BioCarbon Standard

# METHODOLOGICAL DOCUMENT
## FUEL SWITCHING IN INDUSTRIAL THERMAL PROCESSES

# BCR0019
## Fossil Fuel Substitution in Industrial Thermal Processes



BioCarbon Cert®

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## Acronyms and abbreviations

| | |
|---|---|
| ADC | Avoiding Double Counting |
| BAT | Baseline and Additionality Tool |
| BAU | Business as Usual |
| BE | Baseline Emissions |
| CAB | Conformity Assessment Body |
| CDM | Clean Development Mechanism |
| $CH_4$ | Methane |
| $CO_2$ | Carbon dioxide |
| $CO_2e$ | Carbon dioxide equivalent |
| CSR | Combustible Solid Recovered Fuel |
| CSS | Combustible Solid Secondary Fuel |
| dMRV | Digital Monitoring, Reporting and Verification |
| EF | Emission Factor |
| GHG | Greenhouse gas |
| GJ | Gigajoule |
| GWP | Global Warming Potential |
| IPCC | Intergovernmental Panel on Climate Change |
| ISO | International Organization for Standardization |
| LE | Leakage Emissions |
| M-C | Supplementary Module C |
| MRV | Monitoring, Reporting and Verification |
| MWh | Megawatt-hour |
| $N_2O$ | Nitrous oxide |
| NCV | Net Calorific Value |
| PE | Project Emissions |
| QA/QC | Quality Assurance and Quality Control |
| RDF | Refuse-Derived Fuel |
| SEC | Specific Energy Consumption |
| SDSs | Sustainable Development Safeguards |
| SDGs | Sustainable Development Goals |
| SRF | Solid Recovered Fuel |
| SWDS | Solid Waste Disposal Site |
| t | Metric tonne |
| tC | Metric tonne of carbon |
| $tCO_2$ | Metric tonne of carbon dioxide |
| $tCO_2e$ | Metric tonne of carbon dioxide equivalent |
| UNFCCC | United Nations Framework Convention on Climate Change |
| VCC | Verified Carbon Credit |

# 1 Introduction

Industrial thermal processes rely extensively on fossil fuels such as coal, petroleum coke, fuel oil, and natural gas. The partial or complete substitution of these fuels with eligible refuse-derived fuel (RDF), solid recovered fuel (SRF), combustible solid recovered fuel (CSS/CSR), or comparable non-hazardous waste-derived fuels may reduce greenhouse gas emissions where the displacement of fossil fuel consumption is measurable, attributable, and independently verifiable.

This methodology establishes requirements for quantifying greenhouse gas emission reductions resulting from fossil fuel substitution in clinker and quicklime manufacture and in other eligible industrial thermal processes. For the purposes of the BioCarbon Standard, the methodology is classified under the Energy Sector, as the credited mitigation outcome corresponds exclusively to the reduction of fossil fuel combustion emissions in industrial energy use.

The methodology does not quantify methane emissions avoided through the diversion of waste from solid waste disposal sites. Such emission reductions may be addressed separately under BCR0018. Where both methodologies are applied to the same waste stream, the Project Holder shall demonstrate separate accounting boundaries, complete batch-level traceability, clear ownership of mitigation claims, and the absence of double issuance, double use, or double claiming.

# 2 Objectives

This methodology aims to:

(a) establish a consistent and conservative approach for quantifying greenhouse gas emission reductions resulting from the partial or complete substitution of fossil fuels with eligible RDF, SRF, CSS, CSR, or comparable non-hazardous waste-derived fuels in industrial thermal processes;
(b) define specific requirements for clinker and quicklime manufacture, other industrial thermal processes, and eligible co-processing or controlled combustion applications;
(c) ensure that emission reductions are credited only where fossil fuel displacement is measurable, attributable, traceable, and independently verifiable;
(d) account for all material project emissions, leakage sources, uncertainty, and conservative adjustments associated with the preparation, transport, storage, handling, and use of alternative fuels;
(e) prevent double counting with waste-sector activities, including emission reductions quantified under BCR0018; and
(f) promote robust monitoring, data quality, waste hierarchy safeguards, prevention of fossil or waste-management lock-in, and compatibility with applicable BioCarbon Tools and program requirements.

# 3 Scope

This methodology applies to greenhouse gas emission reduction activities in the Energy Sector that partially or completely substitute fossil fuels used to generate process heat in industrial thermal processes with eligible refuse-derived fuel (RDF), solid recovered fuel (SRF), combustible solid recovered fuel (CSS/CSR), or comparable non-hazardous waste-derived fuels.

The methodology shall be applied through one primary methodological route and, where applicable, Supplementary Module C:

Route A: Clinker and quicklime manufacture: partial or complete substitution of fossil fuels in kiln systems used for clinker or quicklime manufacture, based on the principles and accounting approach of ACM0003 as expressly adapted and incorporated into BCR0019.

Route B: Other industrial thermal processes: partial or complete substitution of fossil fuels in industrial furnaces, kilns, boilers, dryers, heaters, calciners, or comparable thermal equipment used to provide an identifiable industrial thermal service outside the clinker or quicklime pyro-process.

Supplementary Module C: Co-processing and controlled final use: additional requirements for fuel acceptance, final-use traceability, controlled combustion, co-processing, operating conditions, air-emission controls, and the final management or incorporation of residues.

Each project component shall apply either Route A or Route B.

Supplementary Module C shall be applied only together with the relevant primary route and shall not establish an independent baseline scenario, additionality demonstration, project boundary, or emission-reduction calculation.

The methodology quantifies only emission reductions resulting from the displacement of fossil fuel combustion. It does not quantify methane emissions avoided through the diversion of waste from solid waste disposal sites, avoided disposal emissions, waste collection benefits, recycling benefits, or other upstream waste-management outcomes.

Activities applying this methodology shall demonstrate measurable and attributable fossil fuel displacement, complete traceability of the alternative fuel, compliance with applicable legal and technical requirements, and adequate monitoring of fuel quantity, energy content, fossil and biogenic fractions, project emissions, leakage, and uncertainty.

The methodology does not apply to hazardous waste, uncontrolled combustion, open burning, incineration without documented energy substitution, activities that increase the production of waste for credit generation, or activities that create or prolong fossil-fuel or waste-disposal lock-in.

Where the same waste stream is also included in an activity applying BCR0018 or another waste-sector methodology, this methodology may quantify only the downstream fossil fuel

substitution component. The Project Holder shall demonstrate separate methodological boundaries, separate datasets, batch-level traceability, clear ownership of mitigation claims, and the absence of double issuance, double use, or double claiming.

# 4 Version

This methodological document constitutes the Public Consultation Version 1.0 of BCR0019 — Fossil Fuel Substitution in Industrial Thermal Processes through the Use of Refuse-Derived Fuel, Solid Recovered Fuel, or Comparable Non-Hazardous Waste-Derived Fuels.

This version is not a final approved methodology and shall not be used for validation, verification, project registration, issuance, or any other program decision until it has been formally approved and published by BioCarbon Cert.

Only the final approved version, as published on the official BioCarbon Cert website, shall be considered valid. The final approved version shall specify its effective date and any applicable transition provisions.

# 5 Applicability conditions

This methodology is applicable only where all general conditions in Section 5.1, the conditions corresponding to the selected methodological route, and, where applicable, the conditions for Supplementary Module C are met.

## 5.1 General applicability conditions

The project activity shall meet all of the following conditions:

(a) The credited mitigation activity consists of the partial or complete substitution of one or more fossil fuels used to generate process heat in an identifiable industrial thermal process;

(b) The alternative fuel shall consist of RDF, SRF, CSS, CSR, or a comparable fuel produced from non-hazardous waste. The waste-derived fuel shall not be classified as hazardous waste under applicable law and shall comply with all applicable technical, environmental, health, safety, and quality requirements;

(c) The industrial installation, thermal equipment, fossil fuels displaced, alternative fuels used, production lines, and points of fuel input shall be clearly identified and included within the project boundary;

(d) The use of the alternative fuel shall result in measurable and attributable displacement of fossil fuel consumption. Activities based solely on waste destruction, waste disposal, uncontrolled combustion, open burning, flaring, or incineration without demonstrated fossil fuel substitution are not eligible;

(e) A credible baseline scenario shall demonstrate that, in the absence of the project activity, the industrial thermal process would have continued to consume the identified fossil fuel or fuels. The baseline shall be determined in accordance with the BioCarbon Baseline and Additionality Tool;

(f) The quantity of each fossil fuel displaced and each alternative fuel consumed shall be determined through direct measurement or a verifiable mass and energy balance. Estimates based exclusively on nominal equipment capacity, contractual quantities, purchase records, or assumed substitution rates are not eligible;

(g) The Project Holder shall monitor, as applicable, fuel quantities, net calorific values, moisture content, carbon content, fossil and biogenic fractions, ash content, relevant contaminants, auxiliary fuel consumption, electricity consumption, thermal or production output, operating hours, and other parameters required to quantify baseline and project emissions;

(h) The alternative fuel shall be subject to a documented sampling and testing program that is representative of its variability. Laboratory analyses, measurement systems, calibration, data management, and QA/QC procedures shall comply with the applicable BioCarbon MRV Tool and recognized technical standards;

(i) Complete chain-of-custody and batch-level traceability shall be maintained from the origin and preparation of the waste-derived fuel to its transport, reception, storage, feeding, consumption, and final industrial use. The traceability system shall identify the waste source, producer or processor, batch or lot, composition, quantity, destination, industrial recipient, date of delivery, date of use, and supporting evidence;

(j) The final use of the alternative fuel shall be documented, legally authorized, and independently verifiable. Quantities produced, transported, sold, or delivered but not demonstrated as consumed in an eligible industrial thermal process shall not generate emission reductions;

(k) The project activity shall maintain an equivalent industrial function, including the required process heat, product output, product quality, and operating conditions. Emission reductions shall not result from reduced production, lower capacity utilization, deterioration of product quality, transfer of production to another installation, or curtailment unrelated to the project activity;

(l) Where production levels, operating conditions, product mix, energy efficiency, or thermal demand vary between the baseline and project scenarios, the quantification approach shall normalize the comparison and conservatively isolate the effect attributable to fossil fuel substitution;

(m) All material emissions associated with the preparation, processing, drying, densification, transport, storage, handling, feeding, and combustion of the alternative fuel shall be included as project emissions or leakage, as applicable. This includes fossil

$CO_2$, $CH_4$, $N_2O$, electricity consumption, auxiliary fuels, additional transport, and treatment or disposal of residues;

(n) The fossil fraction and biogenic fraction of the alternative fuel shall be determined using representative measurements or another method permitted under this methodology. The biogenic fraction shall not be assumed solely on the basis of waste category, supplier declaration, default composition, or commercial fuel designation where direct or more representative evidence is reasonably available[1];

(o) The project activity shall not deliberately increase waste generation, reduce source separation, undermine waste prevention, or divert material from preparation for reuse, reuse, recycling, material recovery, or another demonstrably higher-order use in order to secure alternative-fuel supply or generate emission reductions;

(p) The Project Holder shall assess and document the pre-project destination and realistic alternative use of each eligible material stream. A quantity that, in the absence of the project activity, would credibly have been used for preparation for reuse, reuse, recycling, or material recovery shall be ineligible. Diversion from an identifiable existing energy-recovery user shall be assessed separately as leakage under Section 13.8.2;

(q) The project activity shall not create or prolong fossil-fuel lock-in, waste-disposal lock-in, or artificial dependence on minimum waste throughput. New or modified equipment shall not be credited where its design or contractual arrangements create a material incentive to generate additional waste or prevent feasible waste prevention, reuse, or recycling measures;

(r) The industrial installation shall operate under all applicable permits and authorizations and shall use appropriate combustion controls, emissions-control systems, operating procedures, and monitoring arrangements. Non-compliance with applicable environmental, waste, air-quality, occupational health, or safety requirements renders the affected monitoring period ineligible until compliance is restored and demonstrated;

(s) Residues resulting from the use of the alternative fuel, including ash, dust, slag, or other combustion residues, shall be identified, quantified where material, and managed in accordance with applicable law. Any material greenhouse gas emissions associated with their treatment, transport, recovery, or disposal shall be accounted for;

(t) The project activity shall apply the mandatory BioCarbon documents and tools identified in Sections 6.5 and 8.1;

(u) Digital monitoring, automated data acquisition, remote metering, electronic chain-of-custody systems, or other dMRV components may be used where they meet the

[1] Analytical identification of a carbon fraction as biogenic shall not, by itself, establish its eligibility for exclusion from project emissions. The relevant fraction shall also meet the requirements of Section 13.7.3.

requirements of the applicable BioCarbon Tools. The use of dMRV does not replace independent validation or verification, calibration, QA/QC, data retention, or evidentiary requirements.

## 5.2 Route A: Clinker and quicklime manufacture

Route A is applicable where:

(a) the alternative fuel partially or completely substitutes fossil fuel used in a kiln, calciner, pre-calciner, dryer, or other thermal equipment directly associated with clinker or quicklime manufacture;
(b) the substitution is quantified in accordance with the principles applicable to cement and quicklime manufacture under ACM0003, as adapted by this methodology and the applicable BioCarbon Tools;
(c) fossil fuel consumption, alternative fuel consumption, clinker or quicklime production, relevant operating parameters, and fuel characteristics are separately measurable for the included installation or production line;
(d) the project activity does not claim reductions arising from changes in carbonate decomposition, raw material composition, clinker ratio, cement blending, or other industrial process emissions, unless expressly addressed under another approved methodology; and
(e) any material effect of the alternative fuel on process efficiency, product output, product quality, calcination conditions, auxiliary fuel use, or electricity consumption is monitored and included in the quantification.

## 5.3 Route B: Other industrial thermal processes

Route B is applicable where:

(a) the alternative fuel partially or completely substitutes fossil fuel in an industrial furnace, kiln, boiler, dryer, heater, or comparable equipment used to provide process heat outside clinker or quicklime manufacture;
(b) the eligible thermal process and its useful output can be defined through a measurable parameter, such as useful thermal energy, steam production, mass of product, dried material, treated material, operating hours under standardized conditions, or another technically justified performance indicator;
(c) the relationship between fuel consumption and the relevant thermal or production output can be established for the baseline and project scenarios;
(d) the fossil fuel displacement is demonstrated for the specific installation or thermal equipment and is not inferred solely from facility-wide fuel purchases or reductions in aggregate energy consumption; and

(e) any material change in process efficiency, throughput, product mix, operating temperature, moisture content, production quality, or thermal demand is monitored and conservatively addressed.

Operating hours may be used as the reference output only where load, throughput, temperature, and all other variables material to energy demand are constant or conservatively normalized.

Where a stable and verifiable relationship between fuel consumption and equivalent industrial service cannot be established, the relevant project component shall be ineligible.

## 5.4 Supplementary Module C: Co-processing and controlled final use

Supplementary Module C shall be applied together with Route A or Route B where:

(a) the eligible alternative fuel is co-processed;
(b) the alternative fuel is produced, stored, transferred, or handled at a facility or by an entity different from the industrial recipient;
(c) the fuel passes through an intermediate storage or transfer facility before final use;
(d) the mineral fraction of the alternative fuel is incorporated into an industrial product; or
(e) additional final-use controls are necessary to demonstrate controlled combustion and the final fate of the credited fuel.

The Project Holder shall demonstrate:

(a) documented acceptance and rejection criteria;
(b) non-hazardous classification and legal eligibility;
(c) batch-level traceability from dispatch to actual consumption;
(d) authorized final use in the identified thermal unit;
(e) monitored feeding and controlled-combustion conditions;
(f) operation of applicable air-emission controls;
(g) reconciliation of quantities received, stored, fed, consumed, rejected, returned, transferred, or lost; and
(h) final management, recovery, incorporation, treatment, or disposal of resulting residues.

Supplementary Module C shall not generate an independent mitigation outcome. All emission reductions shall be quantified under the linked Route A or Route B component.

# 6 Methodology type and modular architecture

## 6.1 Methodology type

BCR0019 is a modular greenhouse gas emission reduction methodology classified under the Energy Sector, within the subsector of industrial thermal energy use. It applies to fuel-switching activities that partially or completely substitute fossil fuels with eligible RDF, SRF, CSS, CSR, or comparable non-hazardous waste-derived fuels in industrial thermal processes.

The methodology is designed as a downstream industrial energy-use methodology. The credited mitigation outcome is limited to the reduction of fossil fuel combustion emissions attributable to measurable and verifiable fuel substitution. It does not quantify upstream emission reductions associated with waste collection, treatment, diversion from solid waste disposal sites, or avoided methane generation.

Emission reductions shall be determined on the basis of the actual quantity and characteristics of the fossil fuels displaced and the alternative fuels consumed, after accounting for all applicable project emissions, leakage, and conservative adjustments.

## 6.2 Modular architecture

The methodology consists of a common methodological core, route-specific quantification requirements, and the mandatory application of the relevant BioCarbon Tools.

The common methodological core applies to all project activities and establishes requirements for:

(a) project eligibility and applicability;
(b) identification of the project boundary and relevant emission sources;
(c) baseline determination and demonstration of additionality;
(d) measurement and attribution of fossil fuel displacement;
(e) characterization and traceability of alternative fuels;
(f) quantification of project emissions and leakage;
(g) uncertainty assessment and conservative adjustments;
(h) monitoring, QA/QC, data management, and verification;
(i) waste hierarchy and lock-in safeguards;
(j) avoidance of double counting; and
(k) sustainable development safeguards and contributions.

The common methodological core shall be applied in its entirety and shall not be replaced by route-specific requirements or by Supplementary Module C.

## 6.3 Primary methodological routes and supplementary module

Each project component shall apply one of the following primary routes:

(a) Route A: Clinker and quicklime manufacture; or

(b) Route B: Other industrial thermal processes.

Supplementary Module C shall be applied where the conditions in Section 5.4 are met.

Route A and Route B establish the applicable baseline, project boundary, reference output, fossil-fuel displacement procedure, and emission-reduction calculation.

Supplementary Module C establishes additional final-use, traceability, operating-control, and residue-management requirements and shall not be applied independently.

## 6.4 Selection and combination of routes and module

Each thermal unit or production line shall be assigned to Route A or Route B.

A project activity may include components under both primary routes, provided that each component is separately identifiable, quantifiable, and verifiable.

Supplementary Module C may be combined with either primary route where required under Section 5.4.

A thermal unit shall not be assigned simultaneously to Route A and Route B for the same mitigation outcome.

Results shall be calculated separately for each primary-route component before aggregation.

## 6.5 Mandatory BioCarbon Tools

All project activities applying BCR0019 shall apply the relevant versions of the following BioCarbon Tools:

(a) Baseline and Additionality Tool;
(b) MRV Tool;
(c) Leakage Management Tool;
(d) Conservative Approach and Uncertainty Management Tool;
(e) Avoiding Double Counting Tool;
(f) Permanence and Risk Management Tool, where applicable;
(g) BioCarbon Multi-Methodology Framework, where the project combines methodologies or separately quantifiable project components;
(h) Sustainable Development Safeguards Tool; and
(i) SDG Contribution Tool.

Any additional BioCarbon Tool required by the BioCarbon Standard or identified as applicable to the specific project configuration shall also be applied.

External methodological references shall be applied only as expressly provided in Section 8.3.

# 7 Relationship with other BioCarbon methodologies

## 7.1 General relationship

BCR0019 is a standalone methodology for quantifying greenhouse gas emission reductions resulting from the measurable displacement of fossil fuels in industrial thermal processes. It may be applied independently or in combination with another approved BioCarbon methodology where the methodologies address distinct mitigation outcomes and all applicable requirements for combined application and avoidance of double counting are met.

The application of BCR0019 shall not be used to quantify or claim emission reductions arising from waste diversion, avoided methane generation, recycling, material recovery, renewable electricity generation, industrial process modifications, carbon capture, or any other mitigation outcome addressed under another methodology, unless expressly permitted by BCR0019.

## 7.2 Relationship with BCR0018

BCR0018 and BCR0019 address separate but potentially complementary mitigation outcomes associated with the same physical waste stream.

BCR0018 addresses the upstream mitigation outcome associated with the diversion of eligible waste from solid waste disposal sites and the resulting avoidance of methane emissions.

BCR0019 addresses the downstream mitigation outcome associated with the actual use of eligible RDF, SRF, CSS, CSR, or comparable non-hazardous waste-derived fuel to displace fossil fuel combustion in an industrial thermal process.

BCR0019 does not quantify avoided methane emissions from waste diversion, and BCR0018 does not quantify reductions from the displacement of fossil fuels in industrial thermal processes. The existence of an eligible waste-diversion activity under BCR0018 does not, by itself, demonstrate eligibility, additionality, fossil fuel displacement, or emission reductions under BCR0019.

Where BCR0018 and BCR0019 are applied to the same physical waste stream, the combined application shall comply with Section 10.8, the Avoiding Double Counting Tool, and, where applicable, the BioCarbon Multi-Methodology Framework.

## 7.3 Relationship with other waste-sector methodologies

Where an alternative fuel originates from an activity applying another BioCarbon waste-sector methodology, BCR0019 may be applied only to the downstream fossil fuel substitution component.

The Project Holder shall demonstrate that the other methodology does not already quantify the fossil fuel substitution benefit and that BCR0019 does not incorporate any upstream emission reduction already quantified under the waste-sector methodology.

The classification of a material as RDF, SRF, CSS, CSR, or another commercial fuel category does not transfer an upstream waste-management mitigation outcome into BCR0019 and does not establish eligibility for emission reductions under this methodology.

### 7.4 Relationship with other energy or industrial activity methodologies

BCR0019 may be combined with another approved BioCarbon methodology addressing energy efficiency, renewable energy, industrial process improvements, or another mitigation activity at the same installation only where each intervention and its corresponding mitigation outcome can be separately identified and quantified.

Where more than one methodology affects the same thermal process, production line, equipment, fuel consumption, energy demand, or output parameter, the Project Holder shall isolate the effect of each activity and demonstrate that:

(a) the baseline applicable to one methodology does not incorporate the project effect credited under another methodology;
(b) reductions in fossil fuel consumption are not attributed simultaneously to fuel substitution and energy-efficiency improvements;
(c) changes in production, operating conditions, thermal efficiency, product mix, or useful energy output are consistently treated across the applicable methodologies;
(d) project emissions and leakage are allocated without omission or duplication; and
(e) the aggregate emission reductions do not exceed the total net reduction demonstrated for the installation or project boundary.

Where the mitigation effects cannot be reliably separated, the overlapping activities shall not be credited simultaneously.

