Comprehensive Lowered Emission Assessment and Reporting (CLEAR) Methodology for Cooking Energy Transitions

Developed by the Clean Cooking and Climate Consortium (4C)

In collaboration with Atmosphere Alternative

In memory of our friend and colleague Gajanana Hegde

TABLE OF CONTENTS

1. Definitions

Additionality: The project activity goes beyond what would occur due to enforced legal or regulatory requirements and would not have occurred in the absence of the incentives from the carbon credits.

Artisanal cookstoves: Cookstoves produced by small-scale manufacturing processes that can result in large variations in dimensions; generally made by hand by skilled workers, rather than mass-produced in factories. This methodology requires that for artisanal cookstoves, at least three randomly-selected samples of each cookstove model must be used when testing for ISO thermal efficiency, and where relevant for the Controlled Cooking Test (CCT).

Baseline scenario: The existing baseline technologies and fuel consumption patterns in a planned cooking energy carbon project area. This baseline scenario (or scenarios) includes fuel types, fuel mix proportions, and household size, identified through baseline surveys prior to project implementation. Under the CLEAR methodology, the baseline scenario must be compared to the baseline technologies and fuel consumption patterns of actual households recruited into the project, through the use of retrospective questions of project households during the first usage survey in any given household. Adjustments must be made in the case of any material discrepancy.

Business-as-usual (BAU) scenario: Plausible reference benchmark or scenario for GHG emissions or removals prior to or in the absence of the implementation of the proposed Article 6.4 activity. In the CLEAR methodology, the BAU scenario is in most cases equivalent to the baseline scenario, with adjustments made to the baseline scenario for any changes over time, if necessary (see section B.5.4 for additional details).

Carbon-crediting program: A standard-setting program that registers climate change mitigation activities and issues carbon credits.

Charcoal: A fuel produced by partially burning wood in a low-oxygen environment. The black substance that results is made up mostly of carbon and has higher energy density than the wood.

Continuously tracked energy consumption (CTEC) project: Project that continuously measures fuel or energy consumption directly on all project technologies through built-in or external data loggers (also known as metering), or through fuel sales records. Commonly metered fuels/technologies include electric cookstoves, liquified petroleum gas (LPG), ethanol, and biogas.

Controlled Cooking Test: A test that measures cookstove performance in comparison to traditional cooking methods when a cook prepares a pre-determined local meal, which may include multiple dishes. It is designed to assess cookstove performance in a controlled setting using local fuels, pots, and practices.

Cooking energy transition(s): The shift from one or more cooking fuel/ technology combination to another. In the context of this methodology, it specifically refers to the shift from polluting cooking fuels and technologies to cleaner and/or more efficient alternatives that results in greenhouse gas (GHG) emission reductions.

Cooking event(s): An occurrence in which useful energy is delivered from a cookstove to fulfill a discrete task or set of tasks, such as cooking a meal (which may include multiple dishes), preparing tea, or heating water for bathing.

Crediting period: Period defined by the carbon-crediting program during which the project GHG emission reductions are eligible for the issuance of carbon credits, and may include multiple monitoring periods. This methodology allows a maximum crediting period duration of 5 years, with opportunity for crediting period renewal.

Displacement: The dis-use of baseline cooking technologies and fuels due to use of the project cookstove.

Emission factor: The quantity of a pollutant released to the atmosphere relative to an activity associated with the release of that pollutant. Emission factors are usually expressed as the quantity of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant. In the context of cookstove carbon projects, emission factors measure the average mass of carbon dioxide equivalent (CO_2e) released to the atmosphere per energy unit of cooking fuel (e.g., tonnes per TJ).

Fraction of Non-Renewable Biomass (fNRB): Geographically specific parameter that estimates the percentage of wood that is harvested beyond the landscape's rate of regeneration meaning that the wood is not a carbon-neutral fuel.[1]

Hawthorne Effect: The impact from the act of observation on human behavior affecting a given result or outcome.

Household: An individual residential unit and all the individuals living together and sharing cooking facilities and energy resources within that dwelling as their usual place of residence.

Kitchen Performance Test (KPT): Field–based procedure to quantify fuel consumption under typical household and cookstove usage conditions. It involves daily measurements of the amount of fuel used across several days in the user's kitchen, and it is usually accompanied by descriptive surveys.

Leakage: In the context of carbon-crediting programs, a change in anthropogenic GHG emissions that occur outside the project boundary, and which are attributable to the project activity.

Monitoring period: Time period (up to two years in the case of CLEAR) for which a given batch of emission reductions is verified and certified for issuance; a subset of the crediting period.

Net Calorific Value (NCV) of fuel: The total quantity of heat released during combustion when all water formed by the combustion reaction remains in the vapor state. In this methodology, it is expressed in units of energy per mass (TJ/tonne).

Non-continuously tracked energy consumption (non-CTEC) project: Project that measures project cookstoves energy consumption on only a subset of sites.

Non-permanence: When the emission reductions achieved by a project do not persist and emissions are released back into the atmosphere.

Non-renewable fuels: Refer to the non-renewable fraction of fuelwood and charcoal, as well as fossil fuels such as LPG, coal, and kerosene.

[1] Regeneration of woody biomass can be either natural or managed. The default values referenced in the parameter tables below are based on natural regeneration. Any project situated in regions where large-scale reforestation efforts are underway should use webMoFuSS default values rather than the default values recommended by the UNFCCC.

Off-grid renewable energy: Renewable energy that is generated independently of the national or regional electrical grid, for example, by community- or household-level solar, micro-hydro, or wind installations.

Pellets: An upgraded biomass fuel made from densified dry materials such as residues from wood harvesting or processing, residues from harvesting or processing of agricultural crops or purpose grown plants. Pellet properties can be described according to the ISO 17225 set of standards.

Project technology days (PTDs): The number of days for which project technologies are available (at the participant's household, within the project boundary, and functioning) and in regular use (once or more per week) during a given monitoring period. This parameter is used for non-CTEC projects.

Rebound effect: Increased usage of a product or service resulting from an improvement in its efficiency, potentially negating some or all of the expected emission reductions. In cookstove carbon projects, this effect could occur if households are able to increase how much they cook with the same amount of fuel after the introduction of a project cookstove. Rebound is also often linked to suppressed demand, where the project cookstove meets previously unmet cooking needs (see Suppressed Demand).

Renewable biomass: A by-product, residue, or waste stream from agriculture, forestry, and related industries that would not be used as a fuel or feedstock in the absence of the project activity, or biomass that originates from plantations that operate sustainably where all project and leakage emissions associated with the biomass cultivation are accounted for.

Renewable fuels: Include the renewable fraction of fuelwood and charcoal, waste biomass like crop residues and dung, processed biomass like briquettes and pellets from fully renewable sources, bioethanol, biogas, and solar.

Stove stacking: Use of multiple cooking technologies and/or fuels within a household.

Stove Use Monitor (SUM): Device that quantifies cookstove usage through direct measurements of physical or chemical parameters (e.g., temperature, heat flow, light, power, motion, gas concentration, etc.) of cookstoves, kitchen technologies, and cookware, among others. SUMs do not measure fuel consumption and therefore do not meet the requirements for CTEC projects.

Suppressed demand: Situation where the level of access to a given good or service is insufficient – due to poverty or lack of access to infrastructure – to meet human development needs. In the context of cookstove carbon projects, accounting for suppressed demand means that the baseline scenario is adjusted to an amount of cooking fuel necessary to provide for human needs rather than a potentially lower, actual amount of fuel used for cooking. To account for suppressed demand, this methodology uses a baseline fuel consumption default value equivalent to 0.5 tonnes/(person*year) of air-dried wood; the minimum level of energy services required for cooking.

Third-party entity: An entity that has no affiliation with the project proponent and no financial stake in the project. The independence of the entity may be demonstrated through a signed conflict of interest form in which all conflicts are disclosed (including relational, financial, competitive, and others).

TJ/(person*year): Unit of per capita annual energy consumption.

Tonne: A metric tonne (1,000 kilograms).

Transmission and distribution (T&D) losses: Losses incurred supplying grid electricity from point of the generation to end users.

Upstream emissions: In the context of this methodology, upstream emissions represent the GHG emissions associated with the production, processing, transportation, and distribution of cooking fuels. Upstream emissions apply to both baseline and project scenarios.

Useful energy delivered: Energy transferred to the contents of a cooking vessel, including the sensible heat that raises the temperature of the contents of the cooking vessel and the latent heat of evaporation of water from the cooking vessel.

User: A project participant with a functioning cookstove that is in use once or more per week during a given monitoring period, confirmed through both self-reporting and visual inspection.

Usage: The frequency or quantity of cooking with a given technology.

Validation and Verification Body (VVB): An accredited, independent organization that is responsible for auditing emission reductions in GHG emissions mitigation projects to ensure conformity with relevant standards and regulations.

Wood-to-charcoal conversion factor: This factor expresses the amount of wood needed to produce a standard quantity of charcoal, typically expressed as a ratio of the mass of air-dry or oven-dry wood input per mass of charcoal output. This factor is relevant only for projects that use charcoal in the baseline and/or project scenarios. This methodology uses a 6:1 conversion factor[2], which is incorporated into upstream emission factor values (as noted in Appendix 4: *Upstream Emissions from Other Fuels*), and fNRB (as noted in the fNRB parameter table in Section 13: *Methodology Parameters*).

Woody biomass: Any and all wood, whether or not it is harvested and used as a fuel, including live trees and shrubs, and wood harvested for any purpose.

---

[2] Nonetheless, this methodology also includes emissions factors based on a 4:1 conversion factor, to enable ICVCM Core Carbon Principles (CCP) eligibility

2. Acronyms

4C	Clean Cooking and Climate Consortium
CCT	Controlled Cooking Test
CLEAR	Comprehensive Lowered Emission Assessment and Reporting Methodology for Cooking Energy Transitions
CTEC	Continuously Tracked Energy Consumption
CH_4	Methane
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
FAO	Food and Agriculture Organization
fNRB	Fraction of Non-Renewable Biomass
GHG	Greenhouse Gas
GWP	Global Warming Potential
ISO	International Organization for Standardization
KPT	Kitchen Performance Test
kWh	Kilowatt-hour
LPG	Liquified Petroleum Gas
MJ	Megajoule
N_2O	Nitrous Oxide
NCV	Net Calorific Value
PTDs	Project Technology Days
SDG	Sustainable Development Goal
SUM	Stove Use Monitor
T&D	Transmission and Distribution
TJ	Terajoule
VVB	Validation and Verification Body

3. Introduction

This methodology is a comprehensive carbon project methodology specifically designed for crediting emission reductions from cooking projects. It is applicable for nearly all cooking energy transitions for which the technologies meet the performance applicability criteria noted below.

Background: This methodology originated in response to stakeholder feedback at a side event at the 2022 Clean Cooking Forum focused on field monitoring, responding to a stated need for a new rigorous clean cooking carbon methodology with a harmonized approach, that would increase quality, transparency, and consistency across the clean cooking carbon project ecosystem. It has been developed by the clean cooking sector, for the clean cooking sector, through a process facilitated by the Clean Cooking and Climate Consortium (4C). The methodology was developed in close collaboration with more than 250 key stakeholders including the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, voluntary standards bodies, project proponents, researchers, carbon buyers, and others.

Relevance: This methodology differs from other available cookstove carbon methodologies in a number of key ways. It is the first and only methodology to cover all common cooking transition scenarios, eliminating the need for multiple methodologies. Moreover, it has been developed as a public good available for use by any standards body or bilateral/multilateral agreement and is intended to become the standard methodology for cookstove projects under Articles 6.2 and 6.4 of the Paris Agreement, and across the voluntary carbon market, increasing consistency across the clean cooking carbon landscape.

It incorporates the latest science on key parameters, increasing the requirements for substantiating input parameters that make the most difference in estimating emission reductions, and requires direct in-situ measurements of fuel consumption. As such, by using this methodology, clean cooking carbon projects will generate realistic emission reduction estimates and reduce integrity risks.

Approach: The methodology defines emission reductions as total project emissions subtracted from total baseline emissions, adjusted as noted below. Both baseline and project emissions must account for fuel consumption, renewability, and upstream emissions. Projects are encouraged to have lab and field measurements conducted by an independent third party.

Caps on the number of project technology days (PTDs) for projects that do not provide continuous tracking of energy consumption are based on whether the project provides customer support actions as described in [Section 11.2.2: *Project Emissions for Non-CTEC projects*].

For baseline fuel consumption, project proponents must either back-calculate the amount of baseline fuel displaced by continuously tracked project energy consumption, measure it via Kitchen Performance Tests (KPTs), or use a conservative global default value. Fuel consumption values derived from KPT measurements have both a cap and a threshold above which values are flagged for additional justification. Projects must check that the fuel mix determined for the baseline scenario prior to validation is still applicable as a baseline during the project period, given the fuel mix of actual project households.

The methodology references the most up-to-date estimations of fraction of non-renewable biomass (fNRB) at the national and subnational level and disallows the use of the Clean Development Mechanism (CDM) TOOL30, which historically allowed for wide variability in fNRB calculations, and unrealistically high values.

Cookstove performance degradation over time is addressed through the inclusion of cookstoves of multiple ages in fuel consumption (measured through a KPT) or fuel efficiency (measured through a Controlled Cooking Test (CCT)) monitoring samples.

All projects shall apply a default adjustment factor of 2% to the emission reductions to approximate leakage emissions or evaluate the relevant potential sources of leakage and provide an evidence-based description and estimated quantification of each potential source and its relevance for the project.

The methodology addresses rebound and stacking by requiring direct fuel consumption measurements (through KPTs or continuously tracked project energy consumption), which capture both. Potential Hawthorne effects are addressed through a 25% discount applied to the emission reductions when fuel consumption is measured through a KPT alone without cookstove use sensors.

The methodology addresses uncertainty through a combination of conservative defaults and in-situ measurements and by requiring transparency and justification for all parameter inputs, assumptions, and decisions. This is done by requiring all project parameters utilized to be listed on a Project Information Cover Sheet (see Appendix 1) at the time of project design and updated at the time of each issuance.

The methodology is complemented by a calculator tool that facilitates emission reduction calculations and flags values outside of expected ranges for additional justification. Requirements and best practices for conducting baseline and project surveys, stove use monitors (SUMs), KPTs, and CCTs, as well as sampling requirements for these four categories of activities are provided in Appendices 6-10.

In addition to this written format, the methodology will be available via an interactive online platform, to make its application easier and more convenient.

Finally, 4C has developed an Explanation of Decisions document, which serves as a supplementary resource to the methodology. This document summarizes the key approaches for quantifying emission reductions from clean and improved cookstove activities as outlined in the CLEAR methodology. In addition, it provides the supporting arguments and evidence behind each key requirement, demonstrating why the credits resulting from adhering to these approaches should be considered high integrity.

4. Applicability

This methodology can be applied to nearly all cooking energy transitions implemented at the household level that result in reductions of emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), collectively referred to on a CO_2e basis Future iterations will also apply to institutional and commercial cookstove.

This methodology is applicable for project activities that would not occur in the absence of revenues from carbon credit sales, which must be demonstrated by following Section 10: *Additionality*. There is no restriction on the number of households involved or the total emission reductions achieved.

To qualify to use this methodology, projects must meet the following criteria:

- Project cookstoves shall be identified with a unique identifier affixed to the cookstove in order to avoid double counting of emission reductions by other mitigation actions.

- All projects must identify and replace or retrofit malfunctioning cookstoves with a technology of comparable or better quality and thermal efficiency, or not claim emission reductions for households when such failures occur. Projects must include a documented plan for this process at the project design phase.
- All biomass-burning project cookstove models must be tested for thermal efficiency using the International Organization for Standardization (ISO) Standard 19867-1:2018. For wood-burning project technologies that use a griddle surface (e.g., plancha cookstoves for making tortillas), the thermal efficiency requirement is 20% or higher. Project cookstoves burning charcoal must achieve 30% or higher. All other biomass-burning project cookstoves must achieve 25% or higher.

Caveats and restrictions:

- Projects must follow any relevant carbon-crediting program requirements for avoiding long-term lock-in of fossil fuels for cooking.
- For artisanal cookstoves, at least three randomly selected samples of each cookstove model must be used when testing for ISO thermal efficiency, and when undertaking CCTs.
- For biogas projects, this methodology is only applicable to those using a continuously tracked energy consumption (CTEC) approach. It calculates emission reductions only from cooking fuel consumption, not the use of generated slurry[3].
- For CTEC projects, fuel sale records can be used to track consumption of pellets, LPG and ethanol where LPG and ethanol fuel delivery systems are designed exclusively for use in a specific project technology. Projects should implement safeguards to prevent fuel diversion for non-project activities.
- This methodology is not applicable for households who use electricity as their primary baseline fuel.[4]

5. Safeguards

The project activity shall comply with the corresponding carbon-crediting program safeguarding requirements. Projects using this methodology within bilateral/multilateral agreements shall apply recognized safeguarding requirements, and in the absence of a specific requirement,

[3] Methodologies that do allow credit for slurry include the most recent version of: Gold Standard Methodology for Animal Manure Management and Biogas Use for Thermal Energy Generation; AMS-I.I. - Biogas/biomass thermal applications for households/small users; and AMS-I.E. - Switch from non-renewable biomass for thermal applications by the user.

[4] Use of electricity as a supplemental baseline fuel is permitted as it is not expected to be materially affected by project activities.

the Gold Standard Safeguarding Principles & Requirements and its related standards shall be applied.

This methodology was developed in alignment with the Principles for Responsible Carbon Finance in Clean Cooking, which focus on integrity, transparency, fairness, and sustainability. Project activities may describe compliance with these principles as part of the Project Information Cover Sheet.

6. Sustainable Development Goals (SDGs)

The project activity shall demonstrate contributions to SDGs as indicated by the corresponding carbon-crediting program. Projects using this methodology within bilateral/multilateral agreements shall demonstrate contributions to SDGs according to national requirements of participating countries or by using the Gold Standard SDG Impact Tool[5].

7. Project Boundary

The project boundary corresponds to the physical, geographical sites where project technologies operate including the location from which baseline and project fuels are produced or collected.

Where project devices use electricity, the project boundary includes the electricity generation system and, where applicable, also the transmission and distribution (T&D) system.

Table 1. Emissions sources included in the project boundary.

