Verified Carbon Standard

Draft VCS Methodology

VM0050

ENERGY EFFICIENCY AND FUEL-SWITCH MEASURES IN COOKING DEVICES

Draft Version 2.0

9 July 2026

Sectoral Scope 3: Energy Demand

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1 SUMMARY DESCRIPTION

Project Category	Demand-side energy efficiency and fuel switch
Project Activity Type	• Distribution of improved cookstoves • Distribution of other energy efficiency installations (heat retention devices)
Additionality	Activity Method / Project Method
Crediting Baseline	Project Method
Mitigation Outcome	Reductions

This methodology applies to project activities that introduce energy efficiency and fuel-switch measures in cookstoves and/or through the use of heat retention devices. Projects must be implemented in households, community-based kitchens, institutions (e.g., schools, hospitals), or small and medium-sized enterprises[1] (SMEs).

The rules and requirements for projects implementing heat retention devices are prescribed in Appendix-6 of this methodology.

2 SOURCES

This methodology is based on the following methodologies:

- *CDM AMS-II.G. Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass, v13.1*
- *CDM AMS-I.E. Switch from Non-renewable Biomass for Thermal Applications by the User, v13.0*
- *VMR0006 Energy Efficiency and Fuel Switch Measures in Thermal Applications, v1.2*

This methodology uses the following tools, and guidelines:

- *VT0008 Additionality Assessment*
- *VT0010 Emissions from Electricity Consumption and Generation*

[1] This includes micro enterprises. Some regions and countries refer to micro, small, and medium enterprises (MSMEs).

- *VT0011 Electricity System Emission Factors*
- *CDM AMS-III.K. Avoidance of Methane Release from Charcoal Production*
- *CDM Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*
- *CDM Guidelines for sampling and surveys for CDM project activities and programmes of activities, v4.0*
- *CDM TOOL03 Tool to Calculate Project or Leakage CO_2 Emissions from Fossil Fuel Combustion, v3.0*
- *CDM TOOL12 Project and Leakage Emissions from Transportation of Freight, v1.1.0*
- *CDM TOOL15 Upstream Leakage Emissions Associated with Fossil Fuel Use, v2.0*
- *CDM TOOL16 Project and Leakage Emissions from Biomass, v5.0*
- *CDM TOOL33 Default Values for Common Parameters, v3.0*

The methodology also uses the following protocols developed collaboratively by multiple Clean Cooking Alliance (CCA) partners:[2]

- *Durability Protocol, v1.0*
- *Controlled Cooking Test (CCT) Protocol, v3.0*
- *Kitchen Performance Test (KPT) Protocol, v4.0*
- *Water Boiling Test (WBT) Protocol, v4.2.3*

3 DEFINITIONS

Artisanal cookstoves

Cookstoves manufactured through manual or semi-manual, small-scale production processes, typically by local artisans or workshops. These stoves can be fuel-efficient and may be made from local materials like clay and metal, with production often supporting local economic development.

Batch

A group of similar instances implemented within a defined eligibility area in a single monitoring period[3]

[2] https://cleancooking.org/protocols/

[3] Multiple batches may be installed within a single calendar year, and the date of commissioning of the last project device of the batch is used as the commissioning date for the entire batch.

Biomass
Non-fossilized and biodegradable organic material originating from plants, animals, and micro-organisms. This also includes products, by-products, residues, and waste from agriculture, forestry, and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes.

Biomass residue
Organic material that remains after the primary product has been extracted or harvested. These residues are often biomass by-products, residues, and waste streams from agriculture, forestry, and related industries.

Electric cooking device
Project device powered by electricity and connected to national/regional grid or mini grids. Examples include induction cook stoves, hot plates, ceramic cooking-hob with heating coils, electric pressure cookers, slow cookers, crock pots, electric rice cookers, and multi cookers.

Hawthorne Effect
A form of social desirability bias in which end users alter their behaviour because they are aware of being observed or monitored, potentially biasing measured outcomes (e.g., usage or fuel consumption) during observation periods such as Kitchen Performance Tests.

Heat retention device
Insulated containers, where trapped air and insulating materials (like hay, straw, polystyrene beads or modern vacuum walls) minimise heat loss allowing food to continue cooking using heat retained after a short period on a stove.[4]

Improved cookstove
A device used for cooking that reduces greenhouse gas (GHG) emissions from traditional baseline technologies through energy efficiency improvements and/or fuel switching to a less GHG-intensive fuel

Project device
An individual improved cookstove unit or heat retention device used as part of the project activity

Self-generated renewable electricity
Electricity produced locally in off-grid systems using renewable energy sources, such as photovoltaic solar energy, which is used to power cookstoves

[4] A heat retention device works by first bringing food to a cooking temperature, typically a rolling boil, using a stove. The pot is then placed inside the insulated chamber. This retained heat allows food to finish simmering without additional fuel or electricity. Importantly, these devices typically supplement, rather than replace, existing stoves. The result is a measurable reduction in overall energy consumption for cooking as compared to with the exclusive use of the stove for the same cooking task.

Technical life
Total time for which an improved cookstove is technically designed to operate from its first commissioning, expressed in years or hours of operation

Note – All references to "average" in this document refer to the mean, calculated as the sum of all values divided by the number of values.

4 APPLICABILITY CONDITIONS

This methodology applies to project activities that introduce energy efficiency and fuel-switch measures in cookstoves and/or through the use of heat retention devices. Please refer to Appendix 6 for applicability conditions for projects implementing heat retention devices.

This methodology is applicable where all of the following conditions are met:

1) The project activity corresponds to:
    a) Replacement of non-renewable biomass (e.g., firewood, charcoal)-fired cookstoves with any of the following:
        i) More efficient project devices that use the same fuel as in the baseline;
        ii) Efficient project devices fired by renewable biomass;
        iii) Efficient project devices fired by bioethanol or liquefied petroleum gas (LPG); or
        iv) Electric-powered project devices.
    b) Replacement of solid or liquid fossil fuel (e.g., coal, kerosene)-fired cookstoves with any of the following:
        i) Efficient project devices fired by renewable biomass;
        ii) Efficient project devices fired by bioethanol or LPG; or
        iii) Electric-powered project devices.
2) Project devices are used in households, communities, institutions, or small or medium enterprises (SMEs),[5] collectively referred to in this methodology as the "target population."

[5] This includes micro enterprises.

Use of renewable biomass

3) Where renewable biomass is used, it is exclusively renewable[6] and qualifies as one of the following:

   a) A by-product, residue, or waste stream from agriculture, forestry, and related industries; or

   b) Originating from dedicated plantations that comply with all relevant applicability conditions in the most recent version of CDM *TOOL16*.

4) Where biomass residues are used, they would have been left to decay or burned without energy recovery before implementation of the project activity, and their use does not involve a decrease in carbon pools – in particular of dead wood, litter, or soil organic carbon – on the land areas from which the biomass residues originate.

5) Where biomass residues from a production process are used, project implementation does not result in an increase in the processing capacity of raw input or any other substantial changes (e.g., product change) in this process.

6) Where more than one type of renewable biomass is used, each of the biomass types used complies with the applicability conditions.

Note – Renewable biomass may be processed into fuels, such as briquettes, wood chips, or charcoal.

7) Where project activities introduce renewable biomass as charcoal, it is renewable charcoal produced by efficient charcoal production processes[7] (e.g., retort sedentary kilns, improved sedentary kilns, Casamance kilns). Methane produced during the charcoaling process is captured and destroyed or combusted for energy purposes.

Cookstove characteristics[8] and use

8) Project devices using renewable biomass (fuel-switch) or non-renewable biomass (improved efficiency) are single-pot, multi-pot, portable, or in-situ cookstoves with an initial thermal efficiency[9] of at least 25%.[10]

9) Project devices using LPG or bioethanol are single-pot or multi-pot portable, or in-situ cookstoves with an initial thermal efficiency of at least 30%.

[6] Refer to the applicable version of the *VCS Program Definitions* for the definition of renewable biomass.

[7] Where kilns emit a minimal amount of methane during the charcoaling process (i.e., an efficient process is employed that results in high charcoal yield) and the small amount of methane that is emitted is captured and used or destroyed.

[8] Only thermal efficiency and durability of cookstoves are evaluated.

[9] Initial thermal efficiency for a new stove, which is expected to deteriorate during the project lifetime.

[10] Efficiency thresholds of 20% (Tier 2), 30% (Tier 3), and 40% (Tier 4) from ISO/TR 19867-3, available at: https://www.iso.org/standard/73935.html

10) Improved cookstoves must have a maximum (overall) risk factor score of 15 or less when assessed in accordance with the *Cookstove Durability Protocol,*[11] applying only those tests applicable to the device design and technology, as specified in the Protocol.

11) Electric project devices[12] have the following minimum thermal efficiency:

    a) Hot plates and electric hobs: 40%

    b) Induction stoves and other electric stoves: 70%

12) Project devices using LPG comply with all of the following conditions:

    a) The baseline fuel either includes non-renewable biomass or is a more carbon-intensive fossil fuel (demonstrated by the baseline survey, see Section 7.2);

    b) The project has a provision for metering LPG supplied to each consumer at the LPG filling station or directly in the household, in order to determine household LPG consumption; and

    c) The project does not seek to issue any carbon credits for periods after 31 December 2045.

13) Electric project devices use the following electricity sources:

    a) Decentralized renewable energy systems: Decentralized energy systems using fossil fuels are not eligible, except for backup generators that supply less than 1% of the annual electricity of the decentralized renewable energy system.[13]

    b) Self-generated renewable electricity (with a maximum of 20% electricity from non-renewable sources for backup); or

    c) National or regional electricity grid.

14) The project proponent designs and implements suitable incentive-based mechanisms to reduce the continued use of inefficient baseline devices and practices that can be replaced by the project devices, with the objective of promoting a permanent transition to cleaner cooking technologies and practices in the project areas. The project proponent must clearly describe these mechanisms and the supporting evidence in the project description.

[11] The Cookstove Durability Protocol provides methods for evaluating cookstove durability by carrying out a range of targeted tests. Each test incorporates a numeric scoring method and cookstoves are scored based on their (durability) risk level. The higher the risk of durability issues, the higher the overall score.

[12] Defined as clean technologies by WHO; see https://www.who.int/tools/clean-household-energy-solutions-toolkit/module-7-defining-clean

[13] This restriction aims to avoid the introduction of new, inefficient fossil fuel-fired electricity generation to fuel electric cookstoves.

15) Where a project device has ended its technical life, the project proponent either replaces it with a comparable or better project device or retrofits its essential components to continue meeting the minimum service level requirements (i.e., thermal energy generation), otherwise no further emission reductions may be claimed for the project device. When the project proponent intends to implement replacement or retrofit in line with this condition, they must provide a practicable strategy for the replacement or retrofit (as applicable) of the project devices in the project description.

Avoiding harm and double counting

16) Project proponents implement a method for the distribution and identification of project devices that avoids double counting of emission reductions by other mitigation actions and includes unique product identification on the device itself at the time of distribution/sale (e.g., program logo, alpha/numeric ID, and end-user location, such as geographic coordinates, complete address information). The unique product identifier must be permanently and durably affixed to the project device, such as engraved, embossed, stamped, or otherwise indelibly marked and applied directly to the device body or to a durable component not subject to replacement/retrofit.

17) The project complies with any national, sub-national, or local regulations or guidance for the installation, commercialization, distribution, and use of project devices and/or fuel supply and use for the target population. National, regional, and local regulatory frameworks for the provision of the type of thermal energy services provided by the project activity must be documented.

18) Where project activities reduce emissions from non-renewable biomass, including firewood and charcoal, the risk of double counting is assessed on a national basis by evaluating at validation and crediting period renewal whether there are REDD+ projects or jurisdictional REDD+ programs whose project boundary overlaps with the expected fuel source area of the project. The project proponent must report on the findings of this assessment for informational purposes in the project description.

Note – In the future, the VCS Program may adopt further requirements or guidelines related to the risk of double counting between improved cooking and REDD+ activities.

5 PROJECT IMPLEMENTATION

5.1 Project Start Date

The project start date must be established in accordance with the applicable versions of the *VCS Standard* and *VCS Program Definitions*.

When determining the project start date, the following types of actions must be considered, as applicable:

1) Distributing the first project device(s) to the end user(s). This must be evidenced by verifiable primary records, such as sales/distribution logs or records, sales invoices (including warranty cards) and signed user acceptance forms.
2) Signing contracts to purchase the project devices

Where the project start date occurs after validation, the project proponent must provide an estimated project start date in the Project Description and the actual project start date (in accordance with the above requirements) in the first Monitoring Report.

The above requirements are also applicable when establishing the estimated and actual crediting period start dates on account of crediting period renewal.

5.2 Initial Crediting Period Start Date

The initial crediting period start date must be established in accordance with the applicable versions of the *VCS Standard* and *VCS Program Definitions*.

For this methodology, the initial crediting period start date is the same as the project start date established in Section 5.1.

5.3 Crediting Period Renewal

Project proponents must renew the project crediting period in accordance with the VCS Program rules.

For crediting period renewals, further requirements for reassessing the validity of the baseline scenario and associated GHG emissions are provided in Section 7.3.

Projects transitioning from earlier versions of *VM0050* and other methodologies (including *VMR0006, AMS-II.G* and *AMS-I.E)* to this methodology version must comply with all relevant requirements of this methodology, specifically the determination of baseline scenario (including requirements related to control groups, baseline fuel consumption cross-checks and ongoing baseline reassessment) prescribed in Section 7 of this methodology.

For existing projects updating to *VM0050* that have not established the control households prior to validation, control households must be established before the first verification under *VM0050 (*see Section 7.3*)*.

6 PROJECT BOUNDARY

The project boundary includes the project devices, the geographical site where they are located, and the locations from which baseline and project fuels are sourced.

Where project devices use electricity, the project boundary also includes the electricity generation, transmission, and distribution system.

The GHG sources included in or excluded from the project boundary are shown in Table 1.

Methane and nitrous oxide may be significant sources of GHG emissions especially where charcoal, biomass fuels, and biomass residues are used. The project proponent must assess the significance of such fuel emissions and apply the de minimis criterion in line with the most recent version of the *VCS Methodology Requirements* to determine which sources must be included.

Emissions from fuel production[14] and transportation may be ignored where they are higher in the baseline than the project scenario.

Table 1. GHG sources and sinks accounted for as baseline, project, and leakage emissions

Source/Sink		Type	Gas	Included?	Justification/Explanation
Baseline	Thermal energy generation	Source	CO_2	Yes	Major source
			CH_4	Yes	May be significant for some fuels
			N_2O	Yes	May be significant for some fuels
	Production of charcoal fuel[15]	Source	CO_2	Yes	Major source
			CH_4	Yes	May be significant for charcoal
			N_2O	Yes	May be significant for charcoal
Project	Thermal energy generation due to fuel use	Source	CO_2	Yes	Major source
			CH_4	Yes	May be significant for some fuels
			N_2O	Yes	May be significant for some fuels
		Source	CO_2	Yes	Major source

[14] For example, energy use for renewable biomass processing, such as shredding and compacting in the case of briquetting, may be considered to be equivalent to the upstream emissions associated with the processing of a displaced fossil fuel and hence may be disregarded.

[15] Includes fugitive emissions from charcoal production. Production of fossil fuels is not considered, which is conservative.