### 7.5 Methodological precedence

For any project component claiming reductions from the displacement of fossil fuel combustion through the use of eligible RDF, SRF, CSS, CSR, or comparable non-hazardous waste-derived fuel, the requirements of BCR0019 shall govern the quantification of that downstream mitigation outcome.

The application of another BioCarbon methodology shall not replace the applicability conditions, monitoring requirements, traceability provisions, project-emission accounting, leakage assessment, uncertainty treatment, or double-counting controls established in BCR0019.

## 8 Normative references and methodological basis

### 8.1 Applicable BioCarbon documents

This methodology shall be applied together with the applicable versions of the following BioCarbon program documents:

(a) the BioCarbon Standard;
(b) the BioCarbon Validation and Verification Manual;
(c) the Baseline and Additionality Tool;
(d) the MRV Tool;
(e) the Leakage Management Tool;
(f) the Conservative Approach and Uncertainty Management Tool;
(g) the Avoiding Double Counting Tool;
(h) the Sustainable Development Safeguards Tool;
(i) the SDG Contribution Tool;
(j) the Permanence and Risk Management Tool, where applicable;
(k) BioCarbon Multi-Methodology Framework, where applicable; and
(l) any other BioCarbon document or tool expressly required by the BioCarbon Standard or this methodology.

The applicable version of each program document shall be determined in accordance with the versioning, transition, and effective-date provisions established by BioCarbon Cert. The use of a later version of an external reference shall not automatically modify the requirements of this methodology.

The Project Holder shall also comply with all applicable national and subnational laws, regulations, permits, technical requirements, and authorization conditions governing waste classification, preparation, transport, storage, handling, co-processing, combustion, industrial operations, air emissions, occupational health and safety, product quality, and the management of ash and other residues.

## 8.2 Scientific and greenhouse gas accounting basis

BCR0019 is founded on the principles of conservation of mass and energy and on the physical measurement of fuel consumption, energy content, carbon content, fossil and biogenic fractions, combustion performance, useful thermal output, and industrial production.

The principal scientific basis for greenhouse gas accounting under this methodology is the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, as refined by the 2019 Refinement, particularly:

(a) Volume 1, General Guidance and Reporting, for data quality, completeness, uncertainty, time-series consistency, QA/QC, and selection of emission factors;
(b) Volume 2, Energy, Chapter 2, Stationary Combustion, for $CO_2$, $CH_4$, and $N_2O$ emissions from the combustion of fuels in stationary equipment;
(c) Volume 5, Waste, Chapter 2, Waste Generation, Composition and Management Data, for the characterization and composition of waste streams; and

(d) Volume 5, Waste, Chapter 5, Incineration and Open Burning of Waste, for the determination of dry matter, carbon content, fossil carbon fraction, oxidation, and non-$CO_2$ emissions associated with the combustion of waste-derived materials.

Consistent with the IPCC accounting framework, waste-derived materials used as fuels for energy recovery are treated as fuels within the Energy Sector. Fossil $CO_2$ emissions from the combustion of the waste-derived fuel shall be included in project emissions, while biogenic $CO_2$ shall be quantified and reported separately in accordance with this methodology. $CH_4$ and $N_2O$ emissions shall be included where required by the applicable quantification procedures.

The IPCC Guidelines provide the scientific foundation and data hierarchy for the methodology but shall not be applied as a substitute for project-level accounting. National inventory defaults shall be used only where project-specific or otherwise more representative data are unavailable, their use is permitted by this methodology, and the resulting estimate is conservative.

Unless otherwise specified, the following hierarchy shall apply to activity data, fuel characteristics, and emission factors:

(a) continuous or periodic measurements specific to the relevant installation, fuel, batch, or monitoring period;
(b) representative laboratory analyses and calibrated measurements specific to the fuel supplier or industrial installation;
(c) verified national or regional data applicable to the relevant fuel, technology, and jurisdiction;
(d) internationally recognized default values, including applicable IPCC defaults; and
(e) conservative values or deductions applied in accordance with the Conservative Approach and Uncertainty Management Tool.

A lower-ranked data source shall not be used where a higher-ranked source is reasonably available and can be independently verified.

## 8.3 External methodological references

The following external methodologies and methodological tools were used as references in the development of this methodology:

(a) ACM0003 — Partial substitution of fossil fuels in cement or quicklime manufacture, Version 09.0;
(b) TOOL03 — Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion, Version 03.0;
(c) TOOL05 — Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, Version 03.0; and

(d) TOOL12 — Project and leakage emissions from transportation of freight, Version 01.1.0;
(e) CDM Executive Board, EB 23, Annex 18 — Definition of Renewable Biomass.

Subsequent revisions of ACM0003 or these CDM tools shall apply only where expressly incorporated or required by BioCarbon Cert.

These external references are not incorporated into BCR0019 in their entirety. A provision of an external methodology or tool shall be mandatory only where BCR0019 expressly requires its application. References to CDM methodologies or tools shall not be interpreted as importing CDM program rules, terminology, quantification periods, eligibility decisions, or procedural requirements into the BioCarbon Standard.

## 8.4 Technical standards for recovered fuels

Fuel classification, sampling, sample preparation, laboratory analysis, and determination of fuel characteristics shall follow internationally recognized technical standards appropriate to the type and physical characteristics of the fuel.

Relevant technical references include:

(a) ISO 21640:2021 — Solid recovered fuels — Specifications and classes;
(b) ISO 21644:2021 — Solid recovered fuels — Methods for the determination of biomass content;
(c) ISO 21645:2021 — Solid recovered fuels — Methods for sampling;
(d) ISO 21646:2022 — Solid recovered fuels — Sample preparation;
(e) ISO 21654:2021 — Solid recovered fuels — Determination of calorific value;
(f) ISO 21637:2020 — Solid recovered fuels — Vocabulary;
(g) ISO 21656:2021 — Solid recovered fuels — Determination of ash content;
(h) ISO 21660-3:2021 — Solid recovered fuels — Determination of moisture content using the oven dry method — Part 3: Moisture in general analysis sample;
(i) ISO 21663:2020 — Solid recovered fuels — Methods for the determination of carbon, hydrogen, nitrogen, and sulfur by the instrumental method; and
(j) ASTM D6866-24a — Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis.

These standards provide internationally recognized procedures for classification, representative sampling, sample preparation, determination of biomass content, and measurement of calorific value in solid recovered fuels.

Equivalent national, regional, ASTM, EN, or other internationally recognized standards may be used where the Project Holder demonstrates that they provide equivalent or higher levels of accuracy, representativeness, reproducibility, and quality control. The selected method shall be documented in the project documentation and applied consistently throughout the

monitoring period unless a change is technically justified and does not reduce methodological conservativeness.

Laboratory analyses used to quantify emission reductions shall be conducted by laboratories accredited to ISO/IEC 17025 for the relevant analytical method. Where such accredited capacity is demonstrably unavailable in the relevant jurisdiction, the use of another competent laboratory shall be subject to enhanced QA/QC, documented proficiency, duplicate or reference testing, and acceptance by the CAB.

The commercial designation of a material as RDF, SRF, CSS, CSR, or another waste-derived fuel shall not, by itself, demonstrate eligibility or establish any monitored parameter. Eligibility and quantification shall be based on the actual origin, composition, non-hazardous classification, physical and chemical properties, fossil and biogenic fractions, final use, and documented compliance of the fuel.

## 8.5 International integrity requirements

BCR0019 is designed to comply with the current methodology-level integrity criteria and requirements applicable to high-integrity greenhouse gas crediting activities.

The methodology incorporates requirements addressing:

(a) additionality and the causal role of carbon-credit revenues;
(b) conservative and robust baseline setting;
(c) complete, accurate, and transparent quantification of greenhouse gas emission reductions;
(d) accounting for all material project emissions and leakage;
(e) management of uncertainty, missing data, and residual risks of overestimation;
(f) prevention of double issuance, double use, and double claiming;
(g) traceability, data quality, transparency, and independent verification;
(h) sustainable development safeguards;
(i) avoidance of perverse incentives, fossil-fuel lock-in, and waste-management lock-in; and
(j) consistency with credible long-term decarbonization pathways.

Compliance with this methodology does not, by itself, confer eligibility, approval, authorization, or recognition under any external program, market, jurisdiction, or regulatory framework.

## 8.6 Interpretation and precedence

Where an external reference is used, the Project Holder shall apply only the provisions expressly required or permitted by BCR0019.

External methodologies, standards, and methodological tools shall not override, modify, or reduce the requirements of the BioCarbon Standard, the applicable BioCarbon Tools, or this methodology.

In the event of an inconsistency:

(a) the applicable BioCarbon program requirement shall prevail over an external reference;
(b) the specific requirements of BCR0019 shall prevail over general provisions of an external methodology or tool; and
(c) where the inconsistency is not otherwise resolved, the interpretation that results in the most complete, conservative, and independently verifiable greenhouse gas accounting shall be applied.

Any subsequent revision of an IPCC guideline, external methodology, methodological tool, or technical standard shall apply to projects using BCR0019 only where BioCarbon Cert expressly incorporates, approves, or requires that revision.

# 9 Terms and definitions

## 9.1 General provisions

For the purposes of BCR0019, the following terms and definitions apply. Terms not defined in this section shall have the meaning established in the BioCarbon Standard and the applicable BioCarbon Tools. In particular, the definitions governing baseline scenario, additionality, leakage, uncertainty, conservative approach, double issuance, double use, double claiming, Project Holder, validation, verification, and monitoring period shall not be reinterpreted by this methodology.

Where a definition in this section provides a more specific meaning than a general program definition, the methodology-specific definition shall apply solely for the implementation of BCR0019.

The commercial designation of a material as RDF, SRF, CSS, CSR, or another waste-derived fuel shall not, by itself, establish its eligibility, composition, renewable content, fossil carbon fraction, calorific value, or environmental performance. Eligibility and quantification shall be based on measured characteristics, documented origin, legal classification, final use, and compliance with this methodology.

Unless otherwise specified, any reported fraction or fuel characteristic shall clearly identify its calculation basis, including whether it is expressed on a mass, carbon, or energy basis and whether the value corresponds to dry, wet, or as-received conditions. Biomass content, biogenic mass fraction, biogenic energy fraction, and biogenic carbon fraction shall not be treated as interchangeable parameters unless their relationship has been demonstrated through an approved analytical or calculation method.

## 9.2 Defined terms

**Alternative fuel consumed**

Quantity of eligible alternative fuel actually introduced into and used within the eligible industrial thermal equipment during the monitoring period. It excludes rejected loads, returned material, storage increases, spills, processing losses, quantities transferred to another destination, and quantities delivered but not demonstrated as consumed.

**Authorized industrial recipient**

Industrial installation legally authorized to receive, store, handle, and use the eligible alternative fuel in the identified thermal process and under the operating conditions included in the project activity.

**Baseline fossil fuel**

Fossil fuel, or combination of fossil fuels, that would credibly have been consumed in the absence of the project activity to provide an equivalent industrial service or output.

**Batch or lot**

Uniquely identifiable quantity of waste-derived fuel produced, handled, transferred, sampled, tested, or consumed under defined conditions and for which traceability records and relevant analytical results are maintained. Assignment of a batch or lot identifier shall not, by itself, demonstrate that the material is homogeneous.

**Biogenic carbon**

Carbon contained in material of recent biological origin and not derived from fossilized or geogenic carbon sources.

**Biogenic carbon fraction**

Proportion of the combustible carbon contained in the alternative fuel that is of biogenic origin, determined using an approved analytical method. It shall be expressed on a carbon basis unless this methodology expressly permits another basis.

**Biomass content**

Proportion by mass of biomass-derived material contained in the alternative fuel. Biomass content shall not be used directly as the biogenic carbon fraction unless a validated relationship between both parameters has been established.

**Carbon content**

Mass of carbon contained per unit mass of fuel. The reported value shall specify whether it represents total, organic, combustible, fossil, biogenic, or inorganic carbon and whether it is expressed on a dry or as-received basis.

**Chain of custody**

Documented system that records the origin, ownership, physical movement, processing, transfer, reception, storage, and actual consumption of a waste-derived fuel from its source to its final industrial use. The system shall permit reconciliation of quantities and mitigation claims across all participating entities.

**Co-firing**

Simultaneous or alternating combustion of an eligible alternative fuel and one or more fossil fuels in the same thermal equipment or integrated combustion system to provide process heat.

**Co-processing**

Use of eligible waste-derived fuel in an industrial process in which its combustible fraction provides thermal energy and its mineral fraction may be incorporated into the product or process residues. Under BCR0019, only the mitigation outcome attributable to fossil fuel displacement may be credited.

**Comparable non-hazardous waste-derived fuel**

Prepared fuel derived from non-hazardous waste that performs a function comparable to RDF, SRF, CSS, or CSR but is marketed under another name or is not classified under a specific recovered-fuel standard.

The fuel shall have a documented specification, reproducible quality, representative sampling, measured net calorific value, measured fossil and biogenic carbon fractions, applicable contaminant limits, legal authorization for the intended thermal use, and batch-level traceability. It shall comply with all other eligibility, characterization, monitoring, and final-use requirements of this methodology.

**Conservative adjustment**

Deduction applied to calculated emission reductions to address residual uncertainty, missing data, insufficient sampling representativeness, unresolved discrepancies, or limitations in the available evidence, in accordance with the Conservative Approach and Uncertainty Management Tool.

**Controlled combustion**

Combustion of an eligible alternative fuel in enclosed and legally authorized thermal equipment under monitored operating conditions, with appropriate fuel-feeding systems, combustion controls, air-emission controls, and management of resulting residues. Controlled combustion excludes open burning, uncontrolled burning, and combustion undertaken solely for waste disposal without demonstrated fossil fuel substitution.

**CSS or CSR**

Commercial, technical, or jurisdiction-specific designations used for prepared solid fuels derived from non-hazardous waste, including designations commonly translated as combustible solid secondary fuel or combustible solid recovered fuel. For the purposes of BCR0019, these acronyms do not constitute an independent technical classification and do not exempt the fuel from any eligibility or characterization requirement.

**Digital monitoring, reporting, and verification (dMRV)**

Use of digital technologies to support the collection, transmission, processing, storage, reconciliation, reporting, or verification of project data. dMRV may include calibrated sensors, automated metering, digital chain-of-custody systems, secure data repositories, remote monitoring, and automated QA/QC controls.

**Displaced fossil fuel**

Quantity of baseline fossil fuel consumption demonstrably avoided as a direct result of the project activity, after accounting for equivalent industrial output, fuel characteristics, process efficiency, operating conditions, and any other material factor affecting energy demand. It shall not be assumed to equal the energy content or mass of the alternative fuel consumed.

**Eligible alternative fuel**

RDF, SRF, CSS, CSR, or a comparable non-hazardous waste-derived fuel that meets all applicability, legal, technical, environmental, quality, traceability, monitoring, and final-use requirements established in BCR0019.

**Equivalent industrial service**

Comparable useful thermal function or industrial output delivered under the baseline and project scenarios, considering quantity, quality, operating conditions, product specifications, throughput, moisture, temperature, pressure, or other parameters material to energy consumption.

**Final fate**

Documented end point of the waste-derived fuel, including its actual consumption in the identified industrial thermal equipment and, where applicable, the management, recovery, incorporation, treatment, or disposal of the resulting ash, dust, slag, or other residues. Production, sale, transport, delivery, or reception of the fuel does not constitute final fate.

**Fossil carbon**

Carbon contained in organic material of fossil origin, including petroleum-derived plastics, synthetic rubber, coal-derived material, petroleum coke, fossil oils, natural-gas derivatives, and other fossil organic carbon sources. Fossil carbon excludes inorganic carbon, including carbonate carbon, which is treated separately under this methodology.

**Fossil carbon fraction**

Proportion of the combustible carbon contained in the alternative fuel that is of fossil origin, determined through an approved analytical method and expressed on a carbon basis. Inorganic carbon shall be identified and treated separately where material.

**Fossil fuel**

Fuel containing carbon of fossil origin and used for energy generation, including coal, lignite, petroleum coke, fuel oil, diesel, liquefied petroleum gas, natural gas, or another fossil-derived fuel.

**Fossil-fuel lock-in**

Material risk that the project activity, associated investment, technical design, contractual arrangement, or expected equipment lifetime extends or increases dependence on fossil-fuel consumption or carbon-intensive infrastructure in a manner inconsistent with credible decarbonization pathways.

**Fossil-fuel substitution**

Replacement of part or all of the fossil fuel that would otherwise have been consumed in an eligible industrial thermal process with an eligible alternative fuel, while maintaining an equivalent industrial service.

**Higher-order use**

Waste-management option that ranks above energy recovery under the waste hierarchy applicable to the relevant jurisdiction, including waste prevention, preparation for reuse, reuse, recycling, and material recovery.

**Industrial thermal process**

Controlled industrial operation in which thermal energy is used to heat, dry, evaporate, calcine, sinter, melt, cure, transform, manufacture, or otherwise process a material or product, or to generate steam or another thermal medium for such an operation. It includes eligible furnaces, kilns, calciners, boilers, dryers, heaters, and comparable equipment.

**Inorganic carbon**

Carbon present in mineral or non-combustible forms, including carbonates, that is neither fossil organic carbon nor biogenic organic carbon. Potential $CO_2$ emissions from inorganic carbon shall be quantified where the applicable process conditions may cause its release and the source is material.

**Mass and energy balance**

Quantitative reconciliation of material and energy flows entering, leaving, accumulating within, or being lost from the project boundary or a defined installation. The balance shall include, as applicable, fuel receipts, production, rejects, stock changes, transfers, consumption, residues, fossil fuel inputs, alternative fuel inputs, and useful thermal or production outputs.

**Net calorific value (NCV)**

Quantity of heat released by the complete combustion of a unit quantity of fuel when the water produced remains in vapor form and its latent heat is not recovered. The reported NCV shall identify the measurement or calculation method and whether it is expressed on a dry or as-received basis.

**Non-hazardous waste**

Waste that is not classified as hazardous and does not exhibit hazardous properties under each applicable legal framework governing its generation, transport, processing, transfer, storage, and final use. A non-hazardous classification does not remove the requirement to monitor contaminants relevant to fuel quality, combustion, air emissions, product quality, or residue management.

**Process heat**

Thermal energy generated and used to perform an industrial operation, including direct heating and heat transferred through steam, hot gases, thermal fluids, or another heat-transfer medium.

**Reference output parameter**

Measurable indicator used to establish equivalent industrial service and normalize fuel consumption between the baseline and project scenarios. It may include useful thermal energy, steam supplied, clinker production, quicklime production, product mass, dried-material output, treated-material output, or another technically justified parameter.

**Refuse-derived fuel (RDF)**

Fuel produced from non-hazardous waste through sorting, separation, size reduction, drying, blending, densification, or other preparation intended to improve its suitability for energy recovery. Unless demonstrated otherwise, RDF shall not be presumed to meet the classification and specification requirements applicable to SRF.

**Residual fossil fuel**

Fossil fuel actually consumed by the eligible industrial thermal process after implementation of the project activity.

**Solid recovered fuel (SRF)**

Solid fuel prepared from non-hazardous waste for energy recovery and classified and specified under ISO 21640 or an equivalent recognized standard.

**Thermal equipment**

Furnace, kiln, calciner, pre-calciner, boiler, dryer, heater, burner, combustion chamber, or another identifiable unit in which fuel is converted into thermal energy for an eligible industrial process.

**Thermal substitution rate**

Share of the total thermal energy input supplied by the eligible alternative fuel, normally expressed as a percentage on an NCV basis. The thermal substitution rate is an operational indicator and shall not, by itself, be used as evidence of the quantity of fossil fuel displaced or the emission reductions achieved.

**Traceability**

Capacity to identify, follow, and reconcile a waste-derived fuel and its associated data and claims through each stage from waste origin to preparation, transfer, transport, reception, storage, and actual industrial consumption.

**Useful thermal energy**

Net thermal energy effectively transferred to and used by the eligible industrial process, excluding avoidable losses, unutilized heat, and energy not serving the defined industrial function.

**Waste-derived fuel**

Fuel produced wholly or partly from waste and intended for energy recovery. Under BCR0019, only fuel derived from eligible non-hazardous waste may qualify as an eligible alternative fuel.

**Waste hierarchy**

Order of priority established by applicable law or recognized waste-management principles for preventing and managing waste, generally prioritizing prevention, preparation for reuse, and recycling over energy recovery and disposal.

**Waste-management lock-in**

Material risk that the project activity, processing capacity, supply contract, minimum-throughput obligation, or associated infrastructure creates or prolongs dependence on a sustained quantity or composition of waste in a manner that discourages waste prevention, reuse, recycling, or another demonstrably higher-order use.

# 10 Project boundaries

## 10.1 Boundary principles

The project boundary shall encompass the physical installations, equipment, material flows, energy flows, transport activities, and emission sources required to determine the net greenhouse gas effect of substituting fossil fuels with eligible alternative fuels.

The boundary shall be defined so that the emission reductions calculated under BCR0019 represent only the downstream mitigation outcome attributable to measurable fossil fuel displacement in an eligible industrial thermal process.

The project boundary shall not be limited by legal ownership, contractual control, facility perimeter, or the location of the Project Holder. Relevant activities undertaken by waste generators, alternative-fuel producers, transporters, storage operators, industrial recipients, laboratories, or residue-management facilities shall be included where they result in material baseline emissions, project emissions, or leakage.

The Project Holder shall distinguish between:

(a) the physical boundary, comprising the installations, equipment, sites, and material and energy flows directly associated with the project activity;
(b) the greenhouse gas accounting boundary, comprising all baseline, project, and leakage emission sources included in the quantification; and
(c) the traceability boundary, extending from the documented origin of the eligible waste-derived material to the actual consumption of the alternative fuel and the final fate of resulting residues.

An emission source located outside the physical boundary shall not be excluded where it constitutes a material project emission or leakage source.

## 10.2 Physical and operational boundary

At a minimum, the physical and operational boundary shall include, as applicable:

(a) the source or sources of the eligible waste-derived material;
(b) the facilities and equipment used for sorting, separation, shredding, drying, blending, densification, homogenization, conditioning, or other preparation of the alternative fuel;
(c) intermediate storage and transfer facilities;
(d) transport of the waste-derived material or alternative fuel between the relevant facilities;
(e) the industrial installation receiving and consuming the alternative fuel;
(f) the fuel reception, storage, handling, conveying, feeding, metering, and combustion systems;

(g) the eligible kiln, furnace, calciner, pre-calciner, boiler, dryer, heater, combustion chamber, or other thermal equipment;
(h) the industrial process or production line used to establish equivalent industrial service;
(i) electricity-generation or electricity-consumption sources affected by the project activity;
(j) auxiliary fuel systems and additional equipment introduced or modified by the project activity;
(k) air-pollution control systems materially affected by the use of the alternative fuel; and
(l) the collection, transport, recovery, treatment, incorporation, or disposal of ash, dust, slag, rejects, and other residues where associated emissions are material.

