CLIMATE ACTION RESERVE

U.S. and Canada Biochar Protocol v1.0

Public Comment Webinar

December 7, 2023

Housekeeping

- All attendees are in listen-only mode but will have the opportunity to ask questions throughout via the Q&A dialog.
- We will follow up via email to answer any significant questions not addressed during the webinar
- The slides and a recording of the presentation will be posted online

AGENDA

- Introductions
- Protocol Development Process
- Protocol Overview
- Q&A / Comments
- Next steps

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INTRODUCTIONS

Climate Action Reserve

- Mission: to develop, promote and support innovative, credible market-based climate change solutions that benefit economies, ecosystems and society
- Develop high-quality, stakeholder-driven, standardized carbon offset project protocols across North America and beyond.
- Accredited Offset Project Registry under the California and Washington compliance programs
- Reputation for integrity and experience in providing best-in-class registry services for offset markets
- Based in Los Angeles, CA

Introductions

Reserve Staff:

- Jon Remucal, Director of Nature-Based Solutions
  - Protocol development lead
- Holly Davison, Associate Director of Programs & Marissa Spence, Forestry Manager
  - Protocol development support

External support:

- John Nickerson, Dogwood Springs Forestry

Workgroup Members

Name (alphabetical)	Organization	Name (alphabetical)	Organization
Akio Enders	International Biochar Initiative	Matt Ramlow	World Resources Institute
Allison Flynn	Global Green Energy Solutions Corporation	Melissa Leung	GECA Environment
Bruce Springsteen	Placer County Air Pollution Control District	Micah Elias	Blue Forest / UC - Berkeley
Daniel Sanchez	University of California – Berkeley / Carbon Direct	Nate Anderson	US Forest Service
David Morell	Sonoma Ecology Center	Patricio Ortiz	ACT Commodities
Hannes Etter	South Pole Carbon Asset	Phil Saksa	Blue Forest
Johannes Lehmann	Cornell University	Rachel Rubin	Woodwell Climate Research Center*
Jonah Levine	Biochar Solutions	Shawn McMahon	Aster Global
Josiah Hunt	Pacific Biochar	Tristan Brown	SUNY College of Environmental Science & Forestry
J.P. Bayangos	Shell	Xiaomei Li	Viresco Solutions
Kevin Fingerman	Cal Poly Humboldt		

Funding support

U.S. Forest Service
Wood Innovations Program

CAL FIRE
Forest Health Grant

Funding also supporting:

- Companion market analysis by Blue Forest Conservation (with additional funding support from the Doris Duke Charitable Foundation), **available on the Biochar Protocol webpage**
- Pilot projects to test protocol and demonstrate its viability and versatility

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PROCESS OVERVIEW

Protocol Development Timeline

1. Kick-off meeting (*August 12, 2021*)
2. Workgroup process
   - Formation (*Oct 2021*)
   - Meeting 1 (*November 2021*)
   - Meeting 2 (November 2022)
   - Meeting 3 *(December 2022)*
   - Meeting 4 *(December 2022)*
   - Meeting 5 *(April 2023)*
   - Meeting 6 *(April 2023)*
   - Meeting 7 *(April 2023)*
3. 30-day public comment period (*November – December 2023*)
4. Propose to Board for adoption *(January 2024)*

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PROTOCOL OVERVIEW

Protocol Components

Project Definition & Eligibility

- Defining the project
- Ownership / Aggregation
- Start Date / Crediting period
- Project Location
- Additionality
  - Performance Standard Test
  - Legal Requirement Test
- Regulatory compliance
- Permanence

Quantification

- GHG assessment boundary
- Quantifying project emissions/removals
- Leakage
- Sampling