Scenario	Source	Gas	Included	Justification
Baseline scenario	Thermal energy generation (burning of fuel)	CO_2	Yes	Major source of emissions
		CH_4	Yes	Can be significant for some fuels
		N_2O	Yes	Can be significant for some fuels
	Fuel production and transport	CO_2	Yes	Major source of emissions for some fuels
		CH_4	Yes	Can be significant for some fuels
		N_2O	Yes	Can be significant for some fuels
Project scenario	Thermal energy generation (burning of fuel)	CO_2	Yes	Major source of emissions
		CH_4	Yes	Can be significant for some fuels
		N_2O	Yes	Can be significant for some fuels
	Fuel production and transport	CO_2	Yes	Major source of emissions for some fuels
		CH_4	Yes	Can be significant for some fuels

[5] https://globalgoals.goldstandard.org/sdg-impact-tools/

		N_2O	Yes	Can be significant for some fuels
	Electricity generation, T&D	CO_2	Yes	Major source of emissions in some cases
		CH_4	Yes	Can be significant in some cases
		N_2O	Yes	Can be significant in some cases

8. Baseline Scenario(s)

The baseline scenario(s) shall be defined based on the existing baseline technologies and fuel consumption patterns that are being displaced by the project technology. The baseline scenario survey shall define fuel types, fuel mix proportions, and household size. It may also be used to support the common practice analysis.

Multiple baseline scenarios may be generated as appropriate (e.g., for multiple geographic areas with differing demographics, or multiple kinds of user groups with different baseline fuel mixes), and each compared against the project scenario.

Conversely, if a project is promoting multiple project technologies/fuels, a single baseline scenario can be assessed against multiple project scenarios. Project technologies with similar design and performance characteristics (defined as having the same combustion technology and within 10% thermal efficiency per ISO 19867-1) may be included under a single project scenario. If not, they must be treated as independent project scenarios and are monitored and calculated separately.

For non-CTEC projects opting to measure the baseline using the KPT rather than using a default value, and for CTEC projects opting to use the KPT to measure baseline fuel consumption, the baseline scenario(s) shall be identified and defined through the application of a baseline survey to the target population. The baseline scenario survey can also be used to meet the customer support action of demonstrating that the project has selected technologies and fuels that meet the cooking needs of the target population.

For CTEC projects choosing to back-calculate the baseline, as well as non-CTEC projects opting to use a default value, the baseline scenario survey is needed for common practice analysis. These project types may use other data to establish baseline scenarios at the project design stage, as they will collect all the data necessary to substantiate emissions reductions from actual project households during the usage survey. Where possible, all scenarios will be cross-checked with recent, appropriate (geographically and demographically comparable) information from nationally- or regionally-representative surveys or reputable literature.[6]

All baseline scenarios shall be assessed for consistency with government policies and legal requirements. Any baseline scenario that does not fulfill legal requirements shall be excluded. Any baseline scenario that is not aligned with government policies but instead constrains their outcomes shall be excluded. In the case that observed conditions demonstrate that relevant legal requirements are not enforced, then the project may make an exception, document the inconsistency in the Project Information Cover Sheet, and apply a baseline scenario that is inconsistent with government policies and legal requirements. For example, if charcoal production or sales are restricted by law but charcoal is widely used as a baseline fuel, as is the case in some countries, then charcoal may be included in the baseline scenario. In addition, baseline scenarios surveys should assess the percent of households in the target population with a functional technology that is equivalent to the project technology as a common practice additionality check; if greater than 30%, the project is not additional. An equivalent technology is one that meets all three of the following criteria: accomplishes the same cooking tasks; has similar thermal efficiency; and uses the same fuel(s).

Additional requirements for Non-CTEC and CTEC projects conducting baseline KPTs:

Proponents of non-CTEC or CTEC projects using the KPT to measure the baseline must also use the baseline scenario survey to collect data on the relative fuel use at different times of the year to address potential seasonal variation. The following question (or an appropriate variation) must be asked, "Relative to the amount of fuel you used this week, are there other times of the year when you use more fuel? If so, when? And/or less fuel? If so, when?" For additional information on addressing seasonal variation in fuel consumption, see Section 12: *Monitoring Requirements*.

For projects with KPT baselines, project proponents must also identify any mismatch between values documented during the baseline scenario and those reported by actual project households during the first project usage survey for primary fuel type and household size. This assessment shall be carried out using retrospective questions[7] of project households during the first usage survey in any given household.

[6] Examples of reputable literature include sources that are peer-reviewed and/or published by a national or multi-national agency.
[7] See Appendix 6 for details.

Where a material discrepancy between the baseline scenario households and project households occurs, project proponents must either not claim emission reductions for households that do not conform to the baseline scenario profile or follow requirements on adjusting the baseline (toward lower baseline emissions).

A material discrepancy is defined as more than a 10% absolute difference between the baseline and project scenarios for the primary fuel type used[8], and/or any household size estimate measured during a project usage scenario (Hs) that is greater than the baseline scenario estimate. When calculating the difference, the absolute difference should be relative to the project estimate. For example, if the proportion of use events with wood is 85% in the baseline and 80% in the project, the difference is estimated as (0.85-0.80)/0.80 = 6.2% (within the 10% threshold). Specific requirements for baseline and project scenario comparisons are provided below.

The number of people per household in the project is greater than in the baseline scenario.	The number of people per household (Hs) estimated from project usage surveys must be lowered to the baseline.
The number of people per household in the project is less than in the baseline scenario.	No change
The primary fuel used for cooking events identified through the baseline scenario survey is more than 10% different from that determined retrospectively through the first project usage survey, and the difference results in baseline emissions that are lower than they would be if the proportion of primary fuel from the baseline and project scenarios matched. For example, if the baseline (from before the project technology was introduced) scenario indicates 85% wood use, and 15% charcoal use; and the first project usage survey indicates a baseline of 75% wood use and 25% charcoal use, then the emissions in the baseline scenario would be considered conservative, as charcoal has higher CO2e emissions than wood per unit of	No change

[8] Parameters $PC_{b,i}$ and $PC_{p,j}$ are used in Appendix 10 providing sampling requirements for these proportions of cooking events; they are used in the material difference calculation noted above, and not in emission reduction quantification equations. They are also presented in Section 13.

useful energy delivered. If more than two fuels are used, the same process must be applied for all.	
The primary fuel used for cooking events identified through the baseline scenario survey is more than 10% different from that determined retrospectively through the first project usage survey and the difference results in baseline emissions that are higher than they would be if the proportion of primary fuel in baseline and project scenarios matched. For example, if the baseline scenario indicates 75% primary wood use, and 25% charcoal use; and the first project usage survey indicates a baseline of 85% wood use and 15% charcoal use (from before the project technology was introduced), then the emissions in the baseline scenario would be considered non-conservative, as charcoal has higher CO2e emissions than wood per TJ of useful energy delivered. If more than two fuels are used, the same process must be applied for all.	The project must exclude the baseline energy consumption from non-primary fuels in the estimation of baseline emissions, or proportionately reduce the energy consumption of the primary fuel by the percent difference in primary fuel use between the baseline scenario and project-estimated baseline from the first project usage survey, whichever results in a lower baseline CO2e emissions estimate.

Sample size requirements for baseline scenario parameters are provided in Appendix 10, and the modes of data collection are delineated in the respective sections and parameter tables in Section 11 (Quantification of GHG emissions reduction).

9. Baseline Energy Consumption Defaults and Caps

Global default: Projects may determine non-CTEC energy consumption in the baseline scenario by using a global default for fuelwood or charcoal consumption. This default can only be applied for projects where the baseline is predominantly wood or charcoal (more than 75% of cooking events with wood or charcoal, respectively, as determined via surveys).

The global default for baseline fuelwood consumption is 0.0012 TJ useful energy delivered/(person*year)[9] (0.5 tonnes/(person*year)) of air-dried wood, equivalent to 0.0078 TJ/(person*year) of air-dried wood, and 0.00075 TJ useful energy delivered/(person*year)[10] (0.1 tonnes/(person*year), or 0.0030 TJ/(person*year)) for charcoal. When fuels other than wood or charcoal are in

[9] 0.5 tonnes of air-dried fuel wood with 0.0156 TJ/tonnes NCV, and thermal efficiency of 15%.
[10] 0.1 tonnes of charcoal with 0.0295 TJ/tonnes NCV, and thermal efficiency of 25%.

the respective baselines, their energy use must be accounted for in the 0.0012 and 0.00075 TJ useful energy delivered/(person*year), respectively.[11] These values reflect the minimum level of energy service required for cooking.

Baseline caps: Baseline energy consumption values (estimated with the KPT or back-calculated) for primary fuelwood users (75% of cooking events) are capped at 0.031 TJ useful energy delivered/(person*year) (2.0 tonnes/(person*year) of air-dried wood or a combination of wood and any other additional baseline fuels. Values above 0.016 TJ useful energy delivered/(person*year) (1.0 tonnes/(person*year) of air-dried wood and additional baseline fuels) are flagged for additional justification.

For baselines with charcoal as the primary fuel use, the cap is set at 0.012 TJ useful energy delivered/(person*year) (0.40 tonnes/(person*year)) of charcoal, or charcoal and any additional baseline fuels), and values above 0.0059 TJ useful energy delivered/(person*year) (0.20 tonnes/(person*year)) are flagged for further justification.

For mixed baseline scenarios (no primary fuel is used for more than 75% of cooking events) or those with other primary baseline fuels, the flags and caps are the same as those for primary charcoal baselines.[12]

[11] The energy for each fuel is estimated by applying the thermal efficiencies in Appendix 5 (e.g., 15% thermal efficiency for unimproved baseline wood cookstoves, 25% thermal efficiency for unimproved charcoal cookstoves, and 50% for gas and liquid fueled cookstoves) to the useful energy delivered and relative amount of cooking on each fuel type. For example, if surveys indicate in the baseline that 80% of cooking events are done on wood cookstoves and 20% on LPG cookstoves, then the baseline energy consumption would be as follows: Wood consumption: (0.80*0.0012 TJ useful energy delivered/(person*year)) / 15% thermal efficiency = 0.0091 TJ useful energy delivered/(person*year of wood energy; LPG 0.20*0.0012 TJ useful energy delivered/(person*year) / 50% = 0.00048 TJ useful energy delivered/(person*year) of LPG energy.

[12] If baseline energy consumption is measured at 0.050 TJ/(person*year) of wood and 0.0335 TJ/(person*year) of charcoal, the useful energy delivered would be calculated using efficiency factors of 15% for wood and 25% for charcoal. This results in 0.0075 TJ/(person*year) of useful energy from wood and 0.008375 TJ/(person*year) from charcoal, for a total of 0.015875 TJ/(person*year) of useful energy delivered. Since this results in a mixed baseline of 47.3% energy delivered from wood and 52.7% delivered from charcoal, the mixed baseline cap of 0.012 TJ/(person*year) must be applied and the useful energy must be reduced proportionally to stay within the allowable limit. The adjustment factor needed is 0.012 / 0.015875 = 0.756. Applying this factor, the useful wood energy becomes 0.00567 TJ/(person*year), and the useful charcoal energy becomes 0.00633 TJ/(person*year). Converting these adjusted useful energy values back into total fuel consumption, the wood component would be 0.0378 TJ/(person*year), and the charcoal would be 0.0253 TJ/(person*year).

When the flagged threshold is surpassed, projects must provide justification in the Project Information Cover Sheet for why a higher baseline is realistic in that project area[13]. For example, such justifications could include the case of households using plancha cookstoves or areas where wood is relatively abundant.

10. Additionality

Project activities using this methodology shall demonstrate that the project activity would have not occurred in the absence of the support of revenues from the carbon credit sales, and that the carbon credit revenues enable project implementation.

This includes:

- The increase in financial viability through carbon credit revenues (e.g., being able to reduce cookstove costs, being able to conduct awareness campaigns to convince the population to adopt the cookstove, secure financing, etc.); and
- The financial viability with and without carbon credit revenues, to show that the activity depends on carbon finance to happen.

Project proponents shall also identify and describe relevant barriers faced by the proposed activity, and provide supporting evidence such as independent studies, publicly available surveys, or interviews with relevant stakeholders.

In the case that the carbon-crediting program does not already require consideration of parallel sources of funding for cooking energy transitions (e.g., overseas development assistance, other subsidies) available within the project boundary, the demonstration further must list and describe such sources of funding and explain why they do not apply to the project activity. If they do apply, they must be considered in the demonstration that the project activity would have not occurred in the absence of the support of revenues from the carbon credit sales. Project proponents shall follow additionality guidance provided by the carbon-crediting program for this evaluation.

Further, project activities must demonstrate that the proposed activity is not directly mandated by law or triggered by any legal requirements. If a legal

[13] 4C will provide publicly-available guidance to Validation and Verification Bodies (VVBs) and rating agencies on evaluating these justifications.

mandate comes into effect during the crediting period, the activity can only claim credits until the day the legal requirements become effective.

If the project technology shows a market penetration, meaning the percent of households in the target population with a functional technology that is equivalent to the project technology, greater than 30%, then it is considered common practice and is not additional. The quantification of market penetration should not include technology installed as a result of any voluntary carbon crediting activity.

The project proponent shall further demonstrate additionality by applying any additional requirements of the carbon-crediting program under which the project proponent seeks to issue credits using this methodology. Additionality shall be reassessed at the renewal of the crediting period.

11. Quantification of GHG Emission Reductions

This methodology determines both baseline and project emissions by calculating GHG emissions from electricity, renewable and non-renewable fuels.

Electricity can include both grid and off-grid sources. Emissions from grid electricity are country-specific and calculated based on marginal emission factors from the International Financial Institutions Technical Working Group on GHG Accounting, (provided in Appendix 2: *Grid Emission Factors*) or based on marginal emission factors provided by the relevant national authority. Emissions from off-grid sources are technology-specific (provided in Appendix 3: *Off-Grid Emission Factors for Select Technologies*). The off-grid component includes both individual household systems and mini-grids using either single or multiple sources of power.

Renewable fuels include the renewable fraction of fuelwood and charcoal, waste biomass like crop residues and dung, processed biomass like briquettes and pellets from fully renewable sources, bioethanol, biogas, and solar.

Non-renewable fuels refer to the non-renewable fraction of fuelwood and charcoal, as well as fossil fuels such as liquified petroleum gas (LPG), coal, and kerosene.

To account for renewable and non-renewable woody biomass, the methodology utilizes fNRB.

Methodology parameters are calculated differently for CTEC and non-CTEC projects, and therefore are presented separately in this methodology.

Emissions are calculated on an energy basis, for which the conversions from mass to energy are conducted as follows:

$$EC_x = FC_x \times NCV_x \tag{1}$$

Where:

Parameter	Description	Unit
EC_x	Energy consumption for the respective fuel and scenario *x*	TJ
FC_x	Fuel consumption for the respective fuel and scenario *x*	tonnes
NCV_x	Net calorific value for fuel *x* (see Appendix 5)	TJ/tonnes

11.1. CTEC Projects

Energy consumption for CTEC projects is determined by continuously measuring fuel or energy consumption directly through the use of built-in or external data loggers, or by tracking all fuel sales, to determine the total energy use for all project technology cookstoves. Two options are provided for determining emission reductions for CTEC projects.

Under the first option (see Section 11.1.1), baseline energy consumption is back-calculated from project cookstove energy consumption using specific energy consumption ratios of the baseline and project cookstoves, determined via CCTs performed on each cookstove model.

Under the second option (see Section 11.1.2), the KPT is used to estimate the emission reductions produced per TJ of the continuously tracked project technology energy consumption, and then scaled by the total tracked project energy consumption for the given monitoring period to determine the total emission reductions.

11.1.1. CTEC Projects Using the Back-Calculation Approach for Displaced Baseline Energy Consumption

11.1.1.1. Baseline Back-Calculation Using Specific Fuel Consumption Ratios

Baseline emissions for CTEC projects using the back-calculation option are calculated using Equation (2).

$$BE_y = \sum_i \left(EC_{d-base,i,y} \times \left(fNRB_i \times EF_{base,i,CO2} + EF_{base,i,nonCO2}\right)\right) + \sum_i UE_{base,i,y} \qquad (2)$$

Where:

Parameter	Description	Unit
BE_y	Baseline emissions during year *y*	tCO_2e
$EC_{d-base,i,y}$	Displaced energy consumption of fuel *i* in baseline scenario in year y. Where fuels such as pellets and briquettes are made from a mix of renewable and non-renewable sources (e.g., renewable agricultural waste and non-renewable wood), each source should be considered its own fuel[14]. This parameter is determined following Equation 2.	TJ
$fNRB_i$	Fraction of non-renewable woody biomass fuel *i* consumed. This parameter varies between zero and 100% for fuelwood, charcoal, and other solid biomass fuels that are not fully renewable. When renewable biomass fuels are used (defined above), this parameter is equal to zero. When fossil fuels are used, it is equal to 100%.	%
$EF_{base,i,CO2}$	CO_2 emission factor for baseline fuel *i*	tCO_2e/TJ
$EF_{base,i,nonCO2}$	Non-CO_2 emission factor for baseline fuel *i*	tCO_2e/TJ
$UE_{base,i,y}$	Upstream emissions for baseline fuel *i* in year *y*, determined following [Section 11.3: *Upstream Emissions*]	tCO_2e

This approach calculates baseline energy consumption for each technology that is displaced by determining the amount of equivalent energy required for the baseline technology(ies) to provide the same level of service as the project technology according to its continuously tracked energy consumption. This estimation is done using specific fuel consumption ratios, derived from CCTs performed on each of the baseline and project technology types. When multiple fuel-stove combinations are used in the baseline by the end user in the same premises, the proportional use shall be established from surveys or stove use monitoring (See Appendix 9 for SUMs guidance). For example, if baseline cookstove use is estimated as 50% of cooking events performed on a three-stone fire, 10% on a charcoal

[14] For example: If a pellet fuel consists of 60% wood and 40% sugarcane bagasse (on a TJ basis), and the energy consumption for these pellets is 0.05 TJ/(person*year), then there would be two constituent fuels to sum over; $EC_{d\text{-}base,pellet\text{-}wood}$ = 0.03 TJ/(person*year), and $EC_{d\text{-}base,pellet\text{-}bagasse}$ = 0.02 TJ/(person-year), each with its own respective fNRB, EF, and UE.

cookstove, and 40% on an LPG cookstove, then the baseline energy consumption that the project technologies displace shall be apportioned proportionately in accordance with Equation 3:

$$EC_{d-base,i,y} = tEC_{proj,j,y} \times tPC_{b,i} \times \left(\frac{SC_{b,i}}{SC_{p,j}}\right) \tag{3}$$

Where:

Parameter	Description	Unit
$EC_{d-base,i,y}$	Displaced energy consumption of fuel *i* in baseline scenario in year *y*	TJ
$tEC_{proj,j,y}$	Total tracked energy consumption of project fuel *j* for CTEC projects in year *y*	TJ
$tPC_{b,i}$	Proportion of cooking events conducted using baseline fuel-stove combination *i*	%
$SC_{b,i}$	Specific energy consumption of a baseline fuel-stove combination *i* to cook a given amount of food	MJ/kg food
$SC_{p,j}$	Specific energy consumption of a project fuel-stove combination *j* to cook a given amount of food	MJ/kg food

Baseline fuel consumption caps and flags described in Section 9: *Baseline Energy Consumption Defaults and Caps* apply.