	Transport of fuel (where applicable)		CH_4	Yes	May be significant for some fuels
			N_2O	Yes	May be significant for some fuels
	Production of fuel (where applicable)	Source	CO_2	Yes	Major source
			CH_4	Yes	May be significant for some fuels
			N_2O	Yes	May be significant for some fuels
	Self-generated electricity (non-renewable energy for backup)	Source	CO_2	Yes	Major source
			CH_4	Yes	May be significant for some fuels
			N_2O	Yes	May be significant for some fuels
	Grid electricity generation and distribution	Source	CO_2	Yes	Major source
			CH_4	No	Negligible
			N_2O	No	Negligible
Leakage	Use of non-renewable biomass by other users and other types of GHG reversals	Source	CO_2	Yes	Major source
			CH_4	No	Negligible
			N_2O	No	Negligible
	Use of baseline devices that were replaced by project devices outside the project boundary	Source	CO_2	Yes	Major source
			CH_4	No	Negligible
			N_2O	No	Negligible
	Increased emissions from fossil fuel use by non-project participants	Source	CO_2	Yes	Major source
			CH_4	No	Negligible
			N_2O	No	Negligible
	Shift of pre-project activities due to the establishment of dedicated plantations for renewable biomass supply	Source	CO_2	Yes	Major source
			CH_4	No	Negligible
			N_2O	No	Negligible
	Diversion of biomass residues from other uses to the project activity	Source	CO_2	Yes	Major source
			CH_4	No	Negligible
			N_2O	No	Negligible

For non-renewable biomass fuels, the project proponent must provide a kml file delimiting the geographic area(s) of origin of the biomass fuel used in the project and a description of how that area is defined.

7 BASELINE SCENARIO

The baseline scenario including the GHG sources must be defined according to the technologies, practices, fuel types, and fuel consumption patterns that will be replaced by the project devices in the defined target population.

For project activities distributing heat retention devices, please refer to Appendix 6 for the baseline scenario requirements.

7.1 Identifying the Baseline Scenario

Step 1: Identify alternative baseline scenarios

Define the alternative baseline scenarios according to the cookstove unit type, the type of thermal energy service provided, the fuel type and source, and describe the GHG sources involved.

The alternative baseline scenarios must include both existing and alternative cookstove technologies that provide comparable outputs for cooking to the users of the target population. The project activity, without being registered as a project activity under a GHG program, must be included as an alternative.

Where the project activity replaces a mix of technologies, services, and/or fuel types, the baseline alternative must be defined in a conservative way, considering these variables. Where multiple fuels are used in the baseline, the proportion of baseline fuel usage may be established in terms of energy supplied by each of the identified fuels.

The baseline alternatives must be defined using the results of a baseline survey of the target population and cross-checked with relevant and current information from credible literature, official publications (e.g., surveys, studies), or official statistics from government entities or other credible agencies that is, preferably, specific to the location of the target population and differentiates between rural versus urban and peri-urban conditions. The baseline survey of the target population must apply the procedures and practices described in Section 7.2.

Step 2: Consider existing and forthcoming government policies and legal requirements

Eliminate the baseline alternatives that are inconsistent with existing and forthcoming mandatory legal or regulatory requirements. These may include minimum product efficiency standards and air quality requirements.

Where the legal or regulatory requirements are systematically not enforced and non-compliance is demonstrably widespread in the applicable geographic region, include the alternative scenarios in the list for further consideration. Demonstration of non-enforcement must be

based on authoritative and up-to-date information that is relevant and applicable to the alternative scenario.

Where the mandatory legal or regulatory requirements are enforced, eliminate the alternative scenario from further consideration.

Step 3: Assess financial, institutional, and information barriers

Establish a complete list of realistic and credible barriers that may prevent alternative scenarios from occurring. The barriers must be based on the actual context of the project activity and alternatives and the applicable geographic area, reflecting practical challenges to activity implementation. The applicable geographic region is defined as per the most recent version of *VT0008 Additionality Tool*.

Eliminate the baseline alternatives that face financial, institutional, or information barriers. These barriers are further explained in Step 2a of *VT0008*.

The remaining baseline scenario(s) must be one or a combination, of the following:

i) Non-renewable biomass: The baseline scenario is the target population's continued use of inefficient cookstoves fired with non-renewable firewood or charcoal to meet similar thermal energy outputs for cooking as the project devices.

   Project proponents may use a combination of different non-renewable biomass types in the baseline.

ii) Fossil fuels: The baseline scenario is the target population's continued use of cookstoves fueled by solid or liquid fossil fuels (e.g., coal, kerosene) to meet similar thermal energy outputs for cooking as the project devices.

Cookstoves that have a fuel other than non-renewable biomass or solid or liquid fossil fuels (e.g., electricity, solar thermal, renewable biomass, LPG) in the baseline scenario must be excluded from the project activity.

7.2 Baseline Scenario Survey Requirements

The objective of the baseline survey is to collect critical information related to existing baseline technologies, services, fuel types, and fuel sources in the target population. The survey must be designed, carried out, and analyzed in line with the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*.

The survey results must define the following baseline characteristics for each target population:

1) Baseline fuel type(s) and the percentage of their use by the target population;
2) Source(s) of each baseline fuel (i.e., collected, purchased, or procured through other means, and where purchased, whether the fuel is subsidised);

3) Baseline technologies for cooking and the percentage of their use by the target population; and

4) Average household size (Hh_i) or equivalent, depending on the type of target population.

The survey results must be validated against relevant and current information from credible literature, official publications (e.g., independent surveys, studies), or official statistics from government entities or other credible agencies that is, preferably, specific to the location of the target population and differentiates between rural versus urban and peri-urban conditions

Where survey results for any of the above criteria (i.e., baseline fuel types, fuel sources, cooking technologies, or average household size) deviate significantly from official statistics or credible literature and may lead to a non-conservative baseline (e.g., a baseline of firewood in locations where LPG is widely used), project proponents must:

1) provide additional justification and rationale to explain the deviation, including specific evidence demonstrating why the official literature or statistics are not representative of the target population; or where the deviation cannot be justified,

2) use the values from the literature, official publications, or official statistics for the target population to define a more conservative baseline than the baseline survey results.

use the values from the literature, official publications, or official statistics for the target population. The initial baseline survey must be performed prior to the start of validation. Where the survey data is more than two years old, its validity must be justified in the project description. The project proponent may employ local third-party agencies to carry out the baseline survey.

Survey and data collection methods: The baseline survey performed prior to validation and prior to crediting period renewal must be conducted as physical on-site visits (face-to-face), whereas follow-up baseline surveys during the crediting period may be conducted either as physical on-site visits (face-to-face) or through remote surveys via phone call or virtual meeting.

Timing: The baseline survey must be scheduled to avoid major festivals, holidays, and similar events that could impact the outcomes. It must be scheduled in a way that ensures that the results are conservative, given seasonal variability.

Sample size calculations: The surveys must be conducted for each target population. Where project devices are distributed within regions or target populations with heterogenous conditions (e.g., regional variations in fuel types or cooking practices), the target population must be divided into strata/groups with homogeneous conditions.

The minimum sample size must be determined with respect to use of baseline fuel types and baseline technologies, and household size.

The following key factors must be considered when determining the minimum sample size:

a) Calculations may be completed manually or with appropriate statistical software.

b) The confidence level and precision must be at least 90/10.

c) The target value must be identified (i.e., the expected value of the parameter).

Where a survey covers two or more batches of project activity instances, and the population is homogeneous, simple random sampling must be used. Where the population consists of varying sub-populations (i.e., is not homogenous), stratified random sampling must be used.

Survey reporting: The data collection method and the protocol for producing the final dataset and results must be documented in the project description and monitoring reports.

7.3 Baseline Reassessment

First-ever household usage surveys

The project proponent must assess whether the baseline characteristics established in the baseline scenario are fully consistent with the households participating in the project activity. This assessment must be carried out by questioning the end users about their previous cooking technologies/practices, fuel types/mix, and fuel sources (baseline characteristics) during the first-ever usage (adoption rate) survey conducted for a household after their inclusion in the project activity. The adoption rate usage survey questionnaire for such households must be updated and applied accordingly.

If the assessment reveals any material deviations[16] from the established baseline characteristics leading to overestimations of emissions reductions, the activity developer must either:

- apply conservative adjustments (e.g., lower the increase in observed household size to the value of the ex-ante baseline estimate, or adjust the fuel mix proportions toward lower baseline emissions) or
- exclude from the project activity, those project households that do not adhere to the established baseline characteristics in a way that could lead to overestimations of emissions reductions.

For the purpose of this requirement, material deviations are deviations from the established baseline characteristics that could reasonably lead to an overestimation of GHG emission reductions, including but not limited to deviations beyond predefined thresholds for (i) baseline cooking technology category, (ii) baseline fuel type(s) and fuel mix proportions, (iii) baseline fuel source(s), and/or (iv) average household size.

[16] Here materiality is determined on the basis of de minimis threshold requirements prescribed in the VCS Standard.

Follow up surveys/assessment

Follow-up baseline surveys must be conducted at least every five years from the date of the last survey in control households that do not participate in the project[17]. The project proponent may conduct more frequent surveys at any time, including at crediting period renewal.

These control households must be established prior to validation and must be shown to be statistically equivalent to the pre-project conditions of project households regarding baseline fuel type(s) and percentage of use by the target population, source(s) of each baseline fuel, and baseline technologies for cooking. Control households are an extension of the baseline households that have not been included in/affected by the project activities. The process to select control households must be conducted at the initial phase of the project, prior to implementation, to allow consistent monitoring over time. It is recommended to initially select 150% of the required number of control households to ensure that the target sample is maintained throughout the crediting period. If the project area is already saturated or if sufficient candidates for establishing the control households do not exist (possibly due to their incorporation in other projects/initiatives), the control group may be selected from nearby communities with comparable baseline characteristics (identified above) and economic and geographic conditions, such as income levels and climate, altitude, vegetation respectively, ensuring the statistical equivalence required by the methodology.

Project proponents must apply the relevant requirements of the *CDM Guidelines for sampling and surveys for CDM project activities and programmes of activities* to determine the size of the control households, in addition to the requirements prescribed above. The information regarding selection and identification of control households must be provided in the project description.

For existing projects updating to *VM0050*, control households must be established before the first verification under *VM0050*.

A binding questionnaire is presented in Appendix 3. The project proponent may adopt a different format but must include these questions as a minimum.

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[17] This approach is not a deliberate exclusion of control HHs from receiving project support, but rather letting these households evolve naturally and independently, which could mean them being subsumed by some other project/initiative, and adjusting the baseline of the originally linked project accordingly.

8 ADDITIONALITY

Project proponents must demonstrate additionality through demonstration of regulatory surplus and either confirming that the project activity is on the positive list (activity method) or conducting an investment analysis and common practice analysis (project method).

Where a project activity installs or distributes project devices at zero cost to end users and others that involve partial or full payment by end users, the project proponent may apply additionality requirements separately for each project device category (i.e., cookstoves and HDRs). Step 2 (Positive List) may only be applied where all project devices within a category are provided at zero cost to end users and meet the requirement of the positive list.

Step 1: Regulatory surplus

The project proponent must demonstrate regulatory surplus in accordance with the rules and requirements regarding regulatory surplus set out in the applicable version of the *VCS Standard*.

Where the project proponent demonstrates regulatory surplus, proceed to the next step. Otherwise, the project activity is not additional.

Step 2: Positive list

The project activity must meet both of the following conditions to qualify for the positive list:

1) The project activity introduces:
    a) Efficient biomass-fired cookstoves that replace inefficient biomass-fired cookstoves;
    b) Efficient, solely renewable biomass-fired cookstoves that replace fossil fuel-fired cookstoves; or
    c) Electric cookstoves that replace inefficient biomass-fired or fossil fuel-fired cookstoves.
    d) Heat retention devices
2) The project activity installs or distributes improved cookstoves and/or heat retention devices at zero cost to the end-user and has no revenue source[18] other than from the sale of verified carbon units (VCUs).

[18] Including revenues from selling of firewood, charcoal, LPG, bioethanol, or any commercial relationship with fuel providers

Where the project proponent demonstrates regulatory surplus (Step 1) and the project activity conforms to the conditions of the positive list (Step 2), the project activity is deemed additional. In this case, the project proponent is not required to apply Step 3.

Step 3: Project method

If the project activity is not on the positive list (Step 2), additionality must be demonstrated by applying a barrier analysis or investment analysis as per the most recent version of *VT0008*.

Where a project activity includes both project device categories (i.e., improved cookstoves and HDRs) separately assessed under Step 2 and Step 3, the investment analysis must be applied only to the category subject to Step 3. Any shared investment and operational costs must be allocated to the category subject to Step 3 using a consistent and conservative approach.

The project proponent must also demonstrate that the project activity is not a common practice as per the most recent version of *VT0008.*

Where the project proponent demonstrates regulatory surplus (Step 1) and the project activity meets the requirements of the investment analysis and common practice analysis (Step 3), it is deemed additional. Otherwise, it is not additional.

9 QUANTIFICATION OF REDUCTIONS AND REMOVALS

9.1 Baseline Emissions

Baseline emissions are calculated as follows:

$$BE_y = \sum_{i,j,k} EC_{i,y} \times N_{j,k,y} \times n_{j,k,y} \times \left(EF_{b,i,CO2} \times f_{NRB,y} + EF_{b,i,nonCO2}\right) \quad (1)$$

Where:

BE_y = Baseline emissions during year *y* (t CO_2e)

$EC_{i,y}$ = Average energy consumption of baseline device type *i* in year *y* (TJ)

$N_{j,k,y}$ = Number of commissioned project devices of type *j* from batch *k* in year *y*

$n_{j,k,y}$ = Proportion of commissioned project devices of type *j* from batch *k* that remain operating in year *y* (fraction)

$EF_{b,i,CO2}$ = CO_2 emission factor for fuel used by baseline device type *i* in the baseline scenario (t CO_2/TJ)

$f_{NRB,y}$ = Fraction of woody biomass that is established to be non-renewable used by baseline device in year *y*; this variable is not considered for fossil fuels (fraction)

$EF_{b,i,nonCO2}$ = Non-CO_2 emission factor for fuel used by baseline device type *i* in the baseline scenario (t CO_2e/TJ)

i = Baseline device type and its respective fuel type

j = Project device type and its respective fuel type

9.1.1 Average Energy Consumption of Baseline Device ($EC_{i,y}$)

The average energy consumption of baseline device type *i* is calculated as follows:[19]

$$EC_{i,y} = BC_{b,i,y} \times NCV_{b,i} \quad (2)$$

Where:

$BC_{b,i,y}$ = Fuel used per baseline device type *i* during year *y* (tonnes)[20]

$NCV_{b,i}$ = Net calorific value of baseline fuel for baseline device type *i* (TJ/tonne)

The quantity of fuel that would be used in the baseline scenario must be determined by one of the following two methods.

Option 1: Measurement campaign

A measurement campaign must be conducted following the procedures in the most recent version of the *Kitchen Performance Test Protocol*. Appendix 4 provides further guidance on measurement techniques. The sampling must comply with the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*. The campaign must achieve confidence and precision of at least 90/10 for the target parameter of average daily fuel consumption per adult equivalent. The result must be scaled appropriately using the average household size (Hh_i)[21] to obtain the value of $BC_{b,i,y}$. Where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness deduction as per the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*.

[19] Where charcoal is used as the fuel by baseline and/or project devices, the average energy consumption (derived from the average quantity of charcoal fuel used) in the baseline and/or project scenario may be determined by using a wood to charcoal conversion factor (CF) instead of the fuel emission factor. Further information is provided in the parameter table for CF in Section 10.1.

[20] This parameter corresponds to $BC_{ex\text{-}ante,b,i}$ for the first five years and where the follow-up baseline survey campaign shows that there are no significant changes in baseline fuel consumption. Otherwise, it corresponds to $BC_{b,i,y}$.

[21] This parameter is determined using the procedure described in Section 10.1.