Monitoring / Reporting / Verification

- Chain of custody tracking
- Sampling and laboratory analysis

External Documents

- Eligible Biochar Feedstocks List
- Eligible Biochar End Uses List

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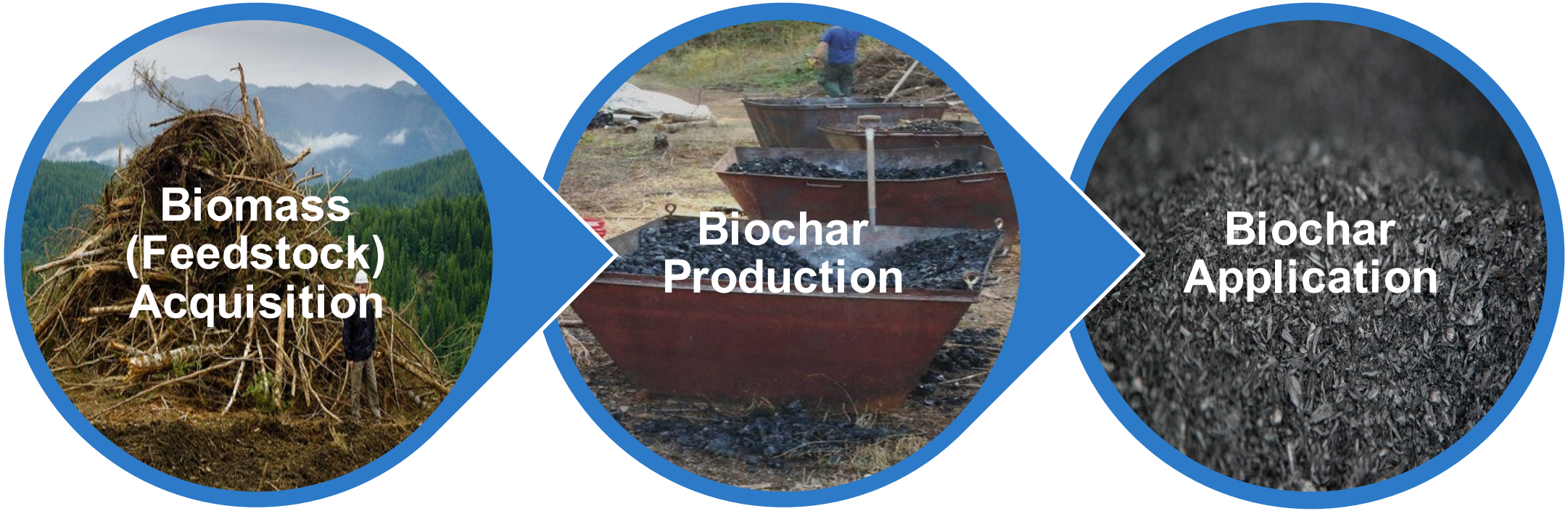
PROJECT DEFINITION & ELIGIBILITY

What Does a Biochar Project Involve?



The conversion of eligible biomass material into biochar, which can be used in soil and non-soil applications to facilitate the long-term sequestration of carbon.

Feedstock Eligibility

Eligible feedstocks specified in Eligible Biochar Feedstocks List

- Maintained separately from protocol
- Updated as needed and review regularly
- Identifies eligible feedstock categories, assumed business as usual fate of biomass, and environmental safeguards

Focus:

- Waste and by-product biomass sources (i.e., typically have no or limited economic use)
- Purpose-grown biomass
  - From perennial, non-woody species that are either native species or sterile non-native species
  - Must meet other environmental safeguards

Eligible Biochar Feedstocks List

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Agricultural waste
- Harvest residues
- Orchard, vineyard, woody biomass prunings
- Orchard/vineyard renewal clearings
- Fruit and vegetable residues, including nut shells

Anaerobic digestion waste
- Digestate from biodigesters

Animal husbandry
- Animal manure

Aquaculture by-products
- Plants/organisms growing as by-product of aquaculture operations (e.g., seaweed, waste algae, invasive plant species)

Food processing residues
- Food processing operations by-products and waste (e.g., washing, cleaning, peeling)
- Expired food
- Food service organic waste/residues

Forestry and wood processing
- By-products and residues from forest management activities (e.g., slash, fuel/pest treatments)
- Non-merchantable post-disturbance (e.g., post-wildfire) woody biomass
- Waste and residues from management of woody vegetation associated with agroforestry and rangelands

Purpose-grown biomass
- Perennial, non-woody species (native or sterile hybrid non-native)

Sewage sludge
- Biosolids

Urban waste
- Urban/rural green waste (e.g., prunings/cuttings/landscaping residues)
- Construction/lumber waste
- Wastepaper and cardboard
- Biomass component of municipal solid waste

Wood processing
- By-products and residues from wood processing facilities (e.g., sawmill sawdust)

Production Technology Eligibility

No specific production technology is required to be used nor are any technologies specifically prohibited

Intent is to provide flexibility that allows new/emerging processes and technologies to be eligible.

Relies on production of char with characteristics meeting the standards outlined in the protocol—including $H:C_{org}$ <0.7—to limit eligibility.

End Use Eligibility

Eligible biochar applications specified in Eligible Biochar End Uses List

- Maintained separately from protocol
- Updated as needed and reviewed regularly
- Identifies eligible end use categories, environmental safeguards, and whether emissions from transportation of biochar to end use must be accounted for

Environmental safeguards tend to rely on material standards specified by laws/regulations applicable to each end use

Permanence

End use eligibility also based on having reasonable assurances about the long-term persistence (i.e., permanence) of C sequestered in biochar

- Permanence defined relative to 100 years
- Crediting adjusted based on expected levels of recalcitrance after 100 years or length of time sequestered if less than 100 years
- Permanence factor (P_{EU}) applied during quantification of C removals
  - If C in biochar is expected to remain sequestered for ≥100 years, then P_{EU} reflects the amount of biochar degradation or C release as of 100 years
    - <100% for some (e.g., soil applications)
    - 100% (e.g., cement additive)
  - If expected to remain for <100 years, P_{EU} reflects time-value of C remaining out of the atmosphere
    - E.g., end use known to have 50-year lifespan, but fate at end of life is uncertain, then P_{EU} = 50%