The boundary shall include only industrial installations and thermal equipment for which fossil fuel displacement can be separately measured or conservatively determined. Facility-wide aggregation shall not be used where fuel consumption, alternative-fuel use, production output, or operating conditions cannot be reliably allocated to the included equipment.

### 10.3 Baseline emissions boundary

The baseline emissions boundary shall include the greenhouse gas emissions associated with the quantity of fossil fuel that would have been consumed to provide an equivalent industrial service in the absence of the project activity.

Baseline emissions shall be limited to the fossil fuel consumption demonstrably displaced by the project activity. The Project Holder shall not calculate baseline emissions based on the total historical fossil fuel consumption of the installation unless the entire installation and its output are included and the total displacement can be demonstrated.

The baseline boundary shall include:

(a) $CO_2$ emissions from the combustion of the displaced baseline fossil fuel or fuels;
(b) $CH_4$ and $N_2O$ emissions from baseline fossil fuel combustion where required by the applicable route-specific procedure and supported by representative and conservative emission factors; and
(c) other baseline emission sources expressly permitted by this methodology and necessary to ensure a like-for-like comparison.

Avoided emissions associated with the extraction, production, refining, processing, distribution, or transport of the displaced fossil fuel shall not be credited unless BCR0019 expressly provides a quantification procedure for such sources. Their exclusion shall be considered conservative.

Baseline emissions shall not include:

(a) avoided methane emissions from diversion of waste from solid waste disposal sites;

(b) avoided emissions from waste collection, treatment, recycling, composting, or other waste-management activities;
(c) industrial process emissions unrelated to fuel combustion, including carbonate decomposition, as creditable baseline emissions. Where the project activity may affect such emissions, the normalized baseline value may be used solely as a comparator for determining incremental project process emissions under Section 13.7.11;
(d) reductions caused by lower production, reduced capacity utilization, changes in product quality, relocation of production, or unrelated energy-efficiency measures; or
(e) emission reductions quantified under another BioCarbon methodology.

## 10.4 Project emissions boundary

The project emissions boundary shall include all material greenhouse gas emissions caused by the preparation, supply, handling, and use of the eligible alternative fuel and by any equipment, energy consumption, or operational change required to implement the project activity.

Project emissions shall include, as applicable:

(a) fossil $CO_2$ emissions from combustion of the fossil carbon fraction of the alternative fuel;
(b) $CH_4$ and $N_2O$ emissions from combustion of the alternative fuel;
(c) emissions from fossil fuels consumed in sorting, processing, shredding, drying, densification, blending, storage, handling, feeding, or other preparation activities;
(d) emissions from electricity consumed by alternative-fuel production, preparation, storage, handling, feeding, combustion-control, air-pollution control, or residue-management systems;
(e) emissions from transport of waste-derived materials, alternative fuels, rejects, and residues;
(f) emissions from auxiliary or start-up fuels attributable to the project activity;
(g) emissions associated with additional air-pollution control requirements or other operating systems introduced because of the alternative fuel;
(h) emissions resulting from treatment, recovery, transport, or disposal of rejects, ash, dust, slag, or other residues;
(i) emissions from storage losses, degradation, self-heating, or other relevant processes where material;
(j) $CO_2$ emissions from inorganic carbon contained in the alternative fuel, accounted for exclusively under $PE_{IC,y}$, and other incremental industrial process emissions caused by the project activity, accounted for under $PE_{PROC,y}$, without duplication; and
(k) any other material emission source caused by the project activity.

The total quantity of residual fossil fuel consumed in the eligible thermal equipment shall be monitored and used to determine fossil fuel displacement. Residual fossil fuel emissions that occur equally in the baseline and project scenarios shall not be deducted twice. Any additional fossil fuel consumption caused by the project activity, including auxiliary fuel required to maintain combustion stability, temperature, product quality, or operating conditions, shall be included in project emissions.

Biogenic $CO_2$ released during combustion of the alternative fuel shall be quantified and reported separately in accordance with Section 13.7.3. Where biogenic origin or eligibility cannot be demonstrated, the affected carbon shall be included in $f_{UC,b,y}$ and treated as fossil carbon.

The exclusion of biogenic $CO_2$ from project emissions shall not exclude fossil emissions associated with collection, preparation, electricity consumption, transport, storage, handling, or combustion of the biogenic component.

## 10.5 Leakage boundary

The leakage boundary shall include material increases in greenhouse gas emissions occurring outside the physical project boundary that are attributable to the project activity.

Diversion from a higher-order use constitutes an eligibility exclusion under Section 13.8.3 and shall not be treated as leakage.

The leakage assessment shall consider, at a minimum:

(a) diversion of alternative fuel from an existing energy-recovery use, where the displaced user increases fossil fuel consumption or obtains another replacement fuel;
(b) displacement of waste or fuel flows to another facility, region, or jurisdiction;
(c) additional processing, transport, storage, or treatment outside the direct control of the Project Holder;
(d) changes in production or thermal-energy supply at another installation caused by the project activity;
(e) indirect substitution effects resulting from contractual, operational, or market arrangements associated with the alternative fuel;
(f) treatment or disposal of rejected materials and residues outside the project installation;
(g) changes in the pre-project destination or final fate of the waste stream; and
(h) any other attributable off-site emission increase identified through application of the Leakage Management Tool.

Where the project diverts material from an existing energy-recovery application, the Project Holder shall determine whether the previous user replaces the diverted material with a fossil fuel or another fuel whose use results in increased emissions. Any such increase shall be quantified as leakage.

Double issuance, double use, double claiming, unclear claim ownership, and undocumented final fate are accounting-integrity failures and shall not be treated solely as greenhouse gas leakage. Where these issues cannot be resolved through traceability, contractual evidence, Registry controls, and application of the Avoiding Double Counting Tool, the affected quantity of alternative fuel and the associated emission reductions shall be ineligible.

Where a material leakage source cannot be reliably quantified, the Project Holder shall apply a conservative approach approved under the applicable BioCarbon Tools. An arbitrary leakage deduction shall not be used to compensate for the absence of essential evidence. Where the uncertainty could materially overstate emission reductions, the affected reductions shall not be credited.

### 10.6 Route- and module-specific boundaries

For Route A, the project boundary shall include the kiln system and all relevant fuel-combustion and fuel-feeding equipment directly associated with clinker or quicklime manufacture. Any dryer or other thermal unit may be included under Route A only where it forms an integral part of the clinker or quicklime thermal process. Other thermal equipment located at a cement installation shall be assessed under Route B.

Carbonate decomposition and other industrial process emissions shall not form part of the credited baseline emissions under BCR0019. Where the alternative fuel changes calcination conditions, raw-material input, clinker chemistry, product composition, or another factor that materially affects process emissions, the incremental emissions shall be quantified as project emissions or the Project Holder shall demonstrate that no material change occurred.

For Route B — Other industrial thermal processes, the project boundary shall encompass the specific furnace, kiln, boiler, dryer, heater, steam-generation unit, or comparable thermal equipment in which fossil fuel substitution occurs, together with the industrial process or output parameter used to demonstrate equivalent industrial service.

Where thermal energy is distributed through a common steam, hot-gas, or thermal-fluid network, the boundary shall include all relevant generation, distribution, metering, and end-use points required to isolate the thermal service attributable to the included project equipment. Allocation between eligible and non-eligible users shall be based on direct measurement or another conservative and verifiable method.

For Supplementary Module C, the project boundary shall be the boundary established under the linked Route A or Route B component and shall additionally cover the evidence and controls required to demonstrate:

(a) final reception and acceptance of the alternative fuel;
(b) storage and feeding;
(c) actual consumption in the authorized unit;
(d) controlled combustion or co-processing conditions;

(e) air-pollution control systems materially affected by the project;
(f) final management or product incorporation of residues; and
(g) complete final-fate reconciliation.

Supplementary Module C shall not create a separate GHG accounting boundary.

## 10.7 Multiple installations and project components

A project activity may include multiple alternative-fuel production facilities, industrial recipients, production lines, thermal units, or jurisdictions, provided that each component:

(a) meets the applicability conditions independently;
(b) has a clearly defined physical and accounting boundary;
(c) applies the appropriate methodological route;
(d) maintains separate and reconcilable activity data;
(e) measures or conservatively determines fossil fuel displacement;
(f) quantifies project emissions and leakage separately; and
(g) can be independently validated and verified.

Emission reductions shall be calculated separately for each industrial installation, production line, or thermal unit before aggregation.

The Project Holder shall not transfer baseline performance, fuel properties, substitution rates, process-efficiency values, or monitoring results between installations unless their technical equivalence and representativeness are demonstrated.

Where material or fuel is transferred between included project components, the transfer shall be recorded once and reconciled so that the same quantity is not treated as consumed by more than one industrial recipient.

## 10.8 Boundary with BCR0018 and other methodologies

Where BCR0019 is applied in connection with BCR0018, avoided methane generation and other upstream waste-diversion benefits shall remain outside the BCR0019 greenhouse gas accounting boundary.

The BCR0019 boundary shall begin with the emission sources required to produce, prepare, supply, and use the alternative fuel and shall end with its actual industrial consumption and the final fate of associated residues. The traceability boundary shall nevertheless extend to the original waste source and pre-project destination so that eligibility, waste hierarchy, additionality, leakage, and double-counting risks can be assessed.

Any emission source shared between BCR0018 and BCR0019, including sorting, preparation, drying, electricity consumption, transport, storage, handling, rejects, or residue treatment, shall be transparently allocated and accounted for once.

Where the Project Holder cannot separate the respective boundaries, datasets, mitigation outcomes, project emissions, leakage sources, or claim ownership, the combined application of the methodologies shall not be permitted.

Where BCR0019 is combined with an energy-efficiency, renewable-energy, industrial-process, or other mitigation methodology at the same installation, the Project Holder shall define separate accounting boundaries and isolate the effect of each intervention. The same reduction in fossil fuel consumption shall not be attributed simultaneously to fuel substitution and another mitigation activity.

### 10.9 Temporal boundary and stock reconciliation

Emission reductions under BCR0019 shall be quantified ex post and only for alternative fuel demonstrated as actually consumed during the relevant monitoring period.

Project emissions associated with the production, preparation, transport, storage, or handling of a batch shall be allocated to the monitoring period in which that batch is consumed, unless another allocation approach is technically justified, consistently applied, and conservative.

Opening and closing stocks of waste-derived material and alternative fuel shall be measured or conservatively estimated and reconciled. Quantities remaining in storage at the end of a monitoring period shall not generate emission reductions until their actual eligible consumption is demonstrated.

Quantities rejected, lost, spilled, degraded, transferred, returned, exported, diverted to another use, or sent for treatment or disposal shall be deducted from the quantity eligible for crediting and their associated emissions shall be accounted for where material.

Where emissions from residue treatment or another project-related activity occur after the monitoring period in which the alternative fuel was consumed, they shall be attributed to the relevant credited quantity using a verifiable and conservative approach.

### 10.10 Boundary documentation

The project documentation shall include:

(a) a geographic map identifying all relevant sites and facilities;
(b) a process-flow diagram showing material, fuel, energy, product, reject, and residue flows;
(c) identification of each methodological route and thermal unit;
(d) the location and function of each measurement point;
(e) the chain-of-custody and batch-identification system;
(f) the baseline, project, and leakage emission sources;
(g) the inclusion or exclusion status of each potential emission source and the technical justification for any exclusion;
(h) the mass- and energy-balance boundaries;

(i) the reference output parameter used to demonstrate equivalent industrial service;
(j) the entities responsible for each stage of the alternative-fuel chain;
(k) any interface with BCR0018 or another methodology; and
(l) the procedures used to prevent omissions, overlaps, double issuance, double use, and double claiming.

The project boundary shall be reassessed at each verification and whenever there is a material change in waste origin, fuel composition, preparation facilities, transport routes, industrial recipient, thermal equipment, production process, monitoring system, residue-management practice, or application of another methodology.

## 10.11 Project boundary matrices

The tables in this section summarize the minimum greenhouse gas sources, gases, physical components, and accounting treatment applicable under BCR0019. The Project Holder shall reproduce and complete these tables in the Project Document for each industrial installation, production line, thermal unit, and methodological route included in the project activity.

The following status codes apply:

I — Included: the source shall be quantified.

C — Conditionally included: the source shall be quantified where it is applicable or material. Any exclusion shall be justified and validated.

R — Reported separately: the source shall be quantified and disclosed but shall not be included in the net emission-reduction calculation.

A — Accounted through another term: the source or parameter is included through another equation, normalization procedure, or incremental calculation and shall not be added separately.

EC — Eligibility control: the issue is not quantified as a leakage source. The affected quantity is ineligible unless the applicable eligibility condition is satisfied or the issue is resolved through the evidence and program controls required by this methodology.

E — Excluded: the source shall not be credited or included in the applicable calculation.

A source not expressly listed in the following tables shall be added where it is attributable to the project activity and could materially affect the net greenhouse gas result. Project-specific sources shall not be excluded solely because they are not expressly identified in this methodology.

Table 1. Baseline emission sources and accounting treatment

| Baseline activity or source | GHG | Status | Applicable Route/Module | Accounting treatment and justification |
|---|---|---|---|---|
| Combustion of the fossil fuel or fossil-fuel mix demonstrably displaced in the eligible thermal unit | $CO_2$ | I | A, B | Included in $BE_{FF,u,y}$. Only the quantity credibly required to provide the equivalent industrial service may be included. |
| Combustion of the displaced baseline fossil fuel | $CH_4$ | C | A, B | Included only where representative technology- and fuel-specific factors are available and their inclusion results in a complete and symmetrical comparison. Otherwise, baseline $CH_4$ shall be set to zero. |
| Combustion of the displaced baseline fossil fuel | $N_2O$ | C | A, B | Included only where representative technology- and fuel-specific factors are available and their inclusion results in a complete and symmetrical comparison. Otherwise, baseline $N_2O$ shall be set to zero. |
| Alternative fuel that would already have been consumed under the validated baseline scenario | $CO_2$, $CH_4$, $N_2O$ | A | A, B | Accounted through $E_{AF,BL,u,y}$, $SEC_{AF,BL,u,y}$, and the determination of incremental alternative-fuel use. It shall not generate emission reductions. |
| Electricity, recovered heat, biomass, or another non-fossil energy source that would have been used in the baseline thermal process | $CO_2e$ | A | A, B | Accounted for through baseline normalization, $SEC_{OTH,BL,u,y}$, $EC_{BL,s,y}$, or the determination of incremental project emissions. It shall not be treated as displaced fossil fuel. |
| Baseline industrial process emissions that may be affected by the alternative fuel | $CO_2$ and other applicable GHGs | A | A, B | Used only as the comparator for determining incremental project process emissions under $PE_{PROC,y}$. Reductions in process emissions are not credited under BCR0019. |
| Extraction, production, refining, processing, and distribution of the displaced fossil fuel | $CO_2e$ | E | A, B | Excluded conservatively. Avoided upstream fossil-fuel supply emissions shall not generate emission reductions under BCR0019. |
| Transport of the displaced fossil fuel to the industrial installation | $CO_2e$ | E | A, B | Excluded unless a specific symmetrical procedure is expressly approved under this methodology. Its exclusion is conservative. |

| Baseline activity or source | GHG | Status | Applicable Route/Module | Accounting treatment and justification |
|---|---|---|---|---|
| Avoided methane generation at solid waste disposal sites | $CH_4$ | E | A, B, M-C | Outside the BCR0019 accounting boundary. Such emissions may be quantified under BCR0018, where applicable. |
| Avoided emissions from waste collection, sorting, treatment, recycling, composting, disposal, or other upstream waste-management activities | $CO_2$, $CH_4$, $N_2O$ | E | A, B, M-C | Outside the credited mitigation outcome of BCR0019. |
| Avoided emissions from production of virgin materials or material substitution | $CO_2e$ | E | A, B, M-C | Not credited under this methodology. |
| Carbonate decomposition or other industrial process emissions unrelated to the fuel substitution activity | $CO_2$ and other applicable GHGs | E | A, B | Excluded from baseline emissions under BCR0019. Any increase caused by the project shall nevertheless be included as a project emission. |
| Avoided grid electricity generation, exported electricity, exported heat, or recovered-energy benefits | $CO_2e$ | E | A, B, M-C | Not credited under BCR0019. Such outcomes require a separate approved methodology, where applicable. |

Table 2. Project emission sources and accounting treatment

| Project activity or source | GHG | Status | Applicable Route/Module | Accounting treatment and justification |
|---|---|---|---|---|
| Combustion of the fossil carbon fraction of the eligible alternative fuel | $CO_2$ | I | A, B, M-C | Included in $PE_{AF,CO_2,y}$ using measured combustible carbon and fossil carbon fraction. |
| Combustion of an unidentified or undetermined carbon fraction | $CO_2$ | I | A, B, M-C | The unidentified carbon fraction shall be treated as fossil carbon. |

| Project activity or source | GHG | Status | Applicable Route/Module | Accounting treatment and justification |
|---|---|---|---|---|
| Combustion of the demonstrably biogenic carbon fraction | $CO_2$ | R | A, B, M-C | Quantified as $BIOCO_{2,y}$ and reported separately only where the requirements of Section 13.7.3 are met. Where biogenic origin or eligibility cannot be demonstrated, the affected carbon shall be included in $f_{UC,b,y}$ and treated as fossil carbon. |
| Release of inorganic carbon contained in the alternative fuel | $CO_2$ | C | A, B, M-C | Included in $PE_{IC,y}$ where process conditions may release the inorganic carbon and the source is material. |
| Combustion of the eligible alternative fuel | $CH_4$ | I | A, B, M-C | Included using representative emission factors or validated direct stack measurement. |
| Combustion of the eligible alternative fuel | $N_2O$ | I | A, B, M-C | Included using representative emission factors or validated direct stack measurement. |
| Residual, start-up, stabilization, support, or pilot fossil fuel consumed in the eligible thermal unit | $CO_2$, $CH_4$, $N_2O$ | A | A, B, M-C | Included in $E_{FF,PJ,u,y}$ and the fossil-fuel displacement calculation. It shall not be added again as a separate project emission. |
| Additional fossil fuel consumed outside the eligible thermal unit for preparation, handling, pollution control, or residue management | $CO_2$, $CH_4$, $N_2O$ | I | A, B, M-C | Included in $PE_{FC,y}$ to the extent that consumption is incremental to the baseline. |
| Sorting, shredding, drying, blending, densification, homogenization, or other alternative-fuel preparation | $CO_2$, $CH_4$, $N_2O$ | I | A, B, M-C | Incremental fuel and electricity emissions shall be included in $PE_{FC,y}$, $PE_{EL,y}$, or another applicable project-emission term. |
| Incremental electricity consumption | $CO_2e$ | I | A, B, M-C | Included in $PE_{EL,y}$, net of baseline electricity consumption for equivalent output where applicable. |
| Transport of waste-derived material, alternative fuel, rejects, ash, dust, slag, or other residues | $CO_2$; $CH_4$ and $N_2O$ only where required under another approved transport-emission procedure. | I | A, B, M-C | Included in $PE_{TR,y}$ for project-attributable transport movements. |

| Project activity or source | GHG | Status | Applicable Route/Module | Accounting treatment and justification |
|---|---|---|---|---|
| Storage, degradation, self-heating, fire, spillage, or handling loss | $CO_2$, $CH_4$, $N_2O$ | C | A, B, M-C | Included in $PE_{ST,y}$ where material. Fuel affected by undocumented or uncontrolled combustion shall be ineligible. |
| Treatment, recovery, transport, or disposal of rejects and combustion residues | $CO_2$, $CH_4$, $N_2O$ | C | A, B, M-C | Included in $PE_{RM,y}$ where material. No recycling, mineral-substitution, or avoided-disposal credit may be claimed. |
| Incremental carbonate decomposition or other industrial process emissions caused by the alternative fuel | $CO_2$ and other applicable GHGs | C | A, B, M-C | Included in $PE_{PROC,y}$ where material. $CO_2$ released from inorganic carbon contained in the alternative fuel and already accounted for under $PE_{IC,y}$ shall not be included in $PE_{PROC,y}$. |
| Additional operation of air-pollution control systems | $CO_2e$ | A | A, B, M-C | Accounted through incremental electricity, fossil-fuel, reagent, and residue-management emissions. |
| Other project-attributable greenhouse gas source | Applicable GHG | C | A, B, M-C | Included in $PE_{OTH,y}$ where material. |
| Avoided fossil-fuel extraction, refining, or distribution | $CO_2e$ | E | A, B, M-C | Not credited. |
| Avoided waste disposal, recycling, material recovery, or virgin-material production | $CO_2e$ | E | A, B, M-C | Not credited. |
| Exported electricity, exported heat, or recovered-energy displacement | $CO_2e$ | E | A, B, M-C | Not credited under BCR0019. |
| Air pollutants that are not greenhouse gases, including particulate matter, $NO_x$, $SO_x$, HCl, HF, dioxins, furans, or heavy metals | Not applicable | E | A, B, M-C | Excluded from the GHG calculation but subject to legal compliance, safeguards, operating controls, and monitoring requirements. |

