y* (tonnes), see application stage. The produced mass of biochar shall be determined in alignment with CDM tool 13 Option 1 using a weighing device or Option 2 without a weighing device[27]

F_{Cp} Organic carbon content of biochar for each production type per tonne of biochar. F_{Cp} for low technology production type when possible, determined through material analysis[28]. Otherwise, F_{Cp} value are fixed to the Table 5 per type of feedstock for low technology production facility.

PR_{de} Permanence adjustment factor due to decay of biochar (dimensionless) in soils. 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, therefore F_{perm} default value of 0.56[29] shall be used. Value is extracted from IPCC (2019 Figure 4Ap.1)[30] when pyrolysis temperature is unknown. The value follows a conservative approach for carbon permanence

ER Calculation at production stage

Values for organic carbon content factor of biochar by production type (F_{Cp})		
Feedstock	**Production Process**	**Values for F_{Cp}**
Animal Manure	Pyrolysis	0.38 ± 49%
	Gasification	0.09 ± 53%
Wood	Pyrolysis	0.77 ± 42%
	Gasification	0.52 ± 52%
Herbaceous (grasses, forbs, leaves; excluding rice husks and rice straw)	Pyrolysis	0.65 ± 45%
	Gasification	0.28 ± 50
Rice husks and rice straw	Pyrolysis	0.49 ± 41%
	Gasification	0.13 ± 50%
Nut shells, pits and stones	Pyrolysis	0.74 ± 39%
	Gasification	0.40 ± 52%
Biosolids (paper sludge)	Pyrolysis	0.35 ± 40%
	Gasification	0.07 ± 50%

FC_P indication