Eligible Biochar End Uses List

Agricultural, horticulture, home gardening, and/or forestry applications

- Direct soil amendment
- Agricultural water filtration, with eventual field application
- Compost additive
- Livestock/animal feed additive
- Animal bedding, with eventual field application
- Horticultural growth media

Construction and engineered materials

- Asphalt additive (cold-mix applications to asphaltic mix only)
- Cement additive
- Clay additive
- Gypsum additive
- Mineral plaster additive
- Wood polymer composites

Environmental remediation, stabilization, and wastewater sanitization

- Soil remediation
- Stormwater management
- Erosion control
- Septic or transpiration trenches
- Effluent polishing

Permanent storage structures

- Spent oil/gas wells
- Subsurface mine remediation
- Landfill disposal, including as alternative daily cover and landfill solidification/stabilization

Urban applications

- Non-food/-feed soil applications, e.g., urban trees and/or landscaping, green roofs

Project Developer

Project developer is entity that:

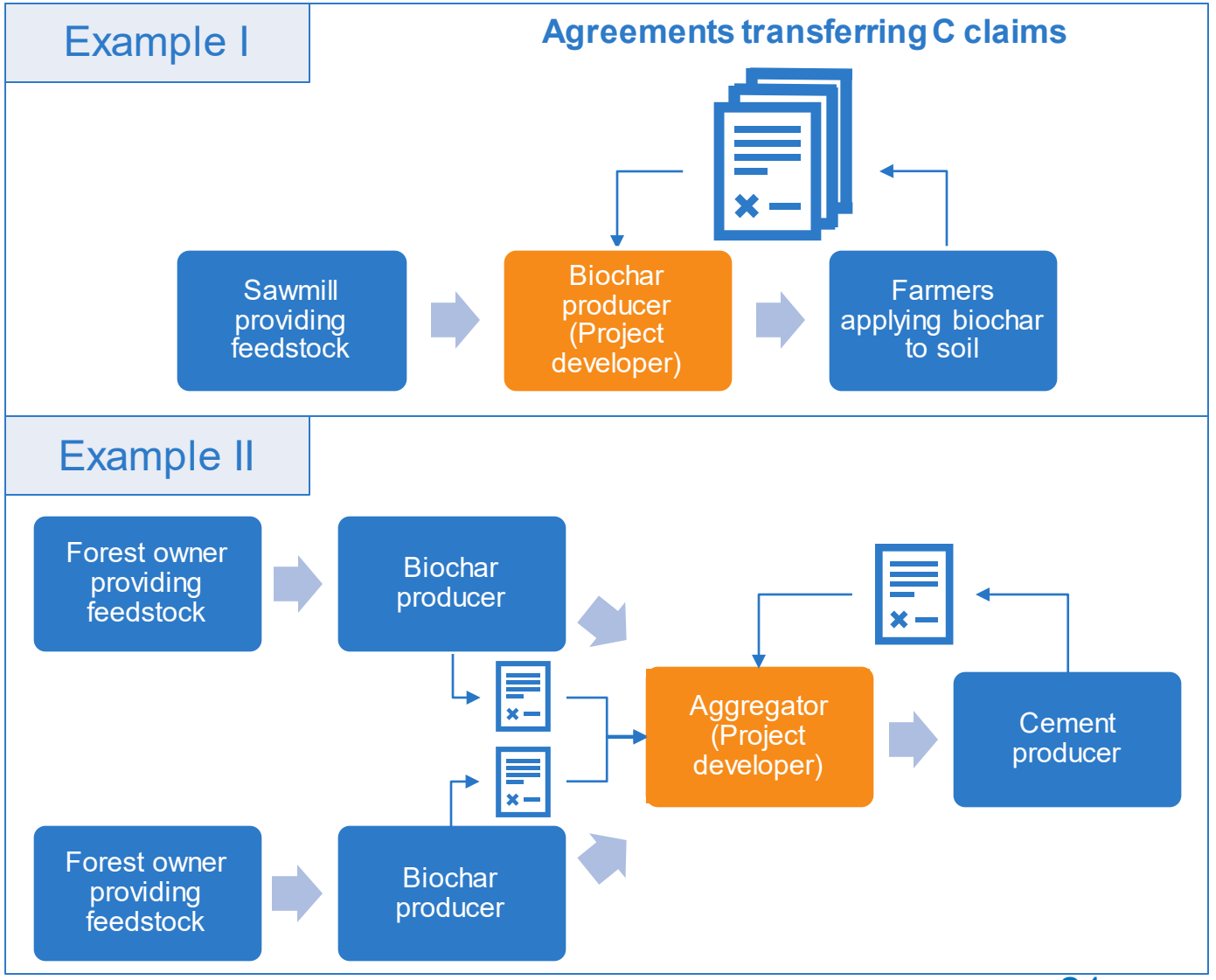
- Has an account with the Reserve
- Submits the project
- Responsible for project reporting and verification
- Is issued the credits

Project developer is assumed to be:

- End user, i.e., the entity/person providing for the long-term persistence of the C in the biochar

