CO2RE THE GREENHOUSE GAS REMOVAL HUB

Biochar Carbon Removal Standards

A comparative assessment of the EU CRCF, ICVCM and Article 6.4

Executive summary

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Technical definitions

Additionality: "Mitigation projects, mitigation policies, or climate finance are additional if they go beyond a 'business as usual' level, or baseline. Additionality is required to guarantee the environmental integrity of project-based offset mechanisms, but difficult to establish in practice due to the counterfactual nature of the baseline" (Allwood et al, 2014, p.1252).

Baseline scenario: A description of the situation and the outcome that is predicted or assumed to occur in the absence of the incentives created by the carbon credits and their associated mitigation activities, while holding all other factors constant (ICVCM, 2024).

Leakage: When the removal, relative to the baseline, in a project is offset by an increase outside the project boundary through displacement of resources, changes in consumption, production, land use, indirect land-use change (iLUC) or trade across other sectors (ibid, p.1265).

Permanence: Refers to the length of time for long-term carbon storage (Schulte, 2024).

Reversal risk: A project's susceptibility of releasing stored GHGs back into the atmosphere (Axelsson et al, 2024).

Project operators: Those implementing the CDR activity and applying for credits. Sometimes referred to in standards as, e.g., project proponents or activity proponents.

Executive summary

Context and purpose

Following the rapid growth of the voluntary carbon removal market, and the need to scale high-integrity, internationally recognised standards, the EU has developed a Carbon Removal and Carbon Farming Regulation (CRCF) (2024/3012) for DACCS (direct air carbon capture and storage), BioCCS (biomass with carbon capture and storage) and biochar. The UK Government has signalled its intention to align British Standards Institution (BSI) greenhouse gas removal (GGR) standards with the EU Carbon Removal and Carbon Farming Regulation (CRCF), including for biochar carbon removal, to avoid duplication and divergence as both markets develop. This report provides a timely assessment of whether the CRCF biochar methodology meets the requirements of internationally recognised, high-integrity carbon crediting frameworks and informs considerations around potential UK–EU carbon market compatibility.

Scope

This report assesses the alignment of the EU CRCF biochar methodology, as set out in the Delegated Regulation on Permanent Carbon Removals (DR PCR (EU) 2026/285), against two internationally recognised benchmarks for carbon credit quality: the Integrity Council for the Voluntary Carbon Market (ICVCM) Core Carbon Principles (CCPs) Assessment Framework, and the Article 6.4 Paris Agreement Crediting Mechanism (A6.4). The assessment examines four pillars that determine carbon credit integrity: additionality, quantification of removals, permanence and sustainability (environmental and social). The European Biochar Certificate (EBC) and the Global Biochar C-Sink Standard are incorporated for sectoral context, particularly on permanence methodology. A detailed review of all EU regulations referenced by the CRCF, and an assessment of individual voluntary carbon market (VCM) standards bodies, falls outside the scope of this report.

Approach

The assessment applies a comparative document analysis framework, supplemented by engagement with academic and policy experts, consistent with the methodology used in the team's prior analysis of BioCCS and DACCS standards (Martirosian et al., 2025). For each of the four pillars, common requirements across the ICVCM CCPs and A6.4 are first established, after which the CRCF biochar methodology is assessed against those requirements. Alignment ratings are assigned using a Red-Amber-Green (RAG) scale: Green indicates good alignment likely to produce comparable outcomes with little or no outcomes that may risk integrity; Amber indicates partial alignment with gaps that may affect outcomes; and Red indicates material gaps likely to produce divergent outcomes and risks to integrity.

Key findings

Additionality

The CRCF DR PCR employs a standardised zero-baseline approach whereby any biochar activity generating net carbon removal is deemed additional. This simplified approach is not accompanied by the legal compliance check, prior consideration assessment, or financial and barrier tests that ICVCM and A6.4 require. In the absence of these checks, there is a risk of non-additionality credits being issued, particularly for biochar applied to agricultural soils, where production is already financially viable and public subsidies may alone be sufficient to fund activities. The DR PCR does not explicitly prohibit the simultaneous claiming of biochar removal credits and soil carbon sequestration credits on the same plot of land, creating a double-counting risk.

Quantification

The CRCF DR PCR requires comprehensive lifecycle accounting across the full biochar production and application chain, including uncertainty assessment and the use of conservative default factors. This broadly aligns with ICVCM and A6.4 requirements. The DR PCR assumes a zero-baseline which, while not giving evidence as to how this was quantified, as required by ICVCM and A6.4, is justified given that in the baseline scenario, activities associated with the biochar project would not take place and no emissions or removals can be associated with it. On leakage (the project activity leads to greenhouse gas fluxes in other sectors e.g. energy or land), the DR PCR relies on preventative safeguards rather than the identification, quantification, and deduction of leakage that ICVCM and A6.4 require. The main safeguards are the EU cascade use of biomass principle and an assessment to ensure biochar for GGR is the primary purpose of the project, not energy production. While this minimises the land-use change risks and impacts on other sectors, no detailed analysis is provided to demonstrate that these safeguards adequately substitute for leakage accounting.