11.1.1.2. Project

Project emissions for CTEC projects using the tracked energy consumption of project technology option are calculated using Equation (4).

$$PE_y = \sum_j \left(tEC_{proj,j,y} \times \left(fNRB_i \times EF_{proj,j,CO2} + EF_{proj,j,nonCO2}\right)\right) + \sum_j UE_{proj,j,y} + PE_{elec,y} \tag{4}$$

Where:

Parameter	Description	Unit
PE_y	Project emissions during year *y*	tCO_2e
$tEC_{proj,j,y}$	Total tracked energy consumption of project fuel *j* for CTEC projects in year *y*. Where fuels such as pellets and briquettes are made from a mix of renewable and non-renewable sources (e.g., renewable agricultural waste and non-renewable wood), each source should be considered its own	TJ

	fuel. (See example following Equation (1)) For any given project participant or technology, if more than half of the possible CTEC data for a monitoring period is missing, only available CTEC data may be included in emission reduction calculations. If missing CTEC data for a given project participant or technology consists of less than half of the possible data, then the project proponent may use the 25th percentile of the available tracked project energy consumption for that project participant or technology as a conservative replacement of the missing data.	
$fNRB_i$	Fraction of non-renewable woody biomass fuel *i* consumed. This parameter varies between zero and 100% for fuelwood, charcoal, and other solid biomass fuels that are not fully renewable. When renewable biomass fuels are used (defined above), this parameter is equal to zero. When fossil fuels are used, it is equal to 100%.	%
$EF_{proj,j,CO2}$	CO_2 emission factor for project fuel *j*	tCO_2e/TJ
$EF_{proj,j,nonCO2}$	Non-CO_2 emission factor for project fuel *j*	tCO_2e/TJ
$UE_{proj,j,y}$	Upstream emissions for project fuel *j in year y*, determined following Section 11.3: *Upstream Emissions* Upstream E	tCO_2e
$PE_{elec,y}$	Emissions from electric energy consumption in year *y*	tCO_2e

The continuously tracked energy consumption in the project scenario is determined by continuously tracking fuel or electricity for the project technology, or from fuel sales.

Other, non-project cookstoves that may be in use in the project scenario are ignored, and the baseline fuel consumption calculation only includes that which is displaced by the project cookstove.

For CTEC project cookstoves:

$$tEC_{proj,j,y} = \sum_{h} tEC_{proj,j,h,y} \tag{5}$$

Where:

Parameter	Description	Unit
$tEC_{proj,j,y}$	Total tracked energy consumption of project fuel *j* for CTEC projects in year *y*	TJ

$tEC_{proj,j,h,y}$	Tracked energy consumption of project fuel *j* in project household *h* in year *y*	TJ
h	Project households	Number

For **project energy sources other than electricity**, use Equation (1)**Error! Reference source not found.** to convert fuel masses to fuel energy.

If the **project cookstove uses electricity**, coming from either the national grid or an off-grid system(s) using renewable or non-renewable energy sources, its project emissions and electricity consumption must be calculated using Equation (6) and Equation (7), and/or Equation (8).

$$PE_{elec,y} = 10^{-6} \times [\frac{tEC_{proj,grid,y} \times EF_{proj,grid,y}}{1-TDL_y} + \left(tEC_{proj,offgrid,y} \times \sum_k f_{k,y} \times EF_{proj,offgrid,k}\right)] \tag{6}$$

Where:

Parameter	**Description**	**Unit**
$PE_{elec,y}$	Emissions from electric energy consumption in year *y*	tCO_2e
$tEC_{proj,grid,y}$	Tracked grid electricity consumption for cooking	kWh
$EF_{proj,grid,y}$	Country-specific marginal grid emission factor. See Appendix 2: *Grid Emission Factors* in year *y*	gCO_2e/kWh
$tEC_{proj,offgrid,y}$	Tracked off-grid electricity consumption for cooking in year y	kWh
$f_{k,y}$	Fraction of off-grid electricity provided by source *k* in year *y*	%
$EF_{proj,offgrid,k}$	Off-grid emission factor for source *k*. This is a technology-specific value provided in Appendix 3: *Off-Grid Emission Factors for Select Technologies*	gCO_2e/kWh
TDL_y	Average technical T&D losses for providing electricity in year *y*	%
10^{-6}	Unit conversion for grams CO_2e to tonnes CO_2e	

Electricity consumption shall be measured, using calibrated equipment[15] such as a built-in or external power meter, from all project electric cookstoves (Equation (7) and/or Equation (8)).

[15] Calibrated according to manufacturer recommendations and/or relevant national requirements as applicable.

$$tEC_{proj,grid,y} = \sum_{h} tEC_{proj,grid,h,y} \quad (7)$$

$$tEC_{proj,offgrid,y} = \sum_{h} tEC_{proj,offgrid,h,y} \quad (8)$$

Where:

Parameter	Description	Unit
$tEC_{proj,grid,y}$	Tracked grid electricity consumption for cooking in year *y*	kWh
$tEC_{proj,grid,h,y}$	Tracked grid electricity consumed for cooking in household *h* in year *y*	kWh
$tEC_{proj,offgrid,y}$	Tracked off-grid electricity consumption for cooking in year *y*	kWh
$tEC_{proj,offgrid,h,y}$	Tracked off-grid electricity consumed for cooking in household *h* in year *y*	kWh
h	Project households	Number

11.1.2. CTEC Projects Using Tracked Energy Consumption and KPTs

This option calculates the emissions in the baseline and project scenarios using metered data for CTEC projects and KPTs.

11.1.2.1. Baseline

For this option the average baseline emissions are estimated using a KPT.

Baseline emissions for CTEC projects using this option are calculated using Equation (9).

$$BE_y = EQ_{base} \times tEC_{proj,j,y} + \sum_{i} UE_{base,i,y} \quad (9)$$

Where:

Parameter	Description	Unit
BE_y	Baseline emissions during year *y*	tCO_2e
EQ_{base}	Emissions quotient for the consumption of energy for cooking in baseline scenario	tCO_2e/TJ or tCO_2e/kWh

$tEC_{proj,j,y}$	Total tracked energy consumption of project fuel *j* for CTEC projects in year *y* (see Equation 4)	TJ or kWh
$UE_{base,i,y}$	Upstream emissions for baseline fuel *i* in year *y*, determined following *Section 11.3: Upstream Emissions*	tCO_2e

This approach involves determining a baseline emission quotient per unit project fuel by using the energy consumption through its measurement by an ex-ante KPT of the baseline scenario and an ex-post KPT of the project scenario.

$$EQ_{base} = \frac{\sum_i [EC_{base,KPT,i} \times (fNRB_i \times EF_{base,i,CO2} + EF_{base,i,nonCO2})]}{tEC_{proj,KPT,j-project}} \quad (10)$$

Where:

Parameter	**Description**	**Unit**
EQ_{base}	Emissions quotient for the consumption of energy for cooking in baseline scenario	tCO_2e/TJ or tCO_2e/kWh
$EC_{base,KPT,i}$	Energy consumption of baseline fuel *i* for CTEC projects based on baseline KPT. Where fuels such as pellets and briquettes are made from a mix of renewable and non-renewable sources (e.g., renewable agricultural waste and non-renewable wood), each source should be considered its own fuel. (See example following Equation (1))	TJ/(person*year)
$fNRB_i$	Fraction of non-renewable woody biomass fuel *i* consumed. This parameter varies between zero and 100% for fuelwood, charcoal, and other solid biomass fuels that are not fully renewable. When renewable biomass fuels are used (defined above), this parameter is equal to zero. When fossil fuels are used, it is equal to 100%.	%
$EF_{base,i,CO2}$	CO_2 emission factor for baseline fuel *i*	tCO_2e/TJ

$EF_{base,i,nonCO2}$	Non-CO_2 emission factor for baseline fuel *i*	tCO_2e/TJ
$tEC_{proj,KPT,j-project}$	Energy consumption of tracked project fuel *j* for project cookstove(s) only from project KPT	TJ/(person*year) or kWh/(person* year)

For baseline energy sources $EC_{base,KPT,i}$ other than electricity, use Equation (1) to convert fuel masses to fuel energy.

If project cookstove energy use is in the form of electricity, then the equation will result in a quotient in terms of tCO_2e/kWh.

Baseline fuel consumption caps and flags described in [Section 9: *Baseline Energy Consumption Defaults and Caps*] apply.

11.1.2.2. Project

For this option the average project emissions are estimated using a KPT.

Project emissions for CTEC projects using this option are calculated using Equation (11).

$$PE_y = EQ_{proj} \times tEC_{proj,j,y} + \sum_j UE_{proj,j,y} + PE_{elec,y} \tag{11}$$

Where:

Parameter	Description	Unit
PE_y	Project emissions during year *y*	tCO_2e
EQ_{proj}	Emissions quotient for the consumption of energy for cooking in project scenario in year *y*	tCO_2e/TJ or tCO_2e/kWh
$tEC_{proj,j,y}$	Total tracked energy consumption of project fuel *j* for CTEC projects in year *y*	TJ or kWh
$UE_{proj,j,y}$	Upstream emissions for project fuel *j* in year *y*, determined following Section 11.3: Upstream Emissions	tCO_2e
$PE_{elec,y}$	Emissions from electric energy consumption in year *y* (See Equation 6)	tCO_2e

This approach for determining energy consumption in the project scenario requires quantifying the energy consumption of all technologies used in the project scenario based on a project KPT, using metered energy consumption data for the project cookstove specific to the KPT period where available. Where metered energy consumption is not available specific to the KPT period, the traditional fuel-weighing KPT approach must be used. Fuel-weighing must always be used for fuel consumption based on sales data. To link total emission reductions with the amount of tracked project fuel consumption, the emission reductions as measured during the KPTs are normalized by project fuel consumption and scaled by the amount of tracked project fuel consumption, as shown in Equation (12).

$$EQ_{proj} = \frac{\sum_j [tEC_{proj,KPT,j} \times (fNRB_i \times EF_{proj,j,CO2} + EF_{proj,j,nonCO2})]}{tEC_{proj,KPT,j-project}} \qquad (12)$$

Where:

Parameter	Description	Unit
EQ_{proj}	Emissions quotient for the consumption of energy for cooking in project scenario in year *y*	tCO_2e/TJ or tCO_2e/kWh
$tEC_{proj,KPT,j}$	Energy consumption of fuels used in project households *j* from project KPT for CTEC projects. Where fuels such as pellets and briquettes are made from a mix of renewable and non-renewable sources (e.g., renewable agricultural waste and non-renewable wood), each source should be considered its own fuel. (See example following Equation (1))	TJ/(person*year)
$fNRB_i$	Fraction of non-renewable woody biomass fuel *i* consumed. This parameter is varies between zero and 100% for fuelwood, charcoal, and other solid biomass fuels that are not fully renewable. When renewable biomass fuels are used (defined above), this parameter is equal to zero. When fossil fuels are used, it is equal to 100%.	%
$EF_{proj,j,CO2}$	CO_2 emission factor for project fuel *j*	tCO_2e/TJ

$EF_{proj,j,nonCO2}$	Non-CO_2 emission factor for project fuel *j*	tCO_2e/TJ
$tEC_{proj,KPT,j-project}$	Energy consumption of tracked project fuel *j* for project cookstove(s) only from project KPT	TJ/(person*year) or kWh/(person*year)

For continuously tracked project energy sources $tEC_{proj,i}$ other than electricity, apply Equation (1) to convert fuel masses to fuel energy. This equation excludes any consumption of electricity in the numerator.

If the project cookstove uses electricity, then the equation will result in a quotient in terms of tCO_2e/kWh.

For determining emissions from energy consumption from electric technologies $PE_{elec,y}$ apply Equation (6), Equation (7), and Equation (8).

11.1.3. Emission Reductions for CTEC Projects

Emission reductions for CTEC projects are calculated using Equation (13).

$$ER_y = (BE_y - PE_y)(1 - LE_y) \tag{13}$$

Where:

Parameter	Description	Unit
ER_y	Emission reductions for the project during year *y*	tCO_2e
BE_y	Baseline emissions during year *y*	tCO_2e
PE_y	Project emissions during year *y*	tCO_2e
LE_y	Percentage deduction to account for leakage emissions during year *y*	%

All projects shall either (1) apply a default adjustment factor of 2% to the emission reductions to approximate leakage emissions or (2) evaluate the relevant potential sources of leakage and provide an evidence-based description and estimated quantification of each potential source and its relevance for the project.

If utilizing option 2, for each source for which the leakage assessment expects an increase in fuel consumption by non-project households/users attributable to the project activity, then calculations must be undertaken to account for the leakage from this source. Leakage is either calculated as a quantitative emissions volume (tCO2e) or as a percentage of total emission reductions. The project documentation shall include a projection of leakage emissions based on available data and information. The monitoring plan must include monitoring parameters to be registered during the leakage investigation every two years to populate the leakage calculation.

When using option 2, the project proponent must conduct a leakage investigation every two years using relevant methods. For example, surveys to determine parameters for the leakage calculation may be combined with project monitoring surveys, as is applicable. Monitoring plans should include field-based measurement methods, especially for the quantification of fuel, as data on fuel use estimated via surveys are often insufficiently accurate.

11.2. Non-CTEC Projects

Non-CTEC projects may combine baseline and project alternatives as preferred.

11.2.1. Baseline Emissions for Non-CTEC Projects

Baseline emissions for non-CTEC projects are calculated using Equation (14).

$$BE_y = \sum_i \left(EC_{base,i,y} \times \left(fNRB_i \times EF_{base,i,CO2} + EF_{base,i,nonCO2}\right)\right) + \sum_i UE_{base,i,y} \tag{14}$$

Where:

Parameter	Description	Unit
BE_y	Baseline emissions during year *y*	tCO_2e
$EC_{base,i,y}$	Consumption of fuel *i* in baseline scenario in year *y*. Where fuels such as pellets and briquettes are made from a mix of renewable and non-renewable sources (e.g., renewable agricultural waste and non-renewable wood), each source should be considered its own fuel. (See example following Equation (1))	TJ
$fNRB_i$	Fraction of non-renewable woody biomass fuel *i* consumed. This parameter varies between zero and 100% for fuelwood, charcoal, and other solid biomass fuels that are not fully renewable. When renewable biomass fuels are used (defined above), this parameter is equal to zero. When fossil fuels are used, it is equal to 100%.	%
$EF_{base,i,CO2}$	CO_2 emission factor for baseline fuel *i*	tCO_2e/TJ
$EF_{base,i,nonCO2}$	Non-CO_2 emission factor for baseline fuel *i*	tCO_2e/TJ

$UE_{base,i,y}$	Upstream emissions for baseline fuel *i* in year *y*, determined following [Section 11.3: *Upstream Emissions*]()	tCO_2e

Non-CTEC projects may choose from two different approaches to determine energy consumption in the baseline scenario: measuring fuel consumption using a baseline KPT or using a global default, as described in Section 9: *Baseline Energy Consumption Defaults and Caps*.

Projects may determine non-continuously tracked fuel consumption by conducting an ex-ante KPT of the baseline scenario. Baseline fuel consumption caps and flags described in Section 9: *Baseline Energy Consumption Defaults and Caps*.

$$EC_{base,i,y} = H_s \times ntEC_{base,i} \times \frac{PTD_{h,\Psi,y}}{CD} \tag{15}$$

$$PTD_{h,\Psi,y} = \Psi_{Survey,y} \times \sum_{h} Days_{y,h} \tag{16}$$

For baseline energy sources other than electricity, use Equation (1) to convert fuel masses to fuel energy.

Where:

Parameter	Description	Unit
$EC_{base,i,y}$	Consumption of fuel *i* in baseline scenario in year *y*	TJ
H_s	Average household size (persons per household, regardless of age or gender)	Number
$ntEC_{base,i}$	Energy consumption of baseline fuel *i* for non-CTEC projects taken from global default baseline energy consumption value, or results from baseline KPT	TJ/(person*year)
$PTD_{h,\Psi,y}$	PTDs of the monitoring period during year *y*	Number
$\Psi_{Survey,y}$	Percent of project households with cookstoves present, where project cookstove is used at least once per week, determined via survey and visual observation in year *y*. Capped at 90% for projects that undertake customer support actions as described below and 75% for those that do not.	%

$Days_{y,h}$	Number of total possible project-technology days during the year y in household *h*	Number
CD	Days in a calendar year *y*. Use 366 for leap years, 365 for other years.	Number

Customer support actions: To be eligible to claim up to 90% of maximum PTDs, project proponents must take the following customer support actions and provide details of how each condition has or will be met on the Project Information Cover Sheet during the design phase of the project.

- Demonstrate that the project has selected technologies and fuels that meet the cooking needs of the target population, either by citing robust research or conducting an investigation of cooking practices and attitudes during the project design phase.
- Provide evidence of project participant support activities. These may include such things as 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 how to access any necessary parts). All project participant communications and materials shall be provided in local language(s) commonly used in the project area.
- Project participants must be able to contact the project proponent to access support (e.g., maintenance and repair services) through a commonly used, toll-free communications channel.

Project proponents who do not undertake all three of these customer support actions may claim up to 75% of maximum PTDs.

11.2.2. Project Emissions for Non-CTEC Projects.

Project emissions for non-CTEC projects are calculated using Equation (17).

$$PE_y = \sum_j \left(ntEC_{proj,j,y} \times \left(fNRB_i \times EF_{proj,j,CO2} + EF_{proj,j,nonCO2}\right)\right) + \sum_j UE_{proj,j,y} + PE_{elec,y} \quad (17)$$

Where:

Parameter	Description	Unit
PE_y	Project emissions during year *y*	tCO_2e
$ntEC_{proj,j,y}$	Consumption of fuel *j* in project scenario in year *y*. Where fuels such as pellets and briquettes are made from a mix of renewable and non-renewable sources (e.g., renewable agricultural	TJ

	waste and non-renewable wood), each source should be considered its own fuel. (See example following Equation (1))	
$fNRB_i$	Fraction of non-renewable woody biomass fuel *i* consumed. This parameter varies between zero and 100% for fuelwood, charcoal, and other solid biomass fuels that are not fully renewable. When renewable biomass fuels are used (defined above), this parameter is equal to zero. When fossil fuels are used, it is equal to 100%.	%
$EF_{proj,j,CO2}$	CO_2 emission factor for project fuel *j*	tCO_2e/TJ
$EF_{proj,j,nonCO2}$	Non-CO_2 emission factor for project fuel *j*	tCO_2e/TJ
$UE_{proj,j,y}$	Upstream emissions for project fuel *j* in year *y*, determined following Section 11.3: *Upstream Emissions*	tCO_2e
$PE_{elec,y}$	Emissions from electric energy consumption in year *y* (See Equation (19))	tCO_2e

Non-CTEC projects may choose from two approaches to determine energy consumption in the project scenario, differentiated by application (or non-application) of SUMs. Adjustments to account for the Hawthorne Effect for each approach are included in Section 11.2.3: *Emission Reductions for Non-CTEC projects*.