BUT others may be project developer if able to secure agreement with end user(s)/others with claim to C

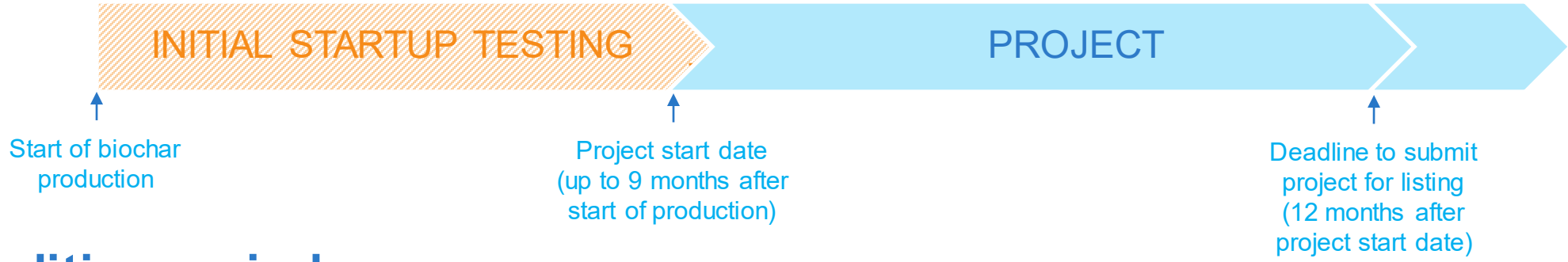
- E.g., biochar producer, aggregator
- Agreement may be in form of sales receipts or purchase orders with acknowledgement of C project and transfer of credit ownership



Start Date and Crediting Period

Start date

- Date the project is submitted to the Reserve, or
- Date biochar production begins using the production technology employed under the project, with allowance for 9-month start-up period
  - From date when biochar is first produced
  - Recognition of time it may take to optimize/stabilize production conditions
  - Project must be submitted for listing within 12 months of start date



Crediting period

- 10 years
- May be renewed up to two times, subject to eligibility requirements at time of renewal

Additionality

Ensuring only crediting for actions that go beyond what would have occurred in the absence of the project

Legal Requirement Test

- Project activities must not be legally required
- e.g., if only biochar production is legally mandated, then project passes test since climate benefits from biochar are dependent on specific conditions also being met by acquisition and end use phases.

Performance Standard Test

- Standard of performance that must be met by a project to be eligible
- Separate performance standard test for each phase of project
  - Biomass acquisition
  - Biochar production
  - Biochar application

Additionality – Performance Standard Test

Biomass Acquisition Phase

Waste and by-product feedstocks

- Biochar production is an uncommon fate for waste/by-product biomass sources
- To be included on Eligible Biochar Feedstocks List, biomass source must have a typical business as usual fate of combustion or decomposition in near-term
- Project developers must also be able to characterize typical fate of their feedstocks as consistent with business as usual fate assumptions embedded in the eligibility list, given local context of their project.

Purpose-grown biomass

- Risk of purpose-grown biomass being cultivated as a replacement for other crops, especially commodity crops, or on areas where vegetation of a higher C stocking was previously
- Also risk of vegetation being harvested does not regrow to pre-harvest levels in short term or cultivation/harvest results in loss of more C than recovered (i.e., enters a biochar project with a C debt)
- Eligibility limited to biomass grown on reclaimed mining sites or on marginal lands (i.e., Land Capability Class 5 or 6)
- Further limited currently to scenarios where risk of initial C debt is minimal
    - Perennial grasses (native species or sterile hybrids)
    - Harvest of crop doesn't lead to longer-term depletion of soil C

Additionality – Performance Standard Test

Biochar Production Phase

- Is financial incentive from C market fostering biochar production?
- Generally, biochar production faces numerous barriers to long-term viability and biochar production can be considered additional in that regard
- Recognition of some success stories in the industry
  - Projects with historical production (>9 months) must deduct the maximum rate of biochar output from the amount of biochar reported under the project, thus only accounting for biochar produced above and beyond what had previously been produced.
  - Projects where production started <9 months prior to the project start date and were essentially in a start-up/optimization phase are not required to account for historical production rate when calculating project removals.

Biochar Application Phase

- End use must meet standard of having high assurance of carbon in biochar remaining sequestered
- Projects may only apply biochar to end uses listed in the Eligible Biochar End Uses List

Location, Regulatory Compliance & Environmental/Social Safeguards

Projects must be located in US or Canada

- Reasonably high regulatory standards
- Reliable enforcement of regulations

Project activities must be in compliance with relevant laws and regulations, which provides assurances against environmental and social harms from project activities.