Permanence

The CRCF DR PCR takes a pragmatic approach to assessing the risk of reversal (carbon loss from storage) of natural in-situ degradation of biochar, given the practical limitations of post-application monitoring. It uses a conservative approach to quantify the stable fraction of biochar, then treats this as effectively permanent, requiring no further monitoring or assessment of reversal risk. The DR PCR offers two approved methods for calculating the stable fraction of biochar that yield divergent persistence estimates (200 years versus 1,000 years). A combined approach to using several (including more advanced) methods to assess 1000-yr persistence is endorsed by the Global Biochar C-Sink Standard. Given the conservative calculation of the stable fraction, and the requirement for regular review and update of methods in CRCF, this approach provides similar outcomes to the A6.4 requirements of monitoring and calculating reversal risk – with regards to natural in-situ carbon storage reversal only. The DR PCR does not address reversal risks arising from physical disturbance such as fires, land-use change, or demolition of structures incorporating biochar aggregates and includes no post-disturbance monitoring requirement or compensation mechanism. This contrasts with the treatment of BioCCS and DACCS under the EU CCS Directive (2009/31/EC) as well as risk reversal assessment requirements of A6.4.

Environmental sustainability

In the EU, environmental sustainability is governed through existing EU-level regulation along with a combination of high-level environmental guidelines for contaminant thresholds and regulations. The effectiveness of national regulations is often limited by monitoring and technical constraints (Pouikli et al., 2024; Giakoumis and Voulvoulis, 2026), relying on data and modelling which can be outdated or lack site specificity. Biochar contaminant limits exist for heavy metals and polycyclic aromatic hydrocarbons broadly aligned with EBC agro-grade standards, as well as prohibiting the use of co-processed non-biogenic materials. For application of biochar in soils, DR PCR establishes a maximum cumulative application threshold of 50t/ha (with limited evidence) as an additional safeguard. This represents strong alignment with ICVCM and A6.4 requirements on soil protection. However, protections for air and water quality rely on the EU Industrial Emissions Directive, which applies only to facilities above a 50 MW thermal input threshold, potentially exempting smaller modular biochar production plants. Biodiversity requirements must adhere to the EU Regulation on Nature Restoration. Co-benefits of biochar, including improved nutrient cycling, crop yields, and ecosystem resilience, are part of sustainability requirements linked to EU objectives, requiring project-level monitoring and reporting. Many of these requirements are quite high-level, compared to A6.4's project-specific comprehensive framework for identifying, monitoring, reporting, and managing risk.

Social sustainability

The CRCF DR PCR does not include specific requirements for project-level social safeguards for GGR activities. Unlike ICVCM and A6.4, which set detailed requirements, the CRCF operates primarily at the certification scheme

level and relies on existing EU and devolved national laws without specifying how social risks should be identified or managed in practice. Regulatory standards, monitoring, and implementation of compliance can vary nationally, risking fungibility in safeguards and enforcement for activities carried out in different countries. Legal compliance alone cannot guarantee the procedural justice outcomes necessary for high-integrity carbon removal, as evidenced by research on biochar interventions in Sub-Saharan Africa and GGR governance in the UK.

Recommendations

Additionality: strengthen additionality requirements

The CRCF DR PCR could require more rigorous additionality assessments, to include a legal compliance check, a prior consideration requirement, and financial or barrier analysis similar to ICVCM and A6.4 requirements. Where public funding alone is sufficient to make an activity financially viable without carbon revenues, this could be addressed in the certification of units issued.

Additionality: prevent double claiming across certification schemes

To prevent simultaneous certification of biochar removal credits and soil carbon sequestration credits on the same land, geolocation of all biochar application sites could be required to ensure full transparency between certification schemes operating in parallel.

Quantification: quantify and deduct leakage

The CRCF DR PCR could require the identification, minimisation, quantification, and explicit deduction of residual leakage, including indirect land-use change and market displacement effects consistent with the approaches mandated by ICVCM and A6.4.

Permanence: adopt more advanced and harmonised permanence methods

The CRCF DR PCR could recommend a combination of analytical methods consistent with the latest updates to the Global Biochar C-Sink Standard. This would improve confidence in the stable fraction estimate, reduce uncertainty, and achieve higher-integrity credits with longer persistence horizons. The DR PCR's minimum four-year review cycle provides a suitable mechanism to incorporate evolving scientific guidance, including forthcoming A6.4 biochar-specific updates and IPCC methodological guidance.

Permanence: introduce reversal risk management for physical disturbances

The CRCF DR PCR could establish provisions to address reversal risks arising from physical disturbances to biochar in soils and aggregates, including an appropriate post-application monitoring period, quantitative risk tools (drawing on the A6.4 reversal risk framework when available), and compensation mechanisms such as buffer pool contributions. This would bring the treatment of biochar into closer alignment with BioCCS and DACCS under the CCS Directive (2009/31/EC).

Environmental sustainability: evidence-base the application threshold and adopt a systematic co-benefit framework

The CRCF could adopt a structured environmental safeguards and co-benefits framework along the lines of Article 6.4, requiring operators to identify, monitor, report, and minimise negative environmental impacts and to assess positive co-benefits, ensuring consistency and fungibility across projects operating in different national regulatory environments.

Social sustainability: adopt project-level social safeguards

The CRCF could adopt the comprehensive A6.4 framework to ensure carbon removal activities uphold human rights, protect local communities, and prevent negative social impacts. Article 6.4 embeds fairness and justice, ensuring meaningful participation and equitable benefit-sharing, so no group is unduly burdened, and positive impacts reach communities and vulnerable groups. This approach would strengthen both the integrity and social legitimacy of biochar and other GGR activities.

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