Table 3. Leakage sources and accounting treatment

| Potential leakage source | GHG | Status | Applicable Route/Module | Accounting treatment and justification |
|---|---|---|---|---|
| Diversion from reuse, preparation for reuse, | Not applicable | EC | A, B, M-C | The affected material quantity is ineligible in accordance with Section |

| Potential leakage source | GHG | Status | Applicable Route/Module | Accounting treatment and justification |
|---|---|---|---|---|
| recycling, or material recovery | | | | 13.8.3. A leakage deduction shall not be used to preserve eligibility. |
| Diversion of alternative fuel or waste-derived material from an existing energy-recovery user | $CO_2$, $CH_4$, $N_2O$ | I | A, B, M-C | Replacement energy emissions at the displaced user shall be quantified under $LE_{EU,h,y}$. |
| Production or acquisition of replacement fuel or material by an affected third party | $CO_2$, $CH_4$, $N_2O$ | I | A, B, M-C | Included where causally attributable to the project activity. |
| Additional off-site preparation, treatment, storage, or transport not included in project emissions | $CO_2$, $CH_4$, $N_2O$ | I | A, B, M-C | Included in $LE_y$ and not duplicated in $PE_y$. |
| Displacement of waste or fuel flows to another facility, region, or jurisdiction | $CO_2$, $CH_4$, $N_2O$ | I | A, B, M-C | The net attributable increase in emissions shall be quantified. |
| Transfer, outsourcing, or relocation of industrial output or fossil-fuel consumption | $CO_2$, $CH_4$, $N_2O$ | I | A, B | Included where the apparent fossil-fuel reduction is caused by transfer of production or energy consumption rather than genuine displacement. |
| Temporary deferral of fossil-fuel combustion or transfer of fossil-fuel inventories | $CO_2$, $CH_4$, $N_2O$ | I | A, B | The affected quantity shall be deducted from displacement or included as leakage. It shall not generate emission reductions. |
| Off-site treatment or disposal of rejected alternative fuel, ash, dust, slag, or other residues | $CO_2$, $CH_4$, $N_2O$ | I | A, B, M-C | Included where not already accounted for as a project emission. |
| Material market-mediated effect on alternative-fuel, recyclable-material, or replacement-fuel supply | $CO_2$, $CH_4$, $N_2O$ | C | A, B, M-C | Included only where the affected market actor, replacement activity, causal relationship, and resulting emission increase can be identified and quantified with sufficient reliability. Otherwise, the affected quantity shall be ineligible where the risk is material. |
| Unresolved double issuance, double use, double claiming, or competing claim ownership | Not applicable | EC | A, B, M-C | Not treated as leakage. The affected quantity shall be ineligible. |

| Potential leakage source | GHG | Status | Applicable Route/Module | Accounting treatment and justification |
|---|---|---|---|---|
| Undocumented final fate or failure of chain of custody | Not applicable | EC | A, B, M-C | Not treated through a percentage deduction. The affected quantity shall be ineligible. |
| Material leakage source that cannot be reliably quantified | Applicable GHG | EC | A, B, M-C | The affected quantity shall be ineligible where the uncertainty could materially overstate emission reductions. |

Table 4. Primary-route and supplementary-module physical boundary components

| Boundary component | Route A: Clinker and quicklime manufacture | Route B: Other industrial thermal processes | Supplementary Module C: Co-processing and controlled final use |
|---|---|---|---|
| Waste-derived material source | Included in the traceability boundary and in the GHG boundary where attributable emissions occur | Included in the traceability boundary and in the GHG boundary where attributable emissions occur | Included through the linked Route A or Route B component |
| Alternative-fuel preparation facility | Sorting, shredding, drying, blending, densification, storage, and quality control, as applicable | Sorting, shredding, drying, blending, densification, storage, and quality control, as applicable | Mandatory where preparation occurs before controlled combustion or co-processing |
| Transport and intermediate storage | Included where project-attributable | Included where project-attributable | Included and reconciled to the final recipient |
| Eligible thermal equipment | Kiln, main burner, pre-calciner, calciner, preheater, dryer, or associated thermal unit | Furnace, kiln, boiler, dryer, heater, calciner, roasting unit, steam generator, or comparable thermal equipment | The authorized controlled-combustion or co-processing unit linked to Route A or Route B |
| Fuel reception, storage, metering, and feeding | Included | Included | Mandatory and subject to final-fate reconciliation |
| Reference industrial output | Clinker or quicklime. Cement output may be used only where it provides an equivalent, direct, and conservative representation of the relevant thermal service. | Useful thermal energy, steam, product mass, treated material, dried material, evaporated water, or another validated parameter | Same reference output as the linked Route A or Route B component |
| Residual fossil-fuel system | Included | Included | Included through the linked Route A or Route B component |
| Electricity and auxiliary-energy systems | Included where affected by the project | Included where affected by the project | Included where affected by the project |

| Boundary component | Route A: Clinker and quicklime manufacture | Route B: Other industrial thermal processes | Supplementary Module C: Co-processing and controlled final use |
|---|---|---|---|
| Industrial process emissions | Incremental changes in carbonate decomposition, raw-material chemistry, or clinker chemistry included where material, excluding inorganic carbon already accounted for under $PE_{IC,y}$ | Incremental process-emission changes included where material | Included through the linked Route A or Route B component |
| Air-pollution control | Included where materially affected | Included where materially affected | Mandatory operating and compliance evidence |
| Rejects, ash, dust, slag, and residues | Included through final management or documented product incorporation | Included through final management | Complete reconciliation of final fate is mandatory |
| Final fate of alternative fuel | Actual consumption in the identified kiln or thermal unit | Actual consumption in the identified industrial thermal unit | Actual controlled combustion or co-processing in the authorized unit |
| Interface with BCR0018 | Included where the same physical waste stream is linked to BCR0018 | Included where the same physical waste stream is linked to BCR0018 | Mandatory disclosure where the upstream waste-diversion outcome is credited separately |
| Independent accounting boundary | Required for each kiln, production line, or separately quantifiable unit | Required for each furnace, boiler, dryer, production line, or separately quantifiable unit | Supplementary Module C shall not establish an independent emission-reduction boundary. |

# 11 Project activities

## 11.1 Nature of the project activity

The project activity consists of the measurable and verifiable partial or complete substitution of one or more baseline fossil fuels with eligible RDF, SRF, CSS, CSR, or comparable non-hazardous waste-derived fuels in an identified industrial thermal process.

For the purposes of BCR0019, the mitigation activity occurs when the eligible alternative fuel is actually consumed and displaces fossil fuel combustion while providing an equivalent industrial service. The production, processing, sale, transport, delivery, reception, or storage of an alternative fuel shall not, by itself, constitute an eligible project activity or generate emission reductions.

The project activity shall result in a physical change in the fuel mix used by the eligible thermal equipment. This change shall be attributable to the project and shall be demonstrated through measured fuel consumption, fuel characteristics, operating data, and the applicable mass and energy balances.

The project activity may include supporting infrastructure and operational measures necessary to enable fossil fuel substitution, provided that all associated emissions and material effects are included in the project accounting boundary.

## 11.2 Eligible implementation measures

Eligible project activities may include one or more of the following measures:

(a) installation or modification of systems for receiving, inspecting, sampling, storing, conveying, metering, and feeding eligible alternative fuels;
(b) modification or retrofit of burners, combustion chambers, kilns, furnaces, calciners, boilers, dryers, heaters, or associated thermal equipment to enable controlled use of the alternative fuel;
(c) installation or modification of fuel-preparation equipment, including sorting, shredding, drying, blending, homogenization, densification, or contaminant-removal systems;
(d) implementation of combustion-control, process-control, and fuel-quality management systems required to maintain stable and efficient operation;
(e) modification or installation of air-pollution control equipment where required by the characteristics of the alternative fuel or applicable law;
(f) establishment of alternative-fuel supply, chain-of-custody, batch-traceability, mass-balance, and final-fate control systems;
(g) implementation of calibrated metering, laboratory testing, automated data acquisition, or optional dMRV systems;
(h) operational changes that increase the share of eligible alternative fuel in the thermal-energy input while maintaining equivalent industrial service; and
(i) co-processing arrangements in which the combustible fraction of the alternative fuel provides process heat and, where applicable, the mineral fraction is incorporated into the industrial product or managed as a process residue.

The implementation of any supporting measure shall not generate emission reductions unless actual and attributable fossil fuel displacement is demonstrated.

## 11.3 Route A: Clinker and quicklime manufacture

Under Route A, eligible project activities include the partial or complete substitution of fossil fuels used in clinker or quicklime manufacture through the controlled consumption of eligible alternative fuels.

The alternative fuel may be introduced through the main kiln burner, pre-calciner, calciner, preheater system, kiln inlet, dryer, or another identified thermal input point, provided that the point of consumption and its relationship with fossil fuel displacement can be independently verified.

The project activity may involve:

(a) introducing an eligible alternative fuel into a production line that previously used only fossil fuels;
(b) increasing the verified thermal substitution rate above the credible baseline level;
(c) substituting a fossil fuel with a different combination of residual fossil fuel and eligible alternative fuel; or
(d) modifying fuel-feeding or combustion systems to enable the controlled and measurable use of the alternative fuel.

Emission reductions under Route A shall arise solely from fossil fuel displacement. Changes in clinker ratio, cement blending, raw-material composition, carbonate decomposition, process chemistry, mineral incorporation, product formulation, or electricity generation shall not be credited under BCR0019.

Where the alternative fuel affects thermal efficiency, kiln stability, clinker or quicklime quality, specific heat consumption, auxiliary fuel use, electricity consumption, or production output, the effect shall be monitored and reflected in the quantification.

### 11.4 Route B: Other industrial thermal processes

Under Route B, eligible project activities include the partial or complete substitution of fossil fuels in industrial thermal equipment outside clinker or quicklime manufacture.

Eligible applications may include, where all applicability and monitoring requirements are met:

(a) industrial boilers producing steam, hot water, hot gases, or thermal fluids for industrial use;
(b) furnaces and kilns used in the production or processing of ceramics, bricks, glass, minerals, metals, food products, chemicals, or other industrial materials;
(c) dryers used for industrial products, raw materials, minerals, agricultural products, or other process streams;
(d) heaters, calciners, roasting units, curing units, melting systems, or comparable thermal equipment; and
(e) integrated thermal-energy systems supplying an identifiable industrial process or group of metered industrial users.

The project activity shall identify a technically appropriate reference output parameter capable of demonstrating equivalent industrial service. Depending on the process, this may include useful thermal energy, steam output, product mass, treated-material mass, dried-material output, evaporated water, standardized operating hours, or another measurable and technically justified parameter.

The project activity shall not derive emission reductions merely from a reduction in fossil fuel consumption at facility level. The Project Holder shall demonstrate that the reduction is attributable to the eligible alternative fuel rather than to lower production, reduced operating time, energy-efficiency improvements, changes in product mix, outsourcing, equipment shutdown, or another unrelated cause.

### 11.5 Supplementary Module C: Co-processing and controlled final use

Supplementary Module C adds final-use controls to an eligible Route A or Route B project activity.

Its application shall demonstrate that each credited alternative-fuel quantity:

(a) meets the applicable acceptance criteria;
(b) is legally eligible and non-hazardous;
(c) is received by the identified industrial recipient;
(d) is introduced into and consumed by the authorized thermal unit;
(e) provides a measurable contribution to the industrial thermal service;
(f) is used under controlled operating conditions;
(g) is fully reconciled through the chain-of-custody and mass-balance systems; and
(h) has a documented final fate, including the management or incorporation of associated residues.

Supplementary Module C shall not credit waste destruction, waste-volume reduction, pollutant destruction, mineral incorporation, or avoided disposal. Its mitigation outcome remains the fossil-fuel displacement quantified under the linked primary route.

### 11.6 Existing, expanded, and new industrial installations

BCR0019 may be applied to:

(a) an existing industrial installation introducing an eligible alternative fuel for the first time;
(b) an existing installation increasing alternative-fuel use above a demonstrated baseline level;
(c) an existing production line undergoing retrofit or modification;
(d) an expansion of an existing industrial installation; or
(e) a new industrial installation, subject to the specific requirements of this section.

For an existing installation, the project activity shall distinguish between the historical use of alternative fuels and the incremental substitution attributable to the project. Alternative-fuel use already occurring in the baseline scenario shall not be credited.

For expanded or new capacity, the Project Holder shall not assume that the baseline consists of the fossil fuel selected in the project design. The baseline shall be established through an assessment of credible technical alternatives, applicable laws and policies, available fuels,

prevailing and best-performing technologies, investment conditions, and the risk of fossil-fuel or waste-management lock-in.

Emission reductions associated with new or expanded capacity shall be eligible only where:

(a) the fossil-fuel baseline is demonstrated as the most credible scenario in the absence of the project activity;
(b) the baseline does not reward the selection of an unnecessarily carbon-intensive technology or fuel;
(c) lower-emission technically feasible alternatives have been assessed;
(d) the applicable baseline procedure includes any required downward adjustment or performance benchmark;
(e) the project does not create or prolong fossil-fuel dependence inconsistent with credible sectoral decarbonization pathways;
(f) the project does not create minimum waste-throughput obligations or other incentives that undermine waste prevention, reuse, or recycling; and
(g) the mitigation outcome remains additional and attributable to the project activity.

Where these conditions cannot be demonstrated, new or expanded capacity shall not be eligible under this methodology.

### 11.7 Changes in alternative-fuel use

Where an installation used alternative fuels before the project start date, only the incremental fossil fuel substitution above the applicable baseline level may be credited.

The baseline level of alternative-fuel use shall be established using historical consumption, operating conditions, production data, contractual commitments, legal requirements, common practice, and other relevant evidence in accordance with the Baseline and Additionality Tool.

Temporary reductions in alternative-fuel use during the baseline period shall not be used to create an artificially low baseline. Temporary shutdowns, supply interruptions, exceptional maintenance, industrial disputes, abnormal market conditions, or other non-representative circumstances shall be identified and treated conservatively.

A change from one alternative fuel to another shall not generate emission reductions unless it results in additional and verifiable displacement of baseline fossil fuel and the net greenhouse gas effect is positive after accounting for changes in fuel composition, fossil carbon fraction, preparation, transport, combustion, residues, and leakage.

### 11.8 Multiple fuels, units, and industrial recipients

A project activity may include multiple baseline fossil fuels, alternative fuels, thermal units, production lines, or industrial recipients.

For each included component, the Project Holder shall identify:

(a) the applicable primary route and, where applicable, Supplementary Module C;
(b) the applicable baseline fuel or fuel mix;
(c) the alternative fuel consumed;
(d) the fossil and biogenic fractions;
(e) the relevant reference output parameter;
(f) the quantity of fossil fuel displaced;
(g) project emissions;
(h) leakage;
(i) uncertainty and conservative adjustments; and
(j) emission reductions.

Calculations shall be performed separately for each materially different installation, thermal unit, fuel type, or operating configuration before aggregation.

The same quantity of alternative fuel shall not be allocated to more than one thermal unit, industrial recipient, project activity, methodology, monitoring period, or mitigation claim.

## 11.9 Non-creditable activities and outcomes

The following activities or outcomes shall not generate emission reductions under BCR0019:

(a) production, certification, sale, purchase, transport, delivery, or storage of alternative fuel without demonstrated eligible consumption;
(b) avoided methane emissions or other upstream benefits from diversion of waste from solid waste disposal sites;
(c) waste prevention, reuse, recycling, composting, material recovery, or avoided production of virgin materials;
(d) combustion of hazardous waste;
(e) open burning, uncontrolled combustion, or combustion in unauthorized equipment;
(f) incineration or thermal treatment without measurable fossil fuel displacement and useful industrial thermal output;
(g) displacement of biomass, electricity, recovered heat, or another non-fossil energy source;
(h) reductions arising from lower production, equipment shutdown, transfer of production, deterioration of product quality, or reduced industrial service;
(i) energy-efficiency improvements not quantified under an applicable approved methodology;
(j) reductions in industrial process emissions unrelated to fossil fuel combustion;
(k) avoided upstream emissions from extraction, refining, production, or transport of fossil fuels, unless expressly quantified under this methodology;

(l) temporary or nominal substitution that cannot be demonstrated through actual fuel consumption and operating records;
(m) use of alternative fuel that diverts material from preparation for reuse, reuse, recycling, material recovery, or another demonstrably higher-order use;
(n) activities that deliberately increase waste generation or reduce source separation to secure alternative-fuel supply;
(o) activities that depend on contractual minimum waste quantities or other arrangements creating material waste-management lock-in;
(p) activities for which the final fate of the alternative fuel cannot be demonstrated; and
(q) any quantity or mitigation outcome subject to unresolved double issuance, double use, double claiming, or competing ownership claims.

### 11.10 Integrity of the project activity

The Project Holder shall demonstrate that the project activity constitutes a real operational intervention and not solely an accounting, contractual, or ownership rearrangement.

A change in the identity of the waste owner, alternative-fuel supplier, industrial recipient, Project Holder, or holder of the environmental attribute shall not constitute a project activity unless it is accompanied by additional and measurable fossil fuel substitution.

The project activity shall be designed and operated so that the resulting emission reductions are:

(a) real and physically supported by measured fuel and process data;
(b) additional to the applicable baseline and legal requirements;
(c) attributable to the project intervention;
(d) calculated ex post;
(e) net of project emissions, leakage, and conservative adjustments;
(f) traceable to the relevant batch, installation, and monitoring period;
(g) independently verifiable; and
(h) free from double issuance, double use, and double claiming.

## 12 Baseline scenario and additionality

### 12.1 General requirements

The Project Holder shall identify the baseline scenario and demonstrate the additionality of the project activity through the full application of the applicable version of the BioCarbon Baseline and Additionality Tool (BAT).

The BAT shall govern the sequence of the assessment, evidentiary requirements, prior consideration of carbon crediting, regulatory surplus, barrier and investment analysis, common practice, selection of the baseline scenario, and the additionality conclusion.

The provisions of this section are methodology-specific requirements that complement, but do not replace, the BAT. No baseline or additionality procedure contained in ACM0003, another CDM methodology, or another external framework shall substitute application of the BAT.

The baseline scenario and additionality shall be determined separately for each materially different industrial installation, production line, kiln system, thermal unit, project component, or independently implementable investment decision.

### 12.2 BCR0019-specific application of the BAT

Project activities applying BCR0019 ordinarily involve material costs, revenues, or savings other than carbon-credit revenues. These may include fossil-fuel savings, alternative-fuel purchase or preparation costs, gate or tipping fees, avoided waste-disposal costs, subsidies, transport costs, equipment investment, additional operating costs, and residue-management costs.

Accordingly, investment analysis shall be mandatory unless the project activity qualifies for and applies a simplified procedure expressly permitted under the BAT.

Barrier analysis may supplement the investment analysis but shall not replace it, except where expressly permitted under the BAT.

Common practice analysis shall be mandatory.

The Project Holder shall demonstrate that carbon-credit revenues have a material and determinative effect on the implementation of the eligible fossil-fuel substitution, including its scale, timing, duration, or thermal substitution level.

Where the carbon-credit revenues accrue to an entity other than the entity making the industrial fuel-substitution decision, binding contractual evidence shall demonstrate how the revenues or equivalent economic benefits reach or support that decision-making entity.

### 12.3 Identification of alternative scenarios

The alternative-scenario assessment shall include, as applicable:

(a) implementation of the proposed project activity without carbon-credit revenues;
(b) continuation of the existing fossil-fuel mix and historical alternative-fuel use;
(c) fossil-fuel substitution at a level required by law, permit, binding contract, or prevailing practice;
(d) another technically feasible fuel-switching configuration;
(e) energy-efficiency improvement;
(f) electrification;
(g) renewable heat, recovered heat, eligible biomass, or another lower-emission energy source;

(h) replacement, retirement, or substantial modification of the relevant equipment;
(i) for new or expanded capacity, alternative process designs and best-performing available technologies; and
(j) provision of the equivalent industrial service by another installation, where realistic.

Each alternative shall be assessed on a consistent basis and shall provide an equivalent industrial service or output.

The pre-project destination of the waste-derived material shall be assessed for eligibility, waste hierarchy, leakage, and double-counting purposes. Avoided waste-management emissions shall not form part of the BCR0019 baseline emissions.

### 12.4 Investment and common practice analysis

The investment analysis shall include all material costs, revenues, savings, incentives, and economic effects attributable to the project activity, including:

(a) engineering, permitting, construction, retrofit, and commissioning;
(b) fuel reception, preparation, storage, conveying, feeding, and combustion systems;
(c) air-pollution control and monitoring equipment;
(d) changes in thermal efficiency, maintenance, refractory wear, corrosion, cleaning, shutdowns, equipment availability, and product quality;
(e) alternative-fuel purchase, preparation, transport, sampling, laboratory, traceability, and residue-management costs;
(f) avoided fossil-fuel expenditure;
(g) gate fees, tipping fees, acceptance fees, and avoided disposal costs;
(h) subsidies, grants, tax benefits, concessional finance, and other incentives; and
(i) revenues or losses associated with products, by-products, recovered material, or other outputs.

The financial model shall use information available at the project decision date and shall be provided in an editable and unprotected format with visible assumptions, formulas, evidence, and sensitivity analysis.

The common practice analysis shall compare the proposed activity with installations that are comparable in industrial subsector, product, process, equipment configuration, capacity, baseline fuel mix, alternative-fuel availability, regulatory context, and implementation period.

The analysis shall assess both the prevalence of alternative-fuel use and the distribution of thermal substitution rates. Nominal or materially lower alternative-fuel use shall not automatically be treated as comparable to the project activity.

For Route A, comparison shall be made with clinker or quicklime kiln systems of comparable configuration and scale.

For Route B, comparison shall be made with installations providing the same or a technically equivalent industrial thermal service.

Supplementary Module C shall not be subject to a separate additionality or common-practice assessment.

### 12.5 Selection and conservative calibration of the baseline

The baseline scenario shall be selected in accordance with the BAT.

Once the baseline scenario has been selected, the fuel mix, specific energy consumption, performance values, emission factors, alternative-fuel use, and other parameters applied under BCR0019 shall be conservatively calibrated to prevent overestimation of baseline emissions.

Where more than one credible value, fuel mix, or performance parameter remains within the selected baseline scenario, the combination that results in the lowest baseline emissions and lowest creditable emission reductions shall be used.

The baseline shall:

(a) provide an equivalent industrial service;
(b) reflect applicable laws, enforced policies, permits, taxes, subsidies, and binding commitments;
(c) incorporate historical and expected autonomous changes in fuel use, energy efficiency, technology, and industrial practice;
(d) consider the technical lifetime and expected replacement or retirement of the relevant equipment;
(e) avoid assuming continued use of an unnecessarily carbon-intensive fuel or technology where a credible lower-emission alternative would otherwise be implemented; and
(f) be quantitatively demonstrated to be conservatively set below applicable business-as-usual conditions.

Baseline conservativeness shall address counterfactual construction risk and shall remain separate from uncertainty adjustments and leakage deductions.

### 12.6 Existing, new, and expanded installations

For an existing installation, only incremental alternative-fuel use above the validated baseline level shall be eligible.

The baseline level shall not be lower than:

(a) representative historical alternative-fuel use;
(b) any legally required level;
(c) any level established by a pre-existing binding commitment; or

(d) a higher conservatively calibrated level required to reflect business-as-usual development, common practice, or autonomous technological change.