Environmental Safeguards

Safeguards specific to contaminants in project biochar

Contaminant	Conditions Under Which Testing Is Required	Maximum concentration
Inorganic contaminants	All end uses where environmental exposure occurs	Legal limits for concentration based on end use
PCBs	Feedstocks w/ risk of high chlorine content Biochar produced at temperatures <500° C	Concentration limits from World Biochar Certificate
Dioxins/furans	Biochar produced at temperatures <500° C	
PAHs	Biochar produced at temperatures >500° C Lack of separation between biochar and pyrolysis gases in reactor and discharge	

Project Stacking

Activities recognized by one protocol overlap with those recognized by another

- Allowed if certain conditions are met, including:
  - Additionality is preserved
  - Double-counting risks are eliminated
- Requires approval and guidance from the Reserve

Examples for biochar:

Soil Enrichment Protocol

Reduced Emissions from Megafires Forecast Methodology

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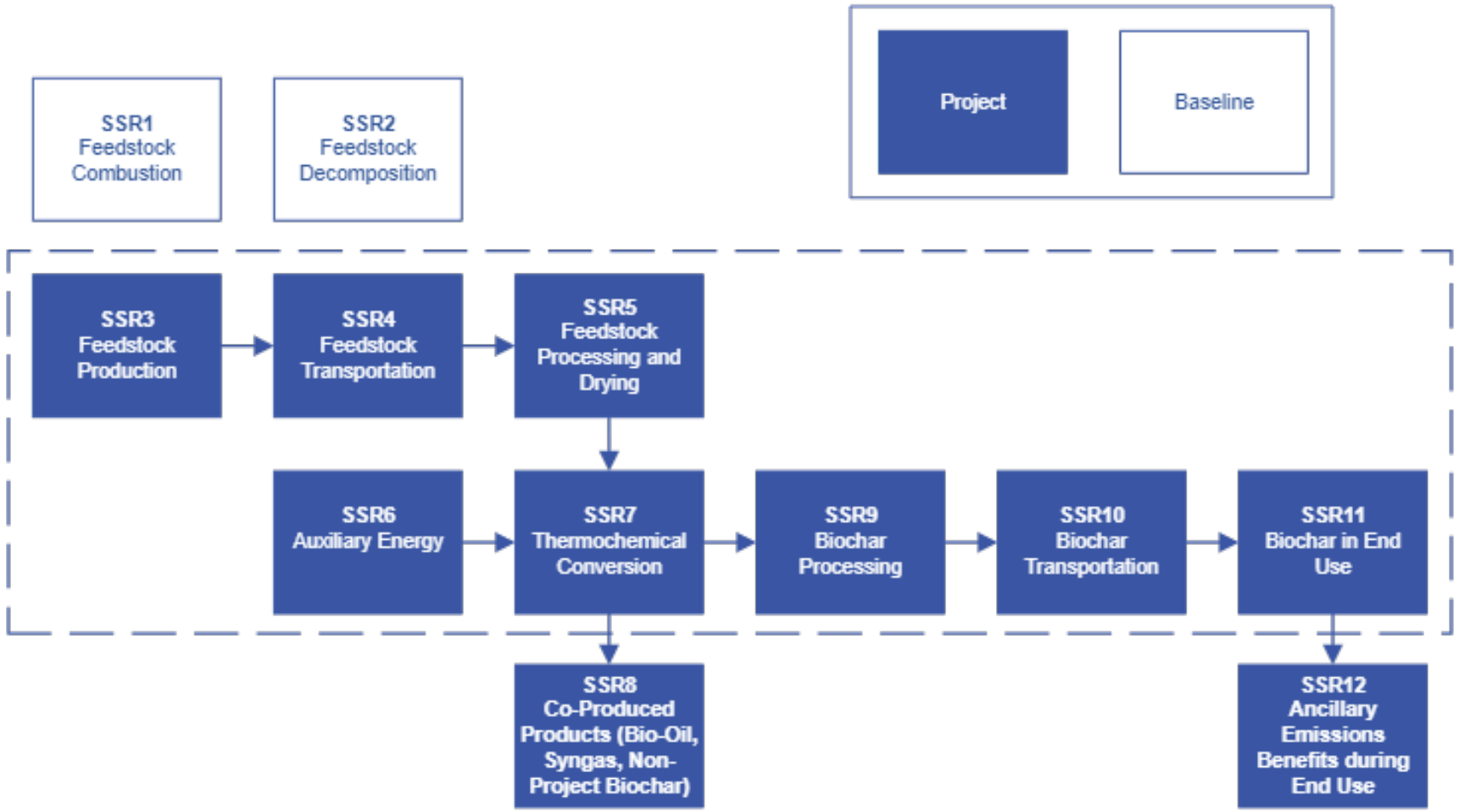
QUANTIFICATION

Quantification

Net Carbon Removals = ([Baseline Emissions] – [Project Emissions]) - ([Baseline Carbon] – [Project Carbon])

Baseline	• Zero-emissions, zero-carbon baseline (assumes baseline emissions > baseline carbon) • Conservative assumption
Project	• Emissions from production and delivery • C sequestered in biochar, discounted based on assumed durability • Proportional and other adjustments to account for only non-baseline biochar per PST • Proportional adjustments if some biochar is produced but not included in project reporting
Quantification Tool	• Biochar CRT Calculation Tool • Facilitates credit calculation • Standardized coefficients and emissions factors built in