Energy consumption calculated using this option must be determined once prior to validation to obtain $BC_{ex\text{-}ante,b,i}$.

Option 2: Default values

$EC_{i,y}$ is calculated based on the default value for the average annual consumption of woody biomass per person for cooking:

- Firewood: 0.5 tonnes/capita/year of air-dried wood
- Charcoal: 0.13 tonnes/capita/year

Where fuels other than firewood or charcoal are also used in the baseline, their energy use must be accounted for in equivalent terms to the values above.

The result must be scaled appropriately using the average household size (Hh_i) to obtain the value of $BC_{b,i,y}$.

Follow-up baseline surveys must be conducted at least every five years from the date of the last survey in control households that do not participate in the project. The project proponent may conduct more frequent surveys at any time, including at crediting period renewal. These households must be established prior to validation as statistically equivalent to the pre-project conditions of project households regarding fuel consumption. Where the follow-up baseline survey campaigns reflect statistically significant changes to the baseline, baseline energy consumption must be updated (using a new measurement campaign conducted in control households) to obtain $BC_{b,i,y}$.

9.1.1.1 Cross-check of ECi,y to address stove stacking for project activities involving more efficient project devices that use the same fuel as in the baseline, or efficient project devices using renewable biomass

Project proponents must address stove stacking (continued use of pre-project devices in project households) by comparing the quantity of baseline energy consumption determined by both options above ($EC_{i,y}$) to energy used in the project scenario ($EC_{p,y}$) using back-calculation. Where the results indicate that baseline consumption ($EC_{i,y}$) is higher than that indicated by back-calculation from the project scenario ($EC_{est,y}$) then stove stacking is occurring (as $EC_{p,y}$ is unable to completely capture household energy consumption from cooking due to the presence/use of pre-project devices). The back-calculation results ($EC_{est,y}$) must be applied in Equation (1) as a conservative cap.

$$EC_{est,y} = EC_{p,y} \times \frac{\eta_{new,avg,y}}{\eta_{old,avg}} \quad (3)$$

Where:

$EC_{est,y}$ = Back-calculated energy consumption of the potential mix of devices and fuels in the baseline in year y (TJ)

$EC_{p,y}$ = Energy used in project scenario by project devices during year *y* (TJ)
$\eta_{new,avg,,y}$ = Weighted average efficiency of project devices in year *y* (fraction)
$\eta_{old,avg}$ = Weighted average efficiency of baseline devices that are replaced by project devices (fraction)

$EC_{p,y}$ must be determined as follows, using the parameters determined as per Section 9.2.1.1.

$$EC_{p,,y} = \sum_{j,k} BC_{p,j,k,y} \times NCV_{p,j} \quad (4)$$

Where:

$BC_{p,j,k,y}$ = Average quantity of fuel used by project device type *j* from batch *k* during year *y* (tonnes or m^3)
$NCV_{p,j}$ = Net calorific value of project fuel used in project device type *j* (TJ/tonne or TJ/m^3)

9.1.1.2 Cross-check of ECi,y to Address Stove Stacking for Project Devices With Additional Characteristics Affecting Energy Consumption

For bioethanol, LPG, electric and electric pressure cooker project devices with additional characteristics that affect energy consumption (e.g., pressure, power control), thermal efficiency alone does not reflect the device's thermal performance. In such cases, Equation (5) must be applied as a cross-check. This requires the determination of specific energy consumption for both baseline and project scenarios using a Controlled Cooking Test (CCT). CCT is also applied since the project device may not fully replace all baseline cooking activities, but only those that can reasonably be performed by the project device.

The CCT must be conducted using dishes and cooking practices typical of the project region. The CCT must be performed for the same cooking tasks with both the project devices and baseline device(s). Cooking tasks that cannot be performed with the project device must be excluded from the baseline CCT.

The following requirements must be applied in addition to the *Controlled Cooking Test Protocol* when conducting CCTs:

1) A minimum of 15 CCTs must be conducted per model of project device, comprising five different cooks each conducting three repetitions. Each repetition includes a baseline device and a project device.

2) The individual CCTs must be conducted by each cook in an alternating sequence between baseline and project devices (i.e., baseline → project → baseline → project → baseline → project) to limit potential bias caused by increased cook efficiency over repetitions.

3) For project devices that qualify as artisanal cookstoves, at least three randomly selected samples of each model must be tested.

Project proponents must address stove stacking (continued use of pre-project devices in project households) and consider power control and cooking behaviour change when using a modern fuel stove by comparing the quantity of baseline energy consumption determined by both options above ($EC_{i,y}$) to energy used in the project scenario ($EC_{p,y}$) using back-calculation.

$$EC_{est,y} = EC_{p,j,k,y} \times \frac{SC_{b,j}}{SC_{p,i}} \quad (5)$$

Where:

$EC_{p,j,k,y}$ = Annual energy consumption of project device type *j* from batch *k* in year *y* (TJ)

$SC_{p,j}$ = Specific energy consumption of electric pressure cooker project device type *j* in the project scenario (TJ/test/person)

$SC_{b,i}$ = Specific energy consumption of baseline device type *i* in the baseline scenario (TJ/test/person)

Where the results of the cross-check indicate that the baseline energy consumption ($EC_{i,y}$):

a) is higher than the value indicated by back-calculation from the project scenario ($EC_{est,y}$), use the $EC_{est,y}$ value.

b) is lower than the value indicated by back-calculation from the project scenario ($EC_{est,y}$), use the $EC_{i,y}$ value.

c) Is more than 20% lower than the value from the back-calculation from the project scenario ($EC_{est,y}$) for an LPG or bioethanol project, a fuel resale risk alert must be generated. In such cases, the project proponent must apply SUMs to verify the fuel sales information against measured stove usage.

Where the project device replaces more than one type of baseline device, the specific consumption ($SC_{b,i}$) must be determined as the weighted average of the specific energy consumption of the replaced baseline cooking devices, weighted by the proportion of cooking tasks performed by the target population with each type of baseline cooking device.

9.2 Project Emissions

Project emissions are calculated as follows:

$$PE_y = PE_{EC,y} + PE_{others,y} \quad (6)$$

Where:

PE_y = Project emissions during year *y* (t CO_2e)

$PE_{EC,y}$ = Project emissions from energy consumption of project devices in year *y* (t CO_2e)

$PE_{others,y}$ = Project emissions from other sources in year *y* (t CO_2e)

To determine project emissions from energy consumption of project devices ($PE_{EC,y}$), one of the following options (Sections 9.2.1–9.2.4) along with equation (9) must be used.

9.2.1 $PE_{EC,unadj,y}$ from Biomass, Fossil Fuels, or Bioethanol

Unadjusted project emissions from energy consumption of project devices using biomass, fossil fuels, or bioethanol in year *y* are calculated as follows:

$$PE_{EC,unadj,y} = \sum_{j}\sum_{k} BC_{p,j,k,y} \times N_{j,k,y} \times NCV_{p,j} \times n_{j,k,y} \times \left(EF_{p,j,CO2} \times f_{NRB,y} + EF_{p,j,nonCO2}\right) \quad (7)$$

Where:

$PE_{EC,unadj,y}$ = Unadjusted project emissions from energy consumption of project devices during year y (t CO_2e)

$EF_{p,j,CO2}$ = CO_2 emission factor for fuel used by project device type *j* in the project scenario (t CO_2/TJ)

$EF_{p,j,nonCO2}$ = Non-CO_2 emission factor for fuel used by project device type *j* (t CO_2e/TJ)

The CO_2 emission factors for renewable biomass and other renewable energy sources are zero. Non-CO_2 emissions of these fuels must be accounted for where they are not deemed de minimis (see Section 6).

9.2.1.1 $BC_{p,j,k,y}$ for Project Devices

There are three approaches to calculating $BC_{p,j,k,y}$.

Option 1: Kitchen Performance Test

A measurement campaign following the *Kitchen Performance Test Protocol* must be designed, carried out, and analyzed in compliance with the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*. The campaign must achieve a confidence and precision of at least 90/10 for the target parameter of average daily fuel consumption per adult equivalent. Only the results for project stove fuel consumption are used to calculate project emissions. The result must be scaled appropriately using the average household size ($Hh_{j,k}$) to obtain the value of $BC_{p,j,k,y}$. Where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness deduction as per Section 4 of the most recent version of CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities.*

Option 2: Direct measurement

Use direct measurement with equipment calibrated in accordance with national/international requirements. All project devices may be measured, or a sample of project devices may be measured such that a confidence and precision of 90/10 is achieved for the target parameter of total annual fuel use. The sampling must comply with the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*. Where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness deduction as per Section 4 of the most recent version of CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities.* Where fuel consumption of all project devices is measured continuously, adoption rate ($n_{j,k,y}$) may be considered equal to one.

Option 3: Fuel purchase monitoring (only for project devices using fossil fuels or bioethanol)

Where applying this option, the project proponent must:

1) keep continuous records of all fuel purchases (e.g., fuel purchase invoices from the supplier).
2) ensure fuel is used only for thermal energy generation by the project device (e.g., by using a fuel cylinder design that may only be attached to the project device).

9.2.2 $PE_{EC,unad,j,y}$ from Electricity

Where the project activity involves the introduction of electric devices, unadjusted project emissions are calculated as follows:

$$PE_{EC,unadj,y} = \sum_{j}\sum_{k} EC_{p,j,k,y} \times N_{j,k,y} \times n_{j,k,y} \times EF_{el,y} \times \left(1 + TDL_{j,y}\right) \quad (8)$$

Where:

$EF_{el,y}$ = Emission factor of the electricity system in year *y*; equal to zero for 100% renewable sources (t CO_2e/MWh)

$TDL_{j,y}$ = Average technical transmission and distribution losses for providing electricity to project device type *j* in year *y*

Electricity consumption $EC_{p,j,k,y}$ must be estimated by one of the following two options (in MWh). For both options, where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness deduction as per Section 4 of the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*.

Option 1: Kitchen Performance Test

A measurement campaign following the *Kitchen Performance Test Protocol* must be designed, carried out, and analyzed in compliance with the most recent version of the CDM *Standard for*

Sampling and Surveys for CDM Project Activities and Programmes of Activities. The campaign must achieve a confidence and precision of at least 90/10 for the target parameter of average daily fuel consumption per adult equivalent. Only the results for project stove fuel consumption are used to calculate project emissions. The result must be scaled appropriately using the average household size ($Hh_{j,k}$) to obtain the value of $BC_{p,j,k,y}$.

Option 2: Direct measurement

Use direct measurement by metering. All project devices may be measured, or a sample of project devices may be measured, following the sampling approach described in the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities* with a confidence level and precision of at least 90/10. Where electricity consumption of all project devices is measured continuously, adoption rate ($n_{j,k,y}$) may be considered equal to one.

9.2.3 Adjustment of project emissions for the Hawthorne effect

To account for the potential bias whereby end users may alter cooking behaviour during the observation period of a project KPT (Option 1 under both Sections 9.2.1 and 9.2.2), the methodology applies a Hawthorne Effect adjustment index. For options 2 and 3 under either Section 9.2.1 and 9.2.2, this adjustment is not relevant, and therefore, $PE_{EC,unadj,y} = PE_{EC,y}$. When applicable, the adjusted project emissions are calculated using the equation below:

$$PE_{EC,y} = PE_{EC,unadj,y} + (BE_y - PE_{EC,unadj,y}) \times (1 - HE_{ind}) \quad (9)$$

Where:

HE_{ind} = Hawthorne Effect adjustment factor (fraction)

The project proponent must apply one of the following options:

Option 1: Default adjustment

If fuel consumption and usage are quantified through KPTs and usage surveys only (i.e., without Stove Use Monitors – SUMs), the project proponent must apply a conservative default Hawthorne Effect adjustment factor $HE_{ind} = 0.75$.

Option 2: SUMs adjustment

If the project complements KPTs with SUMs measurements designed to quantify the magnitude of the Hawthorne Effect, HE_{ind} must be calculated as the ratio between usage during a normal monitoring period and usage during the KPT period. This option requires that SUMs be applied to all project devices in households where the project KPT is performed. See APPENDIX 4: Monitoring/ measurement technique guidance for general SUMs guidance. The Hawthorne Effect adjustment factor must be calculated as follows:

$$HE_{ind} = \min(1, \frac{PTC_m}{PTC_{KPT}}) \quad (10)$$

Where:

PTC_m	=	Average project device cooking events per day over 30 days from SUMs measurements
PTC_{KPT}	=	Average project device cooking events per day over the project KPT period

9.2.4 $PE_{others,y}$ from Transportation, Fuel Production, Fugitive Emissions, and Backup Generators

$$PE_{others,y} = PE_{transp,y} + PE_{prod,y} + PE_{fugitive,y} + PE_{backup,y} \quad (11)$$

Where:

$PE_{transp,y}$	=	Project emissions due to fuel transportation in year *y* (t CO_2e)
$PE_{prod,y}$	=	Project emissions due to fuel production in year *y* (t CO_2e)
$PE_{fugitive,y}$	=	Fugitive emissions in year *y* (t CO_2e)
$PE_{backup,y}$	=	Project emissions from backup generators in year *y* (t CO_2e)

Project emissions from fuel transportation ($PE_{transp,y}$)

$PE_{transp,y}$ must be estimated where the average transportation distance is greater than 200 km or where it is not demonstrated through valid means (like mapping tools) to be less than 200 km. In the latter case, a conservative estimate of the transportation distance must be used. The most recent version of CDM *TOOL12 Project and Leakage Emissions from Transportation of Freight* must be applied.

Where the average transportation distance is less than 200 km, it may be assumed that baseline and project emissions from fuel transportation are similar, and project emissions may be excluded.

Project emissions from fuel production ($PE_{prod,y}$)

$PE_{prod,y}$ must be determined for renewable biomass (e.g., firewood) or biomass-derived fuels (e.g., bioethanol) by applying CDM *TOOL16 Project and Leakage Emissions from Biomass.* $PE_{prod,y}$ must include applicable emissions resulting from soil management, cultivation, thermal/mechanical processing, and biomass burning associated with fuel production.

Projects using LPG must apply CDM *TOOL15 Upstream Leakage Emissions Associated With Fossil Fuel Use* to determine upstream emissions.

Fugitive emissions ($PE_{fugitive,y}$)

$PE_{fugitive,y}$ from renewable charcoal must be estimated by applying the most recent version of *AMS-III.K. Avoidance of Methane Release from Charcoal Production*.[22]

Project emissions from backup generators ($PE_{backup,y}$)

For project devices using electricity from a mini-grid with backup generators, emissions from fuel consumption must be determined as follows:

$$PE_{backup,y} = \sum_{h} FC_{h,y} \times NCV_h \times EF_{fuel,h} \quad (12)$$

Where:

$FC_{h,y}$ = Fuel consumption of backup generator *h* in year *y* (tonnes)
NCV_h = Net calorific value of fuel used by backup generator *h* (TJ/tonne)
$EF_{fuel,h}$ = Emission factor for fuel used by backup generator *h* (t CO_2e/TJ)

9.3 Leakage Emissions

Leakage emissions (LE_y) must be accounted as follows:

1) Leakage emissions associated with reduced or avoided use of non-renewable biomass:
   a) Use of non-renewable biomass by other users and other types of GHG reversals[23]
   b) Reuse outside the project boundaries of baseline devices that were replaced by project devices

   An adjustment factor of 0.95 is applied to the GHG emission reductions in Equation (13) (i.e., 0.95 × (BE_y − PE_y)).

2) Leakage emissions associated with fossil fuel use:

   a) Increased emissions from fossil fuel use by non-project participants

   An adjustment factor of 0.95 is applied to the GHG emission reductions in Equation (13) (i.e., 0.95 × (BE_y − PE_y)).