Both approaches involve determining non-CTEC project fuel consumption through a representative sample with direct measurements of fuel using KPT following the following equations:

$$ntEC_{proj,j,y} = H_s \times ntEC_{proj,j} \times \frac{PTD_{h,\Psi,y}}{CD} \tag{18}$$

Where:

Parameter	Description	Unit
$ntEC_{proj,j,y}$	Consumption of fuel *j* in project scenario in year *y*	TJ
H_s	Average household size (persons per household, regardless of age or gender)	Number
$ntEC_{proj,j}$	Energy consumption of project fuel *j* for non-CTEC projects as measured by the project KPT during year *y*	TJ/(person*year)
$PTD_{h,\Psi,y}$	PTDs of the monitoring period during year *y* (See Equation (16))	Number

CD	Days in a calendar year y. Use 366 for leap years.	Number

For **energy sources other than electricity**, use Equation (1) to convert fuel masses to fuel energy.

In the case of **non-CTEC electricity use in the project scenario**, project emissions must be calculated taking into account the average electricity consumption measured by the project KPT including the use of a plug-in power meter and its corresponding emission factor. Emissions from electric energy consumption from grid and/or off-grid sources are calculated using Equation 19.

$$PE_{elec,y} = 10^{-6} \times \left[\frac{EC_{proj,grid,y} \times EF_{proj,grid,y}}{1 - TDL_y} + \left(EC_{proj,offgrid,y} \times \sum_{k} f_{k,y} \times EF_{proj,offgrid,k}\right)\right] \quad (19)$$

Where:

Parameter	Description	Unit
$PE_{elec,y}$	Emissions from electric energy consumption in year *y*	tCO_2e
$EC_{proj,grid,y}$	Grid electricity consumption for cooking for non-CTEC project in year *y. See Equation 20*	kWh
$EF_{proj,grid,y}$	Country-specific marginal grid emission factor. See [Appendix 2: *Grid Emission Factors*] in year *y*	gCO_2e/kWh
$EC_{proj,offgrid,y}$	Off-grid electricity consumption for cooking in year *y. See Equation 21*	kWh
$f_{k,y}$	Fraction of off-grid electricity provided by source *k* in year *y*	%
$EF_{proj,offgrid,k}$	Off-grid emission factor for source *k*. This is a technology-specific value provided in [Appendix 3: *Off-Grid Emission Factors for Select Technologies*]	gCO_2e/kWh
TDL_y	Average technical T&D losses for providing electricity in year *y*	%
10^{-6}	Unit conversion for grams CO_2e to tonnes CO_2e	

Electricity consumption shall be determined using plug-in power meters during the KPT and calculated using equation 20 for grid electricity, and/or equation 21 for off-grid electricity:

$$EC_{proj,grid,y} = H_s \times \frac{PTD_{h,\Psi,y}}{CD} \times EC_{proj,grid,KPT_y} \tag{20}$$

$$EC_{proj,offgrid,y} = H_s \times \frac{PTD_{h,\Psi,y}}{CD} \times EC_{proj,offgrid,KPT_y} \tag{21}$$

Where:

Parameter	**Description**	**Unit**
$EC_{proj,grid,y}$	Grid electricity consumption for cooking for non-CTEC project in year *y*	kWh
$EC_{proj,offgrid,y}$	Grid electricity consumption for cooking for non-CTEC project in year *y*	kWh
H_s	Average household size (persons per household, regardless of age or gender)	Number
$PTD_{h,\Psi,y}$	PTDs of the monitoring period during year *y*	Number
$EC_{proj,grid,KPT,y}$	Grid electricity consumption in project KPT in year *y*	kWh/(person*year)
$EC_{proj,offgrid,KPT,y}$	Off-grid electricity consumption in project KPT in year *y*	kWh/(person*year)

11.2.3. Emission Reductions for Non-CTEC Projects

To account for the potential impacts of the Hawthorne Effect on project KPTs for non-CTEC projects, the methodology applies an adjustment (HE_{ind}). Emission reductions for non-CTEC projects are calculated using Equation (22).

$$ER_y = (BE_y - PE_y) \times HE_{ind} \times (1 - LE_y) \tag{22}$$

Where:

Parameter	**Description**	**Unit**
ER_y	Emission reductions for the project during year *y*	tCO_2e
BE_y	Baseline emissions during year *y*	tCO_2e
PE_y	Project emissions during year *y*	tCO_2e
HE_{ind}	Adjustment to calculated emission reductions for the Hawthorne Effect, either: 75% when usage surveys are used alone,	%

	or Result of Equation (23) where usage surveys are complemented by SUMs measurements	
LE_y	Percentage deduction to account for leakage emissions during year *y*	%

When projects complement KPTs and surveys with SUMs measurements, the ratio of project technology usage (cooking events/day) measured during the KPT to that measured during the month prior to or following the KPT is used to adjust the emission reduction estimate, such that in Equation (22), HE_{ind} equals the result of this ratio (see Equation (23)). See Section 12.2 for SUMs monitoring requirements and Appendix 9 for general SUMs guidance.

When projects measure fuel consumption through KPTs, complemented by usage surveys only, maximum emission reductions are capped at 75% of the KPT-based estimate to account for the Hawthorne Effect, such that in Equation (22), HE_{ind} equals 75%.

$$HE_{ind} = \min(1, \frac{PTC_m}{PTC_{KPT}}) \tag{23}$$

Where:

Parameter	Description	Unit
HE_{ind}	Adjustment to calculated emission reductions for the Hawthorne Effect	%
PTC_m	Average project technology cooking events per day over 1 month from SUMs measurements	Number
PTC_{KPT}	Average project technology cooking events per day over the project KPT from SUMs measurements	Number

11.3. Upstream Emissions

Upstream emissions for fuels in year y in both the baseline ($UE_{base,i,y}$) and project scenarios ($UE_{proj,j,y}$) for all fuels except electricity are calculated as follows:

$$UE_{base,i,y} = EC_{i,y} \times EF_{i,upstream} \tag{24}$$

$$UE_{proj,j,y} = EC_{j,y} \times EF_{j,upstream} \tag{25}$$

For CTEC projects using the KPT approach, $EC_{i,y}$ and $EC_{j,y}$ are calculated by scaling the amount of energy consumption for each fuel during the KPT per

TJ of project fuel during the KPT by the total tracked project fuel consumption per year:

$$EC_{i,y} = \frac{EC_{base,KPT,i}}{tEC_{proj,KPT,j-project}} \times tEC_{proj,j,y} \tag{26}$$

$$EC_{j,y} = \frac{tEC_{proj,KPT,j}}{tEC_{proj,KPT,j-project}} \times tEC_{proj,j,y} \tag{27}$$

Where:

Parameter	**Description**	**Unit**
$UE_{base,i,y}$	Upstream emissions for baseline fuel *i* in year *y*	tCO_2e
$UE_{proj,j,y}$	Upstream emissions for project fuel *j* in year *y*	tCO_2e
$EC_{i,y}$	Energy consumption for a fuel *i* in the baseline scenario in year *y*	TJ
$EC_{j,y}$	Energy consumption for a *j* in the project scenario in year *y*	TJ
$EF_{i,upstream}$	Upstream emission factor for fuel *i*	tCO_2/TJ
$EF_{j,upstream}$	Upstream emission factor for fuel *j*	tCO_2/TJ
$EC_{base,KPT,i}$	Energy consumption of baseline fuel *i* for CTEC projects based on baseline KPT. Where fuels such as pellets and briquettes are made from a mix of renewable and non-renewable sources (e.g., renewable agricultural waste and non-renewable wood), each source should be considered its own fuel. (See example following Equation (1))	TJ/(person*year)
$tEC_{proj,KPT,j}$	Tracked energy consumption of project fuel *j* from project KPT for CTEC projects. Where fuels such as pellets and briquettes are made from a mix of renewable and non-renewable sources (e.g., renewable agricultural waste and non-renewable wood), each source should be considered its own fuel. (See example following Equation (1))	TJ/(person*year)

$tEC_{proj,KPT,j-project}$	Tracked energy consumption of project fuel *j* for project cookstove only based on project KPT	TJ/(person*year)
$tEC_{proj,j,y}$	Total tracked energy consumption of project fuel *j* for CTEC projects in year *y*	TJ

Upstream emissions from non-electric sources include transport emissions.

Upstream emissions from electricity generation are included in the grid/off-grid emission factors which are presented in Appendix 2 and Appendix 3. The emission factor accounting for the technical T&D losses for providing electricity is not included in the grid emission factors. Technical T&D losses are accounted for separately.

12. Monitoring Requirements

12.1. Monitoring Activity Schedule for CTEC Projects

Activity	Prior to validation	Prior to first verification	Annual	Every monitoring period (two years max)
Emission reduction estimation	X			
Baseline studies				
Baseline scenario survey	X			
Baseline energy consumption measurement for CTEC projects using KPT approach		X		
Specific energy consumption of baseline cookstove and fuel combination (from CCTs) for CTEC projects back-calculating the baseline	X			
Project studies				
Usage survey			X	
Project energy consumption measurement (from KPTs or tracked energy consumption) *Continuous if tracked, and reported every monitoring period		X		X*
Specific energy consumption of project cookstove and fuel combination (from CCTs) before validation and every two years thereafter for CTEC projects that use CCTs to back-calculate the baseline.	X			X
Ongoing monitoring tasks				
Maintenance of total sales and service records, and project databases	Continuous			

12.2. Monitoring Activity Schedule for Non-CTEC Projects

Activity	Prior to validation	Prior to first verification	Annual	Every monitoring period (two years max)
Emission reduction estimation	X			
Baseline studies				
Baseline scenario survey	X			
Baseline energy consumption measurement (from KPTs) (required for all projects not using global default value)		X		
Project studies				
Usage surveys			X	
Project energy consumption measurement (from KPTs)		X		X
Ongoing monitoring tasks				
Maintenance of total sales and service records, and project databases	Continuous			

12.3. Other Monitoring Requirements

KPTs must be undertaken every two years, at the end of the monitoring period for which credits are being validated and issued, rather than at the beginning of a monitoring period.

Evolving baselines

For projects with KPT baselines, project proponents must identify any mismatch between values documented during the baseline scenario and those reported by actual project households during the first project usage survey for primary fuel type and household size. This assessment shall be carried out using retrospective questions of project households during the first usage survey in any given household. Where a material discrepancy between the baseline scenario and project baseline occurs, project proponents must either not claim emission reductions for households that do not conform to the baseline scenario profile or follow requirements on adjusting the baseline (toward lower baseline emissions).

Seasonality

Projects are required to account for the impact of seasonal variation on fuel-use measurements in the baseline and project scenarios. Prior to project validation, projects must collect data during the baseline scenario survey on the relative fuel use at different times of the year (see Section 8: *Baseline Scenario*). Project proponents are required to incorporate the resulting information into their monitoring plan design and to justify on the Project Information Cover Sheet how the approach they are taking will result in accurate baseline and project fuel use measurements. If space heating is common in the project area, the justification must include an explanation of how space heating has been addressed in the project design. If an accurate approach cannot be taken, then the project proponent must instead select and justify a conservative approach.

CTEC monitoring data

For any given project participant or technology, if more than half of the possible CTEC data for a monitoring period is missing, only available CTEC data may be included in emission reduction calculations. If missing CTEC data for a given project participant or technology consists of less than half of the possible data, then the project proponent may use the 25th percentile of the available tracked project energy consumption for that project participant or technology as a conservative replacement of the missing data.

Stove use monitoring

- The algorithm for estimating technology use events must be able to reliably distinguish cookstove use events from other potential factors that could be interpreted as cookstove use events that are caused by external reasons (e.g., temperature fluctuations from typical diurnal patterns). The algorithms shall be clearly presented publicly with associated equations and/or logic rules.
- The same algorithm and SUM device type shall be used for the duration of the project.
- Sampling must meet the 95/10 precision guidelines, per the sampling guidance included in Appendix 10.
- SUMs sampling protocols (installation, placement, downloading) and algorithms used to convert raw data into cooking events must not change between sampling during KPTs and sampling following KPTs. Project participants in the SUMs sample shall not receive any support different or additional to those not in the sample. See Appendix 10.

- For non-CTEC projects using the KPT and SUMs approach (see [Section 11.2.3: *Emission Reductions for Non-CTEC projects*]), the average of the cookstove use events per day during the full 1-month of stove use monitoring must be used to adjust for potential Hawthorn Effects. If SUMs data is incomplete or missing, it must be omitted from the analysis.

13. Methodology Parameters

When the project proponents apply for crediting period renewal, all methodological parameters shall be reassessed as per the latest version of the methodology available at the time of renewal.

Parameters are presented in alphabetical order, in separate sections for ex-ante and monitored parameters.

13.1. Ex-Ante Parameters

Data/Parameter	CD	
Unit	Number	
Description	Days in a calendar year *y*. Use 366 for leap years	
Type of parameter	X	Ex-ante
		Monitored
Source of data		
Value applied	365 (non-leap year) or 366 (leap year)	
Frequency of monitoring		
Description of measurement methods		
QA/QC procedures		
Purpose of data		
Comments		

Data/Parameter	$EC_{base,KPT,i}$	
Unit	TJ/(person*year)	
Description	Energy consumption of baseline fuel *i* for CTEC projects based on baseline KPT	
Type of parameter	X	Ex-ante
		Monitored
Source of data	Ex-ante baseline scenario KPT	
Value applied	-	
Frequency of monitoring	Once per crediting period	
Description of measurement methods	CTEC projects that use tracked energy consumption and KPTs to determine fuel consumption in the baseline scenario must collect data from a representative sample of households and following the most recent version of the KPT protocol available at this link: https://cleancooking.org/protocols/	

QA/QC procedures	The study must meet the minimum confidence and precision of 95/10 for the target parameter of average annual energy consumption per person. The 95/10 rule is applied to the sum of energy consumption across fuels (see parameter $\sum tEC_{base,KPT,i}$ in Appendix 10, which subsumes this parameter). If the target precision is not met, the project proponent shall take the conservative bound of the confidence interval as the parameter value, proportionately applied across all of the fuels used. The conservative bound is that which produces a lower CO2e emissions reduction estimate. Baseline fuel consumption caps and flags described in Section 9: *Baseline Energy Consumption Defaults and Caps* apply and results shall be cross-checked against these.
Purpose of data	Calculation of baseline emissions for CTEC projects that use tracked energy consumption and KPTs
Comments	-

Data/Parameter	$EF_{base,i,CO2}$
Unit	tCO_2e/TJ
Description	CO_2 emission factor for baseline fuel *i*
Type of parameter	X Ex-ante
	Monitored
Source of data	Default values from the latest version of the IPCC Guidelines for National GHG Inventories are provided for most fuels; other fuels shall use data from peer reviewed sources (see the notes and references listed in Appendix 5). If a fuel is not included in Appendix 5, then use literature-based values or project level tests using ISO 19867.
Value applied	See Appendix 5: *Default Point of Use Emission Factors, Thermal Efficiencies, and NCVs*
Frequency of monitoring	N/A
Description of measurement methods	N/A
QA/QC procedures	N/A
Purpose of data	Calculation of baseline emissions

Comments	

Data/Parameter	$EF_{base,i,nonCO2}$	
Unit	tCO_2e/TJ	
Description	Non-CO_2 emission factor for baseline fuel *i*	
Type of parameter	X	Ex-ante
		Monitored
Source of data	Default values from the latest version of the IPCC Guidelines for National GHG Inventories are provided for most fuels; other fuels shall use data from peer reviewed sources (see the notes and references listed in Appendix 5). If a fuel is not included in Appendix 5, then use literature-based values or project level tests using ISO 19867.	
Value applied	See Appendix 5: *Default Point of Use Emission Factors, Thermal Efficiencies, and NCVs*	
Frequency of monitoring	N/A	
Description of measurement methods	N/A	
QA/QC procedures	N/A	
Purpose of data	Calculation of baseline emissions	
Comments		

Data/Parameter	$EF_{proj,j,CO2}$	
Unit	tCO_2e/TJ	
Description	CO_2 emission factor for project fuel *j*	
Type of parameter	X	Ex-ante
		Monitored
Source of data	Default values from the latest version of the IPCC Guidelines for National GHG Inventories are provided for most fuels; other fuels shall use data from peer reviewed sources (see the notes and references listed in Appendix 5). If a fuel is not included in Appendix 5, then use literature-based values or project level tests using ISO 19867.	
Value applied	See Appendix 5: *Default Point of Use Emission Factors, Thermal Efficiencies, and NCVs*	
Frequency of monitoring	N/A	

Description of measurement methods	N/A
QA/QC procedures	
Purpose of data	Calculation of project emissions
Comments	

1081

Data/Parameter	$EF_{proj,j,nonCO2}$	
Unit	tCO_2e/TJ	
Description	Non-CO_2 emission factor for project fuel *j*	
Type of parameter	X	Ex-ante
		Monitored
Source of data	Default values from the latest version of the IPCC Guidelines for National GHG Inventories are provided for most fuels; other fuels shall use data from peer reviewed sources (see the notes and references listed in Appendix 5). If a fuel is not included in Appendix 5, then use literature-based values or project level tests using ISO 19867.	
Value applied	See *Appendix 5: Default Point of Use Emission Factors, Thermal Efficiencies, and NCVs*	
Frequency of monitoring	N/A	
Description of measurement methods	N/A	
QA/QC procedures		
Purpose of data	Calculation of project emissions	
Comments		

1082

Data/Parameter	$EF_{i,upstream}$ and $EF_{j,upstream}$	
Unit	tCO_2e/TJ	
Description	Upstream emission factor for fuel *i* in baseline or fuel *j* in project scenario	
Type of parameter	X	Ex-ante
		Monitored
Source of data	See Appendix 4	
Value applied	See Appendix 4	
Frequency of monitoring	N/A	

Description of measurement methods	N/A
QA/QC procedures	
Purpose of data	Calculation of upstream emissions in baseline and project scenarios
Comments	Upstream emissions for fuelwood are considered as zero

1083

Data/Parameter	$EF_{proj,grid}$	
Unit	gCO_2e/kWh	
Description	Country-specific marginal grid emission factor	
Type of parameter	X	Ex-ante
		Monitored
Source of data	Marginal emission factors from the International Financial Institutions Technical Working Group on GHG Accounting, (provided in Appendix 2: *Grid Emission Factors*), or marginal emission factors provided by the relevant national authority.	
Value applied	See Appendix 2	
Frequency of monitoring	N/A	
Description of measurement methods	N/A	
QA/QC procedures	N/A	
Purpose of data	Calculation of project emissions	
Comments		

1084

Data/Parameter	$EF_{proj,offgrid,k}$	
Unit	gCO_2e/kWh	
Description	Off-grid emission factor for source *k*	
Type of parameter	X	Ex-ante
		Monitored
Source of data	Mini-grid Emission Tool from SEforAll	
Value applied	See Appendix 3	
Frequency of monitoring	N/A	
Description of measurement methods	N/A	

QA/QC procedures	N/A
Purpose of data	Calculation of baseline and project emissions
Comments	

Data/Parameter	$fNRB_{i}$
Unit	Fraction
Description	Fraction of non-renewable woody biomass fuel *i* during year *y*
Type of parameter	X Ex-ante ☐ Monitored
Source of data	National or sub-national default [a] values from the UNFCCC-supported MoFuSS model [b,c]; or Customized project area (not aligned with national or subnational boundaries) using the online MoFuSS Default Scenarios (MoFuSS-DS) interface; or Where applicable, project proponents may run their own model with webMoFuSS [d] using their own rigorously validated inputs, as stipulated in the model. [a] Sub-national values are appropriate for projects concentrated in specific regions. National values are appropriate for projects that are evenly spread throughout a country. [b] Current versions found here: Map/viewer: https://www.mofuss.unam.mx/mofuss-ds/ [c] Permanent open-access data repository with tabulated results: https://zenodo.org/records/14389323 [d] If UNFCCC determines that a marginal approach to calculating fNRB is allowable, MoFuSS may be used to calculate marginal fNRB for a given project under this methodology.
Value applied	
Frequency of monitoring	Determined once ex-ante
Description of measurement methods	

QA/QC procedures	
Purpose of data	Calculation of baseline and project emissions
Comments	This parameter is only considered when woody biomass is used in either baseline or project scenario. This parameter varies between zero and 100% for fuelwood, charcoal, and other solid biomass fuels that are not fully renewable. When renewable biomass fuels are used, this parameter is equal to zero. When fossil fuels are used, it is equal to 100%. Updated at crediting period renewal.