GHG Assessment Boundary

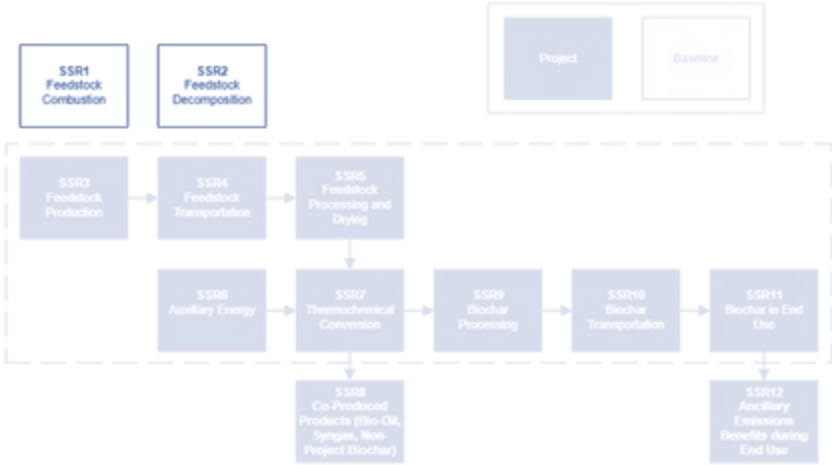


Quantification - Baseline

Assumes no emissions and no stored carbon for quantification purposes

Relies on eligible feedstocks:

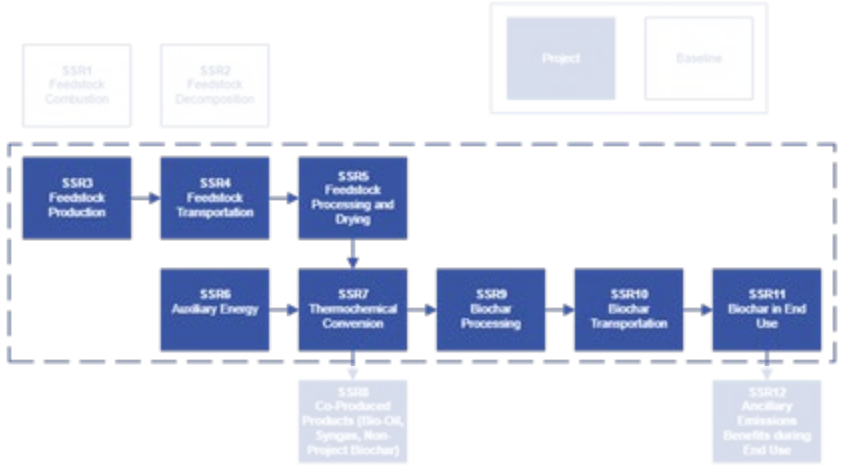
- Identified as having a business as usual fate of short-term combustion or decomposition
- Assumption of [business as usual emissions] > [business as usual stored C] is valid



Quantification - Project

Emissions accounted for:

- Feedstock production emissions (for purpose-grown biomass only)
- Feedstock transportation emissions
- Feedstock processing emissions*
- Auxiliary emissions from biochar production*
- Thermochemical conversion emissions (CH_4)*
- Biochar processing emissions*
- Biochar transportation emissions



*Proportional adjustment factor applied for co-production settings

Removals accounted for:

- Carbon sequestered in biochar (relative to 100-year permanence timeframe)

Based on data collected along chain of custody, results from biochar sampling and laboratory analyses, and standardized emissions factors

Quantification - Permanence

Estimating recalcitrance → Permanence factor

Varies by end use, as specified in the end use eligibility list.

For certain uses (e.g., construction/engineered materials), permanence factor is based on lifespan and risk of C being released into atmosphere at end of life

For soil applications and similar end uses (or for which ultimate fate is residence in soils), permanence factor is based on application of equation from Woolf et al. 2021

- Requires average soil temperature of end use location
- Standardized soil temperature data from Lembrechts et al. 2022
- For biochar with distributed or unknown end use locations (mixer/retailer/distributor shipping to numerous locations), conservative soil temperature applied based on highest average soil temperature in distribution range

Secondary Effects

Increases in GHG emissions outside of the project's assessment boundary as a result of the project activity. Also referred to as "leakage."

Cultivation of purpose-grown biomass for biochar

Shifting of or increase in cultivation of crops when land is used for production of purpose-grown feedstocks for biochar

- Economics provide basic safeguard currently—other crops are typically more valuable, so eligible purpose-grown biomass crop would be less lucrative than existing crop production
- As additional safeguard to prevent leakage, eligibility of purpose-grown feedstocks is limited to biomass grown on lands in classes 5 and 6 of Land Capability Classification system (i.e., production generally restricted to perennial forage crops).