3) Leakage emissions associated with use of renewable biomass ($LE_{RB,y}$):
   a) Shift of pre-project activities due to the establishment of dedicated plantations for renewable biomass supply
   b) Diversion of biomass residues from other uses to the project activity

[22] Using Equation 4 of AMS-III.K, v5.0.

[23] This includes other non-permanence risks, such as forest fires.

These leakage emissions must be calculated using CDM *TOOL16*.

9.4 Net GHG Emission Reductions

Net GHG emission reductions are calculated as follows:

$$ER_y = (BE_y - PE_y) \times 0.95 - LE_{RB,y} \quad (13)$$

Where:

ER_y = Emission reductions during year *y* (t CO_2e)

$LE_{RB,y}$ = Leakage emissions associated with use of renewable biomass during year *y* (t CO_2e)

10 MONITORING

10.1 Data and Parameters Available at Validation

Data/Parameter	$EF_{b,i,CO2}$ $EF_{p,j,CO2}$ $EF_{fuel,h}$
Data unit	t CO_2/TJ
Description	CO_2 emission factor for fuel used by baseline device type *i* in the baseline scenario CO_2 emission factor for fuel used by project device type *j* in the project scenario Emission factor for fuel used by backup generator *h*
Equations	(1), (7), (12)
Source of data	The following data sources may be used, listed in descending order of preference: • Option 1: Project-specific value • Option 2: Regional or national default values • Option 3: Default value from the most recent version of the *IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied	Depends on the source of data chosen.
Justification of choice of data or description of measurement methods and procedures applied	The values must be determined ex ante by using one of the following means:

	1) Testing in accredited/recognized laboratories: Measurements must be undertaken in line with national or international fuel standards. 2) Use of national default values 3) Use of default values from the most recent version of the *IPCC Guidelines for National Greenhouse Gas Inventories* **Wood:** 112 t CO_2/TJ **Charcoal:** • 112 t CO_2/TJ (combustion only): Apply where renewable charcoal is used in the project[24] and emissions from production of charcoal are estimated as project emissions ($PE_{fugitive,y}$). • 165.22 t CO_2/TJ (combustion and charcoal production emissions): Apply where non-renewable biomass charcoal is used in the baseline, or in the baseline and project. IPCC guidelines are a recognized source.
Purpose of data	Calculation of baseline and project emissions
Comments	N/A

Data/Parameter	$EF_{b,i,nonCO2}$ $EF_{p,j,nonCO2}$
Data unit	t CO_2e/TJ
Description	Non-CO_2 emission factor for fuel used by baseline device type *i* in the baseline scenario Non-CO_2 emission factor for fuel used by project device type *j* in the project scenario
Equations	(1), (7)
Source of data	The following data sources may be used, listed in descending order of preference: • Option 1: Project-specific value • Option 2: Regional or national default values • Option 3: Default value from the most recent version of the *IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied	Depends on source of data chosen.
Justification of choice of data or description of	The values must be determined ex ante by using one of the following means:

[24] In this case, f_{NRB} is zero.

measurement methods and procedures applied	1) Testing in accredited/recognized laboratories: Measurements must be undertaken in line with national or international fuel standards 2) Use of national default values 3) Use of default values from the most recent version of the *IPCC Guidelines for National Greenhouse Gas Inventories* **Wood:** 9.46 t CO_2e/TJ (AR5 GWP) **Charcoal:** 5.865 t CO_2e/TJ (combustion only, AR5 GWP) 44.83 t CO_2e/TJ (includes charcoal production)
Purpose of data	Calculation of baseline emissions
Comments	Where the factor *CF* is applied (see parameter table for *CF*), the emissions factor for charcoal production must be derived using Option 1 or 2.

Data/Parameter	*CF*
Data unit	unitless
Description	Wood-to-charcoal conversion factor
Equations	(1), (7)
Source of data	CDM *TOOL33* default value
Value applied	4 tonnes of dry wood input per tonne of charcoal output The project proponent may use a default value of up to 6 tonnes of dry wood input per tonne of charcoal output where the value is substantiated by government-approved/endorsed national or regional values or by published, peer-reviewed literature specific to the project region and context.
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	Only applicable where charcoal is used as the fuel by baseline and/or project devices and the project proponent chooses to apply the CF method instead of the charcoal emission factors method included in the equations. Where the CF method is used, the wood-to-charcoal conversion factor must be applied (in Equations (1 and (7), as applicable) in the following manner: 1) For CO_2 emissions, the conversion factor is multiplied by the EF_{CO2} term, which is the CO_2 emission factor for wood.

	2) For non-CO_2 emissions, the EF_{nonCO2} term is the non-CO_2 emission factor for charcoal combustion. Where applying *CF*, the non-CO_2 emission factor for the production of charcoal may only be included where Option 1 or 2 (in parameter table for EF_{nonCO2}) is used.

Data/Parameter	$NCV_{b,i}$ $NCV_{p,j}$ NCV_h
Data unit	TJ/tonne or TJ/m^3
Description	Net calorific value of baseline fuel used by baseline device type *i* Net calorific value of project fuel used by project device type *j* Net calorific value of fuel used by backup generator *h*
Equations	(2), (4) , (7), (12)
Source of data	The following data sources may be used, listed in descending order of preference: • Option 1: Project-specific values • Option 2: National default value • Option 3: Default value from the most recent version of the *IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied	Depends on the source of data chosen.
Justification of choice of data or description of measurement methods and procedures applied	The values must be determined ex ante by using one of the following means: 1) Testing using standardized methods (e.g., ASTM D5865-12, ISO 1928) 2) Use of regional or national default values 3) Use of default values from the most recent version of the *IPCC Guidelines for National Greenhouse Gas Inventories* The values for wood and charcoal in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* are: • **Wood:** 0.0156 TJ/tonne • **Charcoal:** 0.0295 TJ/tonne
Purpose of data	Calculation of baseline emissions
Comments	Where the factor *CF* is applied (see parameter table for *CF*), the net calorific value for charcoal must be derived using Option 1 or 2, consistent with the option for determining the non-CO_2 emission factor for production of charcoal.

Data/Parameter	$BC_{ex\text{-}ante,b,i}$
Data unit	tonnes
Description	Ex-ante annual average quantity of fuel used per baseline device type *i*
Equations	(2)
Source of data	**Option 1:** A measurement campaign following the *Kitchen Performance Test Protocol* must be designed, carried out, and analyzed in compliance with the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*. The campaign must achieve a confidence and precision of at least 90/10 for the target parameter of average daily fuel consumption per adult equivalent. Where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness deduction as per Section 4 of the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities.* The result must be scaled appropriately using the average household size to obtain the value of $BC_{ex\text{-}ante,b,i}$. **Option 2**: Calculated based on the default value for the average annual consumption of woody biomass per person for cooking • Firewood: 0.5 tonnes/capita/year of air-dried wood (from 0.0012 TJ delivered/capita/year with 0.0156 TJ/tonne NCV, and thermal efficiency of 15%) • Charcoal: 0.13 tonnes/capita/year (from 0.00075 TJ delivered/capita/year with 29.5 TJ/tonne NCV, and thermal efficiency of 25%) Where fuels other than firewood or charcoal are also used in the baseline, their energy use must be accounted for in the 0.0012 and 0.00075 TJ delivered/capita/year. The default value must be scaled appropriately using the average household size to obtain the value of $BC_{ex\text{-}ante,b,i}$.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	Energy consumption must be determined once prior to validation.

Data/Parameter	$\eta_{old,avg}$
Data unit	Fraction
Description	Weighted average efficiency of baseline devices that are replaced by project devices
Equations	(3)
Source of data	The efficiency must be established using one of the following methods, and the corresponding documentation must be presented: 1) For three-stone fire using firewood or a cookstove with no improved combustion air supply or flue gas ventilation, default value of 15% For other baseline devices: 2) Water Boiling Test surveys in compliance with the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*; 3) Manufacturer-certified value that is determined via the Water Boiling Test; 4) Certification by the host country's national standards body or certifying agency; or 5) Approved default values from the most recent version of CDM *TOOL33*. The weighted average efficiency is calculated by multiplying the energy consumption $EC_{i,y}$ of the baseline device *i* by its thermal efficiency $\eta_{old,i}$, and then summing these values for all baseline devices. The resulting sum is divided by the total energy consumption of all baseline devices to determine the weighted average efficiency.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	These methods and sources are recognized by the VCS Program.
Purpose of data	Calculation of baseline emissions
Comments	N/A

Data/Parameter	Hh_i $Hh_{j,k}$
Data unit	Equivalent standard male adults
Description	Average household size of the target population using device type *i*

	Average household size of the target population using device type *j* from batch *k*
Equations	Input to $EC_{i,y}$, $BC_{b,i,y}$, and $BC_{p,j,k,y}$
Source of data	Baseline survey The campaign must achieve a confidence and precision of at least 90/10 for the target parameter of average household size.
Value applied	The following values of equivalent standard male adults[25] must be applied when determining the parameters Hh_i and $H_{hj,k}$

Gender and age	Fraction of standard adult
Child 0-14 years	0.5
Female over 14 years	0.8
Male 15-59 years	1.0
Male over 58 years	0.8

Justification of choice of data or description of measurement methods and procedures applied	Recognized survey methods based on the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*
Purpose of data	Estimation of average energy consumption when applying Option 1: Measurement campaign (Section 9.1.1) Cross-checking energy and fuel consumption values
Comments	This parameter must be determined ex ante via the baseline survey as described in Section 7.2.

Data/Parameter	$SC_{b,i}$ $SC_{p,j}$
Data unit	TJ/test/person
Description	Specific energy consumption of baseline device type *i* in the baseline scenario Specific energy consumption of project device type *j* in the project scenario
Equations	(5)

[25] Values from Table 4 in Clean Cooking Alliance (2018). Kitchen Performance Test version 4.0. Available at: https://cleancooking.org/binary-data/DOCUMENT/file/000/000/604-1.pdf

Source of data	Controlled Cooking Test following the most recent version of the *Controlled Cooking Test (CCT) Protocol* (Clean Cooking Alliance) and in compliance with the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*. The following requirements must be applied in addition to the Controlled Cooking Test Protocol[26] when conducting Controlled Cooking Tests (CCTs): 1) A minimum of 15 CCTs must be conducted per model of project device, comprising five different cooks each conducting three repetitions 2) The individual CCTs must be conducted by each cook in an alternating sequence between baseline and project devices (e.g., baseline → project → baseline → project) to limit potential bias caused by increased cook efficiency over repetitions. 3) For project devices that qualify as artisanal cookstoves, at least three randomly selected samples of each model must be tested. The campaign must achieve a confidence and precision of at least 90/10 for the target parameter of TJ/test/person. Where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness deduction as per Section 4 of the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities.*
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	This parameter must be estimated ex ante.
Purpose of data	Calculation of baseline and project emissions
Comments	The CCT must use the same cooking tasks when assessing baseline and project devices. Cooking tasks that are not compatible with project devices must be excluded from the CCT for baseline devices. When renewing the crediting period, the project proponent must check whether the end users use the project device for preparation of the expected dishes. Where the project device is used differently than expected, the CCT design must be updated to reflect the observed cooking practices of end users using the project device and the CCT campaigns must be undertaken again to redefine $SC_{b,i}$ and $SC_{p,j}$.

[26] Clean Cooking Alliance. Most recent version available at: https://cleancooking.org/research-evidence-learning/standards-testing/protocols/

10.2 Data and Parameters Monitored

Data/Parameter	$N_{j,k,y}$
Data unit	Number
Description	Number of commissioned project devices of type *j* from batch *k* in year *y*
Equations	(1), (7), (8)
Source of data	Monitoring
Description of measurement methods and procedures to be applied	The following data must be recorded during project activity implementation: 1) Number of new devices distributed under the project activity, identified by the type of device and date of commissioning; and 2) Identification information of the recipient of the device distributed under the project activity (e.g., name, address, phone number). Data management and reporting of this information must adhere to both data privacy requirements and good practice.
Frequency of monitoring/recording	Every time that new project devices are distributed
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	The number of project devices must be recorded in a database, sales record, or similar to ensure transparency.

Data/Parameter	$n_{j,k,y}$
Data unit	Fraction
Description	Proportion of commissioned project devices of type *j* from batch *k* that are still being used regularly in year *y*
Equations	(1), (7), (8)
Source of data	Monitoring
Description of measurement methods	**Option 1 (SUMs):** Measured directly using stove use monitors (SUMs) in a sample of users according to the most recent version of the CDM

and procedures to be applied	*Standard for Sampling and Surveys for Project Activities and Programmes of Activities* and achieving 90/10 confidence precision for the proportion of devices in operation. The SUMs must confirm that the stove (or heat retention device when applicable) is frequently used and functional. For projects using direct measurement techniques (such as stove use monitors or electricity meters), usage rates are not capped. **Option 2 (surveys):** Based on an adoption rate determined by a survey according to the most recent version of the CDM *Standard for Sampling and Surveys for Project Activities and Programmes of Activities* and achieving 90/10 confidence precision for the proportion of devices in operation. The lower end of the 90% confidence interval must be used to ensure conservativeness. Furthermore, for projects employing surveys, the usage rate is capped at 90% where all of the following customer support actions are undertaken across the entire target population and demonstrated at verification: 1) Selection of technologies and fuels that fully meet the cooking needs of the target population, demonstrated by citing robust research or conducting an investigation of cooking practices and attitudes 2) Implementation of support activities to assist the target population in effectively operating and maintaining their cookstoves. These may include providing materials (print, in-person, or video) on how to operate the cookstove to prepare common local foods, how to troubleshoot common operational issues, and how to make minor repairs (including obtaining necessary replacement parts). All such communications and materials must be provided in local language(s) commonly used in the project area. 3) Provision of a commonly used, toll-free communications channel through which the target population can contact the project proponent to access support (e.g., maintenance and repair services). For projects employing surveys and that do not implement all of these customer support actions across the entire target population, the usage rate is capped at 75%. The adoption survey must include: • Kitchen observation (which includes visual and physical checks of the stove and its components), including photographic evidence which entails taking photographs of the stove(s), its components, and the cooking areas[27].; and • Interview with the primary cook.

[27] This will enable an assessment of the physical condition of the stove(s) and cooking areas, thereby allowing determination of stove functionality and actual use.

	The project proponent must provide proof of training and supervision to ensure field teams have the capacity required to complete adoption surveys successfully. The physical condition of the stove(s) and the cooking areas will help determine stove functionality and use, as follows: • When the response to the survey question "do you use the project cookstove?" is *yes*, then this response is cross-checked with the physical check of the stove and the coherency with the response to the following question of the survey: "If yes, have you used the stove regularly since you installed it?". • Only if these two responses and the physical check are consistent, can the response be counted as "yes". Otherwise, it is counted as "no"- The proportion is the average of the sum of "yes" (1) responses, and "no" (0) responses. For both Options 1 and 2, where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness deduction as per Section 4 of the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities.*
Frequency of monitoring/recording	**Option 1: (SUMs):** continuous **Option 2 (surveys):** annually
QA/QC procedures to be applied	The date on which a sample project device stopped being used should be taken as follows: **Option 1: (SUMs):** The date on which the SUM ceased registering any activity of the project device **Option 2 (surveys):** Where the project device is not working or not being used at the time of conducting the survey, it should be conservatively assumed that the project device has not been active since the date on which the last adoption survey was conducted.
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	Option 1 is the preferred method. This parameter does not need to be monitored separately and is considered equal to one where project devices are electric cooking devices and the electricity consumption of all devices is measured continuously or are other devices where the fuel use of all devices is measured continuously.