Data/Parameter	H_s	
Unit	Persons per household, regardless of age or gender (number)	
Description	Average household size	
Type of parameter	X	Ex-ante and
	X	Monitored
Source of data	Survey	
Value applied	-	
Frequency of monitoring	N/A	
Description of measurement methods	Baseline survey and annual usage surveys, adjusting to the lower value when a decrease in persons per household is observed.	
QA/QC procedures	The parameter estimate from the survey must meet the minimum confidence and precision of 95/10 to use the mean value. If the target precision is not met, the project proponent shall apply the conservative bound of the confidence interval as the parameter value. The conservative bound is that which produces a lower CO2e emissions reduction estimate.	
Purpose of data	Calculation of baseline and project emissions	
Comments	-	

Data/Parameter	LE_y	
Unit	Percentage	
Description	Percentage deduction to account for leakage emissions during year *y*	
	X	Ex-ante

Type of parameter	Monitored
Source of data	
Value applied	2%
Frequency of monitoring	
Description of measurement methods	All projects shall apply a default adjustment factor of 2% to the emission reductions to approximate leakage emissions or evaluate the relevant potential sources of leakage and provide an evidence-based description and estimated quantification of each potential source and its relevance for the project. All projects shall either (1) apply a default adjustment factor of 2% to the emission reductions to approximate leakage emissions or (2) evaluate the relevant potential sources of leakage and provide an evidence-based description and estimated quantification of each potential source and its relevance for the project. If utilizing the latter, for each source for which the leakage assessment expects an increase in fuel consumption by non-project households/users attributable to the project activity, then calculations must be undertaken to account for the leakage from this source. Leakage is either calculated as a quantitative emissions volume (tCO_2e) or as a percentage of total emission reductions. The project documentation shall include a projection of leakage emissions based on available data and information. The monitoring plan must include monitoring parameters to be registered during the leakage investigation every two years to populate the leakage calculation. When using the latter, the project proponent must conduct a leakage investigation every two years using relevant methods. For example, surveys to determine parameters for the leakage calculation may be combined with project monitoring surveys, as is applicable. Monitoring plans should include field-based measurement methods, especially for the

	quantification of fuel, as data on fuel use estimated via surveys are often insufficiently accurate.	
QA/QC procedures		
Purpose of data		
Comments		

Data/Parameter	NCV_x $(also\ NCV_j)_j$	
Unit	TJ/tonnes	
Description	Net calorific value of fuel *x* (or *j)*	
Type of parameter	X	Ex-ante
		Monitored
Source of data	Default values from the latest version of the IPCC Guidelines for National GHG Inventories are provided for most fuels in Appendix 5). Use of these values for wood and charcoal are required. For other fuels, project level tests using ISO 19867 may be used. Significant variance between such outputs and the values above must be noted and justified in the Project Information Cover Sheet. If a fuel is not included in Appendix 5, then use literature-based values or project level tests using ISO 19867.	
Value applied	See Appendix 5: *Default Point of Use Emission Factors, Thermal Efficiencies, and NCVs*	
Frequency of monitoring	N/A	
Description of measurement methods	N/A	
QA/QC procedures	N/A	
Purpose of data	Calculation of baseline and project emissions	
Comments	Not applicable for electricity as energy source in baseline or project scenario	

Data/Parameter	$ntEC_{\mathrm{base},i}$	
Unit	TJ/(person*year)	
Description	Energy consumption of baseline fuel *i* for non-CTEC projects	
Type of parameter	X	Ex-ante
		Monitored

Source of data	Global default value from Section 9: *Baseline Energy Consumption Defaults and Caps* or results from baseline KPT
Value applied	-
Frequency of monitoring	Beginning of the crediting period
Description of measurement methods	Projects that choose the KPT approach to determine fuel consumption in the baseline scenario must collect data from a representative sample of households and follow the most recent version of the KPT protocol available at this link: https://cleancooking.org/protocols/
QA/QC procedures	The study must meet the minimum confidence and precision of 95/10 for annual fuel energy consumption per person to use the mean values. The 95/10 rule is applied to the sum of energy consumption across fuels. If the target precision is not met, the project proponent shall take the conservative bound of the confidence interval as the parameter value, proportionately applied across all of the fuels used. The conservative bound is that which produces a lower CO2e emissions reduction estimate.
Purpose of data	Calculation of baseline emissions for non-CTEC projects
Comments	-

Data/Parameter	$SC_{b,i}$	
Unit	MJ / kg food	
Description	Specific energy consumption of a baseline cookstove using fuel *i* to cook a given amount of food	
Type of parameter	X	Ex-ante
		Monitored
Source of data	Most recent version of the CCT protocol available at this link: https://cleancooking.org/protocols/	
Value applied	The parameter estimate from the test results must meet the minimum confidence and precision of 95/10 to use the mean value. If the target precision is not met, the project proponent shall apply the conservative bound of the confidence interval as the parameter value. The conservative bound is that which produces a lower CO2e emissions reduction estimate.	

Frequency of monitoring	Before validation
Description of measurement methods	Provided in the CCT protocol
QA/QC procedures	Requirements per the CCT protocol. Additionally: • A minimum of 15 CCTs by 5 different cooks (3 repeats per cook) must be conducted per cookstove model. • The CCTs must be alternated between the baseline and project cookstoves to limit potential bias in increased cook efficiency over repeats. For artisanal cookstoves, at least three randomly-selected samples of each cookstove model must be tested.
Purpose of data	Back-calculation of baseline fuel consumption for CTEC projects using the back-calculation approach for displaced baseline energy consumption
Comments	-

1091

Data/Parameter	$SC_{p,j}$	
Unit	MJ / kg food	
Description	Specific energy consumption of a project cookstove using fuel *j* to cook a given amount of food	
Type of parameter	X	Ex-ante, and
	X	Monitored
Source of data	Most recent version of the CCT protocol available at this link: https://cleancooking.org/protocols/	
Value applied	The parameter estimate from the test results must meet the minimum confidence and precision of 95/10 to use the mean value. If the target precision is not met, the project proponent shall apply the conservative bound of the confidence interval as the parameter value. The conservative bound is that which produces a lower CO2e emissions reduction estimate.	
Frequency of monitoring	Before validation, and every 2 years thereafter	
Description of measurement methods	Provided in the CCT protocol	

QA/QC procedures	Requirements per the CCT protocol. Additionally: • A minimum of 15 CCTs by 5 different cooks (3 repeats per cook) must be conducted per cookstove type. • The CCTs must be alternated between the baseline and project cookstoves to limit potential bias in increased cook efficiency over repeats. For artisanal cookstoves, at least three randomly-selected samples of each cookstove model must be tested.
Purpose of data	Back-calculation of baseline fuel consumption for CTEC projects using the back-calculation approach for displaced baseline energy consumption.
Comments	-

1092

Data/Parameter	TDL_y	
Unit	Percentage	
Description	Average technical T&D losses for providing electricity in year *y*	
Type of parameter	X	Ex-ante
		Monitored
Source of data	T&D loss values should come from the following sources: • If available, the percentage published by the national grid's operator should be used. • If the value from the national grid's operator is not available, then national T&D loss percentages from international, reputable sources such as the World Bank or the International Energy Agency should be used. • If none of the options above are available, a 20% conservative default for T&D losses should be applied.	
Value applied	-	
Frequency of monitoring	Determined once ex-ante	
Description of measurement methods	N/A	
QA/QC procedures	N/A	
Purpose of data	Calculation project emissions	

Comments	-

13.2. Monitored Parameters

Data/Parameter	$Days_{y,h}$
Unit	Number
Description	Number of maximum possible project-technology days during the year *y* in household *h*
Type of parameter	Ex-ante X Monitored
Source of data	Project database
Value applied	-
Frequency of monitoring	Annually
Description of measurement methods	For each project household this is determined using the date the project-technology was obtained by the household, and the dates of the monitoring period.
QA/QC procedures	-
Purpose of data	Calculation of baseline and project emissions for non-CTEC projects
Comments	-

Data/Parameter	$EC_{proj,grid,KPT,y}$ and $EC_{proj,offgrid,KPT,y}$
Unit	kWh/(person*year)
Description	Electricity consumption in project KPT in year *y*
Type of parameter	Ex-ante X Monitored
Source of data	KPT during project scenario
Value applied	Result from KPT
Frequency of monitoring	Every two years during project
Description of measurement methods	A representative sample with built-in or external data loggers, where they conform with industry standards and are calibrated according to manufacturer recommendations and/or relevant national requirements as applicable, shall be used during KPTs.
QA/QC procedures	The study must meet the minimum confidence and precision of 95/10 for the target parameter of average annual energy consumption per person. The 95/10 rule is applied to the sum of energy consumption across fuels (see parameter $\sum tEC_{base,KPT,i}$ in Appendix 10,

	which subsumes this parameter). If the target precision is not met, the project proponent shall take the conservative bound of the confidence interval as the parameter value, proportionately applied across all of the fuels used. The conservative bound is that which produces a lower CO2e emissions reduction estimate.
Purpose of data	Calculation of project emissions for non-CTEC projects
Comments	-

1096

Data/Parameter	FC_x $(or\ FC_{i,h,y}\ or\ FC_{j,h,y})$	
Unit	Tonnes	
Description	Fuel consumption for the respective fuel and scenario *x* (also Fuel consumption for fuel *i* or *j* in household *h* in year *y)*	
Type of parameter		Ex-ante
	X	Monitored
Source of data	Weighing scale	
Value applied	-	
Frequency of monitoring	At baseline and every two years for project KPTs	
Description of measurement methods	KPT. Scales will have the capacity to weigh the respective solid fuels encountered during KPT. They will have a minimum resolution of 10g or 2% of the expected difference between daily weighings for the primary fuel type. Scales remain stable at a zero reading after taring. Check that scales are within 1% of a certified calibration weight. The calibration weight should be within +/- 50% of typical weights for the primary fuel type. For example, if bundles of wood are typically 10kg, then the calibration weight should be between 5 and 15 kg. If a scale indicates it is out of compliance, measurements from the that scale should be discarded until the previous, valid check. Scales will be checked during every day of use that they are within 1% of a certified calibration weight. The calibration weight will be within +/- 50% of	

	typical weights for the primary fuel type. For example, if bundles of wood are typically 10kg, then the calibration weight will be between 5 and 15 kg. If a scale indicates it is out of compliance, measurements from the that scale will be discarded until the previous, valid check.
QA/QC procedures	Scales must remain stable at a zero reading after taring. Scales will be checked during every day of use that they are within 1% of a certified calibration weight. The calibration weight will be within +/- 50% of typical weights for the primary fuel type. For example, if bundles of wood are typically 10kg, then the calibration weight will be between 5 and 15 kg. If a scale indicates it is out of compliance, measurements from the that scale will be discarded until the previous, valid check.
Purpose of data	Calculation of project emissions for CTEC projects
Comments	-

Data/Parameter	$f_{k,y}$	
Unit	%	
Description	Fraction of off-grid electricity provided by source *k* in year *y*	
Type of parameter		Ex-ante
	X	Monitored
Source of data	Measurement of off-grid electricity sources used by the project activity using electric meters	
Value applied	-	
Frequency of monitoring	Annual	
Description of measurement methods	Electric meters measuring off-grid sources.	
QA/QC procedures	Measured generation shall be cross-checked with off-grid source installed capacity and load factor.	
Purpose of data	Apportioning fraction of electricity use for off grid emission factors.	
Comments		

Data/Parameter	H_s
Unit	Persons per household, regardless of age or gender (number)
Description	Average household size

Type of parameter	X	Ex-ante and
	X	Monitored
Source of data	Survey	
Value applied	-	
Frequency of monitoring	N/A	
Description of measurement methods	Baseline survey and annual usage surveys, adjusting to the lower value when a decrease in persons per household is observed.	
QA/QC procedures	The parameter estimate from the survey must meet the minimum confidence and precision of 95/10 to use the mean value. If the target precision is not met, the project proponent shall apply the conservative bound of the confidence interval as the parameter value. The conservative bound is that which produces a lower CO2e emissions reduction estimate.	
Purpose of data	Calculation of baseline and project emissions	
Comments	-	

Data/Parameter	$ntEC_{proj,j,y}$	
Unit	TJ/(person*year)	
Description	Energy consumption of project fuel *j* for non-CTEC projects as measured by the project KPT	
Type of parameter		Ex-ante
	X	Monitored
Source of data	KPT during project scenario	
Value applied	Result from KPT	
Frequency of monitoring	Every two years	
Description of measurement methods	Representative sample using a KPT	
QA/QC procedures	The study must meet the minimum confidence and precision of 95/10 for the target parameter of average annual energy consumption per person. The 95/10 rule is applied to the sum of energy consumption across fuels (see parameter $\sum tEC_{base,KPT,i}$ in Appendix 10, which subsumes this parameter). If the target precision is not met, the project proponent shall take the conservative bound of the confidence interval as the parameter value, proportionately applied across all of the fuels used. The conservative bound is that	

	which produces a lower CO2e emissions reduction estimate.
Purpose of data	Calculate project emissions for non-CTEC projects
Comments	

Data/Parameter	$PC_{b,i}$
Unit	Percentage
Description	Proportion of cooking events conducted using baseline fuel *i*
Type of parameter	☐ Ex-ante X Monitored
Source of data	Surveys
Value applied	
Frequency of monitoring	Once per crediting period
Description of measurement methods	Baseline scenario surveys or stove use monitoring. The survey must ask to identify all the cooking devices present in the household. For all cooking devices present in the household, ask “How many times did you cook using [cooking device] yesterday?” to determine the number of usage events per day per device.
QA/QC procedures	The parameter estimate from the survey must meet the minimum confidence and precision of 95/10 for the percentage of baseline cooking conducted using baseline fuel *i*, with a minimum of 200 households.
Purpose of data	Estimate the proportion of cooking events conducted using baseline fuel *i*, used in conjunction with Parameter $PC_{p,j}$ to calculate a material difference between the baseline scenario and actual project households, for non-CTEC and CTEC with KPT projects. This parameter does not appear in emissions reduction quantification equations.
Comments	When multiple devices/fuels are used in the baseline by the end user in the same premises, the proportional use shall be established from surveys or stove use monitoring as described in Appendix 9.

Data/Parameter	$PC_{p,j}$
Unit	Percentage
Description	Proportion of cooking events conducted using project fuel *j*

Type of parameter	☐ Ex-ante X Monitored
Source of data	Surveys
Value applied	
Frequency of monitoring	Once per crediting period
Description of measurement methods	Project usage surveys or stove use monitoring. The survey must ask to identify all the cooking devices present in the household. For the project cookstove and each other cooking device present in the household, ask “How many times did you cook using [cooking device] yesterday?” to determine the number of usage events per day per device.
QA/QC procedures	The parameter estimate from the survey must meet the minimum confidence and precision of 95/10 for the percentage of baseline cooking conducted using project fuel *j*.
Purpose of data	Estimate the proportion of cooking events conducted using project fuel *j*, used in conjunction with Parameter $PC_{b,i}$ to calculate a material difference between the baseline scenario and actual project households, for non-CTEC and CTEC with KPT projects. This parameter does not appear in emissions reduction quantification equations.
Comments	When multiple devices/fuels are used in the baseline by the end user in the same premises, the proportional use shall be established from surveys or stove use monitoring as described in Appendix 9.

Data/Parameter	PTC_m
Unit	Cooking events/day (Number)
Description	Average project technology cooking events per day over 1 month from SUMs measurements
Type of parameter	☐ Ex-ante X Monitored
Source of data	SUMs monitoring
Value applied	Average
Frequency of monitoring	Once for a one-month duration during the first monitoring period of the crediting period
Description of measurement methods	Installation of SUMs on a representative sample of project technology cookstoves

QA/QC procedures	The study must meet the minimum confidence and precision of 95/10 for the target parameter of average cooking events per day per project technology cookstoves. If the target precision is not met, the project proponent shall take the conservative bound of the confidence interval as the parameter value. The conservative bound is that which tends to underestimate project technology cooking events. SUMs sampling protocols (installation, placement, downloading) and algorithms used to convert raw data into cooking events must not change between sampling during KPTs and sampling during ongoing project operation.
Purpose of data	Calculation of project emissions through KPT and usage surveys complemented with SUMs
Comments	Users in the SUMs sample shall not receive any support different or additional to those not in the sample.