Temporary outages, supply interruptions, abnormal maintenance, industrial disputes, commissioning, or other non-representative conditions shall not be used to create an artificially high fossil-fuel baseline or artificially low alternative-fuel baseline.

For new or expanded capacity, a fully fossil-fueled design shall not be presumed to constitute the baseline solely because it is technically possible or was initially proposed.

The assessment shall consider technically and economically feasible lower-emission configurations, including best-performing technology, efficiency improvement, electrification, renewable or recovered heat, eligible biomass, alternative-fuel use without carbon revenues, and alternative production processes.

For an expansion, existing and incremental capacity shall be assessed separately unless their technical integration prevents reliable separation.

### 12.7 Route-specific baseline requirements

Under Route A, the baseline shall represent the conservatively calibrated fossil fuel or fuel mix that would have been consumed by the relevant clinker or quicklime kiln system. It shall account for kiln configuration, clinker or quicklime output, specific thermal-energy consumption, historical alternative-fuel use, and residual fossil-fuel use.

Cement blending, clinker ratio, raw-material composition, carbonate decomposition, and other industrial process outcomes shall not form part of credited baseline emissions under BCR0019.

Under Route B, the baseline shall represent fossil-fuel consumption required to provide the equivalent useful thermal energy, steam, product output, dried-material output, treated-material output, or other validated reference output.

The baseline shall be normalized for all variables materially affecting thermal demand.

Supplementary Module C shall use the baseline and additionality determination of the linked Route A or Route B component.

### 12.8 Lock-in and transition integrity

The baseline and additionality assessment shall evaluate fossil-fuel, carbon-intensive technology, and waste-management lock-in.

The project activity shall be ineligible where carbon-credit incentives would:

(a) extend operation of equipment that would otherwise be retired or replaced by a materially lower-emission alternative;
(b) support unnecessarily carbon-intensive new capacity;

(c) materially delay feasible electrification, renewable heat, recovered heat, or another lower-emission solution;
(d) establish minimum waste-throughput obligations that undermine waste prevention, reuse, or recycling;
(e) create an incentive to generate additional waste or reduce source separation; or
(f) divert material from a higher-order use.

### 12.9 Reassessment and documentation

The baseline scenario shall be reassessed in accordance with the BAT every seven years, at each renewal of the quantification period, and whenever a material change may affect the validity of the baseline or additionality conclusion.

Reassessment shall consider changes in laws, permits, policies, taxes, subsidies, fuel prices, fuel availability, technology, common practice, production conditions, equipment, lower-emission alternatives, carbon-revenue allocation, and contractual commitments.

Any revised baseline shall be applied prospectively in accordance with the BAT and the applicable BioCarbon program requirements.

The Project Document shall include:

(a) all realistic and credible alternative scenarios;
(b) the regulatory-surplus assessment;
(c) the investment analysis and sensitivity analysis;
(d) the common-practice analysis;
(e) the selected baseline and conservative calibration;
(f) baseline fuel mix, energy performance, alternative-fuel level, and reference output;
(g) the below-BAU demonstration;
(h) the lock-in assessment; and
(i) all required supporting evidence.

Failure to demonstrate either a valid baseline scenario or additionality shall render the affected project component ineligible.

## 13 Quantification of GHG Emission Reductions

### 13.1 General quantification approach

BCR0019 quantifies ex post greenhouse gas emission reductions resulting from the measurable and attributable displacement of fossil fuels in eligible industrial thermal processes through the consumption of eligible RDF, SRF, CSS, CSR, or comparable non-hazardous waste-derived fuels.

This methodology does not quantify carbon dioxide removals. It does not quantify avoided methane emissions from the diversion of waste from solid waste disposal sites, avoided waste-disposal emissions, avoided production of virgin materials, recycling benefits, or any other upstream waste-management outcome.

Emission reductions shall be calculated using measured activity data, representative fuel-characterization data, mass and energy balances, the validated baseline scenario, and the procedures established in this methodology and the applicable BioCarbon Tools.

The quantification shall be based only on alternative fuel demonstrated as actually consumed in an eligible industrial thermal process during the monitoring period. Alternative fuel produced, certified, purchased, sold, transported, delivered, received, or stored, but not demonstrated as consumed, shall not generate emission reductions.

The calculation shall distinguish:

(a) baseline greenhouse gas emissions from the fossil fuel demonstrably displaced by the project activity;
(b) project emissions associated with the preparation, supply, storage, handling, feeding, combustion, and final fate of the eligible alternative fuel;
(c) leakage emissions attributable to the project activity; and
(d) conservative adjustments required to address measurement uncertainty, sampling uncertainty, data gaps, allocation limitations, or other residual risks of overestimation.

Emission reductions shall be calculated separately for each materially different industrial installation, production line, thermal unit, baseline fossil fuel, alternative-fuel type, and methodological route before aggregation.

Where the project activity includes multiple industrial recipients, thermal units, production lines, or countries, each component shall be separately identifiable, measurable, traceable, and independently verifiable.

All greenhouse gas emissions shall be expressed in tonnes of carbon dioxide equivalent, $tCO_2e$. $CH_4$ and $N_2O$ emissions shall be converted using the Global Warming Potential values required by the applicable version of the BioCarbon Standard for the relevant vintage. Where host-country or authorized-use reporting requires a different GWP set, the alternative result shall be reported separately and shall not replace or be combined with the BioCarbon crediting calculation.

The Project Holder shall calculate emissions at the highest practicable temporal and operational resolution. Batch, fuel, unit-, and installation-specific calculations shall be used where the required data are available. Aggregated or average values shall not be used where their use could conceal material variability or overestimate emission reductions.

Baseline parameters applied under this section shall correspond to the validated baseline scenario determined in accordance with Section 12 and the BioCarbon Baseline and Additionality Tool. Any conservative calibration or downward adjustment already incorporated into the baseline shall not be applied again as an uncertainty deduction or leakage deduction.

## 13.2 Indices, calculation units, and notation

The following indices apply:

| | | |
|---|---|---|
| u | = | eligible industrial thermal unit, kiln system, production line, or separately quantifiable installation; |
| i | = | fossil fuel type; |
| b | = | alternative-fuel batch, lot, or separately characterized fuel stream; |
| p | = | project-related preparation, processing, auxiliary, handling, pollution-control, or residue-management activity; |
| s | = | electricity source or consumption point; |
| t | = | transport movement or transport category; |
| r | = | reject, ash, dust, slag, or other residue stream; |
| k | = | leakage source; |
| g | = | greenhouse gas species, limited to $CH_4$ or $N_2O$ where used in direct stack-emission calculations; |
| h | = | displaced energy user affected by diversion of an alternative fuel or waste-derived material; |
| m | = | another methodology or separately identifiable concurrent mitigation intervention; |
| x | = | applicable fossil-fuel mix, dataset, or reference case used to determine a conservative baseline emission factor; |
| y | = | year within the monitoring period; |
| MP | = | monitoring period. |

Unless otherwise specified:

M shall be expressed in tonnes of material on an as-received basis;

FC shall be expressed in tonnes, cubic meters, liters, or another directly measured fuel unit;

NCV shall be expressed in GJ per unit of fuel on a basis consistent with the corresponding fuel quantity;

E shall be expressed in GJ;

O shall be expressed in the applicable unit of industrial output or useful thermal service;

SEC shall be expressed in GJ per unit of industrial output or useful thermal service;

EF shall be expressed in $tCO_2e$ per GJ, $tCO_2e$ per MWh, $tCO_2e$ per tonne-kilometer, or another applicable activity unit;

All baseline, project, leakage, conservative-adjustment, and emission-reduction results shall be expressed in $tCO_2e$.

The reference output parameter $O_{u,y}$ shall be the parameter validated for the relevant Route A or Route B component. It may consist of clinker, quicklime, steam, useful thermal energy, product mass, mass of dried or treated material, evaporated water, or another parameter demonstrated to represent an equivalent industrial service. Cement output may be used only under the conditions established in Section 13.5.6 or as an eligible Route B output.

Each parameter, coefficient, factor, calculated result, and index shall be defined at its first occurrence. Subsequent equations may refer to previously defined terms, provided that the reference is explicit and unambiguous.

Fuel quantities, net calorific values, carbon contents, carbon fractions, emission factors, and energy values shall be expressed on mutually consistent measurement bases. Values reported on a dry, wet, or as-received basis shall not be combined without documented conversion.

## 13.3 General emission reduction equation

For each year y, net greenhouse gas emission reductions shall be calculated as follows:

| | |
|---|---|
| $ER_y = BE_{FF,y} - PE_y - LE_y - CA_y$ | Equation 1 |

Where:

| | | |
|---|---|---|
| $ER_y$ | = | net greenhouse gas emission reductions in year y before application of the monitoring-period floor, $tCO_2e$; |
| $BE_{FF,y}$ | = | baseline greenhouse gas emissions associated with the fossil fuel demonstrably displaced in year y, $tCO_2e$; |
| $PE_y$ | = | project emissions in year y, $tCO_2e$; |
| $LE_y$ | = | leakage emissions in year y, $tCO_2e$; |
| $CA_y$ | = | conservative adjustment applicable to year y, $tCO_2e$. |

The amount eligible for issuance for monitoring period MP shall be calculated as follows:

| | |
|---|---|
| $$ER_{MP} = max\left(0, \sum_{y \in MP} ER_y\right)$$ | Equation 2 |

Where:

| | | |
|---|---|---|
| $ER_{MP}$ | = | net greenhouse gas emission reductions eligible for issuance for monitoring period MP, $tCO_2e$. |

Negative results from an individual year, installation, production line, thermal unit, or project component shall be retained in the monitoring-period aggregation and shall not be selectively excluded, set to zero, or transferred to another project component for the purpose of increasing emission reductions.

Where the aggregate result for the monitoring period is zero or negative, no VCCs shall be issued for that monitoring period.

Negative results shall not be carried forward beyond the applicable monitoring period unless such reconciliation is expressly required by the BioCarbon Standard.

For each separately quantifiable thermal unit u:

| | |
|---|---|
| $$ER_{u,y} = BE_{FF,u,y} - PE_{u,y} - LE_{u,y} - CA_{u,y}$$ | Equation 3 |

Where:

| | | |
|---|---|---|
| $ER_{u,y}$ | = | net greenhouse gas emission reductions attributable to thermal unit, production line, kiln system, or separately quantifiable installation u in year y, $tCO_2e$; |
| $BE_{FF,u,y}$ | = | baseline emissions from fossil fuel displaced in unit u in year y, $tCO_2e$; |
| $PE_{u,y}$ | = | project emissions allocated to unit u in year y, $tCO_2e$; |
| $LE_{u,y}$ | = | leakage emissions allocated to unit u in year y, $tCO_2e$; |
| $CA_{u,y}$ | = | conservative adjustment allocated to unit u in year y, $tCO_2e$. |

Annual project results shall be determined as:

| | |
|---|---|
| $ER_y = \sum_u ER_{u,y}$ | Equation 4 |

Shared project emissions, leakage emissions, or conservative adjustments shall be allocated once among the applicable units before Equation 4 is applied. Shared emissions shall not be omitted or deducted more than once.

## 13.4 Determination of eligible alternative fuel consumed

### 13.4.1 General requirements

Only alternative fuel physically introduced into and consumed by the eligible thermal unit shall be included in the quantification.

For each batch b, thermal unit u, and year y, the Project Holder shall reconcile:

(a) opening stocks;
(b) quantities received;
(c) quantities transferred into the thermal unit;
(d) quantities consumed;
(e) closing stocks;
(f) rejected or returned quantities;
(g) quantities transferred to another recipient or use;
(h) handling and processing losses; and
(i) quantities sent for treatment or disposal.

The mass balance shall satisfy:

| | |
|---|---|
| $M_{open,b,u,y} + M_{rec,b,u,y} = M_{recon,b,u,y} + M_{close,b,u,y} + M_{rej,b,u,y} + M_{tr,b,u,y} + M_{loss,b,u,y}$ | Equation 5 |

Where:

| | | |
|---|---|---|
| $M_{open,b,u,y}$ | = | opening stock of batch b attributable to thermal unit u in year y, t; |
| $M_{rec,b,u,y}$ | = | quantity of batch b received in year y, t; |
| $M_{recon,b,u,y}$ | = | quantity of batch b reconciled as consumed in thermal unit u in year y through the stock and mass-balance procedure, t; |

| | | |
|---|---|---|
| $M_{close,b,u,y}$ | = | closing stock of batch b, t; |
| $M_{rej,b,u,y}$ | = | rejected, returned, or non-conforming quantity, t; |
| $M_{tr,b,u,y}$ | = | quantity transferred to another destination, project, installation, or use, t; |
| $M_{loss,b,u,y}$ | = | documented processing, handling, degradation, spillage, or other physical loss, t. |

The reconciled consumed quantity shall be calculated as:

$$M_{recon,b,u,y} = M_{open,b,u,y} + M_{rec,b,u,y} - M_{close,b,u,y} - M_{rej,b,u,y} - M_{tr,b,u,y} - M_{loss,b,u,y} \quad \text{Equation 6}$$

Where all terms are as defined in Equation (5).

Where calibrated feed-point measurement and stock reconciliation are both available, the eligible quantity shall be:

$$M_{AF,elig,b,u,y} = max\left[0, min\left(M_{feed,b,u,y}, M_{recon,b,u,y}\right)\right] \quad \text{Equation 7}$$

Where:

| | | |
|---|---|---|
| $M_{AF,elig,b,u,y}$ | = | eligible alternative fuel from batch b consumed in thermal unit u in year y, t; |
| $M_{feed,,b,u,y}$ | = | quantity measured by the calibrated feeding or consumption system, t; |

Where storage or stock records are shared among more than one thermal unit, opening stocks, receipts, transfers, closing stocks, and losses shall first be reconciled once at the storage-facility level. The reconciled quantity shall then be allocated to the relevant thermal units using calibrated feed-point measurements or another conservative and verifiable method.

Where a different measurement architecture is used, it shall provide an equivalent or higher level of accuracy, completeness, and traceability and shall be validated by the CAB.

An unexplained positive mass-balance discrepancy shall not be treated as fuel consumed. The affected quantity shall be deducted from eligible consumption.

An unexplained negative discrepancy shall be investigated and its associated project emissions shall be included where their exclusion could overestimate emission reductions.

Quantities that cannot be linked to an identified source, batch, industrial recipient, thermal unit, consumption date, and final fate shall be ineligible.

### 13.4.2 Characterization of eligible alternative fuel

For every eligible batch or statistically representative lot, the Project Holder shall determine, as applicable:

(a) net calorific value;
(b) moisture content;
(c) total carbon content;
(d) combustible carbon content;
(e) fossil carbon fraction;
(f) biogenic carbon fraction;
(g) inorganic carbon content;
(h) ash content;
(i) chlorine, sulfur, halogens, heavy metals, and other contaminants relevant to combustion, product quality, emissions control, or residue management; and
(j) any other parameter required by the applicable fuel specification, permit, industrial process, or BioCarbon Tool.

Fuel quantities, net calorific values, carbon contents, and carbon fractions shall be expressed on a consistent dry, wet, or as-received basis.

Where laboratory values are reported on a dry basis, they shall be converted to the as-received basis before being combined with as-received fuel quantities.

Batch-level data shall be used directly in the calculations. Weighted averages may be used only where:

(a) the underlying batches are fully identified;
(b) the weighting is based on the corresponding mass or energy quantity;
(c) the sampling program is representative;
(d) the averaging does not conceal material variability; and
(e) the resulting value is conservative.

Where the fossil carbon fraction cannot be reliably determined, the unidentified carbon fraction shall be treated as fossil carbon.

## 13.5 Determination of fossil fuel displacement

### 13.5.1 Project energy inputs

The thermal-energy input from eligible alternative fuel shall be calculated as:

| | |
|---|---|
| $E_{AF,PJ,u,y} = \sum_{b} (M_{AF,elig,b,u,y} \times NCV_{AF,b,y})$ | Equation 8 |

Where:

| | | |
|---|---|---|
| $E_{AF,PJ,u,y}$ | = | energy input from eligible alternative fuel consumed in thermal unit u in year y, GJ; |
| $NCV_{AF,b,y}$ | = | net calorific value of alternative-fuel batch b on an as-received basis, GJ/t. |

The energy input from fossil fuels consumed in the eligible thermal unit shall be:

| | |
|---|---|
| $E_{FF,PJ,u,y} = \sum_{i} (FC_{FF,i,u,y} \times NCV_{FF,i,y})$ | Equation 9 |

Where:

| | | |
|---|---|---|
| $E_{FF,PJ,u,y}$ | = | fossil-fuel energy input to thermal unit u in year y, GJ; |
| $FC_{FF,i,u,y}$ | = | measured consumption of fossil fuel i in thermal unit u in year y; |
| $NCV_{FF,i,y}$ | = | net calorific value of fossil fuel i, expressed consistently with $FC_{FF,i,u,y}$. |

$E_{FF,PJ,u,y}$ shall include all fossil fuels introduced into the eligible thermal unit, including start-up, stabilization, support, pilot, and auxiliary fuels used by that unit.

Energy supplied by electricity, renewable fuels, recovered heat, biomass not included as an eligible alternative fuel, or another energy source shall be separately quantified as $E_{OTH,PJ,u,y}$

### 13.5.2 Baseline energy inputs for equivalent industrial service

The baseline fossil-fuel energy required to provide the actual eligible industrial output or useful thermal service shall be:

| | |
|---|---|
| $E_{FF,BL,u,y} = O_{u,y} \times SEC_{FF,BL,u,y}$ | Equation 10 |

Where:

| | | |
|---|---|---|
| $E_{FF,BL,u,y}$ | = | baseline fossil-fuel energy associated with the actual eligible output of thermal unit u in year y, GJ; |
| $O_{u,y}$ | = | actual eligible industrial output or useful thermal service in year y; |
| $SEC_{FF,BL,u,y}$ | = | validated and conservatively calibrated baseline specific fossil-energy consumption, GJ per unit of O. |

Where the baseline includes existing alternative-fuel consumption, the baseline alternative-fuel energy associated with the actual output shall be:

| | |
|---|---|
| $E_{AF,BL,u,y} = O_{u,y} \times SEC_{AF,BL,u,y}$ | Equation 11 |

Where:

| | | |
|---|---|---|
| $E_{AF,BL,u,y}$ | = | alternative-fuel energy that would have been consumed in the baseline scenario, GJ; |
| $SEC_{AF,Bl,u,y}$ | = | validated and conservatively calibrated baseline specific alternative-fuel energy consumption for unit u in year y, GJ per unit of O. |

Where the baseline does not include alternative-fuel consumption:

| | |
|---|---|
| $E_{AF,BL,u,y} = 0$ | Equation 12 |

The incremental alternative-fuel energy attributable to the project activity shall be:

| | |
|---|---|
| $E_{AF,inc,u,y} = max(0, E_{AF,PJ,u,y} - E_{AF,BL,u,y})$ | Equation 13 |

Only $E_{AF,inc,u,y}$ may support a claim of additional fossil fuel substitution.

For new or expanded industrial installations, $SEC_{FF,BL,u,y}$ and any other baseline specific-energy parameter shall be derived from the validated baseline scenario, performance

benchmark, or market-representative approach established under Section 12. A proposed fully fossil-fueled design shall not automatically constitute the baseline.

Where useful thermal energy is directly measured and the baseline consists entirely of fossil-fuel combustion, Equation 10 may be expressed as:

| | |
|---|---|
| $$E_{FF,BL,u,y} = \frac{Q_{useful,u,y}}{\eta_{FF,BL,u,y}}$$ | Equation 14 |

Where:

| | | |
|---|---|---|
| $Q_{useful,u,y}$ | = | useful thermal energy delivered to the eligible industrial process in year y, GJ; |
| $\eta_{FF,BL,u,y}$ | = | validated baseline efficiency for conversion of fossil-fuel energy into useful thermal energy, dimensionless. |

Equation 14 may be used only where useful thermal energy and baseline efficiency can be reliably determined and where its use is consistent with the validated baseline scenario.

Equations (15) and (17) shall be applied only where $O_{u,y}$ is greater than zero. A period with no eligible industrial output or useful thermal service shall not generate emission reductions. Project emissions and leakage attributable to that period shall nevertheless be quantified and included in the monitoring-period aggregation.

### 13.5.3 Project specific thermal energy consumption and fuel penalty

Project specific thermal-energy consumption shall be:

| | |
|---|---|
| $$SEC_{TH,PJ,u,y} = \frac{E_{FF,PJ,u,y} + E_{AF,PJ,u,y} + E_{OTH,PJ,u,y}}{O_{u,y}}$$ | Equation 15 |

Where:

| | | |
|---|---|---|
| $SEC_{TH,PJ,u,y}$ | = | project specific thermal-energy input, GJ per unit of O; |
| $E_{OTH,PJ,u,y}$ | = | other energy inputs serving the same thermal process, GJ. |

Baseline total specific thermal-energy consumption shall be:

| | |
|---|---|
| $SEC_{TH,BL,u,y} = SEC_{FF,BL,u,y} + SEC_{AF,BL,u,y} + SEC_{OTH,BL,u,y}$ | Equation 16 |

Where:

| | | |
|---|---|---|
| $SEC_{TH,BL,u,y}$ | = | total validated baseline specific thermal-energy input for unit u in year y, GJ per unit of O; |
| $SEC_{OTH,BL,u,y}$ | = | baseline specific energy consumption from energy sources other than fossil fuel and eligible alternative fuel, GJ per unit of O. |

Where project specific thermal-energy consumption exceeds the baseline value, the excess energy input shall be treated as a fuel penalty:

| | |
|---|---|
| $FP_{u,y} = O_{u,y} \times max[0, SEC_{TH,PJ,u,y} - SEC_{TH,BL,u,y}]$ | Equation 17 |

Where:

| | | |
|---|---|---|
| $FP_{u,y}$ | = | energy penalty attributable to higher project specific thermal-energy consumption, GJ. |

The fuel penalty shall capture, as applicable:

(a) lower combustion efficiency;
(b) higher moisture content;
(c) additional drying requirements;
(d) combustion instability;
(e) changes in excess air;
(f) changes in heat transfer;
(g) additional start-up or support fuel;
(h) deterioration in kiln, furnace, boiler, or dryer performance; and
(i) any other increase in thermal-energy demand associated with the project activity.

Where the effect is already fully reflected in directly measured useful thermal energy and fossil fuel displacement, the Project Holder shall demonstrate that application of the fuel penalty does not duplicate the same effect.