Data/Parameter	$f_{NRB,y}$
Data unit	Fraction or %
Description	Fraction of woody biomass that is established to be non-renewable used by device in year *y*
Equations	(1, (7)
Source of data	One of the following sources must be used: 1) The most recent national or sub-national default value(s) published by UNFCCC, for example approved by the Supervisory Body of the Paris Agreement Crediting Mechanism 2) The values derived for project-specific scenarios using the MoFuSS Default Scenarios (MoFuSS-DS) tool[28] 3) Default value of the most recent version of CDM *TOOL33*
Description of measurement methods and procedures to be applied	See "Source of data"
Frequency of monitoring/recording	Ex-ante for each crediting period Proponents applying draft UNFCCC national default values must apply updated approved default values in any verification requests submitted after UNFCCC approval of the default values.
QA/QC procedures to be applied	Where using the UNFCCC f_{NRB} value(s), the project proponent must report the related uncertainties along with the value in the project description.
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	Where switching to the approved default f_{NRB} is the only proposed change to a registered project design, project proponents do not need to follow the methodology and/or project description deviation process. The application of default national or sub-national f_{NRB} values by projects is permitted only under the following conditions: • **National values** ○ In case of charcoal use, the specific source of the charcoal and biomass used for charcoal production is not known, or

[28] https://www.mofuss.unam.mx/mofuss-ds/

	when the specific source(s) are known these are located across multiple sub-national jurisdictions. ○ In case of fuelwood use, the specific source of the fuelwood is not known, and fuelwood is not harvested by the project households • **Sub-national values** ○ In the case of charcoal use, the specific source of the charcoal and biomass used for charcoal production must be known, is reported in a .kml file or similar and is verifiable, and the location is within one sub-national jurisdiction. ○ In case of fuelwood use, the specific or approximate source must be known, is reported in a .kml file or similar, and fuelwood is harvested by project households. • **In other cases**, the lower value of the national fnrb and sub-national f_{NRB} must be chosen corresponding to the project location.

Data/Parameter	$BC_{b,i,y}$
Data unit	tonnes
Description	Fuel used per baseline device type *i* during year *y*
Equations	(2)
Source of data	**Option 1:** A measurement campaign following the *Kitchen Performance Test Protocol* in control households that do not participate in the project, established prior to validation as statistically equivalent to the pre-project conditions of project households regarding baseline fuel consumption **Option 2**: For project activities applying the default values, this parameter does not need to be updated during the crediting period and the same values as for $BC_{ex\text{-}ante,b,i}$ are applied.
Description of measurement methods and procedures to be applied	**Option 1:** Follow-up baseline surveys must be conducted at most every five years in control households that do not participate in the project, established prior to validation as statistically equivalent to the pre-project conditions of project households regarding baseline fuel consumption. Measurement campaign must be updated where follow-up baseline surveys show that the fuels, fuel sources, or technologies used by the control group are no longer statistically equivalent to the pre-project conditions of project households. The measurement campaign must be designed, carried out, and analyzed in compliance with the most recent version of the CDM

	Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities. The result must be scaled appropriately using the average household size to obtain the value of $BC_{b,i,y}$. **Option 2**: See "Source of data"
Frequency of monitoring/recording	At most every five years
QA/QC procedures to be applied	The baseline alternatives must be defined using the results of a baseline survey of the target population and cross-checked with relevant and current information from credible literature from the specific project region, official publications (e.g., surveys, studies), or official statistics from government entities or other credible agencies that is specific to the location of the target population and differentiates between rural versus urban and peri-urban conditions. The sources must be relevant to the context of the project activity, reflecting baseline cookstove types, types of users, and cooking practices. Where used for cross-checks, these sources must reflect data collected no more than five years ago. The campaign must achieve a confidence and precision of at least 90/10 for the target parameter of average daily fuel consumption per adult equivalent. Where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness deduction as per Section 4 of the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities.*
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	N/A

Data/Parameter	$\eta_{new,avg,y}$
Data unit	Fraction
Description	Weighted average efficiency of project devices in year *y*
Equations	(3)
Source of data	Monitoring
Description of measurement methods and procedures to be applied	The efficiency must be established using one of the following methods, and the corresponding documentation must be presented: 1) Water Boiling Test campaigns achieving 90/10 confidence and precision levels as per the most recent version of the CDM

	Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities; 2) Manufacturer-certified value that is determined via Water Boiling Test; with the test results made available for validation by a VVB or 3) Certification from the host country's national standards body or certifying agency based on the Water Boiling Test. For all three options, cookstove efficiency must be determined based on the Water Boiling Test following the most recent version of the Water Boiling Test Protocol[29] or equivalent national standard/protocol. While carrying out the tests, the low and high power (not simmer) efficiencies must be used to calculate the average thermal efficiency. The decrease in thermal efficiency of project device *j* from batch *k* due to aging must be accounted for during the monitoring period, as presented below. For devices using biomass or fossil fuel, one of the following options must be selected, listed in descending order of preference: a) Standard Water Boiling Test campaigns[30] b) A linear decrease approach, applying a default schedule of linearly decreasing efficiency up to the terminal efficiency (assumed to be 25%) through the lifespan of the project device[31] For all other electric project devices, efficiency loss is calculated by measuring the total heat absorbed by a known mass for a given time and dividing it by the input of electrical energy measured by a power analyzer and comparing to the result of the previous year. The weighted average efficiency is calculated by multiplying the energy consumption $EC_{p,j,k,y}$ of the project device j of batch k by its thermal efficiency $\eta_{new,j,k,y}$ and then summing these values for all project devices. The resulting sum is divided by the total energy consumption of all project devices to determine the weighted average efficiency.
Frequency of monitoring/recording	Annually
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline and project emissions

[29] Clean Cooking Alliance. Most recent version available at: https://cleancooking.org/research-evidence-learning/standards-testing/protocols/

[30] Must be carried out following national standards (where available) or international standards or guidelines.

[31] Consider non-binding best practice example 6 in AMS-II.G.

Calculation method	N/A
Comments	N/A

Data/Parameter	$BC_{p,j,k,y}$
Data unit	tonnes or m^3
Description	Average quantity of fuel used by project device type *j* from batch *k* during year *y*
Equations	(4), (7)
Source of data	Monitoring
Description of measurement methods and procedures to be applied	**Option 1: Kitchen Performance Test (KPT)** A measurement campaign following the Kitchen Performance Test protocol must be designed, carried out, and analyzed in compliance with the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*. The campaign must achieve confidence and precision of at least 90/10 for the target parameter of average daily fuel consumption per adult equivalent. The result must be scaled appropriately using the average household size to obtain the value of $BC_{p,j,k,y}$. Project activities applying KPTs must also measure the quantity of fuel used by pre-project devices that are still operational and provide it in the calculation sheet and monitoring reports (this is a reporting-only requirement). **Option 2: Direct measurement** Apply continuous direct measurement using equipment calibrated in accordance with national/international requirements. A sample of project devices may be measured in such a way that confidence and precision of 90/10 is achieved for the target parameter of total annual fuel use. The sampling must comply with the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*. **Option 3: Fuel purchase monitoring (only for project devices using fossil fuels or bioethanol)** Under this option, the project developer must: 1) keep continuous records of all fuel purchases (e.g., fuel purchase invoices from the supplier). 2) ensure fuel is used only for thermal energy generation by the project device (e.g., by using a fuel cylinder design that may only be attached to the project device).

	For any of the options above, where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness deduction as per Section 4 of the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities.*
Frequency of monitoring/recording	Biennial or annual for Option 1 Continuous and aggregated annually for Options 2 and 3
QA/QC procedures to be applied	As a crosscheck, compare results to government publications, peer-reviewed literature, third party assessments, and/or official data or statistics. Where SUMs are used to measure project stove adoption, the stove usage indicated by the measurements for this parameter must be consistent with the frequency of use indicated by SUM measurements.
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	N/A

Data/Parameter	$EC_{p,j,k,y}$
Data unit	MWh
Description	Annual consumption of electricity by electric project device type *j* from batch *k* in year *y*
Equations	(5), (8)
Source of data	Monitoring
Description of measurement methods and procedures to be applied	Apply direct measurement by metering. This may be applied to a sample of project devices, following the sampling approach described in the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities* with a confidence level and precision of at least 90/10. Where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness deduction as per Section 4 of the most recent version of CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities.*
Frequency of monitoring/recording	Continuous and aggregated annually
QA/QC procedures to be applied	Measurement must use credible and calibrated equipment. Calibration frequency must be specified by the manufacturer.

	Attached or in-built data loggers may be used where they conform with industry standards and are calibrated according to relevant national requirements. As a cross-check, compare measurements to government publications, peer-reviewed literature, third party assessments, and/or official data or statistics. Where it is not possible to justify energy use using these sources of information, the reference value must be used in Equation (5), while the real monitored value must be used in Equation (8).
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	Where backup generators in decentralized energy systems supply more than 1% of the annual electricity, the same percentage of emission reductions from project devices powered by these systems must be excluded during the monitoring period. The total energy generation of self-generated renewable electricity systems must be estimated and compared to the electricity use of the project device. Where self-generated renewable electricity is supplemented by non-renewable electricity (e.g., a back-up generator), such non-renewable electricity must not account for more than 20% of the electricity consumed by the project devices. Where a verification audit finds that the threshold has been exceeded, the project device must be excluded from emission reduction calculations.

Data/Parameter	$EF_{el,y}$
Data unit	t CO_2e/MWh
Description	Emission factor of the electricity system in year *y*
Equations	(8)
Source of data	Calculated
Description of measurement methods and procedures to be applied	Must be determined using VCS TOOL VT0011. Where the electricity comes from a renewable source, the emission factor is considered to be zero.
Frequency of monitoring/recording	Annually
QA/QC procedures to be applied	Use credible data for the electricity system.
Purpose of data	Calculation of project emissions

Calculation method	N/A
Comments	N/A

Data/Parameter	$TDL_{j,y}$
Data unit	Fraction
Description	Average technical transmission and distribution losses for providing electricity to project device type *j* in year *y*
Equations	(8)
Source of data	Calculated
Description of measurement methods and procedures to be applied	Must be determined using VCS TOOL VT0010.
Frequency of monitoring/recording	Once per monitoring period
QA/QC procedures to be applied	Use credible data for the electricity system.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data/Parameter	$FC_{h,y}$
Data unit	tonnes
Description	Fuel consumption of backup generator *h* in year *y*
Equations	(12)
Source of data	Measured
Description of measurement methods and procedures to be applied	The amount of fuel used by the backup generator(s) is determined using one of the following options: 1) Apply direct measurement by metering using credible, manufacturer-calibrated equipment; or 2) Keep continuous records of fuel purchases.

Frequency of monitoring/recording	Annually
QA/QC procedures to be applied	N/A
Purpose of data	Compliance with applicability conditions for project devices using grid electricity
Calculation method	N/A
Comments	N/A

Data/Parameter	PTC_m
Data unit	number
Description	Average project device cooking events per day over 30 daysfrom SUMs measurements
Equations	(10)
Source of data	SUMs monitoring
Description of measurement methods and procedures to be applied	Installation of SUMs on a sample of project devices
Frequency of monitoring/recording	Once for a 30 day duration during the first monitoring period of the crediting period
QA/QC procedures to be applied	The minimum confidence and precision of 90/10 for the target parameter of average cooking events per day per project devices shall be met. If the target precision is not met, the project proponent shall take the conservative bound of the confidence interval as the parameter value. The SUMs sampling protocols (installation, placement, downloading) and algorithms used to convert raw data into cooking events must remain unchanged between sampling during KPTs and sampling during ongoing project operation.
Purpose of data	Calculation of project emissions
Calculation method	User households in the SUMs sample shall not receive any support different or additional to those not in the sample.
Comments	N/A

Data/Parameter	PTC_{KPT}
Data unit	number
Description	Average project device cooking events per day over the project KPT from SUMs measurements
Equations	(10)
Source of data	SUMs monitoring
Description of measurement methods and procedures to be applied	Installation of SUMs on the project devices during the project KPT
Frequency of monitoring/recording	Once during the project KPT
QA/QC procedures to be applied	The minimum confidence and precision of 90/10 for the target parameter of average cooking events per day per project devices shall be met. If the target precision is not met, the project proponent shall take the conservative bound of the confidence interval as the parameter value. The SUMs sampling protocols (installation, placement, downloading) and algorithms used to convert raw data into cooking events must remain unchanged between sampling during KPTs and sampling during ongoing project operation.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	User households in the SUMs sample shall not receive any support different or additional to those not in the sample.

10.3 Description of the Monitoring Plan

The project proponent must maintain a record of the date of commissioning of project devices of each type *j* and batch *k*. Relevant parameters must be monitored and recorded during the crediting period as indicated in Section 10.2 above.

Data recording

The project proponent must compile data on each device that is derived from the total sales record, with project technologies differentiated by different project scenarios. These data must be differentiated into sections based on the results of the applicable monitoring studies for each project scenario, so that emission reductions can be calculated appropriately, section by section.

The information captured for each project device included in the project activity must include, at a minimum:

1) Date of sale;
2) Geographic area of sale;
3) Model/type of project technology sold/distributed;
4) Name, telephone number (where available), and address of recipient; and
5) Unique alpha/numeric ID for each device that is sold/distributed.

In addition, the project proponent must maintain a comprehensive project database containing records for every unit distributed and ensure the database is maintained throughout the crediting period and for at least two years after the end of the last crediting period.

Sampling

Where measurement campaigns are conducted, the sampling approach described in the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities* must be followed.

When developing a sampling plan, project proponents must calculate the sample size required to achieve the required level of reliability. The sample size should be determined manually or using appropriate statistical software.

The calculation is dependent on all of the following as well as the target level of confidence and the precision of 90/10:

a) The type of parameter of interest (i.e., mean value or proportion)
b) The target value (i.e., the expected value of the parameter), which should be determined using the project proponent's knowledge and experience
c) Expected variance (or standard deviation) for that measure in the sample, based on results from similar studies, including other similar mitigation projects or previous monitoring periods, pilot studies, or from the project proponent's own knowledge

The project proponent is encouraged to ensure that all surveys and tests performed for the quantification of GHG emission reductions within this methodology are performed by an independent party qualified for these procedures. This ensures the integrity, accuracy, and transparency of reduction claims and supports the credibility of the project's environmental benefits.

QA/QC and data management

The project proponent must establish and implement Quality Assurance (QA) and Quality Control (QC) procedures to ensure the accuracy, reliability, and validity of monitored data.

Where feasible, the project proponent should engage independent, qualified entities to conduct KPTs and any standardized efficiency testing. In all cases, field staff responsible for monitoring (including KPTs and Usage Surveys) must be operationally independent from commercial activities, i.e., enumerators must not perform, nor be supervised by teams responsible for, sales, marketing, distribution, or customer service for the project proponent or its implementation partners.

All KPT campaigns must be implemented using recognized, standardized KPT procedures (e.g., Clean Cooking Alliance KPT protocol or an equivalent internationally accepted protocol), and personnel involved must receive formal training appropriate to the protocol and the field context.

All measurement instruments used (e.g., scales, moisture meters) must be calibrated and checked in accordance with manufacturer instructions and/or applicable standards. Weighing scales must be verified at regular intervals no less frequently than weekly during field campaigns using a certified calibration weight. Calibration/verification logs must be retained and made available for verification. If any instrument fails a verification check, measurements collected since the last successful check must be treated as invalid and excluded from the analysis.

Finally, the project proponent must implement data entry validation and cross-checking procedures and a documented approach for identifying and handling outliers. Any exclusion of outliers must be justified in writing, and both excluded observations and the rationale for exclusion must be retained to ensure full traceability.