Secondary Effects

Diversion of energy sources from bioenergy production

Secondary Effects Scenario	Feedstock diverted away from bioenergy facility (i.e., prevented from ever reaching the facility)	Biochar produced during bioenergy feedstock combustion is harvested from fly ash rather than being reinjected into furnace to be combusted
Potential leakage outcome	Decrease in energy output from bioenergy facility, leading to compensation by power generated elsewhere on the grid from a facility with a higher GHG emissions intensity.	
How addressed by protocol	Biochar feedstock must come from an area outside of biomass energy facility feedstock range or from a biomass energy supply-shed that is not supply-limited.	Leakage must be calculated based on replacement electricity from grid when bioenergy production decreases <5% relative to prior 3 years. Exception if project developer can demonstrate decline in energy production is caused by an external factor (e.g., extreme weather event/conditions, grid requirements, power purchase agreements)

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MONITORING, REPORTING AND VERIFICATION

Monitoring, Reporting & Verification

Chain of custody documentation

- Transfers of biomass from feedstock source to biochar producer to end user
- Feedstock characterization
- End use description

Data collection

- Amount of biomass processed and biochar produced
- Estimate of recalcitrance based on lab testing of biochar samples

Reporting Tools from the Reserve

- Credit quantification tool
- Project report templates

Verifier qualification

- ISO-accredited
- Approved by the Reserve
- Trained under the protocol

Review process

- Desk review of data and documentation
- Site visit (not required for every verification)

Chain of Custody Tracking

Critical component of monitoring, reporting, and verification (MRV) for biochar projects

Chain of custody documentation

- Transfers of biomass from feedstock source to biochar producer to end user, including intermediary entities
- Includes information that corroborates data used for credit quantification
- May also include agreements transferring/relinquishing claims to credits

Biomass Acquisition

- Characterization
- Physical location (parcel, facility, etc.) of the feedstock source
- Date the feedstock was obtained/harvested
- Mass of feedstock obtained/harvested

Biochar Production

- Date the biomass was acquired
- Mass of biomass acquired
- Date the biochar was produced
- Mass of biochar produced
- Date it was transported from the production facility

Biochar Application

- Mass of biochar received by each party
- End-use application
- Location of end-use application

Data Collection

Data category	Basis for data
Feedstock production (purpose-grown biomass only)	Area (hectares) of production
Feedstock transportation	Volume of fuel consumed OR mass of feedstock and distance transported
Feedstock processing	Volume of fuel and/or amount of electricity consumed OR type of processing used
Auxiliary energy use	Volume of fuel and/or amount of electricity consumed
Biochar processing	Volume of fuel and/or amount of electricity consumed OR type of processing used
Biochar transportation	Volume of fuel consumed OR mass of biochar and distance transported
Biochar produced and applied to eligible end use	• Mass, by end use type • Dry matter % • Organic C content %

Biochar Sampling – Overall Approach

- Purpose of sampling (and associated laboratory testing results)
  - Determine eligibility of biochar
    - $H:C_{org}$ <0.7
    - Contaminants (inorganic and organic) within limits specified by legal standards/environmental safeguards
  - Establish values for quantification metrics
    - $H:C_{org}$
    - Organic carbon content
    - % dry matter*

- Composite samples taken each day biochar is produced throughout the crediting period
- Samples are valid for 6 months for quantification purposes
- Two types of sampling:
  - Initial parameter sampling
  - Retention sampling

Biochar Sampling – Initial Parameter Sampling

- Performed for each distinct production configuration (feedstocks, production technology/temperature/residence time)
- Project developer chooses how many samples comprise Initial Parameter Sampling (i.e., first *X* days of production), with a minimum of 10 samples required
- Establishes eligibility of biochar ($H:C_{org}$ and contaminant levels)
  - Once established, eligibility of biochar is maintained unless/until new Initial Parameter Sampling is performed
- Establishes initial values for metrics for quantification of removals, based on 95% confidence interval of mean from samples
  - $H:C_{org}$ (upper bound of 95% CI)
  - Organic carbon content (lower bound of 95% CI)
  - % dry matter (lower bound of 95% CI)
  - Used for initial quantification of gross project removals
  - Values updated over time via Retention Sampling

Biochar Sampling – Retention Sampling

- Purpose:
  - Update quantification metrics
  - Determine if new Initial Parameter Sampling must be performed
- At least one daily composite sample per month sent to lab for analysis of quantification metrics
- May submit more to improve confidence intervals and/or to ensure replacement of expiring samples
- Daily sample(s) to be submitted are based on monthly randomized date list provided by the Reserve at the end of each month
- Analyzed samples used to update quantification metrics ($H:C_{org}$, organic C, dry matter)
  - Intent is to capture subtle changes to biochar quality over time that may impact credit quantification, especially if production configuration changes
- If lab results are significantly different from previous results (>2 standard deviations from mean), Initial Parameter Sampling must be performed based on retention samples

Laboratory Analyses

Lab must be accredited to ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories" by relevant national governing body or international standard-setting body, such as:

- National Environmental Laboratory Accreditation Program (NELAP)
- American Association for Laboratory Accreditation (A2LA)
- International Standards Organization (ISO)