### 13.5.4 Output-based determination of displaced fossil energy

The output-based estimate of fossil-fuel displacement shall be:

| | |
|---|---|
| $E_{FF,disp,out,u,y} = max[0, E_{FF,BL,u,y} - E_{FF,PJ,u,y} - E_{FF,other,u,y}]$ | Equation 18 |

Where:

| | | |
|---|---|---|
| $E_{FF,disp,out,u,y}$ | = | fossil-fuel energy displacement demonstrated through normalized baseline and project performance, GJ; |
| $E_{FF,other,u,y}$ | = | reduction in fossil-fuel consumption attributable to one or more separately identifiable concurrent mitigation interventions that are not already reflected in the reference output, baseline or project specific-energy consumption, or the fuel penalty, GJ. |

$E_{FF,other,u,y}$ may include only fossil-fuel reductions attributable to separately identifiable concurrent mitigation interventions, such as an energy-efficiency measure, electrification, renewable-energy input, recovered heat, or another mitigation activity or methodology, where the effect is not already reflected in $O_{u,y}$, $SEC_{TH,PJ,u,y}$, $SEC_{TH,BL,u,y}$, or $FP_{u,y}$.

Changes in production volume, product mix, feedstock or product moisture, operating temperature, pressure, throughput, operating hours, equipment availability, shutdowns, or transfer of production shall be addressed through normalization, project emissions, leakage, or eligibility controls, as applicable. They shall not be included in $E_{FF,other,u,y}$ where their effect has already been reflected elsewhere.

The same operational change, intervention, or reduction in fossil-fuel consumption shall not be deducted more than once.

Where the separate effect of another intervention cannot be reliably determined, the overlapping fossil-fuel reduction shall not be credited under BCR0019.

### 13.5.5 Alternative-fuel-based cap

The maximum fossil-fuel displacement supported by incremental alternative-fuel energy shall be:

| | |
|---|---|
| $E_{FF,disp,AF,u,y} = max[0, E_{AF,inc,u,y} - FP_{u,y}]$ | Equation 19 |

The creditable displaced fossil-fuel energy shall be the lower of the output-based estimate and the alternative-fuel-based estimate:

| | |
|---|---|
| $E_{FF,disp,u,y} = min(E_{FF,disp,out,u,y}, E_{FF,disp,AF,u,y})$ | Equation 20 |

Where all terms are as defined in Equations (13), (17), (18), and (19).

This dual-cap approach ensures that fossil-fuel displacement:

(a) does not exceed the reduction demonstrated through normalized fossil-fuel consumption;
(b) does not exceed the incremental alternative-fuel energy actually consumed;
(c) excludes changes attributable to reduced output or unrelated efficiency improvements; and
(d) accounts for any increase in specific thermal-energy consumption caused by the project activity.

A contractual substitution rate, nominal thermal substitution rate, equipment capacity, fuel purchase, supplier declaration, or facility-wide decrease in fossil-fuel purchases shall not replace the calculation required by Equations 18 to 20.

### 13.5.6 Route A: Clinker and quicklime manufacture

For Route A, calculations shall be performed at the level of each kiln system or separately metered thermal unit.

An integrated kiln system comprising the preheater, pre-calciner, calciner, main kiln, kiln inlet, main burner, and associated fuel-feeding points shall be treated as a single quantification unit unless fuel inputs, energy use, and relevant industrial output can be separately measured and allocated without omission or duplication.

$O_{u,y}$ shall ordinarily consist of clinker or quicklime production. Cement output shall not be used as the reference output for the clinker pyro-process unless the Project Holder demonstrates that it provides an equivalent, direct, and conservative representation of the relevant thermal service.

Thermal equipment at a cement installation that is not part of clinker or quicklime manufacture shall be assessed under Route B.

The Route A calculation shall:

(a) apply Equations 8 to 20 separately to each kiln, calciner, pre-calciner, dryer, or separately quantifiable production line;

(b) account for alternative fuel introduced at every eligible feeding point;
(c) include all residual, start-up, and support fossil fuel in $E_{FF,PJ,u,y}$;
(d) determine baseline specific thermal-energy consumption using the validated and conservatively calibrated baseline;
(e) apply the fuel-penalty provision where project specific thermal-energy consumption exceeds the baseline;
(f) monitor any material effect on clinker or quicklime production, product quality, kiln stability, calcination conditions, and electricity consumption; and
(g) include any incremental process emissions caused by changes in raw-material or fuel composition.

Changes in clinker ratio, cement blending, carbonate decomposition, raw-material chemistry, or mineral incorporation shall not generate emission reductions under BCR0019.

### 13.5.7 Route B: Other industrial thermal processes

For Route B, $O_{u,y}$ shall be the validated parameter that most accurately represents the useful industrial thermal service.

The selected parameter shall be normalized where energy demand is materially affected by:

(a) product type or quality;
(b) feedstock or product moisture;
(c) operating temperature or pressure;
(d) throughput;
(e) batch duration;
(f) steam conditions;
(g) ambient conditions;
(h) equipment availability;
(i) product mix; or
(j) another relevant process variable.

Where a boiler or common thermal network serves multiple users, generation, distribution, and consumption shall be metered or conservatively allocated so that only the eligible industrial service is included.

Facility-wide fossil-fuel consumption may be used only where the entire facility and all material energy uses are included and where the fossil-fuel displacement attributable to the project can be isolated.

### 13.5.8 Supplementary Module C: Co-processing and controlled final use

Supplementary Module C shall not establish an independent fossil-fuel displacement calculation.

A component applying Supplementary Module C shall use:

(a) the Route A calculation where the relevant thermal service forms part of clinker or quicklime manufacture; or
(b) the Route B calculation for any other eligible industrial thermal process.

The Module C mass and energy balance shall demonstrate actual reception, acceptance, storage, feeding, consumption, useful thermal contribution, fossil-fuel displacement, and final fate of all associated rejects and residues.

No emission reduction shall be attributed to waste destruction, volume reduction, pollutant destruction, mineral incorporation, avoided disposal, or another outcome separate from verified fossil-fuel displacement.

## 13.6 Baseline emissions

### 13.6.1 Greenhouse gas emission factor of baseline fossil fuels

For each fossil fuel i, the greenhouse gas emission factor may be calculated as:

| | |
|---|---|
| $EF_{GHG,FF,i,y} = EF_{CO_2,FF,i,y} + EF_{CH_4,FF,i,y} \times GWP_{CH_4} + EF_{N_2O,FF,i,y} \times GWP_{N_2O}$ | Equation 21 |

Where:

| | | |
|---|---|---|
| $EF_{GHG,FF,i,y}$ | = | greenhouse gas emission factor of fossil fuel i, $tCO_2e/GJ$; |
| $EF_{CO_2,FF,i,y}$ | = | carbon dioxide emission factor of fossil fuel i, $tCO_2/GJ$; |
| $EF_{CH_4,FF,i,y}$ | = | methane emission factor of fossil fuel i, $tCH_4/GJ$; |
| $GWP_{CH_4}$ | = | applicable Global Warming Potential for methane; |
| $EF_{N_2O,FF,i,y}$ | = | nitrous oxide emission factor of fossil fuel i, $tN_2O/GJ$; |
| $GWP_{N_2O}$ | = | applicable Global Warming Potential for nitrous oxide. |

The carbon dioxide emission factor may be determined from fuel carbon content as:

| | |
|---|---|
| $EF_{CO_2,FF,i,y} = \frac{CC_{FF,i,y} \times OF_{FF,i,y} \times \frac{44}{12}}{NCV_{FF,i,y}}$ | Equation 22 |

Where:

| | | |
|---|---|---|
| $CC_{FF,i,y}$ | = | carbon content of fossil fuel i, expressed in tonnes of carbon per corresponding fuel unit; |
| $OF_{FF,i,y}$ | = | oxidation factor for fossil fuel i, dimensionless; |
| $NCV_{FF,i,y}$ | = | net calorific value of fossil fuel i, GJ per corresponding fuel unit; |
| $44/12$ | = | molecular-weight ratio of $CO_2$ to carbon. |

Fuel-specific measured data shall be used where available and representative. Otherwise, national, regional, supplier-specific, or applicable IPCC values may be used in accordance with the data hierarchy established by this methodology.

Baseline $CH_4$ and $N_2O$ emissions may be included only where:

(a) their inclusion is required under the applicable BioCarbon or host-country accounting rules;
(b) representative emission factors are available;
(c) the factors are applicable to the baseline fuel and combustion technology; and
(d) their inclusion does not create an asymmetric or non-conservative comparison.

Where these conditions are not met, baseline $CH_4$ and $N_2O$ emissions shall be set to zero. Project $CH_4$ and $N_2O$ emissions shall nevertheless be included where material.

### 13.6.2 Direct identification of the displaced fossil fuel

Where the displaced fossil fuel or fuel mix is directly identifiable through metering, operating records, burner dispatch, contracts, technical controls, or another independently verifiable method, baseline emissions shall be:

$$BE_{FF,u,y} = \sum_{i} \left( E_{FF,disp,i,u,y} \times EF_{GHG,FF,i,y} \right)$$ Equation 23

Subject to:

$$\sum_{i} E_{FF,disp,i,u,y} = E_{FF,disp,u,y}$$ Equation 24

Where:

| | | |
|---|---|---|
| $E_{FF,disp,i,u,y}$ | = | energy of fossil fuel i demonstrably displaced in thermal unit u in year y, GJ. |

The Project Holder shall not allocate all displacement to the fossil fuel with the highest emission factor unless operating evidence demonstrates that this fuel would have been displaced first under the baseline scenario.

### 13.6.3 Conservative baseline emission factor

Where the displaced fossil-fuel mix cannot be directly and unambiguously identified, the Project Holder shall determine the lowest applicable and credible energy-weighted emission factor among:

(a) the representative historical fossil-fuel mix;
(b) the residual fossil-fuel mix consumed during the project;
(c) the fossil-fuel mix identified in the validated baseline scenario; and
(d) another lower-emission credible fossil-fuel mix that would be available under baseline conditions.

For each applicable dataset x:

$$EF_{FF,x,u,y} = \frac{\sum_i \left(E_{FF,i,x,u,y} \times EF_{GHG,FF,i,y}\right)}{\sum_i E_{FF,i,x,u,y}} \quad \text{Equation 25}$$

Where:

| | | |
|---|---|---|
| $EF_{FF,x,u,y}$ | = | energy-weighted greenhouse gas emission factor for dataset x applicable to unit u in year y, $tCO_2e/GJ$; |
| $E_{FF,i,x,u,y}$ | = | fossil-fuel energy of fuel i represented in dataset x for unit u in year y, GJ. |

The conservative baseline emission factor shall be:

$$EF_{FF,BL,u,y} = min\left(EF_{FF,hist,u}, EF_{FF,res,u,y}, EF_{FF,scen,u,y}, EF_{FF,other,u,y}\right) \quad \text{Equation 26}$$

Where:

| | | |
|---|---|---|
| $EF_{FF,BL,u,y}$ | = | conservative baseline GHG emission factor applicable to fossil fuel displacement in unit u in year y, $tCO_2e/GJ$; |
| $EF_{FF,hist,u}$ | = | representative energy-weighted emission factor of the historical fossil-fuel mix, $tCO_2e/GJ$; |
| $EF_{FF,res,u,y}$ | = | energy-weighted emission factor of the residual project fossil-fuel mix, $tCO_2e/GJ$; |
| $EF_{FF,scen,u,y}$ | = | energy-weighted emission factor of the fossil-fuel mix identified in the validated baseline scenario, $tCO_2e/GJ$; |
| $EF_{FF,other,u,y}$ | = | emission factor of another lower-emission credible fossil-fuel mix available under baseline conditions, where applicable, $tCO_2e/GJ$. |

Only applicable, representative, and evidence-based factors shall be included in Equation 26.

Baseline emissions shall then be:

| | |
|---|---|
| $$BE_{FF,u,y} = E_{FF,disp,u,y} \times EF_{FF,BL,u,y}$$ | Equation 27 |

Total baseline emissions shall be:

| | |
|---|---|
| $$BE_{FF,y} = \sum_{u} BE_{FF,u,y}$$ | Equation 28 |

Where all terms are as defined above.

Baseline emissions shall not include:

(a) avoided methane emissions from an SWDS;
(b) emissions avoided through waste diversion or alternative waste treatment;
(c) avoided extraction, production, refining, or transportation of fossil fuels;
(d) avoided industrial process emissions not directly related to fossil-fuel combustion;
(e) avoided production of virgin materials;
(f) avoided waste collection or disposal;
(g) displacement of biomass, recovered heat, renewable energy, or electricity; or
(h) any emission reduction quantified under another methodology.

The exclusion of upstream fossil-fuel supply emissions shall be considered conservative.

## 13.7 Project emissions

### 13.7.1 General project-emission equation

Project emissions shall be calculated as:

| | |
|---|---|
| $$PE_y = PE_{AF,CO_2,y} + PE_{AF,nonCO_2,y} + PE_{IC,y} + PE_{FC,y} + PE_{EL,y} + PE_{TR,y} + PE_{ST,y} + PE_{RM,y} + PE_{PROC,y} + PE_{OTH,y}$$ | Equation 29 |

Where:

| | | |
|---|---|---|
| $PE_{AF,CO_2,y}$ | = | fossil $CO_2$ emissions from combustion of the incremental eligible alternative fuel, $tCO_2e$; |
| $PE_{AF,nonCO_2,y}$ | = | $CH_4$ and $N_2O$ emissions from combustion of the incremental eligible alternative fuel, $tCO_2e$; |
| $PE_{IC,y}$ | = | $CO_2$ emissions from inorganic carbon contained in the alternative fuel, $tCO_2e$; |
| $PE_{FC,y}$ | = | emissions from additional fossil fuels not already included in the displacement calculation, $tCO_2e$; |
| $PE_{EL,y}$ | = | emissions from incremental electricity consumption, $tCO_2e$; |
| $PE_{TR,y}$ | = | emissions from project-attributable transportation, $tCO_2e$; |
| $PE_{ST,y}$ | = | emissions from storage, handling, or degradation of the alternative fuel, $tCO_2e$; |
| $PE_{RM,y}$ | = | emissions from management of rejects and residues, $tCO_2e$; |
| $PE_{PROC,y}$ | = | incremental industrial process emissions caused by the project activity, $tCO_2e$; |
| $PE_{OTH,y}$ | = | other material project emissions, $tCO_2e$. |

Project emissions shall be calculated for the incremental alternative-fuel use supporting the credited fossil-fuel displacement.

Where the baseline already includes alternative-fuel use, the Project Holder shall allocate batches between baseline and incremental use through direct records or a conservative allocation. Where direct separation is not possible, baseline consumption shall be assigned first to batches with the lowest project-emission intensity, so that the batches with the highest project-emission intensity remain assigned to incremental project consumption.

The allocated incremental quantities shall satisfy:

| | |
|---|---|
| $\sum_{b}(M_{AF,inc,b,u,y} \times NCV_{AF,b,y}) = E_{AF,inc,u,y}$ | Equation 30 |

Where:

| | | |
|---|---|---|
| $M_{AF,inc,b,u,y}$ | = | quantity of batch b allocated to incremental project consumption, t. |

### 13.7.2 Fossil $CO_2$ emissions from alternative-fuel combustion

The adjusted fossil carbon fraction shall be:

| | |
|---|---|
| $f_{FC,adj,b,y} = f_{FC,b,y} + f_{UC,b,y}$ | Equation 31 |

Subject to:

| | |
|---|---|
| $f_{FC,b,y} + f_{BC,b,y} + f_{UC,b,y} = 1$ | Equation 32 |

Where:

| | | |
|---|---|---|
| $f_{FC,b,y}$ | = | measured fossil fraction of combustible carbon in batch b; |
| $f_{BC,b,y}$ | = | measured biogenic fraction of combustible carbon in batch b; |
| $f_{UC,b,y}$ | = | unidentified or undetermined fraction of combustible carbon in batch b; |
| $f_{FC,adj,b,y}$ | = | fossil carbon fraction used for project-emission accounting |

Fossil $CO_2$ emissions from alternative-fuel combustion shall be:

| | |
|---|---|
| $PE_{AF,CO_2,y} = \sum_{u}\sum_{b}\left(M_{AF,inc,b,u,y} \times CC_{comb,b,y} \times f_{FC,adj,b,y} \times OF_{AF,b,u,y} \times \frac{44}{12}\right)$ | Equation 33 |

$OF_{AF,b,u,y}$ Where:

| | | |
|---|---|---|
| $CC_{comb,b,y}$ | = | combustible carbon content of alternative-fuel batch b, tC/t fuel on an as-received basis; |
| | = | oxidation factor applicable to batch b and thermal unit u. |

Unless a lower value is supported by representative measurement and a complete carbon balance, $OF_{AF,b,u,y}$ shall be set equal to 1.

Any value lower than 1 shall be supported by representative evidence of carbon retained in products, ash, dust, slag, or other residues and shall not result in the omission of emissions associated with the subsequent treatment, oxidation, or final fate of that carbon.

An equivalent batch-specific fossil $CO_2$ emission factor may be calculated as:

$$EF_{CO2,AF,b,u,y} = \frac{CC_{comb,b,y} \times f_{FC,adj,b,y} \times OF_{AF,b,u,y} \times \frac{44}{12}}{NCV_{AF,b,y}}$$ Equation 34

Where:

| | | |
|---|---|---|
| $EF_{CO2,AF,b,u,y}$ | = | fossil $CO_2$ emission factor of alternative-fuel batch b, $tCO_2/GJ$. |

Equation 33 may then be expressed as:

$$PE_{AF,CO_2,y} = \sum_{u}\sum_{b}\left(M_{AF,inc,b,u,y} \times NCV_{AF,b,y} \times EF_{CO_2,AF,b,u,y}\right)$$ Equation 35

Where all terms are as defined above.

Equations 33 and 35 are equivalent and shall not be applied simultaneously.

A default assumption that the alternative fuel is renewable, carbon neutral, or entirely biogenic shall not be permitted.

### 13.7.3 Biogenic $CO_2$ reporting

Biogenic $CO_2$ emissions from combustion of the eligible alternative fuel shall be quantified and reported separately:

| | |
|---|---|
| $BIOCO_{2,y} = \sum_{u}\sum_{b}\left(M_{AF,inc,b,u,y} \times CC_{comb,b,y} \times f_{BC,b,y} \times OF_{AF,b,u,y} \times \frac{44}{12}\right)$ | Equation 36 |

Where:

| | | |
|---|---|---|
| $BIOCO_{2,y}$ | = | biogenic $CO_2$ released from combustion of incremental alternative fuel in year y, $tCO_2$. |

Analytical identification of carbon as biogenic shall not, by itself, establish eligibility for exclusion from project emissions.

The Project Holder shall demonstrate that the relevant biogenic fraction:

(a) constitutes the non-fossil fraction of eligible industrial or municipal waste; or
(b) otherwise complies with the applicable BioCarbon renewable-biomass, legal-sourcing, sustainability, waste-hierarchy, traceability, project-emission, and leakage requirements.

The exclusion shall not apply where use of the relevant material causes an attributable decrease in land-based carbon stocks, unsustainable biomass extraction, diversion from a higher-order use, or another material greenhouse gas increase that has not been fully accounted for.

Where biogenic origin or eligibility cannot be demonstrated with sufficient and verifiable evidence, the affected fraction shall be included in $f_{UC,b,y}$ and treated as fossil carbon.

$BIOCO_{2,y}$ shall not be:

(a) included in $PE_{AF,CO_2,y}$ where the requirements of this section are met;
(b) treated as a carbon dioxide removal;
(c) treated as a stored carbon quantity;
(d) deducted from baseline emissions;
(e) issued as a separate mitigation outcome; or
(f) used to claim avoided upstream waste-management emissions.

The exclusion of eligible biogenic combustion $CO_2$ shall not exclude fossil emissions associated with collection, preparation, sorting, drying, electricity consumption, transport, storage, handling, feeding, auxiliary fuels, air-pollution control, or residue management.

### 13.7.4 Emissions from inorganic carbon

Where the alternative fuel contains inorganic carbon that may be released as $CO_2$ under the applicable thermal conditions, emissions shall be:

$$PE_{IC,y} = \sum_{u}\sum_{b}\left(M_{AF,inc,b,u,y} \times CC_{inorg,b,y} \times f_{rel,b,u,y} \times \frac{44}{12}\right)$$

Equation 37

Where:

| | | |
|---|---|---|
| $CC_{inorg,b,y}$ | = | inorganic carbon content of batch b, expressed in tonnes of inorganic carbon per tonne of alternative fuel on an as-received basis consistent with $M_{AF,inc,b,u,y}$ |
| $f_{rel,b,u,y}$ | = | fraction of inorganic carbon released as $CO_2$ in thermal unit u, dimensionless. |

The Project Holder may exclude $PE_{IC,y}$ only where representative analysis and process evidence demonstrate that the source is immaterial or that the inorganic carbon remains permanently incorporated in the product or residue under the applicable operating conditions.

$PE_{IC,y}$ shall exclusively account for $CO_2$ released from inorganic carbon contained in the alternative fuel. The same inorganic carbon shall not be included in $PE_{PROC,y}$.

Where the Project Holder claims that inorganic carbon remains incorporated in the product or residue, the retained quantity shall be supported by a complete carbon balance, representative product or residue analysis, and evidence that the carbon is not released under the applicable process conditions.

### 13.7.5 $CH_4$ and $N_2O$ emissions from alternative-fuel combustion

Fuel-based $CH_4$ and $N_2O$ emissions shall be:

$$PE_{AF,nonCO_2,y} = \sum_{u}\sum_{b} E_{AF,inc,b,u,y}\left(EF_{CH_4,AF,b,u,y} \times GWP_{CH_4} + EF_{N_2O,AF,b,u,y} \times GWP_{N_2O}\right)$$

Equation 38

Where:

| | | |
|---|---|---|
| $E_{AF,inc,b,u,y}$ | = | incremental alternative-fuel energy allocated to batch b and thermal unit u in year y, calculated as $M_{AF,inc,b,u,y} \times NCV_{AF,b,y}$ , GJ; |
| $EF_{CH_4,AF,b,u,y}$ | = | methane emission factor for batch b and thermal unit u, $tCH_4/GJ$; |
| $EF_{N_2O,AF,b,u,y}$ | = | nitrous oxide emission factor for batch b and thermal unit u, $tN_2O/GJ$. |

For direct stack measurement:

| | |
|---|---|
| $PE^{stack}_{AF,nonCO_2,y} = \sum_{u} \sum_{g \in (CH_4,N_2O)} max[0, SG_{u,y} C_{g,SG,u,y} - EM_{g,noninc,u,y}] GWP_g$ | Equation 39 |

Where:

| | | |
|---|---|---|
| $PE^{stack}_{AF,nonCO_2,y}$ | = | $CH_4$ and $N_2O$ emissions attributable to incremental alternative-fuel combustion, determined through direct stack measurement, $tCO_2e$; |
| $SG_{u,y}$ | = | standardized stack-gas volume for unit u in year y, $Nm^3$; |
| $C_{g,SG,u,y}$ | = | measured concentration of gas g on a basis consistent with $SG_{u,y}$, t gas/$Nm^3$; |
| $EM_{g,noninc,u,y}$ | = | measured or conservatively determined quantity of gas g attributable to residual fossil fuel, baseline alternative-fuel use, or another non-incremental input, t gas; |
| $GWP_g$ | = | applicable Global Warming Potential for gas g. |

Equation (39) may replace Equation (38) only where direct stack measurement is technically appropriate, representative of the monitoring period, and supported by a validated source-apportionment procedure that reliably isolates or conservatively allocates emissions attributable to incremental alternative-fuel combustion.

