**SUPPLEMENTAL INFORMATION**

The CM002 Component Methodology, developed as a digital protocol on AD Tech’s carbon removal accounting platform, provides the necessary standardized requirements and procedures for the quantification of GHG benefits following the production of biochar from waste biomass using low-technology kiln types. The digital CM002 protocol is in essence, a step-by-step guide to biochar production, facilitated via the platform’s smartphone and web-based applications, that ensures easy baseline setting and additionality, planning, real-time data collection, monitoring, and verification, which in turn, can enable individuals and smaller projects to access the available climate change-related funding. The digital protocol assists in reducing the high costs and time associated with traditional monitoring, reporting, and verification (MRV) while maintaining high levels of trust, transparency, and traceability down to a batch and kiln level in real time. This ultimately reduces the barrier to entry for smaller projects and creates a scalable solution.

While the CM002 component methodology has been guided by Verra VM0044 and EBC Artisan C-Sink Standards, the methodology has been developed specifically for flame carbonization of woody debris in forests, woodlands, and alien invasive tree management. The rationale behind this is two-fold: (1) While the Verra methodology does make provision for the aforementioned biomass feedstocks, it is mainly designed for high-technology biochar production facilities and deploys unnecessarily low discount factors for low-technology production facilities, negatively impacting the financial feasibility of low technology biochar production, (2) The EBC Artisan standard is designed for biochar production from agricultural residues in developing regions and thus omits woody biomass from vegetation/conservation management. This restriction is important where the possibility exists of tree-cutting solely for the purpose of biochar production. However, disposal of woody debris is a vital activity that occurs globally to reduce the fuel load of forest and woodland landscapes under threat from drought and wildfires in order to protect communities and ecosystems. These materials are most commonly incinerated for disposal. Converting them to biochar instead is a clear benefit from both an environmental and a climate standpoint.

**Digital Protocol**

The digitized CM002 component methodology has been designed to maximize biochar quantity and quality while minimizing emissions throughout the process, from the feedstock sourcing stage to the biochar application stage. Given that biochar production from low-technology kilns is a manual, labor-intensive process that typically occurs in remote locations, the digital protocol prioritizes factors that can be controlled on the ground as well as key parameters that need to be collected and monitored in the field for accurate GHG benefit calculations.

The digital protocol for field data collection and monitoring during the implementation of biochar production is split into three sequential stages: 

1. Sourcing stage: Where the initial waste biomass is sourced, collected and prepared.
2. Production stage: Where waste biomass is carbonized through eligible low technology pyrolysis for the purpose of biochar production.
3. Application stage: Where the biochar is applied in soils as a long-term carbon sink.

Each stage has a number of key proof points which need to be submitted via the smartphone application in the form of either a photo, video, or questionnaire. The digital software tracks the date, time, and location of the data uploads, ensuring project credibility.

The information submitted is then stored in a database to calculate the project’s net negative emissions. This final step can only be completed when the lab samples return from an accredited laboratory with the carbon content of biochar or if sufficient data is available in the database for a project’s feedstock and kiln type. Once Biochar Carbon Removal Certificates are issued, they are added to a registry to ensure traceability, transparency, and no double counting.

The quantification of GHG benefits or net carbon dioxide removals associated with the project is calculated using the following simplified formula:

nCDRp = (ERPS,p -PEPS,t,p-PEAS,p-PESS,p) - LEp

Where:

nCDRp = Net carbon dioxide removal in project p (tCO2e)

PESS,p  = Project emissions sourcing stage in project p (tCO2e)

ERPS,p  = GHG emissions removals at production stage in project p (tCO2e)

PEAS,p = Project emissions at application stage in project p (tCO2e)

LEp = Total leakage emissions in project p (tCO2e)

**Funding biochar production activities**

The D-MRV results provided by AD Tech’s platform can be instrumental in securing finance or funding for biochar production projects. These results, which quantify the GHG benefits of biochar production, serve as a reliable and verifiable data source that can be presented to potential funders. In the evolving landscape of carbon removal, such data is invaluable. It provides a solid foundation for projects to demonstrate their environmental impact and sustainability, thereby attracting funding from companies, governments, municipalities, conservation groups, and other entities interested in supporting environmentally sustainable practices.

However, navigating this changing landscape to find funding requires a strategic approach, and selling “carbon credits” is one of the most complicated models available. One effective method is to engage with local entities that can fund biochar production at a project level, where they have a mandate to reduce wildfire risks, reduce GHG emissions or improve soil health. This "carbon in-setting" model allows these entities to directly contribute to the biochar carbon removal in their ecosystem or value chain, while also reducing the costs associated with due diligence. For example, a local municipality, can fund the additional biochar production activities and "claim" the carbon removal benefits unlocked through their funding.

Alternatively, projects can collaborate with carbon marketplaces that can sell the carbon removal certificates after they have been verified. However, this approach often requires upfront funding commitments since biochar producers cannot fund these additional biochar activities themselves. This is where innovative funding models like the Puro.earth pre-CORC funding can be beneficial. In this model, projects can estimate the carbon removal certificates they will be willing or able to deliver, and funders can view and commit to the project at a set price. Once the results are reported and verified, the funding will be paid to the project.

The results from the D-MRV process provide data on Biochar Carbon Removal, which needs to align with international best practice “carbon credit” principles, which are:

1. **Unique.** It should be ensured that biochar carbon removals are unique, with no double counting, issuing, usage, or claiming being permitted.
2. **Real.** It should be ensured that all removals are real, measured, monitored, and verified post-event.
3. **Permanence.** Biochar removal certificates should be issued for removals that are permanent.
4. **Additionality.** Emission reductions and removals resulting from projects should be beyond what would have occurred without the project. A conservative business-as-usual scenario should be demonstrated, and it should be ensured that projects are surplus to regulatory requirements.
5. **Measurability.** Biochar carbon removals should be quantifiable, with data per batch being measured and metadata being captured in the digital protocol, along with adjustments for uncertainty or leakage. It should be ensured that leakage is minimal and adequately addressed, mitigated, and calculated.