Avoidance of double counting

Project proponents must demonstrate that the project prevents double counting of GHG emission reductions by any actor[32] who may wish to claim reductions from project devices. Ownership of the reductions resulting from the project activity must be clearly communicated by contract or clear written assertions in the transaction paperwork to all involved parties. Users must be notified that they are not permitted to claim reductions from the project.

Use of renewable biomass

For project activities introducing renewable biomass in the form of charcoal, it must be demonstrated (on an ongoing basis) that methane produced during the charcoaling process is captured and destroyed or combusted for energy purposes. The project proponent must document this both in the project description and monitoring reports.

Project activities must ensure that renewable biomass sources are documented in the project description and monitoring reports, including origin, quantities, and conditions prior to use

[32] For example, project technology manufacturers, wholesale providers, target population, among others

under the project activity. Where the biomass is sourced from a third party, proof of purchase must be provided (e.g., contractual agreements or purchase receipts).

Decentralized energy systems

Where backup generators in decentralized energy systems supply more than 1% of the annual electricity, the same percentage of emission reductions from project devices powered by these systems must be excluded during the monitoring period.

Self-generated renewable electricity system

The total energy generation of the self-generated renewable electricity system must be estimated and compared to the electricity use of the project device. Where self-generated renewable electricity is supplemented by non-renewable electricity (e.g., a back-up generator), such non-renewable electricity must not account for more than 20% of the electricity consumed by the project devices. Where a verification audit finds that the threshold has been exceeded, the project device must be excluded from emission reduction calculations.

Incentive based mechanisms

Project proponents must systematically monitor and evaluate the effectiveness of all incentive-based mechanisms implemented under Applicability Criterion 14), including through documented tracking of distribution, participation, and incentive delivery. They must demonstrate, using robust and verifiable evidence, that these mechanisms result in a measurable decline in the use of baseline devices and practices, and support a sustained transition to cleaner cooking technologies. Monitoring must include usage assessment, analysis of adoption rates, and behavioral changes over time. All evidence must be transparently documented and attributable to project beneficiaries to substantiate the permanence and effectiveness of the intervention.

11 REFERENCES

Clean Cooking Alliance (2004). *Controlled Cooking Test Protocol 2.0*. Available at: https://cleancooking.org/binary-data/DOCUMENT/file/000/000/80-1.pdf

Clean Cooking Alliance (2014). *Water Boiling Test Protocol 4.2.3.* Available at: https://cleancooking.org/binary-data/DOCUMENT/file/000/000/399-1.pdf

Clean Cooking Alliance (2018). Kitchen Performance Test Protocol 4.0. Available at: https://cleancooking.org/binary-data/DOCUMENT/file/000/000/604-1.pdf

ISO 19867-1:2018 Clean cookstoves and clean cooking solutions — Harmonized laboratory test protocol – Part 1: Standard test sequence for emissions and performance, safety and durability. Available at: https://www.iso.org/standard/66519.html

ISO/TR 19867-3:2018 Clean cookstoves and clean cooking solutions — Harmonized laboratory test protocols — Part 3: Voluntary performance targets for cookstoves based on laboratory testing. Available at: https://www.iso.org/obp/ui/en/#iso:std:iso:tr:19867:-3:ed-1:v1:e

WHO: Defining clean fuels and technologies. Available at: https://www.who.int/tools/clean-household-energy-solutions-toolkit/module-7-defining-clean

APPENDIX 1: THERMAL EFFICIENCY PERFORMANCE THRESHOLDS

This appendix only applies to improved cookstoves and is not applicable to projects involving the distribution of heat retention devices.

The following default values for thermal efficiency performance thresholds are taken from *ISO/TR 19867-3: Clean cookstoves and clean cooking solutions — Harmonized laboratory test protocols — Part 3: Voluntary performance targets for cookstoves based on laboratory testing*.[33]

Table 2: Default values for voluntary performance targets

	Tier	Thermal efficiency (%)	Durability score
Better performance ↑	5	≥50	<10
	4	≥40	<15
	3	≥30	<20
	2	≥20	<25
	1	≥10	<35
	0	<10	>35

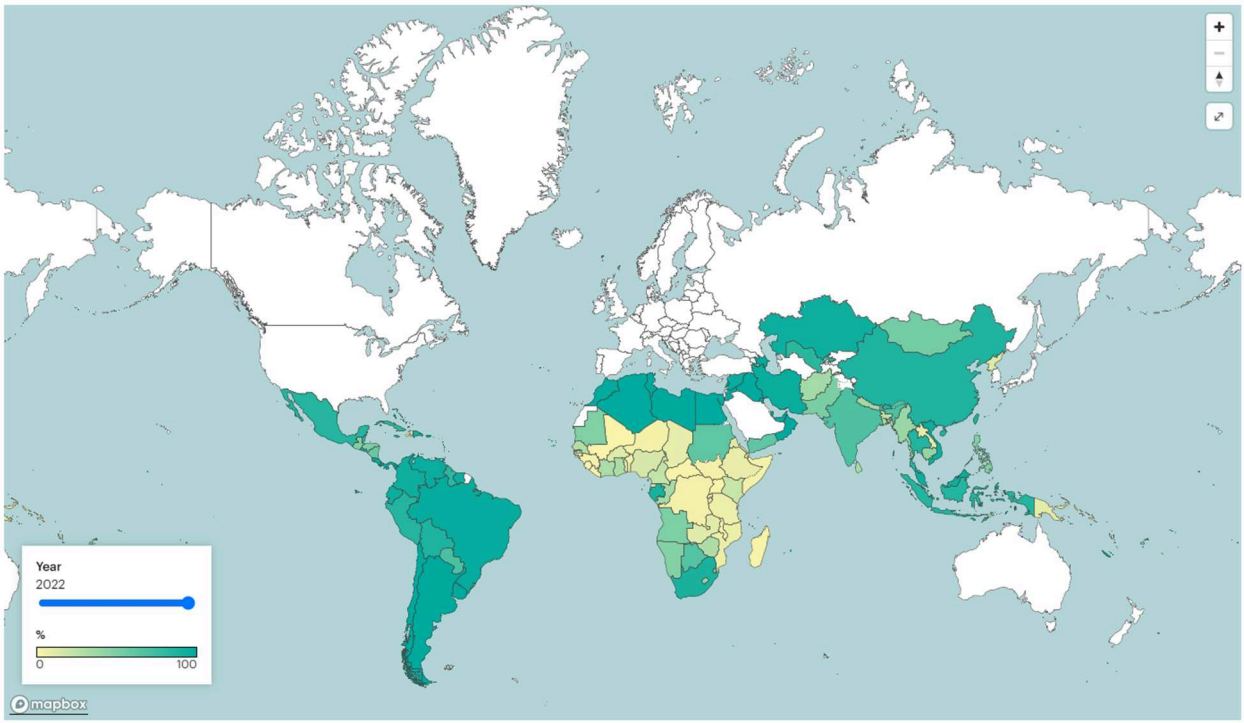
[33] Publicly available sections of ISO/TR 19867-3 are available at: https://www.iso.org/standard/73935.html A technical report providing a preview of some of the other content is available at: https://cdn.standards.iteh.ai/samples/73935/feb537d3c06f400dbe46e1b44ecbb67b/ISO-TR-19867-3-2018.pdf

APPENDIX 2: ACTIVITY PENETRATION

To establish a penetration rate of less than 20% for the project device technology, the UN SDG 7 progress report[34] has been used as a reference. Based on Appendix 1, the cookstoves applicable under this methodology belong to Tier 2 and above, meaning either intermediate or advanced cooking solutions. Hence, for some countries, while penetration of improved cooking solutions may be higher than 20%, the penetration of intermediate and advanced improved cooking solutions may be very low. Project proponents may use other sources to establish penetration rates of less than 20% for respective technologies.

The International Energy Agency (IEA) uses the World Health Organisation (WHO) Household Energy Database for people without access to clean cooking for historic numbers and the World Energy Model and official energy balances to present the map shown in Figure 1.

Figure 1: Share of population with access to clean cooking[35]



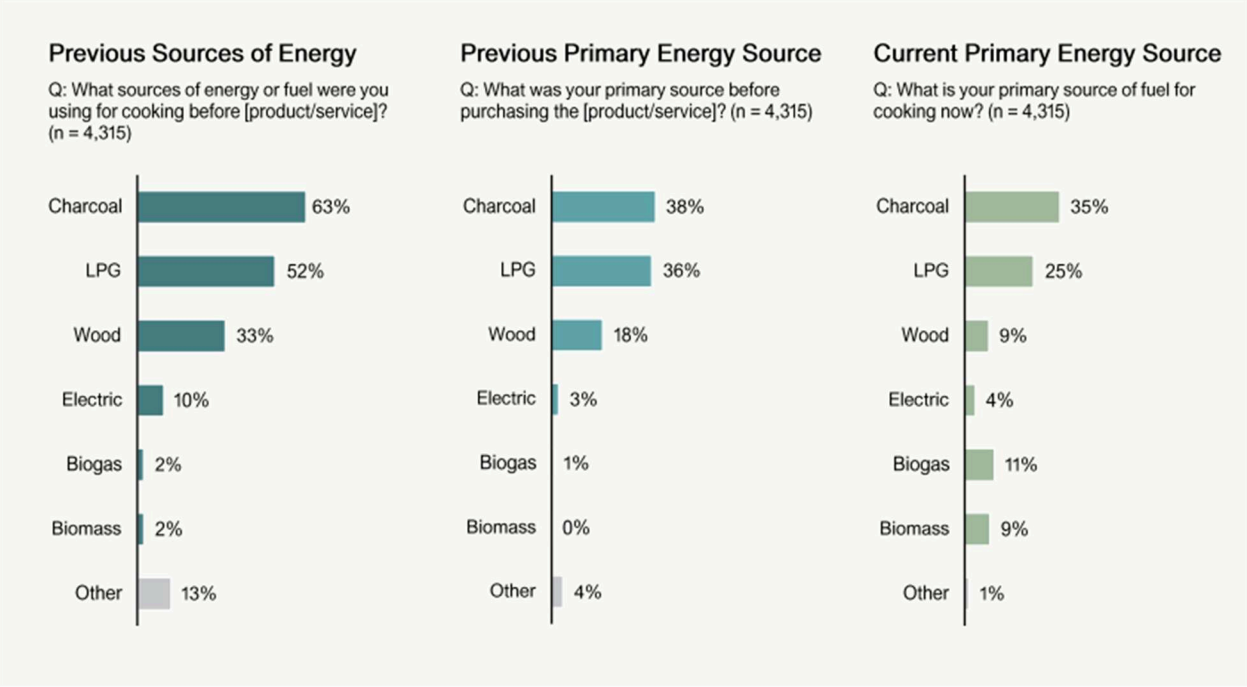
The Clean Cooking Alliance (CCA) in its *Lean Data Insights Aggregate Report* presents the sources of fuels used for cooking before and after purchasing products from CCA portfolio companies (Figure 2). Cleaner and safer energy sources such as biomass, biogas, and electricity have a lower penetration rate compared to common fuels such as charcoal.

[34] Available at: https://sustainabledevelopment.un.org/content/documents/2019_Tracking_SDG7_Report.pdf

[35] Source: https://www.iea.org/reports/sdg7-data-and-projections/access-to-clean-cooking

Figure 2 presents the results based on a sample of surveyed households. According to the report, the distribution of these households was as follows: rural households 32% (village or countryside), peri-urban households 29% (town), and urban households 39% (city). This distribution reflects the diversity of contexts in which the surveys have been carried out, thus allowing for a broader and more representative view of the situation in different areas.

Figure 2: Sources of cooking fuels before and after purchasing products from CCA portfolio companies[36]



[36] Source: https://cleancooking.org/wp-content/uploads/2023/07/Clean-Cooking-Alliance_Lean-Data-Insights-Aggregate-Report.pdf

APPENDIX 3: BINDING SURVEY QUESTIONNAIRE[37]

The following is a binding questionnaire with the minimum requirements for the baseline survey. The project proponent may choose a different format but must include these questions, at minimum.

1. Survey Format A: Baseline Fuel Consumption Pattern

1.1. General information

Title of project activity	
Name of surveyor	
Date of survey	dd/mm/yyyy
Survey method	Face to face / remote / telephone

1.2. Household profile[38]

Name (household representative)	
Household size (total number of people)	
- Females over 14 years	
- Males 15–59 years	
- Males over 59 years	
- Children 0–14 years	
Type of area (urban/rural)	
Address or coordinates	
Phone number	

1.3. Stove(s) used prior to project implementation

(Mark "x" for all that apply)

A three-stone fire or a conventional system with no improved combustion air supply nor flue gas ventilation system (i.e., without a grate or chimney)	Apply? (Mark "x" if yes)	Number of stoves used
Basic charcoal stove		
Improved woodfuel cookstove		
Improved charcoal cookstove		
LPG cookstove		

[37] For heat retention devices, see Section A6.9.10 of Appendix 6.

[38] Selection of households should be based on a sampling plan.

Electric cookstove		
Other (describe)		

1.4. Household fuel consumption pattern prior to project implementation

How many meals did you prepare yesterday? Is this a typical value? If the answer is "No," how many meals are prepared in a typical day?	meals/day Yes/No meals/day
Is there any difference with the amount of meals prepared during a typical weekend day?	(open response)
Describe any other ways in which you used your stove last week (e.g., water boiling for drinking, water boiling for hygiene, space heating).	(open response)

1.4.1. Fuel used for cooking[39]

	Yes/No	Quantity of usage	Unit
Charcoal			kg/ month or year
Wood			kg/ month or year
LPG			kg or cylinders / month or year
Kerosene			liters/ month or year
Coal			kg/ month or year
Electricity			kWh/ month or year
Other fuels (explain)			

1.4.2. Fuel sources

	Collected/ Purchased	Source or location of fuel
Charcoal		
Wood		
LPG		
Kerosene		
Coal		

[39] Where surveys are biennial, they may be designed to capture results for each year separately (e.g., the survey may ask for utilization hours for year 1 and year 2 separately). The end-user may not be able to provide information on the quantity of cooking fuel in the units given here. In many places, the volume of firewood (e.g., the volume capacity and level of filling of the transporting/storage room) is measured, rather than its weight. Local measurement practices vary. The project proponent should include such local measurement units in the questionnaire. The measurement unit may also be given in terms of money spent on purchasing fuel. The project proponent must provide guidelines for how to convert the reported values to required units (mass or volume). For example, where a household uses a bag of charcoal every 10 days, the monthly average may be calculated if the weight (or volume and bulk density) of the full bag is determined.

Electricity		
Other fuels (explain)		

2. Survey Format B: Adoption Rate Survey

2.1. General information

Title of project activity	
Name of surveyor	
Date of survey	dd/mm/yyyy
Survey method	Face to face
Period of usage (for adoption rate)	dd/mm/yyyy to dd/mm/yyyy

2.2. Household profile[40]

Name (household representative)	
Household size (total number of people)	
- Female over 14 years	
- Male 15–59 years	
- Male over 59 years	
- Children 0–14 years	
Type of area (urban/rural)	
Address or coordinates	
Phone number	

2.3. Household fuel consumption pattern following project implementation

Cooking device	
Model name/number	
Unique ID	
Date of installation	dd/mm/yyyy
Do you use the project cookstove? (Physically check the stove)[41]	Yes/No
If yes, have you used the stove regularly (a least once in day or several times a week) since you installed it?[42]	Yes/No

[40] Selection of households should be based on a sampling plan.

[41] This is to determine whether the cookstove is currently in use and includes visual checks. Physical checks to verify usage may include checking stove conditions (e.g., warm to touch, ashes in grate, soot on stove).