Data/Parameter		PTC_{KPT}
Unit		Cooking events/day (Number)
Description		Average project technology cooking events per day over the project KPT from SUMs measurements
Type of parameter		Ex-ante
	X	Monitored
Source of data		SUMs monitoring
Value applied		Average
Frequency of monitoring		Once during the project KPT
Description of measurement methods		Installation of SUMs on the project technology cookstoves during the project KPT
QA/QC procedures		The study must meet the minimum confidence and precision of 95/10 for the target parameter of average cooking events per day per project technology cookstoves. If the target precision is not met, the project proponent shall take the conservative bound of the confidence interval as the parameter value. The conservative bound is that which tends to underestimate project technology cooking events. SUMs sampling protocols (installation, placement, downloading) and algorithms used to convert raw

	data into cooking events must not change between sampling during KPTs and sampling during ongoing project operation.
Purpose of data	Calculation of project emissions through KPT and usage surveys complemented with SUMs
Comments	

1104

Data/Parameter	$SC_{p,j}$	
Unit	MJ / kg food	
Description	Specific energy consumption of a project cookstove using fuel *j* to cook a given amount of food	
Type of parameter	X	Ex-ante, and
	X	Monitored
Source of data	Most recent version of the CCT protocol available at this link:	
Value applied	The parameter estimate from the test results must meet the minimum confidence and precision of 95/10 to use the mean value. If the target precision is not met, the project proponent shall apply the conservative bound of the confidence interval as the parameter value. The conservative bound is that which produces a lower CO2e emissions reduction estimate.	
Frequency of monitoring	Before validation, and every 2 years thereafter	
Description of measurement methods	Provided in the CCT protocol	
QA/QC procedures	Requirements per the CCT protocol. Additionally: • A minimum of 15 CCTs by 5 different cooks (3 repeats per cook) must be conducted per cookstove type. • The CCTs must be alternated between the baseline and project cookstoves to limit potential bias in increased cook efficiency over repeats. For artisanal cookstoves, at least three randomly-selected samples of each cookstove model must be tested	
Purpose of data	Back-calculation of baseline fuel consumption for CTEC projects using the back-calculation approach for displaced baseline energy consumption	

Comments	-

1105

Data/Parameter	$tEC_{proj,grid,h,y}$	
Unit	kWh	
Description	Tracked grid electricity consumed for cooking in household *h* in year *y*	
Type of parameter		Ex-ante
	X	Monitored
Source of data	Metered electricity use for each household	
Value applied	-	
Frequency of monitoring	Continuous and aggregated annually	
Description of measurement methods	Applies for households consuming energy from the grid. All project technologies are monitored continuously. Built-in or external data loggers may be used, where they conform with industry standards and are calibrated according to manufacturer recommendations and/or relevant national requirements as applicable.	
QA/QC procedures	Measured project technology electricity use shall be cross checked with the wattage of the project-technology and the estimated operating hours for a sample of project-technology units.	
Purpose of data	Calculation of project emissions for CTEC projects	
Comments	-	

1106

Data/Parameter	$tEC_{proj,KPT,j}$ and $tEC_{proj,KPT,j-project}$	
Unit	TJ/(person*year) or (in the case of electricity) kWh/(person*year)	
Description	Energy consumption of project fuel *j* from project KPT for CTEC projects	
Type of parameter		Ex-ante
	X	Monitored
Source of data	Project scenario KPT	
Value applied	-	
Frequency of monitoring	Once per crediting period	
Description of measurement methods	CTEC projects that use tracked energy consumption and KPTs must collect data on all cookstoves operating in parallel with the project cookstove, from	

	a representative sample of households and following the most recent version of the KPT protocol available at this link: [https://cleancooking.org/ protocols/](https://cleancooking.org/protocols/) $EC_{proj,KPT,j-project}$ is extracted from the same measurements and comprises energy consumption of project fuel *j* for project cookstove only. It also may be expressed in kWh/(person*year) if the project-technology consumes electricity.
QA/QC procedures	The study must meet the minimum confidence and precision of 95/10 for the target parameter of average annual energy consumption per person. The 95/10 rule is applied to the sum of energy consumption across fuels (see parameter $\sum tEC_{base,KPT,i}$ in Appendix 10, which subsumes this parameter). If the target precision is not met, the project proponent shall take the conservative bound of the confidence interval as the parameter value, proportionately applied across all of the fuels used. The conservative bound is that which produces a lower CO2e emissions reduction estimate.
Purpose of data	Calculation of project emissions for CTEC projects that use tracked energy consumption and KPTs
Comments	-

Data/Parameter	$tEC_{proj,offgrid,h,y}$	
Unit	kWh	
Description	Tracked off-grid electricity consumed for cooking in household *h* in year *y*	
Type of parameter		Ex-ante
	X	Monitored
Source of data	Metered electricity use for each household	
Value applied	-	
Frequency of monitoring	Continuous and aggregated annually	
Description of measurement methods	Applies for households consuming energy from off-grid sources. All project technologies are monitored continuously. Built-in or external data loggers may be used, where they conform with industry standards and are calibrated according to manufacturer	

	recommendations and/or relevant national requirements as applicable.
QA/QC procedures	Measured project technology electricity use shall be cross checked for consistency with the wattage of the project-technology and the estimated operating hours for a sample of project-technology units.
Purpose of data	Calculation of project emissions for CTEC projects
Comments	-

1108

Data/Parameter	$tPC_{b,i}$	
Unit	Percentage	
Description	Proportion of cooking events conducted using fuel-stove combination *i*	
Type of parameter		Ex-ante
	X	Monitored
Source of data	Surveys	
Value applied		
Frequency of monitoring	Once per crediting period	
Description of measurement methods	Baseline scenario surveys or stove use monitoring. The survey must ask to identify all the cooking devices present in the household. For the project cookstove and each other cooking device present in the household, ask “How many times did you cook using [cooking device] yesterday?” to determine the number of usage events per day per device.	
QA/QC procedures	The parameter estimate from the survey must meet the minimum confidence and precision of 95/10 for the percentage of baseline cooking conducted on each cookstove-fuel combination present in the baseline.	
Purpose of data	Estimate the displacement of the baseline cookstove(s) in CTEC Back-calculating option	
Comments	When multiple devices/fuels are used in the baseline by the end user in the same premises, the proportional use shall be established from surveys or stove use monitoring as described in Appendix 9.	

1109

Data/Parameter	$\Psi_{Survey,y}$
Unit	Percentage
Description	Percent of project households with cookstoves present, where project cookstove is used at least

	once per week, determined via survey and visual observation in year *y*.
Type of parameter	Ex-ante X Monitored
Source of data	Usage survey and visual observation
Value applied	-
Frequency of monitoring	Annual
Description of measurement methods	Household surveys of project households with cookstoves present for which participants are asked if they use the cookstove more than once per week on average. The cookstove must also be visually observed and indicate signs of consistent intended use: • Cookstove is unpacked • Present in an easily accessible area • Not being used for a non-cooking purpose • Appears in working condition • Does not have signs of disuse such as being covered in dust or filled with spider webs Capped at 90% for projects that undertake customer support actions as described below and 75% for those that do not. **Customer support actions:** To be eligible to claim up to 90% of maximum PTDs, project proponents must take the following customer support actions and provide details of how each condition has or will be met on the Project Information Cover Sheet during the design phase of the project. • Demonstrate that the project has selected technologies and fuels that meet the cooking needs of the target population, either by citing robust research or conducting an investigation of cooking practices and attitudes during the project design phase. • Provide evidence of project participant support activities. These may include such things as 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 how to access any necessary parts). All project participant communications and materials shall be provided in local language(s) commonly used in the project area. • Project participants must be able to contact the project proponent to access support (e.g., maintenance and repair services) through a commonly used, toll-free communications channel. Project proponents who do not undertake all three of these customer support actions may claim up to 75% of maximum PTDs.
QA/QC procedures	Sampling must be conducted to meet the 95/10 precision guideline on the target parameter of the percentage of project households with cookstoves present in which project cookstove is used at least once per week.
Purpose of data	Calculation of baseline and project emissions for non-CTEC projects
Comments	-

14. Appendices

Included here:

Appendix 1: Project Information Cover Sheet

Appendix 2: Grid Emission Factors

Appendix 3: Off-Grid Emission Factors for Select Technologies

Appendix 4: Upstream Emissions from Other Fuels in tonne/TJ

Appendix 5: Default Point of Use Emission Factors, Thermal Efficiencies, and NCVs

Appendix 6: Requirements and Best Practices for Baseline and Project Surveys

Appendix 7: Requirements and Best Practices for KPTs

Appendix 8: Requirements and Best Practices for CCTs

Appendix 9: Requirements and Best Practices for SUMs

Appendix 10: Sampling Requirements and Best Practices for Surveys, KPTs, CCTs, SUMs

Appendix 1: Project Information Cover Sheet

To be completed at the project design stage (validation) and updated at time of each verification (highlighting changes from originals)

Name of Project proponent:
Organization name:
Phone:
Email:

Project title:
Project ID:
Project location:
Crediting period start date:
Crediting period end date:

Baseline fuel type/s:
Project fuel type/s:
Project cookstove type/s, model/s:
Project cookstove(s) ISO thermal efficiency/ies:
ISO tier(s) for PM2.5 emissions (optional):
ISO tier(s) for CO emissions (optional):
Number of households:
Average household size (persons per household, regardless of age or gender):
Number of cookstoves of each type:
Expected CO_2e emission reductions (per household):
Calculation sheet publicly available? (Y/N)

Fuel consumption continuously tracked for all project cookstoves in all households? (Y/N)
If no:
- Baseline fuel consumption approach (default or KPT):
- Baseline fuel consumption value:
- Justification if value over flagged threshold:
- Project monitoring approach (KPT or KPT+SUMs):
- Third party used for KPTs? (Y/N):
- Number of households sampled for KPT:
- Number of households sampled for SUMs:

If yes:
- Project monitoring approach (tracked fuel consumption+back-calculated baseline displacement or baseline+project KPTs):
- Type of fuel consumption data:
- Third party used for KPTs? (Y/N)
- Number of households sampled for KPT:

fNRB source (published MoFuSS defaults/WebMoFuSS-derived):
fNRB value:

NCV approach for other than wood and charcoal (default or self-determined):
If self-determined, method used:
If self-determined results vary significantly from Appendix 5 values, justification for the difference:

EFs default or self-determined:

If observed conditions demonstrate that relevant legal requirements are not enforced, explanation and justification for applying a baseline scenario that is not consistent with government policies and legal requirements:

Details on customer support activities provided:
- Demonstration that the project has selected technologies and fuels that meet the cooking needs of the target population:
- Project participant operations and maintenance support activities:
- Support communication channels availability to project participants:

How seasonality is addressed in the project monitoring plan:
- Justification for how this approach will result in accurate baseline and project fuel use measurements
- If space heating is common in the project area, how space heating has been addressed in the project design.

How additionality was established (investment analysis, barrier analysis, performance-based, other (describe)):

For CTEC projects using fuel sale records to track consumption of pellets, LPG or ethanol, safeguards taken to prevent fuel diversion for non-project activities:

Description of any missing and outlier/excluded data for KPTs, CCTs, SUMs, surveys:

SUMs validation checks performed, for projects using SUMs:

Compliance with Principles for Responsible Carbon Finance in Clean Cooking (optional):

Appendix 2: Grid Emission Factors

The CLEAR methodology uses marginal grid emission factors. These grid emission factors should be sourced from the estimates provided by the International Financial Institution's Technical Working Group (IFI-TWG) on GHG Accounting, or from the marginal grid emission factors provided by the relevant national authority.

The IFI-TWG uses the Combined Margin (CM) grid emission factor for Electricity Consumption. CM is a weighted average of each country's Operating Margin (33%) and Build Margin (67%). Operating Margin is the cohort of existing power plants that are most likely to be brought online to meet an additional unit of demand. Build Margin is the cohort of power plants expected to come online based on a country-specific assessment of planned and expected new generation capacity.

For IFI-TWG estimates, the most recent values should be used where available. To obtain a grid emission factor for a specific country, download the full database and use the data from Column E "Electricity Consumption". For reference, grid emission factors from 2024 for several countries are provided below.

Country / Territory / Island	gCO2/kWh	Country / Territory / Island	gCO2/kWh	Country / Territory / Island	gCO2/kWh
Afghanistan	193	Gabon	533	Palau	497
Algeria	397	Gambia	591	Panama	230
Angola	748	Ghana	276	Papua New Guinea	315
Bangladesh	412	Guam	428	Paraguay	0
Belize	183	Guatemala	427	Peru	252
Benin	576	Guinea	460	Philippines	525
Bhutan	0	Guinea-Bissau	577	Rwanda	416
Bolivia, Plurinational State of	393	Guyana	616	Samoa	434
Botswana	1070	Haiti	765	Sao Tomé & Principe	565
Brazil	150	Honduras	359	Senegal	656
Burkina Faso	539	India	608	Seychelles	479
Burundi	197	Indonesia	675	Sierra Leone	246
Cambodia	588	Jamaica	498	Solomon Islands	563
Cameroon	354	Kenya	274	Somalia	582
Cape Verde	505	Kiribati	530	South Africa	786
Central African Republic	77	Lao People's Democratic Republic	555	South Sudan	704
Chad	581	Lebanon	567	Sri Lanka	506
Chile	235	Liberia	374	Sudan	398
China (PRC and Hong Kong)	485	Libya	493	Suriname	565
Colombia	208	Madagascar	567	Tajikistan	106
Comoros	589	Malawi	243	Tanzania, United Republic of	336
Congo, Democratic Republic of	0	Mali	623	Thailand	351
Congo, Republic of	405	Mauritania	513	Timor-Leste	589
Costa Rica	39	Mauritius	543	Togo	597
Côte d'Ivoire	314	Mexico	359	Tonga	533
Cuba	391	Micronesia	557	Tunisia	348
Djibouti	575	Morocco	547	Turkmenistan	676
Dominica	433	Mozambique	111	Tuvalu	497
Dominican Republic	426	Myanmar	407	Uganda	116
Ecuador	280	Namibia	139	Uruguay	65
Egypt	406	Nauru	521	Uzbekistan	467
El Salvador	275	Nepal	0	Vanatu	504
Equatorial Guinea	361	Nicaragua	372	Venezuela, Bolivarian Republic of	368
Eritrea	704	Niger	718	Viet Nam	381
Eswatini	0	Nigeria	358	Yemen	615
Ethiopia	0	Pakistan	386	Zambia	197
Fiji	334	Palestinian Authority	517	Zimbabwe	880

Appendix 3: Off-Grid Emission Factors for Select Technologies

Generation technology	gCO_2e/kWh	Source
Petrol generator	1252	https://www.seforall.org/system/files/2021-08/SEforALL_Carbon-emissions-methodology-note.pdf
Diesel generator	1000	https://www.seforall.org/system/files/2021-08/SEforALL_Carbon-emissions-methodology-note.pdf

Appendix 4: Upstream Emissions from Other Fuels in tonne/TJ[16]

Fuel	CO_2	CH_4	N_2O	CO_2e
Kerosene[a]	9.0	0.10	0.00016	11.9
LPG from crude oil	18.4	0.12	0.00029	22.1
LPG from natural gas	9.9	0.15	0.00019	14.5
LPG derived from a mix of crude and natural gas inputs[b]	13.6	0.11	0.00019	16.8
Coal mining and cleaning	1.5	0.23	0.00003	8.3
Sugarcane-based ethanol[c,d,e]	-9.8	0.58	0.061	24.2
Pellets	4.6	0.0085	0.0014	5.2
Charcoal (traditional kiln assuming 6:1 conversion) [f, 1-6]	139	3.3	0.0119	CO_2 must be multiplied by fNRB before adding up to CO_2e
Charcoal (traditional kiln assuming 4:1 conversion)[f]	72	1.6	0.0119	

Project proponents must use the emissions factors for the fuels provided here. For pellet fuels, which can have widely varying feedstocks, project proponents may estimate their own upstream emissions factors or justify values through published literature.

GWPs from the IPCC Sixth Assessment Report (AR6.4) should be multiplied by the emission factors to convert them to CO_2e as follows:

- CO_2: 1
- CH_4 fossil fuels: 29.8
- CH_4 non fossil fuels: 27.2
- N_2O: 273

Notes:

a) Kerosene emissions are based on jet fuel from the GREET model

b) Combined LPG is a weighted average using the 2021 global input mix, which was 37% crude and 63% natural gas

c) CO_2 is negative because it accounts for carbon fixed during plant growth

d) CH_4 emissions are due to field burning, which is common for cane produced in many LMICs

[16] From Floess et al. 2023.

e) Life Cycle Assessment impacts are allocated by mass assuming 20% of farm-gate output goes toward ethanol

f) Charcoal production emission factors are taken from six peer-reviewed studies of emissions from traditional kilns. The average conversion rate from those studies is 3.7 tonnes of oven-dry wood per tonne of charcoal. However, those studies were conducted under controlled conditions, which tend to yield higher conversion efficiencies than those typically observed in field conditions. In more industrialized contexts, a charcoal conversion factor 4:1 is appropriate. However, CLEAR research supports a 6:1 charcoal conversion factor for LMIC contexts, as noted in the Explanation of Decisions document. For this methodology, we use a default conversion rate of 6:1 to better reflect conversion efficiencies observed in the field. This is incorporated into emissions factors here and fNRB calculations. Using a rate of 6:1 means that more wood, and therefore more carbon, is required to obtain the same amount of charcoal compared to the controlled studies. This results in higher carbon emissions. Accordingly, we proportionally adjust CO2 and CH4 emission factors to reflect this increased input. Nonetheless, this table also includes emissions factors based on a 4:1 conversion factor, to enable ICVCM Core Carbon Principles (CCP) eligibility.