Where source apportionment cannot be demonstrated, Equation (38) shall be applied using conservative emission factors.

Equations (38) and (39) are alternative approaches and shall not be applied simultaneously to the same emissions.

Where stack measurements cover emissions from both fossil and alternative fuels, the Project Holder shall use a validated carbon, energy, or operational allocation procedure. Any unresolved portion shall be allocated conservatively to the project activity.

### 13.7.6 Additional fossil-fuel emissions

Additional fossil-fuel emissions shall include fossil fuels consumed in:

(a) alternative-fuel preparation;
(b) shredding, sorting, drying, blending, or densification;
(c) loading, unloading, and material handling;
(d) auxiliary generators;
(e) storage and feeding systems;
(f) air-pollution control systems;
(g) residue treatment; and
(h) any other project-attributable activity.

Additional fossil-fuel consumption shall be:

| | |
|---|---|
| $FC_{add,i,p,y} = max(0, FC_{PJ,i,p,y} - FC_{BL,i,p,y})$ | Equation 40 |

Where:

| | | |
|---|---|---|
| $FC_{add,i,p,y}$ | = | incremental consumption of fossil fuel i attributable to project activity p in year y; |
| $FC_{PJ,i,p,y}$ | = | consumption of fossil fuel i by activity p under project conditions in year y; |
| $FC_{BL,i,p,y}$ | = | consumption of fossil fuel i that would have occurred for the same activity and equivalent output under baseline conditions in year y. |

$FC_{add,i,p,y}$, $FC_{PJ,i,p,y}$, and $FC_{BL,i,p,y}$ shall be expressed in the same directly measured fuel unit used with the corresponding NCV value.

Emissions shall be:

| | |
|---|---|
| $PE_{FC,y} = \sum_{p} \sum_{i} (FC_{add,i,p,y} \times NCV_{FF,i,y} \times EF_{GHG,FF,i,y})$ | Equation 41 |

Fossil fuels already included in $E_{FF,PJ,u,y}$ shall not be included again in $PE_{FC,y}$.

Residual fossil fuel consumed in the eligible thermal unit is accounted for through the displacement calculation in Equation 18. It shall not be deducted again as a project emission.

### 13.7.7 Electricity-related emissions

Incremental electricity consumption shall be:

| | |
|---|---|
| $EC_{add,s,y} = max(0, EC_{PJ,s,y} - EC_{BL,s,y})$ | Equation 42 |

Where:

| | | |
|---|---|---|
| $EC_{add,s,y}$ | = | incremental electricity consumption at source or consumption point s in year y, MWh; |
| $EC_{PJ,s,y}$ | = | project electricity consumption at source or consumption point s, MWh; |
| $EC_{BL,s,y}$ | = | electricity consumption that would have occurred for the same output under the baseline scenario, MWh. |

Electricity-related project emissions shall be:

| | |
|---|---|
| $PE_{EL,y} = \sum_{s} (EC_{add,s,y} \times EF_{EL,s,y})$ | Equation 43 |

Where:

| | | |
|---|---|---|
| $EF_{EL,s,y}$ | = | applicable electricity emission factor, $tCO_2e/MWh$. |

Electricity consumption and emission factors shall be determined in accordance with the applicable BioCarbon requirements and, where expressly required by this methodology, CDM TOOL05.

Electricity generated or recovered by the project may offset project electricity consumption only where it is directly metered, physically attributable to the project system, and permitted under the applicable electricity-accounting procedure.

Exported electricity, electricity savings, or displacement of grid electricity shall not generate additional emission reductions under BCR0019 unless quantified under a separate approved methodology.

Any electricity used to offset project electricity consumption shall not be associated with an electricity credit, renewable-energy certificate, environmental attribute, or other mitigation claim issued, transferred, or claimed separately for the same quantity.

### 13.7.8 Transportation emissions

Transportation emissions shall be determined in accordance with CDM TOOL12 where its applicability conditions are met. Under that approach, only $CO_2$ emissions from freight transportation shall be quantified; $CH_4$ and $N_2O$ shall not be separately added.

Return movements shall be included in accordance with the selected TOOL12 option and shall not be counted twice where they are already embedded in the applicable emission factor or monitored fuel consumption.

Where transportation is a main or material source for which the applicability conditions of TOOL12 are not met, the Project Holder shall apply another complete, conservative, and approved transport-emission procedure.

Avoided transport emissions in the baseline scenario shall not generate emission reductions under BCR0019.

Where the tonne-kilometer approach is applied:

| | |
|---|---|
| $$TK_{t,y} = M_{t,y} \times D_{t,y}$$ | Equation 44 |

| | |
|---|---|
| $$PE_{TR,y} = \sum_{t} \left( TK_{t,y} \times EF_{CO_2,TR,t,y} \right)$$ | Equation 45 |

Where:

| | | |
|---|---|---|
| $TK_{t,y}$ | = | freight transport activity for movement t, tonne-kilometers; |
| $M_{t,y}$ | = | transported mass, t; |
| $D_{t,y}$ | = | applicable loaded and, where required, empty-trip distance, km; |
| $EF_{CO_2,TR,t,y}$ | = | $CO_2$ emission factor applicable to transport movement t in year y, $tCO_2$ per tonne-kilometer. |

A direct fuel-consumption approach may be used where fuel consumption is metered or otherwise reliably determined.

### 13.7.9 Storage and handling emissions

Alternative fuel shall be stored and handled under conditions that prevent anaerobic degradation, self-heating, uncontrolled combustion, fire, and material loss.

$PE_{ST,y}$ may be set equal to zero only where:

(a) the applicable storage and handling controls were continuously implemented;
(b) no material degradation, self-heating, fire, uncontrolled combustion, or unexplained loss occurred;
(c) the mass balance was satisfactorily reconciled; and
(d) the relevant evidence is available for verification.

Where a material storage or handling incident occurs, emissions shall be quantified using direct incident-specific data, representative measurements, or another validated conservative method.

Where the effect of a material incident cannot be reliably quantified, the affected batch, storage interval, or project component shall be ineligible.

### 13.7.10 Reject and residue-management emissions

Emissions from the treatment, recovery, transport, or disposal of rejects and residues shall be:

| | |
|---|---|
| $PE_{RM,y} = \sum_{r} (Q_{r,y} \times EF_{RM,r,y})$ | Equation 46 |

Where:

| | | |
|---|---|---|
| $Q_{r,y}$ | = | quantity of reject or residue stream r, t; |
| $EF_{RM,r,y}$ | = | gross positive greenhouse gas emission factor associated with the documented treatment, recovery, transport, or disposal route for residue stream r in year y, $tCO_2e/t$. |

$EF_{RM,r,y}$ shall represent gross positive emissions associated with the documented residue-management route.

Avoided disposal, recycling, mineral substitution, avoided virgin-material production, or another environmental benefit shall not be netted against $PE_{RM,y}$.

Where a calculated residue-management factor is negative, it shall be set equal to zero for the purposes of BCR0019.

The calculation shall include, as applicable:

(a) sorting rejects;
(b) non-compliant or rejected alternative fuel;

(c) bottom ash;
(d) fly ash;
(e) kiln or boiler dust;
(f) slag;
(g) air-pollution control residues;
(h) wastewater or leachate;
(i) spent sorbents or reagents; and
(j) other material residual streams.

Avoided production benefits, recycling credits, mineral-substitution benefits, or avoided disposal emissions associated with residues shall not be credited under BCR0019.

### 13.7.11 Incremental industrial process emissions

Where the project activity materially changes industrial process emissions, incremental emissions shall be:

| | |
|---|---|
| $PE_{PROC,y} = max(0, PROCEM_{PJ,y} - PROCEM_{BL,adj,y})$ | Equation 47 |

Where:

| | | |
|---|---|---|
| $PE_{PROC,y}$ | = | incremental non-combustion industrial process emissions caused by the project activity in year y, $tCO_2e$; |
| $PROCEM_{PJ,y}$ | = | actual industrial process emissions under project conditions, $tCO_2e$; |
| $PROCEM_{BL,adj,y}$ | = | baseline industrial process emissions adjusted to the actual equivalent output and operating conditions, $tCO_2e$. |

$PE_{PROC,y}$ shall include material incremental non-combustion industrial process emissions caused by the project activity, including changes in raw-material chemistry, carbonate decomposition unrelated to inorganic carbon already accounted for in $PE_{IC,y}$, reducing or oxidizing conditions, process-gas generation, or product and residue chemistry.

$CO_2$ released from inorganic carbon contained in the alternative fuel shall be accounted for exclusively under $PE_{IC,y}$.

A decrease in industrial process emissions shall not generate credits under BCR0019. Where applicable, such a decrease may be addressed only under a separate approved methodology.

### 13.7.12 Other project emissions

$PE_{OTH,y}$ shall include any material project-attributable GHG emission source not otherwise captured in Equation (29).

The quantification method, activity data, emission factors, monitoring frequency, and uncertainty treatment for each $PE_{OTH,y}$ source shall be specified ex ante in the Project Document and validated before the source is included in a crediting calculation.

A material source shall not be assigned an unsupported project-specific method during verification.

Where a material source cannot be quantified with sufficient reliability, the affected batch, period, or project component shall be ineligible.

## 13.8 Leakage emissions

### 13.8.1 General leakage equation

For each identified leakage source k:

| | |
|---|---|
| $$LE_{k,y} = max(0, EM_{PJ,k,y} - EM_{BL,k,y})$$ | Equation 48 |

Where:

| | | |
|---|---|---|
| $LE_{k,y}$ | = | leakage emissions from source k in year y, $tCO_2e$; |
| $EM_{PJ,k,y}$ | = | emissions from leakage source k under project conditions, $tCO_2e$; |
| $EM_{BL,k,y}$ | = | emissions from the same source or function in the absence of the project activity, $tCO_2e$. |

Total leakage shall be:

| | |
|---|---|
| $$LE_y = \sum_k LE_{k,y}$$ | Equation 49 |

Where all terms are as defined above.

Negative values for an individual leakage source shall be set to zero unless the applicable BioCarbon Leakage Management Tool expressly permits a symmetrical net calculation.

The leakage assessment shall include, at a minimum:

(a) diversion of alternative fuel from an existing energy-recovery user;
(b) replacement fuel or material used by a displaced user;
(c) market effects caused by a material change in alternative-fuel or recyclable-material supply;
(d) off-site preparation, transport, storage, or treatment not included in project emissions;
(e) displacement of waste or fuel flows to another facility or jurisdiction;
(f) increased emissions from rejected material or residues;
(g) changes in the pre-project final fate of the waste stream; and
(h) other attributable off-site emission increases.

### 13.8.2 Diversion from an existing energy use

Where the eligible material or alternative fuel was previously consumed by another energy user, leakage shall include the net increase in emissions caused by the replacement energy source:

| | |
|---|---|
| $LE_{EU,h,y} = max(0, EM_{rep,h,y} - EM_{pre,h,y})$ | Equation 50 |

Where:

| | | |
|---|---|---|
| $LE_{EU,h,y}$ | = | leakage associated with displaced energy user h, $tCO_2e$; |
| $EM_{rep,h,y}$ | = | emissions from the replacement fuel or energy source used by displaced user h, $tCO_2e$; |
| $EM_{pre,h,y}$ | = | emissions associated with the material or fuel previously used by user h, $tCO_2e$. |

Where the replacement source cannot be identified, the Project Holder shall use a conservative and evidence-based replacement scenario. If a material leakage risk cannot be quantified with sufficient reliability, the affected alternative-fuel quantity shall be ineligible.

### 13.8.3 Diversion from a higher-order use

A waste-derived material stream that, in the absence of the project activity, would credibly have been used for reuse, preparation for reuse, recycling, or material recovery shall be ineligible to the extent of the attributable diversion.

The Project Holder shall demonstrate the pre-project destination and realistic alternative use of each material stream through verifiable historical, contractual, market, regulatory, or third-party evidence.

A leakage deduction shall not be used to preserve eligibility where the project activity materially diverts material from a higher-order use.

Diversion from an identifiable existing energy-recovery user shall be assessed separately under Section 13.8.2.

Where the available evidence is insufficient to distinguish energy recovery from a higher-order use, the affected quantity shall be treated as ineligible.

### 13.8.4 Accounting-integrity failures

Double issuance, double use, double claiming, competing ownership claims, undocumented final fate, and failure of chain of custody are not leakage sources that may be resolved through a percentage deduction.

Where any such issue remains unresolved:

(a) the affected batch or quantity shall be ineligible;
(b) the associated emission reductions shall be set to zero;
(c) the issue shall be disclosed in the Monitoring Report; and
(d) the applicable Avoiding Double Counting Tool requirements shall be applied.

## 13.9 Conservative adjustment

### 13.9.1 General approach

The conservative adjustment shall be determined under the BioCarbon Conservative Approach and Uncertainty Management Tool.

The result before the conservative adjustment shall be:

| | |
|---|---|
| $ER_{preCA,y} = BE_{FF,y} - PE_y - LE_y$ | Equation 51 |

Where:

| | | |
|---|---|---|
| $ER_{preCA,y}$ | = | emission reductions before application of the conservative adjustment in year y, $tCO_2e$. |

The conservatively adjusted result determined under the applicable BioCarbon Tool shall be $ER_{cons,y}$.

The conservative adjustment shall be:

| | |
|---|---|
| $CA_y = max(0, ER_{preCA,y} - ER_{cons,y})$ | Equation 52 |

Where:

| | | |
|---|---|---|
| $ER_{cons,y}$ | = | conservatively adjusted emission reductions determined under the applicable BioCarbon Tool in year y, $tCO_2e$; |
| $CA_y$ | = | conservative adjustment applied in year y, $tCO_2e$. |

The annual net result may therefore also be expressed as:

| | |
|---|---|
| $ER_y = ER_{preCA,y} - CA_y$ | Equation 53 |

The conservative adjustment shall address residual risks associated with:

(a) measurement uncertainty;
(b) sampling uncertainty;
(c) temporal or spatial representativeness;
(d) laboratory uncertainty;
(e) missing or substituted data;
(f) allocation between baseline and incremental fuel use;
(g) allocation among thermal units or industrial recipients;
(h) stock and mass-balance discrepancies;
(i) uncertainty in fossil and biogenic carbon fractions;
(j) uncertainty in calorific values or carbon contents;
(k) uncertainty in project and leakage emission factors; and
(l) other data-quality limitations capable of overestimating emission reductions.

### 13.9.2 Directional conservativeness

Where a parameter uncertainty could increase baseline emissions or fossil-fuel displacement, the lower conservative value or lower confidence bound shall be used.

Where a parameter uncertainty could reduce project emissions, leakage emissions, or the conservative adjustment, the higher conservative value or upper confidence bound shall be used.

At a minimum:

(a) uncertain alternative-fuel quantities supporting displacement shall be adjusted downward;
(b) uncertain alternative-fuel net calorific values supporting displacement shall be adjusted downward;
(c) uncertain baseline fossil-fuel emission factors shall be adjusted downward;
(d) uncertain fossil carbon fractions of alternative fuel shall be adjusted upward;
(e) unidentified carbon shall be treated as fossil;
(f) uncertain project or leakage emission factors shall be adjusted upward;
(g) unverified final-fate quantities shall be excluded; and
(h) unexplained mass-balance quantities shall not support emission reductions.

### 13.9.3 Prevention of duplicate conservativeness

Baseline conservativeness addresses counterfactual and business-as-usual risk.

The conservative adjustment under this section addresses measurement, sampling, allocation, and data-reliability risk.

Leakage deductions address attributable emission increases outside the physical project boundary.

The same source of risk shall not be deducted more than once. Where a conservative value has already been embedded in an input parameter, the same uncertainty shall not be included again in $CA_y$.

The Project Holder shall maintain an uncertainty and conservativeness register identifying:

(a) each source of uncertainty;
(b) the affected parameter or equation;
(c) the treatment applied;
(d) whether the treatment is embedded in the baseline, project emissions, leakage, or $CA_y$; and
(e) the evidence demonstrating that no duplicate deduction has occurred.

A conservative adjustment shall not substitute for essential missing evidence. Where actual fuel consumption, fossil-fuel displacement, fossil carbon fraction, final fate, legal eligibility, or chain of custody cannot be demonstrated, the affected quantity shall be ineligible rather than subject to an arbitrary discount.

## 13.10 Combination with other energy or industrial methodologies

Where another methodology is applied at the same installation, the Project Holder shall isolate the fossil-fuel reduction attributable to each intervention.

The following relationship shall be satisfied:

| | |
|---|---|
| $E_{FF,red,attr,u,y} = E_{FF,disp,BCR0019,u,y} + \sum_{m} E_{FF,red,m,u,y}$ | Equation 54 |

Where:

| | | |
|---|---|---|
| $E_{FF,red,attr,u,y}$ | = | aggregate fossil-fuel reduction attributed across BCR0019 and all other methodologies or concurrent mitigation interventions in unit u in year y, GJ; |
| $E_{FF,disp,BCR0019,u,y}$ | = | fossil-fuel displacement attributed to BCR0019 in unit u in year y, GJ; |
| $E_{FF,red,m,u,y}$ | = | fossil-fuel reduction attributed to methodology or intervention m in unit u in year y, GJ; |
| $E_{FF,red,total,u,y}$ | = | total physical fossil-fuel reduction demonstrated through measured and normalized performance for unit u in year y, GJ. |

The aggregate attributed reduction shall not exceed the total measured and normalized reduction:

| | |
|---|---|
| $E_{FF,red,attr,u,y} \leq E_{FF,red,total,u,y}$ | Equation 55 |

The physical total $E_{FF,red,total,u,y}$ shall be determined independently from the allocation of reductions among methodologies.

The Project Holder shall not define the measured physical total as the arithmetic sum of the quantities claimed under the applicable methodologies.

Where the effects of BCR0019 and another intervention cannot be separately isolated, the overlapping fossil-fuel reduction shall not be credited simultaneously.

## 13.11 Aggregation, reporting, and issuance limits

Calculations shall be performed separately for each:

(a) thermal unit;
(b) production line;
(c) industrial recipient;
(d) alternative-fuel type;
(e) baseline fossil fuel or fuel mix;

(f) materially different operating configuration;
(g) methodological route; and
(h) country, where the project operates in more than one jurisdiction.

The Project Holder shall aggregate results only after:

(a) all mass and energy balances have been reconciled;
(b) all shared emissions have been allocated once;
(c) all negative unit- and year-level results have been retained;
(d) all project emissions and leakage emissions have been included;
(e) conservative adjustments have been applied;
(f) all quantities have passed chain-of-custody and final-fate controls; and
(g) double-counting controls have been completed.

The following limits shall apply:

| | |
|---|---|
| $ER_y \leq BE_{FF,y}$ | Equation 56 |

| | |
|---|---|
| $E_{FF,disp,u,y} \leq E_{AF,inc,u,y}$ | Equation 57 |

| | |
|---|---|
| $\sum_b M_{AF,inc,b,u,y} \leq \sum_b M_{AF,elig,b,u,y}$ | Equation 58 |

Emission reductions shall be quantified ex post. Projected, contracted, expected, delivered, or installed substitution capacity shall not generate VCCs.

Intermediate calculation results shall retain sufficient decimal precision to avoid material rounding effects. Rounding shall occur only after aggregation of the final monitoring-period result.

The Monitoring Report shall separately disclose:

(a) baseline fossil-fuel emissions;
(b) fossil $CO_2$ emissions from alternative-fuel combustion;
(c) project $CH_4$ emissions;

(d) project $N_2O$ emissions;
(e) biogenic $CO_2$ reported separately;
(f) electricity-related emissions;
(g) transport emissions;
(h) preparation and auxiliary-fuel emissions;
(i) residue-management emissions;
(j) process emissions;
(k) leakage by source;
(l) conservative adjustment;
(m) negative unit- or year-level results;
(n) the net monitoring-period result; and
(o) any quantity excluded because of insufficient evidence, traceability failure, legal non-compliance, or double-counting risk.

### 13.12 Quantification documentation and reproducibility

The Project Holder shall provide the complete quantification in an editable and unprotected calculation file containing:

(a) visible formulas;
(b) clearly identified input, intermediate, and output cells;
(c) units for every parameter;
(d) batch-, unit-, and year-level calculations;
(e) data sources;
(f) laboratory reports;
(g) calibration and maintenance records;
(h) stock and mass-balance reconciliations;
(i) energy balances;
(j) baseline specific-energy calculations;
(k) calculation of the fuel penalty;
(l) fossil-fuel displacement calculations;
(m) fossil and biogenic carbon-fraction calculations;
(n) project-emission calculations;
(o) leakage calculations;
(p) uncertainty propagation and conservative adjustments;
(q) allocation of shared emissions;
(r) links with BCR0018 or another methodology, where applicable; and
(s) reconciliation with the values reported in the Project Document and Monitoring Report.

The calculation system shall allow the CAB to reproduce every material result from primary evidence.

Manual overrides, hidden formulas, inaccessible external links, unsupported constants, unexplained macros, or hard-coded calculation results shall not be permitted.

Any correction to monitored data or calculation formulas shall be documented through a controlled audit trail identifying:

(a) the original value;
(b) the corrected value;
(c) the reason for the correction;
(d) the person authorizing the correction;
(e) the date of the correction; and
(f) its effect on the reported emission reductions.

# 14 Monitoring requirements

## 14.1 General requirements

The Project Holder shall monitor all data and parameters required to quantify greenhouse gas emission reductions in accordance with Section 13 and to demonstrate continued compliance with the applicability conditions of this methodology.