[42] This is to determine whether the cookstove has been continuously used.

If yes, is your stove in functional condition?[43]	Yes/No
If no, why did you stop using the stove?	
How many meals did you prepare using the project cookstove last week or last month?	meals/ week or month
Do you also use your traditional (baseline) cookstove?	Yes/No
If yes, how many meals did you prepare using the traditional (baseline) cookstove last week or last month?[44]	meals/ week or month
Do you use any other stove?[45]	Yes/No
If yes, list the types and number of other non-project stoves.	
How many times a week do you use the non-project stoves?	
How much do you spend on fuel for cooking per type of cooking device in a week/month?	

[43] The project proponent may rephrase the question keeping in mind the objective (i.e., whether or not the project cookstove is in functional condition). Where the project cookstove is not in functional condition, the project proponent must exclude such stoves from the project database for the whole crediting year and subsequent years. The project proponent may include such stoves again on replacing them with new cookstoves of similar efficiency.

[44] This is to determine whether the baseline stove is being used, in order to accurately account for project emissions. Where celebrations and/or festivals at the time of the survey may alter the number of meals prepared, provide an average value considering normal conditions.

[45] This is to cross-check whether the project cookstove is used for all cooking requirements. It may also detect situations where a household is taking part in more than one project activity, thereby avoiding double counting.

APPENDIX 4: MONITORING/ MEASUREMENT TECHNIQUE GUIDANCE

Stove Use Monitors

Stove use monitors (SUMs) are devices that quantify stove usage through direct measurements of physical or chemical parameters (e.g., temperature, heat flow, light, power, motion, gas concentration) on stoves, kitchen technologies, and cookware, among others. These monitors are often employed in regions where cooking primarily uses solid fuels such as wood, charcoal, or dung. The data collected by these monitors can provide valuable insights into cooking behaviors, patterns, and the effectiveness of interventions aimed at promoting cleaner cooking practices.

SUMs used for determining stove usage are sensors containing internal software that identifies stove usage when a temperature threshold is reached. Event identification can be performed using the "fire-finder" method for instance[46], which allows removal of events that are too short, and detects the beginning (threshold, high slope) and the end (threshold, low slope, and slowing decreasing temperature) of stove use events.

Parameters such as threshold values, positive slope, and negative slope must be adjusted based on the stove type, and it is recommended that stove usage start and stop times are periodically verified manually as a cross-check. SUMs require careful positioning to ensure a robust response capturing temperature variation and avoiding heat damage.

When characteristic temperature signals or "signatures" of the main cooking tasks are obtained and their frequency is measured, the adoption niche of each cooking device can be quantified from SUMs-based data in terms of the redistribution of cooking tasks.

The following table describes some recommendations that the project proponent may adopt for field deployment of SUMs to quantify adoption.[47]

Table 3: Recommendations for stove use monitors (SUMs)

Placement of SUMs and sampling frequency	• Determine the stove locations and SUM support configuration that will keep the SUMs within the temperature limits specified by each manufacturer. • Use real-time temperature indicators to check locations during a firing cycle performed at maximum fuel intensity.

[46] Wilson, Daniel Lawrence, Kendra N. Williams, and Ajay Pillarisetti on behalf of the HAPIN Investigators. 2020. "An Integrated Sensor Data Logging, Survey, and Analytics Platform for Field Research and Its Application in HAPIN, a Multi-Center Household Energy Intervention Trial" Sustainability 12, no. 5: 1805. https://doi.org/10.3390/su12051805

[47] Recommendations adapted from Ruiz Mercado I. 2012. The Stove Adoption Process: Quantification Using Stove Use Monitors (SUMs) in Households Cooking with Fuelwood, University of California, Berkeley.

	• Record temperature with SUMs and holder setup at selected stove locations for two to three days in real homes. Identify the least obtrusive locations. • Check that the signals are not saturated and that the temperature of the SUMs is not too close to the operating limits. • Determine the appropriate sampling frequency for the level of detail desired (days of use, number of meals per day, duration of cooking events, duration for which the stove is on) and for the number of samples needed per monitoring period. Placement recommendations • Avoid stoves where water may drip on the monitors. • In most monitors, slower sampling rates and lower operating temperatures lead to longer battery life.
Data collection and management	• Staff should be monitored and trained to follow strict protocols to ensure the integrity of SUM data. • Implement data collection field forms for each SUM in each deployment-programming-download cycle. • Document relevant observations of household behavior on the forms. • Keep a record of the operation and status of the sensors at each location. • Establish a data file protocol that includes all identified keys such as name and specifications of the monitor, household, stove identification numbers, start and end date of temperature readings, monitoring cycle number, among others, in order to have an accurate and reliable file. • Perform annual baseline measurements on all deployed monitors.

Kitchen Performance Test (KPT) with digital monitors

Digital monitors can be included in traditional KPTs to optimize fuel consumption monitoring, since fuel consumption is one of the most important metrics of cooking intervention performance. To directly monitor fuel consumption in households, digital monitors record time-stamped fuel mass data using a logging load cell.

Digital monitoring systems can operate in tension for fuels like firewood, charcoal, and agricultural residues, or in compression for LPG, ethanol, or kerosene. Where households stack with multiple stoves or fuels, a separate sensor can be installed for each stove or fuel type.

Two versions of the system have been developed, one manufactured by Waltech Systems that relies on SD cards (first generation) and an updated model manufactured by Climate Solutions Consulting that

collects data wirelessly using a custom-designed launcher and collection device (second generation).[48] Wireless data collection allows for faster data collection integrated with multiple sensors (fuel, temperature, emissions) in a home, and enables troubleshooting and preliminary data reporting at the source.

General system components include:

- Off-the-shelf S-type tensile or compressive load cell with eye bolts for attachment
- Internal temperature sensor
- Integrated power supply, analog-to-digital converter (ADC), and control module with internal clock
- Battery power supply
- Plastic housing
- Fuel storage container

Components specific to first generation systems include:

- External thermocouple port
- SD card port for data storage

Components specific to second generation systems include:

- Wireless data launcher
- Initial pre-processed data analytics (calibration equations applied before storing data)
- Wireless infrared temperature logger

For first generation systems, logging rate is normally programmed to 49 seconds and decreased to 7 seconds when a specified weight change is detected, until no additional changes in mass are detected. Data is stored on SD cards as .csv files.

For second generation systems, the measurement rate is normally programmed to 30 seconds, with data written to memory once per minute. The data are stored in the device's internal memory and then downloaded wirelessly to the launcher SD card as a .csv file.

For adequate operation, a household cook must be trained to store his or her fuel supply in the bucket- or sling-type fuel holder, remove fuel as needed for cooking, and refill when empty. These actions result in discrete reductions in weight, which are recorded by the load cell and integrated to determine total fuel use over a specified time.

[48] Ventrella J., Lefebvre O., and MacCarty N. 2020. Techno-economic comparison of the FUEL sensor and Kitchen Performance Test to quantify household fuel consumption with multiple cookstoves and fuels. Development Engineering, 5, 100047. https://doi.org/10.1016/j.deveng.2020.100047

How to approach seasonality with KPT

Project proponents must provide a description of seasonality at the project location(s) (e.g., wet/dry, cold/warm, temporality during the year), as well as observed and expected impacts on cooking practices and cooking energy use.

The project proponent must consider one of the following options to address seasonality.

- Perform the measurement campaign in such a way that it captures seasonal factors that may affect fuel consumption over the year, or
- Perform the measurement campaign in a way that ensures that the results are conservative, given seasonal variability and ensure that baseline and project KPT are performed at the same moment.

APPENDIX 5: SAMPLING GUIDANCE

According to the *Guidelines on Sampling and Surveys for CDM Project Activities and Programmes of Activities*,[49] it is important to distinguish between two categories of data when determining sample size: those related to mean and those related to proportions.

Sample size refers to the number of observations or individuals included in a statistical study or experiment. Determining the appropriate sample size is critical to ensuring that the results of the study are accurate and representative of the population being studied.

- **Mean values:** Corresponding to average values inferred from data that are often referred to as continuous variables
- **Proportion (or percentage) values:** Values that are derived from data that are described as attributes, yes/no data, or binary data

The "population" in this methodology refers to the total number of project devices commissioned, whereas the sample target represents a specific subset of these devices. The following table specifies the parameters described in the methodology to be considered in relation to the CDM sampling guidelines, together with a description of the type of data to which they correspond (mean or proportion).

Scenario	Parameter	Description	Mean value	Proportion
General	$N_{j,k,y}$	Number of commissioned project devices of type *j* from batch *k* in year *y*	X	
	$n_{j,k,y}$	Proportion of commissioned project devices of type *j* from batch *k* that remain operating in year *y* (fraction)		X
Baseline	$BC_{b,i,y}$	Fuel used per baseline device type *i* during year *y*	X	
	$SC_{b,i}$	Specific energy consumption of baseline device type *i* in the baseline scenario	X	
Project	$BC_{p,j,k,y}$	Average quantity of fuel used by project device type *j* from batch *k* during year *y*	X	
	$EC_{p,j,k,y}$	Annual consumption of electricity by electric project device type *j* from batch *k* in year *y*	X	

[49] Available at: https://cdm.unfccc.int/Reference/Guidclarif/index.html

	$SC_{p,j}$	Specific energy consumption of project device type *j* in the project scenario	X	

Recommended sampling methods selected based on specific project conditions and available sampling and/or prospecting capabilities are listed below.

Sampling Method	Characteristics
Simple random sampling	• Conceptually straightforward and easy to implement • Particularly advantageous when assuming population homogeneity, such as within the same climate zone or socioeconomic circumstances • Costs of data collection can be higher than other sampling approaches when the population is large and geographically dispersed. • Not applied where the population covers a large geographical area.
Stratified random sampling	• Ensures that each subgroup is represented proportionally in the final sample, which can lead to more accurate and reliable results compared to simple random sampling. • Applied for heterogeneous populations and most applicable to situations where there are obvious groupings of population elements whose characteristics are more similar. • Stratification factors should be selected to reflect significant differences in the population regarding the parameter of interest. • Requires prior knowledge or information about the population to correctly identify and define the strata. • Tends to be more complex, demanding additional calculations in contrast to simple random sampling.

To perform sample size calculations, the parameters of interest must be estimated. This procedure can be accomplished by:

1) **Preliminary data analysis:** Conduct an exploratory study using previously collected data, where available. This can give a first idea of the data distribution and parameter variability.
2) **Literature research:** Previous research related to the topic of study can be examined.
3) **Pilot or feasibility studies:** Conduct pilot or feasibility studies to gather preliminary data. This can help estimate parameters of interest and adjust sample size calculations accordingly.
4) **Expert consultation:** Obtain opinions and knowledge from experts in the relevant field.
5) **Own experience:** Using estimates based on the researcher's own experiences.

The following equations must be followed to determine the sampling plan.

A5.1 Simple Random Sampling

Simple random sampling is suited to populations that are homogeneous. This method is often used because it is straightforward and ensures that each member of the population has an equal chance of being included in the sample. The sample-based estimate (mean or proportion) is an unbiased estimate of the population parameter.

Sample size determination for mean parameter

$$n \geq \frac{1.645^2 N \times V}{(N-1) \times 0.1^2 + 1.645^2 \times V}$$

$$V = \left(\frac{SD}{mean}\right)^2$$

Where:

n	=	Sample size for households
N	=	Total number of households
SD	=	Expected standard deviation
mean	=	Expected mean, depends on similar studies or location
1.645	=	Represents the 90% confidence required
0.1	=	Represents the 10% relative precision

Sample size determination for proportion parameter

The equation for a 90/10 confidence/precision to give the required sample size is:

$$n \geq \frac{1.645^2 N \times p(1-p)}{(N-1) \times 0.1^2 \times p^2 + 1.645^2 \times p(1-p)}$$

Where:

n	=	Sample size for households
N	=	Total number of households
p	=	Expected proportion of parameter of interest
1.645	=	Represents the 90% confidence required
0.1	=	Represents the 10% relative precision

The result, *n*, represents the number of households with data available for analysis. Where it is anticipated that a certain proportion of the sampled households will respond, adjust this number accordingly by dividing *n* by the anticipated proportion.

The expected proportion must not be more than one. A conservative range to apply could be between 0.5 to 0.7.

The equation for 95/10 confidence/precision to give the required sample size is:

$$n \geq \frac{1.96^2 N \times p(1-p)}{(N-1) \times 0.1^2 \times p^2 + 1.96^2 \times p(1-p)}$$

Where:

n	=	Sample size for households
N	=	Total number of households
p	=	Expected proportion of operating cookstoves
1.96	=	Represents the 95% confidence required
0.1	=	Represents the 10% relative precision

A5.2 Stratified Random Sampling

Where the project covers a large geographic area, stratified random sampling may be applied. This consists of dividing the area into different districts based on the likelihood that stoves will continue to operate. The number of districts (*D*) should cover the total number of households. Estimates of the proportion of cookstoves still in operation in each district, as well as the population size of each district, are required.

Total sample size determination for proportion parameter

$$n \geq \frac{1.645^2 \times NV}{(N-1) \times 0.1^2 + 1.645^2 \times V}$$

$$V = \frac{SD^2}{\bar{p}^2}$$

Where:

n	=	Sample size for households
N	=	Total number of households
V	=	Overall variance
1.645	=	Represents the 90% confidence required
0.1	=	Represents the 10% relative precision
SD	=	Standard deviation
$\bar{p}$	=	Overall proportion

Then, standard deviation is based on g_d and proportion p_d.

$$SD = \sum_d \frac{g_d \times p_d(1-p_d)}{N}$$

Where:

SD	=	Standard deviation
g_d	=	Number of households with cookstoves in district *d*
$p_d(1 - p_d)$	=	Variance of a proportion
N	=	Total number of households

The overall proportion is based on the number of households in a district and the proportion with cookstoves.

$$\bar{p} = \sum_d \frac{(g_d + p_d)}{N}$$

Where:

$\bar{p}$	=	Overall proportion
g_d	=	Number of households with cookstoves in district *d*
p_d	=	Proportion of households with cookstoves in district *d*
N	=	Total number of households

To decide on the number of households in the sample that come from each district, proportional allocation can be used, where the proportion from different districts is the same as the proportion of that district in the population.

$$n_d = \frac{g_d}{N} \times n$$

Where:

n_d	=	Sample size for district *d*
g_d	=	Number of households with cookstoves in district *d*
N	=	Total number of households
n	=	Total sample size

Sample size determination for mean parameter

$$n \geq \frac{1.645^2 \times NV}{(N-1) \times 0.1^2 + 1.645^2 \times V}$$

$$V = \left(\frac{SD_{overall}}{mean}\right)^2$$

Where:

$SD_{overall}$	=	Weighted overall standard deviation
mean	=	Weighted overall mean

The overall standard deviation is:

$$SD_{overall} = \sqrt{\frac{\sum_{d=1}^{D} g_d \times SD_d^2}{N}}$$

Where:

$SD_{overall}$	=	Weighted overall standard deviation
SD_d	=	Standard deviation for district *d*

g_d	=	Number of households with cookstoves in district *d*
N	=	Total number of households

The overall mean is:

$$mean = \sum_{d=1}^{D} \frac{(g_d + m_d)}{N}$$

Where:

mean	=	Weighted overall mean
g_d	=	Number of households with cookstoves in district *d*
m_d	=	Mean cookstoves in district *d*
N	=	Total number of households

APPENDIX 6: HEAT RETENTION DEVICES

This appendix applies to project activities that entail distribution of heat retention devices (HRDs).