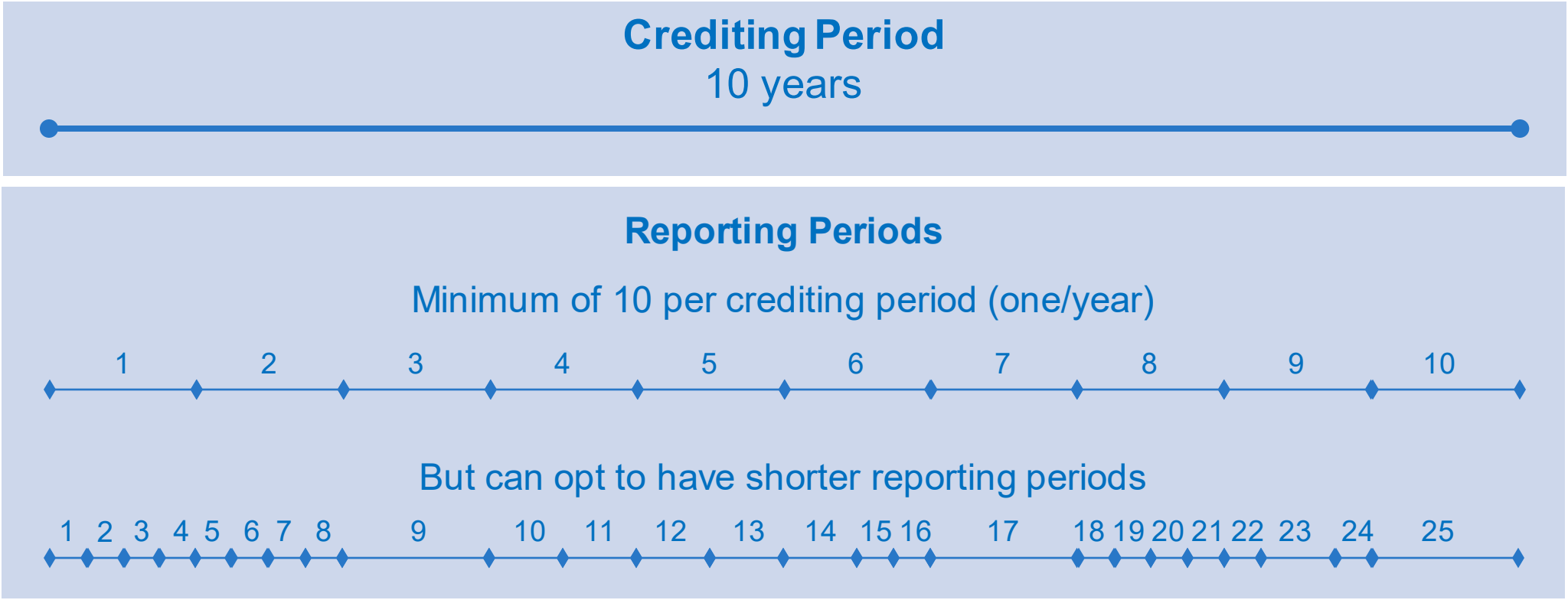
Analyses performed by lab:

- Organic C content
- $H:C_{org}$
- Other analyses dependent on end use and applicable laws, regulations, and other environmental safeguards specified in protocol and Eligible Biochar End Uses List
- Must be consistent with either IBI or WBC testing methods

Reporting Period

Reporting period

- Maximum length of 12 months, but otherwise may be as short as desired
  - Exception for projects with start dates pre-dating the adoption of the protocol, for which first reporting period may extend 12 months after the date of protocol adoption (max 36 months)
- No gaps allowed between reporting periods, but may opt for zero-credit reporting period



Verification Cycle

- Each reporting period must be verified within 12 months
- Site visit verifications required:
  - *In-person site visit required*
    - Initial reporting period
    - Reporting period no more than 4 years since the start date of the reporting period previously subject to an in-person site visit
    - When changing verification bodies (must change at least every six years)
    - If significant changes in the production technology, or the processes used to process feedstocks or biochar
  - *Virtual site visit*
    - Required at a minimum for the reporting period containing the date no more than 2 years since the start date of the reporting period previously subject to an in-person site visit
- Desktop verifications may occur between site visit verifications

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Q&A / COMMENTS

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NEXT STEPS

Next Steps

- ***Continue public comment period***
- Reserve staff to post draft of Biochar CRT Calculation Tool for review prior to end of public comment period
- **Submit comments by EOD Thursday, December 21**
  - **Word or PDF format to jremucal@climateactionreserve.org**
- Reserve staff will review and respond to submitted comments, with consideration for potential revisions to the protocol
- Aiming to submit final protocol to the Reserve's board of directors to be considered for adoption at January 2024 board meeting

Key contacts

Protocol development lead:

Jon Remucal, Director of Nature-Based Solutions

jremucal@climateactionreserve.org

General inquiries:

Policy@climateactionreserve.org