Monitoring shall be conducted in accordance with the applicable versions of the BioCarbon MRV Tool, Conservative Approach and Uncertainty Management Tool, Leakage Management Tool, Avoiding Double Counting Tool, and the validated Monitoring Plan.

The monitoring system shall demonstrate, at a minimum:

(a) the quantity and characteristics of the eligible alternative fuel actually consumed;
(b) the quantity and characteristics of the fossil fuel consumed and displaced;
(c) the industrial output or useful thermal service delivered;
(d) all material project emissions and leakage;
(e) complete chain of custody and final fate; and
(f) the absence of double issuance, double use, and double claiming.

Emission reductions shall be quantified ex post. Quantities produced, purchased, sold, transported, delivered, received, or stored shall not generate emission reductions unless actual eligible consumption in the identified industrial thermal unit is demonstrated.

Monitoring shall be performed separately for each industrial installation, production line, thermal unit, alternative-fuel stream, and methodological route before results are aggregated.

Direct measurement shall be used wherever technically feasible. Commercial records and supplier declarations may support, but shall not replace, measurement of actual fuel consumption, industrial output, or final fate.

## 14.2 Monitoring Plan

The Project Holder shall prepare and implement a Monitoring Plan in accordance with the BioCarbon MRV Tool.

The Monitoring Plan shall identify the project installations and measurement points; the monitored and calculated parameters; measurement, sampling, laboratory, calibration, QA/QC, missing-data, and record-retention procedures; the entities responsible for data collection and control; and the procedures for chain of custody, final-fate reconciliation, leakage assessment, and interaction with BCR0018 or another methodology.

The Monitoring Plan shall include a process-flow diagram and a parameter register linking each monitored value to the corresponding thermal unit, batch or lot, measurement instrument, source record, calculation, and monitoring period.

The Monitoring Plan shall be updated where a material change affects the project boundary, methodological route, fuel source, fuel composition, industrial recipient, thermal equipment, monitoring system, calculation procedure, project emissions, leakage, or traceability. Material changes shall be assessed in accordance with the BioCarbon Standard before being used as the basis for VCC issuance.

## 14.3 Data and parameters not monitored

The parameters in Table 5 shall be established at validation from the baseline scenario determined under Section 12 and the BioCarbon Baseline and Additionality Tool. They shall remain fixed until the applicable baseline reassessment or until a material change requires their revision.

Where a baseline parameter is indexed by y, the complete validated value or trajectory applicable to each year shall be established ex ante. It shall not be updated ex post using project-performance data.

Any revised value shall be independently validated and applied prospectively.

Table 5. Data and parameters not monitored

| Data or parameter | Unit | Description and source | Update requirement | Use |
|---|---|---|---|---|
| Reference output parameter and normalization specification | Project-specific | Definition of $O_{u,y}$, including the industrial output or useful thermal service selected for thermal unit u and all applicable normalization variables and procedures | At validation and whenever the industrial process, product, operating conditions, or output definition materially changes | Equations 10–18 |
| Baseline reference period or benchmark | Dates or dataset | Representative historical period, performance benchmark, or market-representative dataset used | Every seven years, at each renewal of the quantification period, and whenever a material | Section 12 |

| Data or parameter | Unit | Description and source | Update requirement | Use |
|---|---|---|---|---|
| | | to establish baseline performance | change affects the validity of the baseline. | |
| $SEC_{FF,BL,u,y}$ | GJ/unit of (O) | Conservatively calibrated baseline specific fossil-energy consumption | Every seven years, at each renewal of the quantification period, and whenever a material change affects the validity of the baseline. | Equations 10, 15–20 |
| $SEC_{AF,Bl,u,y}$ | GJ/unit of (O) | Baseline specific alternative-fuel energy consumption, where alternative fuel would already be used in the baseline | Every seven years, at each renewal of the quantification period, and whenever a material change affects the validity of the baseline. | Equations 11–13 and 16 |
| $SEC_{OTH,BL,u,y}$ | GJ/unit of (O) | Baseline specific energy supplied by electricity, recovered heat, biomass, or another energy source | Every seven years, at each renewal of the quantification period, and whenever a material change affects the validity of the baseline. | Equations 15–17 |
| $\eta_{FF,BL,u,y}$ | Dimensionless | Baseline fossil-fuel conversion efficiency, where useful thermal energy is directly measured | Every seven years, at each renewal of the quantification period, and whenever a material change affects the validity of the baseline. | Equation 14 |
| Baseline fossil-fuel mix and displacement rule | Fuel type and energy share | Fossil fuel or fuel mix that would have been consumed and the validated procedure for allocating displacement among fossil fuels | Every seven years, at each renewal of the quantification period, and whenever a material change affects the validity of the baseline. | Equations 23–27 |

## 14.4 Minimum data and parameters monitored

The data and parameters in Table 6 constitute the minimum monitoring requirements. A parameter identified as applicable only under specified circumstances may be omitted where the Project Holder demonstrates that it is not relevant to the project configuration and the omission is validated by the CAB.

Additional parameters shall be monitored where required by the selected route, industrial process, project configuration, applicable BioCarbon Tool, or legal requirement.

Table 6. Minimum data and parameters monitored

| Data or parameter | Unit | Description and source | Minimum frequency | QA/QC and conservative treatment | Use |
|---|---|---|---|---|---|
| $M_{recon,b,u,y}$, $M_{AF,inc,b,u,y}$, $M_{open,b,u,y}$, $M_{rec,b,u,y}$, $M_{feed,b,u,y}$, $M_{close,b,u,y}$, $M_{rej,b,u,y}$, $M_{tr,b,u,y}$, $M_{loss,b,u,y}$, and $M_{AF,elig,b,u,y}$ | t | Opening stock, receipts, feeding, closing stock, rejections, transfers, losses, and eligible alternative fuel actually consumed | Each delivery or feeding event; stocks and mass balance reconciled at least monthly and for each monitoring period | Calibrated weighing or feeding systems; reconcile receipts, stocks, transfers, and consumption. Unexplained quantities shall not support emission reductions | Equations 5–8 and 30–35 |
| $FC_{FF,i,u,y}$ and fossil-fuel stocks | Fuel-specific unit | Fossil fuel consumed in the eligible thermal unit, including residual, start-up, stabilization, support, and auxiliary fuel | Continuous or each consumption event; aggregated at least daily | Calibrated fuel meter; cross-check against purchases, opening and closing stocks, production, and operating records | Equations 9, 18 and 21–28 |
| $NCV_{AF,b,y}$ and $MC_{AF,b,y}$ | GJ/t and % | Net calorific value and moisture content of alternative-fuel batch or representative lot, on a basis consistent with the monitored mass | Each batch or representative lot at a frequency justified by fuel variability | Representative sampling and accredited laboratory analysis; convert results to the as-received basis | Sections 13.4.2 and 13.5.3; $NCV_{AF,b,y}$ is used in Equations 8, 13, 19, and 30–35. $MC_{AF,b,y}$ is used to ensure consistent dry/as-received conversion and to assess moisture-related effects on thermal performance |

| Data or parameter | Unit | Description and source | Minimum frequency | QA/QC and conservative treatment | Use |
|---|---|---|---|---|---|
| $CC_{comb,b,y}$, $f_{FC,b,y}$, $f_{BC,b,y}$, $f_{UC,b,y}$, $CC_{inorg,b,y}$, $f_{rel,b,u,y}$ and $OF_{AF,b,u,y}$ | tC/t or fraction | Combustible carbon content; fossil, biogenic, and unidentified carbon fractions; inorganic carbon parameters; and the oxidation factor applicable to alternative-fuel combustion. | Each batch or representative lot; inorganic carbon where applicable | Each batch or representative lot; inorganic carbon and the oxidation factor where applicable. | Equations 31–37 |
| Ash content and relevant contaminants | % or applicable unit | Ash, chlorine, sulfur, halogens, heavy metals, and other parameters relevant to fuel eligibility, operation, product quality, and residue management. | Each batch or representative lot, or at the stricter permit frequency. | Compare against fuel specifications, permits, and acceptance limits; non-conforming fuel shall be separately controlled. | Sections 5.1, 5.4, 13.4.2, and 13.7.10 |
| $NCV_{FF,i,y}$ $EF_{GHG,FF,i,y}$; and, where Equation (22) is applied, $CC_{FF,i,y}$ and $OF_{FF,i,y}$ | GJ/unit; $tCO_2e/GJ$; tC/unit; and fraction | Fuel-specific data shall be preferred. Otherwise, the data hierarchy and conservative-selection requirements of this methodology shall apply. Carbon content, oxidation factor, net calorific value, and fuel quantity shall be expressed on | Each delivery or representative fuel period; emission factors updated when the fuel or approved source changes | Fuel-specific data preferred; otherwise apply the data hierarchy and conservative selection requirements of this methodology | Equations 9 and 21–28 |

| Data or parameter | Unit | Description and source | Minimum frequency | QA/QC and conservative treatment | Use |
|---|---|---|---|---|---|
| | | consistent measurement bases. | | | |
| $O_{u,y}$, $Q_{useful,u,y}$, and relevant normalization variables | Project-specific and GJ | Actual industrial output or useful thermal service and variables affecting thermal demand, such as product type, moisture, temperature, pressure, throughput, or steam conditions | Continuous, each production batch, or at least daily, as appropriate | Calibrated production or thermal-energy measurement; reconcile with production and quality records | Equations 10–18 |
| $E_{FF,other,u,y}$ | GJ | Fossil-fuel reduction attributable to separately identifiable concurrent mitigation interventions not already reflected in the normalized baseline or project-performance calculation | Each monitoring period and whenever another intervention is introduced or modified | The attribution method shall be validated. Production, product mix, moisture, temperature, or other normalization effects shall not be deducted again | Equation 18 and Equations 54–55 |
| $E_{OTH,PJ,u,y}$, $EC_{PJ,s,y}$, $EC_{BL,s,y}$, $EF_{EL,s,y}$, $FC_{PJ,i,p,y}$, and $FC_{BL,i,p,y}$ | GJ, MWh, fuel unit, and $tCO_2e$/MWh | Other project energy inputs, incremental electricity consumption, electricity emission factor, and additional fossil fuels consumed outside the eligible thermal unit | Continuous or monthly, according to the source | Direct sub-metering preferred; prevent duplication with fossil fuel already included in $FC_{FF,i,u,y}$ | Equations 15–18 and 40–43 |

| Data or parameter | Unit | Description and source | Minimum frequency | QA/QC and conservative treatment | Use |
|---|---|---|---|---|---|
| $M_{t,y}$, $D_{t,y}$, and $EF_{CO_2,TR,t,y}$ | t, km, tonne-kilometers, and $tCO_2$ per tonne-kilometer | Mass, transport distance, mode, and $CO_2$ emission factor for project-attributable freight transport | Each transport movement | Apply TOOL12 where its applicability conditions are met; include attributable return movements as required; do not add $CH_4$ or $N_2O$ under the same simplified approach | Equations 44–45 |
| Storage and handling incident data | t, hours, temperature, or applicable unit | Quantity, duration, operating conditions, and material affected by degradation, self-heating, fire, uncontrolled combustion, spillage, or unexplained physical loss during storage or handling. | Continuous incident recording and each monitoring period. | $PE_{ST,y}$ may be set equal to zero only where storage and handling controls, mass reconciliation, and the absence of material incidents are demonstrated. Where the greenhouse gas effect of a material incident cannot be reliably quantified, the affected batch, storage interval, or project component shall be ineligible. | Section 13.7.9 and $PE_{ST,y}$ |
| $Q_{r,y}$, residue-management route, and $EF_{RM,r,y}$ | t and $tCO_2e/t$ | Quantity and final management of rejects, ash, dust, slag, and other residues. The applied emission factor shall represent gross positive emissions. Recycling, avoided-disposal, or mineral-substitution benefits shall not be netted against project emissions. | Each shipment or at least monthly | Reconcile with fuel input, ash content, process records, transport documents, and final-recipient evidence | Equation 46 |

| Data or parameter | Unit | Description and source | Minimum frequency | QA/QC and conservative treatment | Use |
|---|---|---|---|---|---|
| $EF_{CH_4,AF,b,u,y}$, $EF_{N_2O,AF,b,u,y}$, or $SG_{u,y}$, $C_{g,SG,u,y}$, and $EM_{g,noninc,u,y}$ | t gas/GJ; $Nm^3$; t gas/$Nm^3$; and t gas | $CH_4$ and $N_2O$ emissions determined using applicable emission factors or direct stack measurement, including the measured or conservatively determined non-incremental quantity used for source apportionment. | Each monitoring period or at the frequency required by the selected measurement method and applicable law | Demonstrate the applicability and representativeness of the selected emission factors. Direct measurements shall be calibrated, corrected to a consistent stack-gas basis, and supported by the source-apportionment procedure required by Equation (39). Where source apportionment cannot be demonstrated, Equation (38) shall apply. | Equations 38–39 |
| $PROCEM_{PJ,y}$ and $PROCEM_{BL,adj,y}$ | $tCO_2e$ | Project and normalized baseline industrial process emissions where the alternative fuel may materially affect process emissions | Each monitoring period, where applicable | Use a like-for-like output and process basis. Reductions in process emissions shall not generate credits under BCR0019. Inorganic carbon already accounted for under $PE_{IC,y}$ shall not be included in $PROCEM_{PJ,y}$ or $PROCEM_{BL,adj,y}$. | Equation 47 |
| Existing energy-use diversion and other quantifiable leakage activity data | Applicable unit | Data required to quantify diversion from an existing energy-recovery user, replacement fuels or energy, off-site preparation, transport, | Each occurrence and each monitoring period. | Apply the Leakage Management Tool. Where material leakage cannot be reliably quantified, the affected quantity shall be ineligible. | Equations 48–50 |

| Data or parameter | Unit | Description and source | Minimum frequency | QA/QC and conservative treatment | Use |
|---|---|---|---|---|---|
| | | storage, treatment, relocation of production, and other attributable emission increases. | | | |
| Waste-hierarchy and higher-order-use eligibility records | Documentary and batch-specific | Evidence of the pre-project destination and realistic alternative use of the material stream, including preparation for reuse, reuse, recycling, and material recovery. | Each batch or representative material stream and each monitoring period. | Material diverted from a higher-order use is ineligible. No leakage deduction may be used to preserve eligibility. | Sections 5.1, 11.9, and 13.8.3. |
| Chain-of-custody, final-fate, legal-compliance, and linked-methodology records | Documentary and batch-specific | Records linking waste source, fuel preparation, transport, industrial recipient, thermal unit, actual consumption, claim ownership, permits, and any interface with BCR0018 | Each batch or lot and each monitoring period | Complete physical and documentary reconciliation. Book-and-claim or unsupported contractual matching is not permitted. Unresolved traceability, final-fate, legal, or ownership failures render the affected quantity ineligible | Eligibility, Sections 10.8, 13.8.4, and 14.1 |

## 14.5 Specific monitoring provisions

Alternative-fuel sampling and sample preparation shall follow ISO 21645, ISO 21646, or an equivalent recognized standard. Biomass content and fossil and biogenic carbon fractions shall be determined using ISO 21644, radiocarbon analysis, or another validated method appropriate to the fuel composition. Net calorific value shall be determined using ISO 21654 or an equivalent recognized standard.

Analyses used directly in the quantification of emission reductions shall be conducted by laboratories accredited to ISO/IEC 17025 for the relevant method. Where accredited capacity is demonstrably unavailable, an alternative laboratory may be used only in accordance with the enhanced QA/QC requirements of the BioCarbon MRV Tool.

For Route A, fuel consumption and industrial output shall be monitored separately for each kiln or production line and, where applicable, for each feeding point. Clinker or quicklime shall ordinarily constitute the reference output. Any material change in specific thermal-energy consumption, kiln operation, product quality, raw-material composition, or process emissions shall be accounted for.

For Route B, the Project Holder shall monitor the validated reference output and all variables required to demonstrate equivalent industrial service and normalize thermal-energy demand. Where a common steam or thermal-energy system supplies more than one user, eligible and non-eligible uses shall be directly metered or conservatively allocated.

Where Supplementary Module C applies, the Project Holder shall monitor, in addition to the requirements of the linked Route A or Route B component, fuel acceptance and rejection, non-hazardous classification, dispatch, receipt, storage, feeding, actual consumption, controlled-combustion conditions, air-pollution control operation, unauthorized transfers, and final management or incorporation of residues.

Supplementary Module C shall not generate a separate emission-reduction calculation.

Measurement equipment shall be calibrated and maintained in accordance with applicable legal requirements, recognized metrological practice, and the BioCarbon MRV Tool. Data affected by equipment failure or calibration outside the permitted tolerance shall be corrected conservatively or excluded.

Missing-data procedures shall follow the BioCarbon MRV Tool and Conservative Approach and Uncertainty Management Tool. Missing-data substitution shall not be used to replace essential evidence of actual alternative-fuel consumption, fossil-fuel displacement, fuel composition, equivalent industrial service, chain of custody, final fate, legal eligibility, or absence of double counting. Where such evidence is unavailable, the affected quantity shall be ineligible.

Optional dMRV systems may be used where they preserve the underlying raw data, audit trail, calculation transparency, access for validation and verification, and all applicable calibration and QA/QC requirements.

The Monitoring Report shall present the monitored data, calculation results, mass and energy balances, project emissions, leakage, conservative adjustments, excluded quantities, missing-data treatment, material incidents, and reconciliation with BCR0018 or another methodology, where applicable. All reported results shall be reproducible from the underlying evidence and editable calculation files.

# 15 Permanence and reversal risk management

## 15.1 Nature of the credited mitigation outcome

BCR0019 quantifies ex post greenhouse gas emission reductions resulting from the measurable and attributable displacement of fossil fuel combustion in eligible industrial thermal processes.

The methodology does not quantify carbon dioxide removals, carbon sequestration, carbon capture and storage, carbon retained in products, biological or geological carbon stocks, or another mitigation outcome dependent on continued carbon storage.

The Project Holder shall document an applicability screening under the applicable BioCarbon Permanence and Risk Management Tool.

For the core mitigation outcome quantified under BCR0019, physical reversal risk shall ordinarily be considered not applicable because:

(a) no atmospheric $CO_2$ is removed and stored;
(b) no credited carbon reservoir is created or enhanced;
(c) emission reductions are quantified only after eligible fossil fuel combustion has been demonstrably displaced; and
(d) subsequent project discontinuation does not release a carbon stock previously credited under this methodology.

BCR0019 does not establish a methodology-specific buffer contribution for its core mitigation outcome. Any program-level requirement expressly imposed by the BioCarbon Standard shall nevertheless apply.

## 15.2 Physical reversal and future non-performance

Subsequent reduction or cessation of alternative-fuel use, interruption of supply, return to fossil-fuel use, closure of the installation, termination of the project, or failure to achieve projected future reductions shall not constitute physical reversal of previously verified BCR0019 emission reductions.

Such events prevent the generation of future emission reductions and may require reassessment of applicability, baseline, additionality, or monitoring arrangements.

Where the project activity ceases:

(a) no emission reductions shall be credited after the cessation date unless eligible operation is resumed and demonstrated;
(b) all fuel quantities, stocks, project emissions, leakage, rejects, residues, and unresolved batches associated with the final monitoring period shall be reconciled;
(c) unresolved quantities shall be excluded; and
(d) any restart shall be assessed as a material change.

The absence of physical reversal risk shall not be interpreted as a guarantee of continued project performance.

### 15.3 Genuine displacement and issuance integrity

The credited mitigation outcome shall represent genuine fossil-fuel displacement and not temporary deferral, stock accumulation, transfer of production, transfer of fossil-fuel consumption, reduced output, or accounting reclassification.

Opening and closing fossil-fuel stocks, transfers, consumption, industrial output, and operating conditions shall be monitored and reconciled where material.

Where genuine displacement cannot be demonstrated, the affected quantity shall not be credited.

Quantification errors, overstatement of alternative-fuel consumption, understatement of fossil-fuel use, incorrect fuel characterization, missing project emissions, unaccounted leakage, chain-of-custody failure, undocumented final fate, legal non-compliance, double counting, or unsupported claim ownership are issuance-integrity failures and not physical reversals.

Such failures shall not be addressed through a permanence buffer or arbitrary percentage deduction. They shall be managed under the applicable BioCarbon rules governing data correction, over-issuance, non-conformity, double counting, Registry action, and program enforcement.

### 15.4 Relationship with other methodologies

Where BCR0019 and BCR0018 are applied to the same physical waste stream, permanence and reversal considerations shall be assessed separately for each mitigation outcome.

Discontinuation of downstream fossil-fuel substitution shall not, by itself, reverse an upstream methane-avoidance outcome already validly quantified under BCR0018. A subsequent change in the upstream waste-management arrangement shall not, by itself, reverse a downstream BCR0019 emission reduction already validly quantified.

An event affecting batch reconciliation, final fate, claim ownership, shared emissions, or double-counting controls may nevertheless affect the eligibility of outcomes under both methodologies and shall be assessed separately for each.

Where BCR0019 is combined with a methodology that quantifies carbon dioxide removals, carbon storage, or another reversible mitigation outcome:

(a) each mitigation outcome shall remain separately quantified;
(b) the removal or storage component shall apply its applicable permanence, risk, buffer, monitoring, compensation, and reversal-response requirements;

(c) the non-reversible classification of BCR0019 shall not exempt the other component from those requirements; and
(d) reversal of the removal or storage component shall not automatically invalidate correctly quantified BCR0019 emission reductions.

## 16 Document status

This document is issued for public consultation and has no methodological effect until formally approved and published by BioCarbon Cert.

Its use, validity, versioning, effective date, and transition provisions are governed by Section 4 and the applicable BioCarbon program requirements.

## 17 Bibliographic references

The references listed below comprise the principal program, scientific, technical, and methodological sources directly used in the development of BCR0019.

Inclusion of an external standard, methodology, or methodological tool does not incorporate that document in its entirety or alter the normative hierarchy established in Section 8.

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BioCarbon Cert. Leakage Management Tool. Most recent version in force.

BioCarbon Cert. Conservative Approach and Uncertainty Management Tool. Most recent version in force.

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United Nations Framework Convention on Climate Change (UNFCCC). Clean Development Mechanism. TOOL05. Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation. Version 03.0.

United Nations Framework Convention on Climate Change (UNFCCC). Clean Development Mechanism. TOOL12. Project and leakage emissions from transportation of freight. Version 01.1.0.

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