A6.1 Summary Description

This appendix provides requirements for HRDs and applies to project activities that introduce energy efficiency measures through the operation such devices. The project may involve either continued use of the existing stove or replacement of the existing stove with an improved cookstove. In both cases, the HRD is introduced as a complementary technology that reduces fuel requirements per relevant cooking event.

More than one HRD may be distributed to a single household or user. Where this occurs, the project proponent must calculate emission reductions on a per-device basis or otherwise normalise monitored fuel or energy savings to the number of heat retention devices and relevant cooking tasks, to avoid double counting the same cooking event or stove-use instance.

A6.2 Sources

Section 2 of this methodology applies.

A6.3 Definitions

Section 3 of this methodology applies.

A6.4 Applicability Conditions

Project activities distributing HRDs must comply with the applicability conditions 2, 3, 4, 5, 6, 13, 15, 16, 17, 18 and 19 in Section 4. Further, such project activities must comply with the following additional applicability conditions:

1) The HRDs:

    a) are designed to retain thermal energy from a stove, allowing food to continue cooking after the stove is turned off.
    b) operate without requiring additional external energy inputs, built-in combustion or active heating elements (e.g. electricity, combustion, gas burners or hybrid electric cookers).
    c) do not include additional heat sources such as a soapstone or brick.
    d) remain closed throughout the cooking process to ensure food is cooked safely and the efficiency of the heat retention device is maintained.
    e) must demonstrate that they retain the heat at a minimum of 65 °C after six hours in accordance with the Heat Retention Test described in Section *A6.9.3 Description of the Monitoring Plan*.

A6.5 Project Implementation

Section 5 of this methodology applies, as applicable.

A6.5 Project Boundary

Section 6 of this methodology applies.

A6.6 Baseline Scenario

A.6.6.1 Identifying the Baseline Scenario

Section 7.1 of this methodology applies with respect to Steps 1 and 2 taking into consideration that the baseline stove may not be replaced with an HRD. Where Step 1 and 2 refer to cookstove technology, heat retention projects should consider heat retention technologies instead. Apply Step 3 but the remaining baseline scenario(s) can be one or a combination of the following.

1) Non-renewable biomass: The baseline scenario is the target population's continued use of inefficient stoves with non-renewable firewood or charcoal to meet similar cooking needs as the project activities.

   Project proponents may use a combination of different non-renewable biomass types in the baseline.

2) Fossil fuels: The baseline scenario is the target population's continued use of stoves fueled by solid or liquid fossil fuels (e.g. coal, paraffin, kerosene or LPG) to meet similar cooking needs as the project activity.

3) Electricity: The baseline scenario is the target population's continued use of stoves fueled by grid electricity to meet similar cooking needs as the project activity.

There are several baseline to project pathways that are applicable to heat retention devices. Each pathway and their respective emission reduction quantification procedure is listed in the table below.

SNo	Pathway	Quantification Procedure
1	3-stone fire to 3-stone fire with HRD	Apply the quantification methods and procedures in Appendix 6 of this methodology
2	Baseline charcoal stove to baseline charcoal stove with HRD	
3	Improved cookstove to improved cookstove[50] with HRD	
4	Baseline electric stove to baseline electric stove with HRD	

5	Baseline LPG stove to baseline LPG stove with HRD	
6	Baseline paraffin stove to baseline paraffin stove with HRD	
7	Baseline coal stove to baseline coal stove with HRD	
8	Baseline other fossil fuel stove to baseline fossil fuel stove with HRD	
9	3-stone fire to improved cookstove[51] with HRD	Apply the quantification methods and procedures in Section 8 of this methodology

A project may distribute one or more eligible technologies covered under the methodology to households. Requirements for the identification of the baseline scenario must be applied in the following manner, based on the proposed project scenario:

Proposed project scenario	Applicable requirements (section)
Distribution of improved cookstoves only	Section 7.1
Distribution of both improved cookstoves and HRDs	Section 7.1
Distribution of HRD only	This appendix
Distribution of improved cookstoves and HRDs to different households within the same project area	Section 7.1 for improved cookstoves This appendix for HRDs

A6.6.2 Baseline Scenario Survey Requirements

Section 7.2 of this methodology applies.

A6.6.3 Baseline Reassessment

Section 7.3 of this methodology applies.

A6.7 Additionality

Section 8 of this methodology applies.

A6.8 Quantification of Reductions and Removals

A6.8.1 Baseline Emissions

Section 9.1 equations apply. In addition, the following project pathways and quantification procedures apply to HRD pathways 1-8.

There are several baseline to project pathways that are applicable to HRDs. Each pathway and their respective emission reduction quantification procedure is listed below:

- Project only distributes HRDs. Cooking in the project scenario occurs on the baseline stove with the HRD. Quantification procedures in Section A6.8 of this Appendix applies, in addition to Section 9.
- Project distributes HRDs and improved cookstove to the same households. Quantification procedures in Section 9 of this methodology applies.
- Project distributes HRDs and improved cookstoves to different households. Quantification procedures in Section 9 of this methodology apply to the cookstove instances while procedures in this Appendix apply to the HRD instances.

There is the possibility for a rebound effect to occur due to increased availability of cooking fuels due to reduced stove-time on account of the use of the heat retention device along with the project cooking device. Rebound is defined as an increase in service level (and resulting availability of fuel) as a result of the project activity which could lead to diversion of available fuel for other, possibly unaccounted for, uses (like space heating, water boiling etc.). In the case of HRD projects, the service level is the number of meals cooked in the baseline. In order to account for this, equation 1 of this Appendix must be applied to ensure that the calculation is based on the baseline energy consumption.

Energy consumption is directly linked to the number of instances of stove use (which includes preparation of meals and other non-meal preparation applications like boiling water or space heating). Energy consumption associated with non-meal preparation applications must be excluded from the calculation of baseline emissions. The baseline survey must determine the average instances of stove use per week, which will serve as the maximum allowable value for calculating GHG emission reductions.

During monitoring, user habit surveys must record the average number of weekly stove-use instances and must be designed to ensure that non-meal preparation applications are explicitly identified and documented. This information must be used to ensure that energy consumption associated with non-meal preparation applications are excluded from the calculation of baseline emissions. If the average number of weekly stove use instances exceeds the baseline value, the baseline energy consumption must be must capped at the baseline stove use count.

The rebound factor (RF_y) must be calculated using the following equation:

$$RF_y = \min(1, \frac{M_{BL,week}}{M_{PJ,week}})$$ (Equation 1 of Appendix 6)

Where:

RF_y	Factor to account for the rebound effect relating to increased meals cooked (fraction)
$M_{BL,week}$	Average number of stove use instances in the baseline (number)
$M_{PJ,week}$	Average number of stove use instances in the project (number)

A stove use instance is defined as the use of the stove for any purpose, including but not restricted to, meal preparation, water boiling or space heating. The number of instances will be established through the use of user habit surveys.

The baseline emissions are calculated as follows to obtain the capped baseline emissions.

$$BE_{capped,y} = BE_y \times RF_y$$ (Equation 2 of Appendix 6)

Where:

$BE_{capped,y}$	Capped baseline emissions to account for rebound (tCO_2e)
BE_y	Baseline emissions in year y (tCO_2e)

A6.8.1.1 Average Energy Consumption of Baseline Device ($EC_{i,y}$)

Section 9.1.1 applies. The quantity of fuel that would be used in the baseline scenario for HRDs must be determined by one of the methods prescribed in Section 9.1.1 or by a CCT. The CCT must comply with the requirements set in Section 9.1.1.2.

A6.8.1.1.2 Cross-check of ECi,y to address stove stacking for Project Devices With Additional Characteristics Affecting Energy Consumption

Section 9.1.1.1 of this methodology applies. Projects that only distribute HRDs cannot be considered to have stove stacking. Where a project activity distributes heat retention devices together with improved cookstoves to the same households, the stove-stacking provisions apply to the improved cookstove component. For HRD-only project activities, continued use of the baseline stove with the HRD is part of the intended project configuration and must be addressed through the HRD-specific quantification and monitoring requirements in this Appendix, including the rebound provisions.

A6.8.2 Project Emissions

Section 9.2 of this methodology applies.

A6.8.2.1 PEenergy,y from Biomass, Fossil Fuels, or Bioethanol

Section 9.2.1 of this methodology applies.

A6.8.2.1.1 $BC_{p,j,k,y}$ for Project Devices

Section 9.2.1.1 of this methodology applies. In addition, project distributing HRDs may also use CCT instead of KPT. The CCT must comply with the requirements in Section 9.1.1.1.

A6.8.2.2 $PE_{energy,y}$ from Electricity

Section 9.2.2 of this methodology applies.

A6.8.2.3 Adjustment on project emissions for the Hawthorne effect

Section 9.2.3 of this methodology applies.

A6.8.2.4 $PE_{others,y}$ from Transportation, Fuel Production, Fugitive Emissions, and Backup Generators

Section 9.2.4 of this methodology applies.

A6.8.3 Leakage Emissions

Section 9.3 of this methodology applies.

A6.8.4 Net GHG Emission Reductions

Net GHG emission reductions are calculated as follows:

$$ER_y = \left(BE_{capped,y} - PE_y\right) \times 0.95 - LE_{RB,y}$$

uation 3 of pendix 6)

Where:

ER_y = Emission reductions during year *y* (t CO_2e)

$LE_{RB,y}$ = Leakage emissions associated with use of renewable biomass during year *y* (t CO_2e)

A6.9 Monitoring

A6.9.1 Data and Parameters Available at Validation

Section 10.1 of this methodology applies. In addition, projects distributing HRDs must apply the following parameter table.

Data/Parameter	$M_{BL,week}$
Data unit	Number
Description	Number of stove use instances in the baseline per week
Equations	Equation 1 of Appendix 6
Source of data	**Option 1:** Measured directly using stove use monitors for at least one month in a sample of the target population according to the most recent version of the CDM *Standard for Sampling and Surveys for Project Activities and Programmes of Activities* and achieving 90/10 confidence precision for the average stove use instances per week. **Option 2 (surveys):** Based on the responses to the baseline survey questions (APPENDIX 3: Binding Survey Questionnaire) section 1.4. Household fuel consumption pattern prior to project implementation, carried out according to the most recent version of the CDM *Standard for Sampling and Surveys for Project Activities and Programmes of Activities* and achieving 90/10 confidence precision for the average stove use instances per week, and applying the lower bound of the confidence interval as the parameter value. For both Options 1 and 2, where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness adjustment as per Section 4 of the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities.*
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	Recognized survey methods based on the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities*
Purpose of data	Calculation of baseline emissions
Comments	-

A6.9.2 Data and Parameters Monitored

Section 10.2 of this methodology applies. In addition, projects distributing HRDs must apply the following parameter table.

Data/Parameter	$M_{PJ,week}$
Data unit	Number
Description	Number of stove use instances in the project per week
Equations	Equation 1 of Appendix 6
Source of data	Monitoring
Description of measurement methods and procedures to be applied	**Option 1:** Measured directly using stove use monitors in a sample of users according to the most recent version of the CDM *Standard for Sampling and Surveys for Project Activities and Programmes of Activities* and achieving 90/10 confidence precision for the average stove use instances per week. **Option 2 (surveys):** Based on the responses to the adoption rate survey question, "How many meals did you prepare using the project device last week or last month? "carried out according to the most recent version of the CDM *Standard for Sampling and Surveys for Project Activities and Programmes of Activities* and achieving 90/10 confidence precision for the average stove use instances per week, and applying the upper bound of the confidence interval as the parameter value. For both Options 1 and 2, where the project does not achieve the target precision in a monitoring period, the project proponent must apply an appropriate conservativeness adjustment as per Section 4 of the most recent version of the CDM *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities.*
Frequency of monitoring/recording	**Option 1: (monitoring):** continuous **Option 2 (surveys):** annually
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	-

A6.9.3 Description of the Monitoring Plan

Monitoring options for heat retention device projects:
Along with the requirements mentioned below, all relevant provisions (except decentralized energy systems and self-generated renewable electricity system) of section 10.3 above apply:

The monitoring of HRDs may include the use of smart/Internet of Things (IoT) devices to monitor, through a sample, the fraction of HRDs actively in use across the project population. This approach will enhance data accuracy, and reduce reliance on periodic surveys, particularly in large-scale distributions.

Monitoring options for HRDs projects may also include Controlled Cooking Tests (CCTs) as a valid method for all fuel types, including electricity, LPG, paraffin, and coal, where the same fuel is used both in the baseline and the project, alongside the existing options of Kitchen Performance Tests (KPTs) and direct fuel metering. Specific parameters will need to be defined for fossil fuel usage, including the quantity and frequency of fuel consumption per household.

Rebound effect

The following monitoring parameters are required to incorporate the rebound effect in heat retention device projects:

- $M_{BL,week}$ as the average stove use instances per week in the baseline. This should be established during the baseline survey and be statistically representative meeting a 95/10 confidence and precision threshold.
- $M_{PJ,week}$ as the average stove use instances per week in the project scenario. This should be established during user habit surveys and meet the same statistical requirements as the parameter $M_{BL,week}$.

QA/QC procedures
The project proponent must ensure that households are trained to use the HRD correctly. This training must include topics relating to the correct and safe use of the devices, fuel savings, switching the stove off once the pot is removed and keeping the device closed while food is cooking.

Heat retention testing

A representative sample of heat retention devices must pass a “Heat Retention Test” at renewal of the crediting period.

A Heat Retention Test is conducted by bringing a pot filled with 4 litres of water to the boil and placing it within the HRD. The temperature change of the water is monitored over the period of 6 hours to determine its thermal integrity and performance. A temperature probe is used to monitor the temperature at 1-minute intervals. To pass the test, the temperature remains above 65 °C over the entire 6 hour period to prevent bacterial growth in line with international

guidelines. All HRD types must comply with this minimum performance requirement specified here.

LPG

Where LPG is used for cooking both in the baseline and in the project and direct metering of cylinder refills is not feasible at scale, fuel savings may be estimated using direct metering, fuel purchase invoices; KPTs, or CCTs.

A6.9.10 Binding Survey Questionnaire

The following is a binding questionnaire is based on the requirements of Appendix 3 of this methodology, with specific reference to heat retention devices. This questionnaire provides the minimum requirements for the baseline survey in heat retention device projects. The project proponent may choose a different format but must include these questions, at minimum.

1. **Survey Format A: Baseline Fuel Consumption Pattern**

Appendix 3 of this methodology applies, considering that HRDs should be considered where the term 'cookstove' is used.

In addition, the following question is required for projects distributing HRDs:

- How many times do you use your stove on average for all purposes in a week? (Stove use instance per week)

2. **Survey Format B: Adoption Rate Survey**

Appendix 3 of this methodology applies.

DOCUMENT HISTORY

Version	Date	Comment
v1.0	09 Oct 2024	Initial version
v2.0 (draft)	09 July 2026	This draft revision includes the following updates: • Inclusion of the MoFuSS—DS (default scenarios) tool as an option for the determination of f_{NRB} values • Removal of CDM TOOL30 as an option for the determination of f_{NRB} • Inclusion of corrections and clarifications published on 3 February 2025 • Inclusion of the Hawthorne effect in the quantification procedure for the determination of ER values • Expansion of the scope to the use of heat retention devices and inclusion of related requirements and procedures (Appendix 6) • Additional guidance on the design and maintenance of control households • Inclusion of requirements and best practices for installing and implementing Stove Usage Monitors (SUMs), carrying out Kitchen Performance Tests (KPTs), and Controlled Cooking Tests (CCTs) as per the CLEAR methodology (external) • Alignment with the current best practices and latest scientific understanding related to cookstove projects, where needed • Editorial improvements and corrections (including alignment with the latest methodology template and the VCS program rules/requirements)