Sources:

[1]Bertschi, Isaac T., Robert J. Yokelson, Darold E. Ward, Ted J. Christian, and Wei Min Hao. "Trace Gas Emissions from the Production and Use of Domestic Biofuels in Zambia Measured by Open-Path Fourier Transform Infrared Spectroscopy." Journal of Geophysical Research-Atmosphere 108 (2003): 5–1, 5–13

[2]Lacaux, J. P., J. M. Brustet, R. Delmas, J. C. Menaut, L. Abbadie, B. Bonsang, H. Cachier, J. Baudet, M. O. Andreae, and G. Helas. "Biomass Burning in the Tropical Savannas of Ivory Coast: An Overview of the Field Experiment Fire of Savannas (FOS/DECAFE 91)." Journal of Atmospheric Chemistry 22, no. 1–2 (October 1995): 195–216. https://doi.org/10.1007/BF00708189

[3]Smith, K. R., D. P. Pennise, P. Khummongkol, V. Chaiwong, K. Ritgeen, J. Zhang, W. Panyathanya, R. A. Rasmussen, and M. A. K. Khalil. "Greenhouse Gases from Small-Scale Combustion in Developing Countries: Charcoal Making Kilns in Thailand." Research Triangle Park, NC: US EPA, 1999

[4]Pennise, D., K. R. Smith, J. P. Kithinji, M. E. Rezende, T. J. Raad, J. Zhang, and C. Fan. "Emissions of Greenhouse Gases and Other Airborne Pollutants from Charcoal-Making in Kenya and Brazil." Journal of Geophysical Research-Atmosphere 106 (2001): 24143–55

[5]Akagi, S. K., R. J. Yokelson, C. Wiedinmyer, M. J. Alvarado, J. S. Reid, T. Karl, J. D. Crounse, and P. O. Wennberg. "Emission Factors for Open and Domestic Biomass Burning for

Use in Atmospheric Models." Atmospheric Chemistry and Physics 11, no. 9 (May 3, 2011): 4039–72. https://doi.org/10.5194/acp-11-4039-2011

[6]Christian, T. J., R. J. Yokelson, B. Cárdenas, L. T. Molina, G. Engling, and S.-C. Hsu. "Trace Gas and Particle Emissions from Domestic and Industrial Biofuel Use and Garbage Burning in Central Mexico." Atmospheric Chemistry and Physics 10, no. 2 (January 21, 2010): 565–84. https://doi.org/10.5194/acp-10-565-2010

Appendix 5: Default Point of Use Emission Factors, Thermal Efficiencies, and NCVs

Fuel	Net Calorific Value (TJ/tonnes)	Thermal efficiency	CO2 Emission Factor (tonnes/TJ)	CH4 Emission Factor (tonnes/TJ)	N2O Emission Factor (tonnes/TJ)
Biogas[1]	0.0504[1]	50%	54.6[1]	0.005[1]	0.0001[1]
Charcoal [2-5]	0.0295	25%	78.5	0.2	0.008
Kerosene[1]	0.0438	50%	71.9	0.01	0.0006
LPG[1]	0.0473	50%	63.1	0.005	0.0001
Wood[1]	0.0156	15%	112	0.3	0.004
Dung[1, 6-9]	0.012	15%	80.4	.83	0.004
Other liquid biofuels [1]	0.0274	50%	79.6	0.01	0.0006
Anthracite[1]	0.0267	Project-specific	98.3	0.3	0.0015
Other (Bituminous Coal)[1]	0.0258	Project-specific	94.6	0.3	0.0015
Sub-Bituminous[1]	0.0189	Project-specific	96.1	0.3	0.0015

Notes:

- To avoid double counting, the fuel emission factors above do not include upstream emissions, which are accounted for separately.
- Project proponents must use the NCV values for wood and charcoal listed here. For other fuels, project level tests using ISO 19867 may be used. Significant variance between such outputs and the values above must be noted and justified in the Project Information Cover Sheet.
- Default net calorific values and default emission factors for other fuel types (e.g., specific types of coal) can also be found in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories or may be justified from literature and/or testing reports.
- GWPs from the IPCC Sixth Assessment Report (AR6.4) should be multiplied by the emission factors to convert them to CO_2e as follows:
    - CO_2: 1
    - CH_4 fossil fuels: 29.8
    - CH_4 non fossil fuels: 27.2
    - N_2O: 273.
- The tonnes CO_2e per TJ for CO_2, CH_4, and N_2O should be summed.

Sources

[1] Gomez, Darío R., and John D. Watterson. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. edited by S. Eggleston, L. Buendia, K. Miwa, T. Ngara, and K. Tanabe. Kamiyamaguchi Hayama, Japan: Institute for Global Environmental Strategies.

[2] Brocard, D., C. Lacaux, J. P. Lacaux, G. Kouadio, and V. Yoboue. "Emissions from the Combustion of Biofuels in Western Africa." In Biomass Burning and Global Change, edited by J. S. Levine, 1:350–60. Cambridge, MA: MIT Press, 1996.

[3] Bertschi, Isaac T., Robert J. Yokelson, Darold E. Ward, Ted J. Christian, and Wei Min Hao. "Trace Gas Emissions from the Production and Use of Domestic Biofuels in Zambia Measured by Open-Path Fourier Transform Infrared Spectroscopy." Journal of Geophysical Research-Atmosphere 108 (2003): 5–1, 5–13.

[4] Akagi, S. K., R. J. Yokelson, C. Wiedinmyer, M. J. Alvarado, J. S. Reid, T. Karl, J. D. Crounse, and P. O. Wennberg. "Emission Factors for Open and Domestic Biomass Burning for Use in Atmospheric Models." Atmospheric Chemistry and Physics 11, no. 9 (May 3, 2011): 4039–72. https://doi.org/10.5194/acp-11-4039-2011

[5] Smith, Kirk, R. Uma, V. V. N. Kishore, K. Lata, V. Joshi, Junfeng Zhang, R. A. Rasmussen, and M. A. K. Khalil. "Greenhouse Gases From Small-Scale Combustion Devices In Developing Countries Phase IIa: Household Stoves In India." Research Triangle Park, NC: US Environmental Protection Agency, June 2000.

[6]IPCC. Guidelines for National Greenhouse Gas Inventories: Reference Manual. 1996.

[7]Fleming LT, Weltman R, Yadav A, et al. Emissions from village cookstoves in Haryana, India, and their potential impacts on air quality. Atmos Chem Phys. 2018;18:15169–15182.

[8]Stockwell CE, Christian TJ, Goetz JD, et al. Nepal Ambient Monitoring and Source Testing Experiment (NAMaSTE): emissions of trace gases and light-absorbing carbon from wood and dung cooking fires, garbage and crop residue burning, brick kilns, and other sources. Atmospheric Chemistry and Physics. 2016;16:11043–11081.

[9]Akagi SK, Yokelson RJ, Wiedinmyer C, et al. Emission factors for open and domestic biomass burning for use in atmospheric models. Atmospheric Chemistry and Physics. 2011;11:4039–4072.

[10]The Earth's Energy Budget, Climate Feedbacks and Climate Sensitivity, Table 7.15 in AR6 WG1 Chapter 7. https://doi.org/10.1017/9781009157896.009

Appendix 6: Requirements and Best Practices for Baseline and Project Surveys

Overview
Surveys are an integral part of the CLEAR methodology for developing the baseline scenario ex-ante, conducting a baseline Kitchen Performance Test (KPT) ex-ante, measuring usage annually, and completing a project KPT bi-annually.

This Appendix provides:

- General guidance on conducting high quality surveys;
- Resources with sample questionnaires related to clean cooking; and
- Particular instructions for each required survey.

Requirements and guidance for selecting samples of appropriate size and representativeness can be found in Appendix 10.

General Survey Requirements and Guidance
All surveys undertaken for CLEAR must be conducted by trained enumerators. Best practice is for these enumerators to be independent of the project proponent's organization. At a minimum, enumerators must not be engaged in a customer-facing role for the project proponent or its implementation partners, such as selling, marketing, distributing, or providing customer service for project technologies.

Before conducting surveys, the project proponent must ensure that relevant local authorities and community leaders have been consulted. All laws for the jurisdiction must be followed, and local customs should also be respected.

Wherever possible, all surveys should be conducted using an electronic platform with built-in quality checks.

All surveys should be conducted with the main household cook, who must give her informed consent prior to the start of the interview. Consent must be documented as part of the survey form. If cultural or domestic constraints require that the interview be conducted with someone else, the main cook should be present at the interview, and the enumerator should endeavor to vet the answers with her. If the main household cook is a dependent child, both the child and their guardian must provide consent and be present for the interview.

If the enumerators do not speak the local language fluently, an interpreter must be brought in to assist with administration of the questionnaire.

Surveys should be as concise as possible. Enumerators must provide a realistic estimate of the time needed to complete the survey, and efforts should be made to schedule interviews at times that minimize disruptions to the household.

Retrospective questions should ask the cook to report on their activities on a certain day, commonly "yesterday," as this approach has been shown to be more accurate than asking interviewees to aggregate or approximate their activities over a longer period of time, such as “last week.”

The methodology uses the term “cooking event” to refer to any occurrence where useful energy is delivered from a cookstove to fulfill a discrete task or set of tasks, such as cooking a meal (which may include multiple dishes), preparing tea, or heating water for bathing. Surveys undertaken for CLEAR should use similar language, and project proponents must ensure that respondents include all types of tasks conducted using their cookstoves in their responses.

General guidance on conducting high quality surveys in the low- and middle-income country (LMIC) context can be found in the following documents:

- Household Sample Surveys in Developing and Transition Countries
- Designing Household Survey Samples: Practical Guidelines
- WHO WORLD HEALTH SURVEY SURVEY MANUAL
- Siwatu,Gbemisola Oseni; Palacios-Lopez,Amparo; Mugera,Harriet Kasidi; Durazo,Josefine. *Capturing What Matters : Essential Guidelines for Designing Household Surveys (English).* LSMS Guidebook Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/381751639456530686

Specific survey guidance and tested questions relating to various aspects of household energy patterns and transitions, including cooking carbon projects, can be found in the following resources. Not all questions may be relevant for CLEAR application.

- Guidance on survey design from the authors of Gill-Wiehl, A., Kammen, D.M. & Haya, B.K. Pervasive over-crediting from cookstove offset methodologies. Nat Sustain 7, 191–202 (2024). https://doi.org/10.1038/s41893-023-01259-6
- Gold Standard’s MECD Survey Questionnaire
- Gold Standard’s TPDDTEC Survey Questionnaire
- Clean Cooking Alliance’s Fuel Stacking Toolkit

Baseline Scenario Survey

Purpose:

- Establish household size;
- Identify cooking fuels and technologies used;
- Document the percentage of cooking events carried out on each fuel-technology combination;
- Capture seasonal or other variation in the percentage of cooking events carried out on each fuel-technology combination over the course of one year; and
- Understand the impact of space heating on fuel consumption (if any).

Project proponents are required to incorporate the resulting information on seasonal or other variations in fuel use into their monitoring plan design and to justify on the Project Information Cover Sheet how the approach they are taking will result in accurate baseline and project fuel use measurements. If space heating is common in the project area, the justification must include an explanation of how space heating has been addressed in the project design. If an accurate approach cannot be taken, then the project proponent must instead select and justify a conservative approach.

Baseline and Project KPT surveys
Purpose:

- Track the number of people cooked for; and
- Document any unusual cooking events.

Usage Survey
Purpose:

- Determine the frequency with which the household uses the project technology in order to determine if the household may be counted as a user.
- Assess the types and characteristics of seasonal variations that may affect the project's emission reductions.

Usage survey results shall be corroborated with a visual inspection using a standardized checklist to assess if the project technology is present in the kitchen and shows signs of recent use. Enumerators must also take photographs with a Geographic Information System (GIS) and time record of all the cookstoves present in the household, as well as of the cooking area(s). The photographs must include both close-ups of each technology and its fuel (if present) and wider compositions showing the position of the cookstoves within or near the household.

Supplemental purpose of first usage survey administered for any given household

- Establish household size;
- Identify cooking fuels and technologies used prior to acquisition of project technology (retrospective baseline);
- Document the percentage of cooking events carried out on each fuel-technology combination used prior to acquisition of project technology (retrospective baseline);

This supplemental usage survey activity is used to check how well the project household characteristics match the ex-ante baseline scenario. Retrospective questions are added to the first usage survey conducted in any given household. To the extent possible, these retrospective questions should be identical to the questions in the baseline scenario survey, just asked retrospectively. Project proponents must identify any mismatch between the primary fuel type and household size documented during the baseline scenario and those reported by actual project households during the project roll-out (see Section 8 for further details).

Appendix 7: Requirements and Best Practices for Kitchen Performance Tests (KPTs)

Overview

The KPT is a field-based methodology used to estimate household fuel consumption under real-world conditions. Within the CLEAR methodology, the KPT serves as the primary tool for assessing fuel savings needed to calculate emissions reductions.

This document provides context for how the KPT protocol should be applied in the CLEAR methodology. It refers to the latest version of the KPT protocol available on the CCA website at https://cleancooking.org/protocols. Where guidance provided here conflicts with the directives of the KPT protocol, guidance here should be followed for projects using CLEAR.

Sampling Requirements

Projects must meet the 95/10 precision guideline for the total energy consumption (TJ/(person*year)) for the project and baseline KPTs or use the conservative 95% confidence bound that results in the lower emissions reduction estimate.

For baseline and project KPTs, households shall be selected from the group of households included in the baseline scenario survey and project usage surveys, respectively. Households are anticipated to be statistically similar to those of the larger surveys and must be within 10% of the household size and proportion of cooking done with the primary fuel for the respective baseline and project scenarios. If either of these conditions are not met, the project will conduct additional sampling until these conditions are met. This requirement is separate and additional to checking that the baseline scenario is representative of the project scenario (see Section 8 of the methodology). For the project scenario, sampling shall be stratified across technology ages to ensure representative results.

Given that simple random sampling may result in impractical logistics for four days of consecutive household visits, a household may be excluded if all of the following conditions are met:

1. The household requires more than one hour of transportation from the next nearest household in the sample;
2. The households in the area where the samples are excluded can be demonstrated to be similar in household size, fuel use type, and energy demand; and
3. The total number of excluded households is not greater than 10% of households initially selected for the KPT sample.

Measurements and Sample Integrity

<u>Scale Checks</u>

- Scales must be checked with a certified calibration weight (5–20 kg) at least weekly during field campaigns and results of calibration checks clearly recorded to facilitate verification by Validation and Verification Bodies (VVBs).

- The scale must be accurate within 1% of the calibration mass.
- If a scale fails a check, any data collected since the last successful check must be excluded from the analysis.

<u>Accounting for Wood Moisture</u>

- Default energy conversions assume air-dried wood (~20% moisture, wet basis) with a Net Calorific Value (NCV) of 0.0156 TJ/tonne.
- This NCV should be applied to wood quantities before making any moisture adjustments.
- While NCV assumptions provide a standardized approach, it is best practice to measure actual moisture content, particularly to:
    - Identify potential outliers
    - Assess seasonal variations in fuel characteristics

Fuel provision

Because providing fuel to households can introduce substantial bias, fuel should not be provided to households for use during the KPT in most cases.

In situations where households normally collect their fuel (e.g., wood, crop residues, dung) daily and are not able to collect and store a full day's fuel in advance, project proponents may provide fuel for the KPT under the following conditions:

- The number of households that are unable to collect and store a full day's fuel in advance must comprise more than 40% of the KPT sample; otherwise, those households should simply be excluded from the sample.
- Where fuel is provided, the household must be identified as having been provided fuel, and a 20% discount must be applied to the fuel consumption measured for that household during the baseline KPT.
- The amount of fuel provided must not exceed 30 MJ/(person*day) (approximately 2kg/(person*day)).
- If fuel is provided to a household for the baseline KPT, the same amount of fuel must also be provided to that household for the project KPT.

For households where the primary fuel is purchased in discrete quantities, and it is impractical to store three times the amount typically used in a day, projects must follow the KPT protocol guidance for fuel purchases and estimate weights accordingly.

Alternatively, rather than providing fuel, project proponents may use fuel-weighing sensors that measure fuel consumption in real-time. This option may be used for any KPT, regardless of household fuel constraints.

Data Quality and Outlier Handling

<u>Outliers Identification and Exclusion Criteria</u>

Outliers shall be defined as data points that fall beyond 1.5 times the interquartile range (IQR) from its endpoints. Outliers may only be excluded if there is a clear, documented reason for their removal. Any excluded data must be retained along with an explanation. Acceptable reasons for exclusion are:

- Data entry errors;
- Documented unusual events (e.g., party, non-household members using the cookstove); or
- A per capita fuel consumption >175 MJ/(person*day) for any single day (equivalent to ~10 kg of wood/(person*day)).

Minimum Data Requirements

- Only households with at least three complete days of data may be included in the analysis.
- These three days do not need to be consecutive if:
    - Some data are missing due to measurement failures; and
    - Additional visits were conducted to compensate.
    - All data collection must occur within a two-week period.

CTEC KPT considerations

The CTEC KPT approach for determining energy consumption in the project scenario requires quantifying the energy consumption of all technologies used in the project scenario based on a project KPT. The project must use metered energy consumption data for the project technology/fuel specific to the KPT period where available.

Where metered energy consumption is not available specific to the KPT period, the traditional fuel-weighing KPT approach must be used. Fuel-weighing must always be used for fuel consumption based on sales tracking data.

Appendix 8: Requirements and Best Practices for Controlled Cooking Tests (CCTs)

Overview
The CCT is a field test used to measure cookstove performance in a controlled setting using local fuels, pots, and cooking practices, with local cooks preparing a pre-determined local meal, which may include multiple dishes.

Within the CLEAR methodology, the CCT is used to assess the specific energy consumption of both baseline and project cookstoves, the ratio of which is used to back-calculate displaced baseline energy consumption in continuously tracked energy consumption (CTEC) projects.

This document provides context for how the CCT protocol should be applied in the context of the CLEAR methodology. It refers to the latest version of the CCT protocol available on the CCA website at https://cleancooking.org/protocols. Where guidance provided here conflicts with the directives of the CCT protocol, guidance here should be followed for projects using CLEAR.

Sampling Requirements
To ensure robust and representative data collection for the CCT within the CLEAR methodology, the following sampling and testing requirements must be adhered to.

1- ***Selection and Testing of Baseline and Project Cookstoves***
- Baseline technologies must be tested in order to be included in baseline fuel consumption displacement. Untested baseline technologies shall not be included in calculating displaced fuel consumption. For example, if project surveys indicate that a baseline technology accounts for 10% of cooking events and the project does NOT conduct a CCT with that baseline technology, then the 10% displacement that would have been attributed to that baseline technology is disregarded and not included in the back calculation, nor is it redistributed to the other cookstove types, resulting in a lower baseline than could otherwise be claimed;
- The most common type of a given type of baseline cookstove should be selected (see section on cookstove types below). For example, if there are multiple simple open-fire cookstove types (e.g., three-stone fire or U-shaped mud cookstove), the most common, representative type should be chosen. This selection should be made as part of the process with project area cooks to determine the standard meal, per the CCT protocol;
- At least three samples of each baseline cookstove type must be tested to account for inter-stove type variability;
- Each cook must prepare at least three meals per baseline cookstove type (at least one on each baseline cookstove type sample) to capture variability in performance.
- All project technologies must be tested.
- When CCTs are conducted as part of ongoing project monitoring, including to account for any degradation over time, then at least three cookstoves per

vintage randomly sampled from project households, should be tested (households should receive a new replacement cookstove).

2- ***Selection of Cooks***

- At least three local cooks, who are unfamiliar with each other and reside in different locations within the project area, shall be recruited for testing;
- Cooks recruited for testing must not be affiliated with the project beyond their participation in the CCTs. Ideally, they would not be project participants, but if they are they must not receive any special treatment beyond what is required for the CCT. All cooks may be compensated for their time and travel for the CCT testing;
- The cooks should be familiar with and comfortable cooking on all of the baseline cookstove phenotypes;
- If any of the cooks do not yet have the project cookstove, they should be given one to use at their household for a minimum of two weeks before starting the CCT. They should be given the same training and support (and no extra) that regular project participants receive; and
- Ideally, the same cooks should be used for the initial CCTs conducted during the validation phase and for subsequent project monitoring periods. If not possible, alternate cooks may be selected using the same criteria as above.

Testing Matrix and Precision Guidelines

The figure below represents the minimum required testing configuration for a CCT given the set of stoves listed above. Each of the three cooks should conduct an equal number of tests across all cookstove types. The cookstove types included in the example below are:

- CTEC cookstove (e.g., electric, LPG, ethanol, or biogas cookstove);
- LPG cookstove (baseline);
- Charcoal cookstove (baseline); and
- Simple wood cookstove (baseline, e.g., three-stone fire or mud cookstove).

To minimize bias, cookstove models should be rotated systematically so that no cook follows the same sequence repeatedly.

As shown in the example below (Figure 1), each set of three tests is conducted simultaneously, with Cook 1, Cook 2, and Cook 3 testing different cookstoves at the same time. The cookstove type order changes for each test block to ensure that no cook consistently follows the same cookstove sequence.

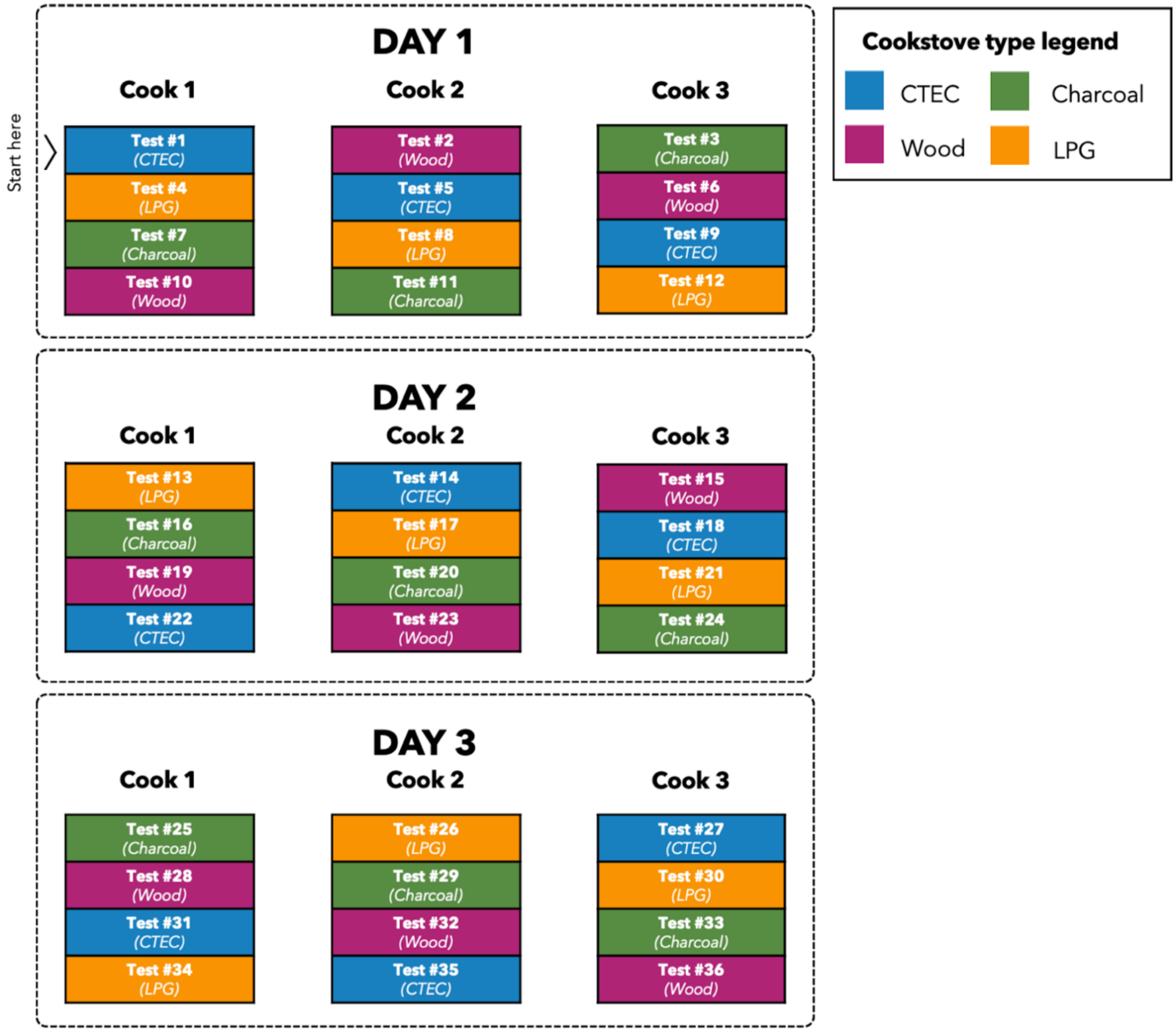

Figure 1. Minimum Testing Configuration and Example Schedule for CCT.

Measurements and Sample Integrity

Scale Checks

- Scales must be checked with a certified calibration weight (5–20 kg) daily during the testing campaign;
- The scale must be accurate within 1% of the calibration mass; and
- If a scale fails a check, any data collected since the last successful check must be excluded from the analysis.

Data Quality and Outlier Handling

Outliers Identification and Exclusion Criteria

Outliers shall be defined as data points that fall beyond 1.5 times the interquartile range (IQR) from its endpoints. Outliers may only be excluded if there is a clear, documented reason for their removal. Any excluded data must be retained along with an explanation. Acceptable reasons for exclusion are:

- Data entry errors;
- Documented unusual events (test was interrupted, weather impacts, etc.); and
- A cook reports a problem with the specific test.

Minimum Data Requirements

- There must be equal numbers of successfully completed CCTs for each cook-technology combination; and
- A minimum of three cooks and three repeated CCTs per cook-technology combination must be completed.

Classifying Baseline Cookstove Types

Baseline cookstoves can be categorized into distinct types based on their physical structure. This classification helps standardize the selection of representative cookstove models for performance testing and emissions reduction calculations. The types described here are common examples found in many regions, but they are not exhaustive. Different contexts, geographies, and cultural cooking practices will influence the specific baseline cookstoves used in a given project.

Project proponents must identify and justify the most appropriate types for their specific setting, ensuring that selected models accurately represent the prevailing baseline cooking technologies. These types should be used as the basis for testing fuel consumption, thermal efficiency, and emissions when establishing baseline parameters.

Examples of Common Wood Cookstove Types

1. Three-Stone Fire
    - A setup using three stones or bricks arranged in a triangular shape to support a cooking pot, with an open fire in the center.
    - Materials: Natural stones, bricks, or compacted earth.
2. Sunken Pit Cookstove
    - A shallow pit dug into the ground where wood is burned.
    - Materials: Bare earth or reinforced with clay.
3. U-Shaped Mud Cookstove
    - A simple mud or clay structure in a U-shape, designed to hold a pot over an open fire.
    - Materials: Locally sourced mud or clay, sometimes reinforced with straw.
4. Traditional Chulha/Chulho
    - Cookstove A raised, built-in clay or brick cookstove with one or more burner holes for pots.
    - Materials: Clay, bricks, or mud, sometimes with cow dung.
5. Plancha Cookstove (Traditional)
    - A raised clay or metal cookstove with a flat griddle (plancha) for cooking tortillas or flatbreads.
    - Materials: Clay, bricks, metal griddle.

Examples of Common Charcoal Cookstove Types

1. Metal Bucket Cookstove

- A metal bucket or shallow metal bowl with ventilation holes at the bottom and a top grate for placing charcoal.
- Materials: Sheet metal, iron, steel.

2. Ceramic-Lined Charcoal Cookstove
   - A metal bucket cookstove with a ceramic liner inside for heat retention and insulation.
   - Materials: Sheet metal exterior with a ceramic inner lining.
3. Clay Pot Cookstove
   - A clay vessel with an opening for airflow and a flat surface for a cooking pot.
   - Materials: Fired clay or terracotta.

Appendix 9: Requirements and Best Practices for Stove Use Monitors (SUMs)

In the context of the CLEAR methodology, non-continuously tracked energy consumption (non-CTEC) projects may choose from two approaches to determine energy consumption in the project scenario, differentiated by application (or non-application) of SUMs, which correspond to two different methods for accounting for the Hawthorne Effect.

When projects complement Kitchen Performance Tests (KPTs) and surveys with SUMs measurements, the ratio of project technology usage (cooking events/day) measured during the KPT to project technology usage measured during the month prior to or following the KPT is used as a multiplier in the emission reduction estimate calculation (only when that value is less than 1).

When projects measure fuel consumption through KPTs, complemented by usage surveys only without SUMs, maximum emission reductions are capped at 75% of the KPT-based estimate to account for the Hawthorne Effect (the equivalent of a 75% ratio of project technology usage described above).

Project proponents opting to use the SUMs method must place SUMs on the project cookstoves for the duration of the KPT, as well as for the contiguous 30 days (before, after, or any combination of before and after) to serve as a reference point.

SUMs may also be used to characterize the primary fuel-stove combination usage for identification of a potential mismatch between the baseline and project scenario profiles or to determine the proportion of cooking done on baseline cookstoves for back-calculating the baseline energy consumption ($tPC_{b,i}$).

This appendix provides requirements and best practice guidance for using SUMs within the CLEAR methodology.

Requirements for the Use of SUMs in the CLEAR Methodology

- The algorithm for estimating cookstove usage must be able to reliably distinguish cooking events from other potential factors that could be interpreted as cooking events but that are actually caused by external circumstances (e.g., temperature fluctuations from typical diurnal patterns). The algorithm shall be clearly presented publicly with associated equations and/or logic rules, such as publishing on GitHub, in a paper, or on a website.
- The same algorithm and SUM device type shall be used for the duration of the project.
- Sampling must meet the 95/10 precision guidelines, per the sampling guidance included in Appendix 10.
- SUMs sampling protocols (installation, placement, downloading) and the algorithm used to convert raw data into cooking events must not change

between sampling during the KPTs and sampling prior to or following the KPTs.

- Project participants in the SUMs sample shall not receive any support different or additional to those not included in the sample.
- Project proponents shall ensure that photographs of the SUMs placement in each sampled household are taken and retained as part of the monitoring record.
- The average of the cooking events per day during the full 30 days of cookstove use monitoring must be used to adjust for potential Hawthorne Effects. If SUMs data is incomplete or missing, it must be omitted from the analysis.

Additional Requirements for the Use of SUMs to characterize fuel-stove use proportions

- If SUMs sampling is being used to characterize the primary fuel-stove combination usage for identification of a potential mismatch between the baseline and project scenario profiles ($PC_{b,i}$) and ($PC_{p,j}$), or for determination of proportion of cooking done on baseline cookstoves for back-calculating the baseline energy consumption ($tPC_{b,i}$), the following guidelines must be followed:
    - The guidance in the above bullet points must be followed, including the sample size guidance in Appendix 10
    - SUMs must be placed on all cookstove-fuel combinations (in each household) that are to be included in the baseline.

Best practice guidance for using SUMs

Installation

Project proponents should follow manufacturer installation requirements (if provided) for the SUMs instrumentation being used. Unless specifically indicated otherwise, placement of the device should generally follow these key guidelines.

- The project cookstoves' temperature profiles during cooking events should be analyzed before the field campaign to determine optimal placement.
- Temperature sensors and loggers should not be placed in a location where temperatures exceed their maximum operating/sensing temperature specifications.
- Sensor placements should provide a maximum temperature differential between ambient and cookstove temperature (without exceeding maximum operating temperature for the sensor).
- Cookstoves and sensing units (e.g., thermocouple leads) should be kept out of direct sunlight when possible to reduce sensors logging the radiant heat of the sun, which can be confounded with cooking.
- Sensor placement must be standardized as much as possible across the sample.
- Sensor placement should not get in the way of the pot, or obstruct or interrupt the cooking, or be located where liquids are likely to collect or boil over.

- Sensor placement should not interfere with participants' normal activities. Placement should also minimize risk of the sensor being accessed, moved, and/or damaged by participants, other people, or common household features, such as water, insects, or animals.
- Project proponents should explain to household members that the SUMs are for measuring temperature and should not be tampered with. Household members should not press buttons, move parts, or disconnect or connect the sensors to computers or power.

Cookstove Temperature Analysis

Project proponents should follow manufacturer guidelines for data analysis[17] where available. Unless specifically indicated otherwise, analysis should generally follow these key guidelines.

- Subtracting ambient temperature generally improves the ability to resolve a temperature response during cookstove events from normal diurnal and seasonal temperature variation.
- Perform validation or sense checks on the algorithms used to determine cookstove use. These can include:
    - Having a person with expertise manually inspect at least a subset of analyzed files to check that the algorithm is determining apparent cooking events as intended.
    - Cross-referencing observational data on cooking events with the analyzed data.
    - Using common sense checks with what is generally known about cooking behaviors in the region. For example, if only one cooking event per week is being estimated when it's known that people are using several kg of fuel every day, the placement or algorithm are not working properly.

[17] Of note, data analysis can be challenging for cookstoves that are frequently moved indoors and outdoors for cooking, due to solar radiation affecting heating and cooling rates, so piloting placement of temperature monitors or probes is critical for such applications.

Example photos of SUMs placement.

Appendix 10: Sampling Requirements and Best Practices for Surveys, Kitchen Performance Tests (KPTs), Controlled Cooking Tests (CCTs), and Stove Use Monitors (SUMs)

This appendix supports project proponents in planning sample sizes for data collection and ensuring that monitored parameters meet required precision standards. Specifically, it addresses the 95/10 precision guideline, which stipulates that sample sizes must be sufficient to achieve 95% confidence interval is less than 10% of the mean estimate. If a monitored parameter estimate does not meet precision guideline, then additional sampling must be conducted or the confidence bound that results in a lower emission reduction estimate must be applied.

The appendix is structured into four components. First, it presents sampling method approaches. Next, a table outlining the monitored parameters that require sample size determination, including their descriptions, data sources, and applicable rules. This table provides direction on which sampling guidance section to follow for each parameter. The third section focuses on proportional parameters, such as the proportion of cooking conducted using a primary fuel, detailing methods for determining sample sizes. The last section provides guidance for continuous variables, such as baseline energy consumption, incorporating statistical approaches for variables with skewed normal distributions.

Sampling Methods

Two sampling approaches are used in the CLEAR methodology: Simple Random Sampling and Cluster Random Sampling. The choice between these methods depends on the characteristics of the target population and logistical considerations.

Simple Random Sampling

- Each household in the population has an equal probability of being selected.
- Suitable when the population is relatively homogeneous, such as within the same climate zone or socio-economic setting.
- Provides unbiased estimates.
- Can be costly and time-consuming, particularly if the population is spread over a large geographical area.

Cluster Random Sampling

- The population is divided into clusters, such as villages or communities, and a random selection of clusters is made. All or a subset of households within selected clusters are then sampled.
- Useful when the population is widely dispersed, reducing costs and logistical challenges.
- More efficient for large-scale studies but requires adjusting for the intraclass correlation coefficient (ICC), which measures the degree of similarity between households within the same cluster. A high ICC indicates that households within a cluster are more alike, meaning that the effective sample size is smaller than the actual number of observations, often

requiring an increase in the number of clusters to achieve the desired precision.
- Assumes that each cluster represents the overall population, which may introduce bias if clusters are highly variable.
- The design and calculations for this approach are more complex. Projects applying cluster sampling must involve someone with sufficient statistical expertise to ensure appropriate design, analysis, and interpretation.

Parameter	**Description**	**Unit**	**Data source**	**Rule and guidance**	**Reference section for guidance**
$tPC_{b,i}$	For CTEC back-calculated baseline projects: Proportion of cooking events conducted using baseline fuel-stove combinations *i*	Percentage	Baseline scenario surveys or SUMs	95/10 for the primary cookstove-fuel combination. Minimum 200 households	Proportional distribution
$PC_{b,i}$	For non-CTEC and CTEC with KPT projects: Proportion of cooking events conducted using baseline fuel *i*	Percentage	Baseline scenario surveys or SUMs	95/10 for the primary fuel type Minimum 200 households	Proportional distribution
$PC_{p,j}$	For non-CTEC and CTEC with KPT projects: Proportion of cooking events conducted using project fuel *j*	Percentage	Project usage surveys or SUMs	95/10 for the primary fuel type Minimum 200 households	Proportional distribution
H_s	Average household size	Persons per household (Number)	Baseline and project usage surveys	95/10 Minimum 200 households	Continuous distribution

$\sum EC_{base,i}$	Total energy consumption of baseline fuels (*i*) non-CTEC projects (summed over all fuels used in households)	TJ/(person*year)	KPT		95/10 Minimum 50 households	Continuous distribution
$\sum EC_{proj,j}$	Total energy consumption of project fuels (*j*) non-CTEC projects (summed over all fuels used in households)	TJ/(person*year)	KPT		95/10 Minimum 50 households	Continuous distribution
$SC_{b,i}$	Specific energy consumption of a baseline fuel-stove combination *i* to cook a given amount of food	MJ/kg food	CCT		95/10 Minimum 9 CCTs per cookstove type	Continuous distribution
$SC_{p,j}$	Specific energy consumption of a project fuel-stove combination *j* to cook a given amount of food	MJ/kg food	CCT		95/10 Minimum 9 CCTs per cookstove type	Continuous distribution
$\sum tEC_{base,KPT,i}$	Total energy consumption of baseline fuels (*i*) for CTEC projects from KPT	TJ/(person*year)	KPT		95/10 Minimum 50 households	Continuous distribution

$\sum tEC_{proj,KPT,j}$	Total energy consumption of all fuels in project scenario (*j*) for CTEC projects from KPT	TJ/(person*year)	KPT	95/10 Minimum 50 households	Continuous distribution
PTC_m	Average project technology cooking events per day over 1 month from SUMs measurements	Cooking events/day	SUMs	95/10 Minimum 50 households	Continuous distribution
PTC_{KPT}	Average project technology cooking events per day over the project KPT from SUMs measurements	Cooking events/day	SUMs	95/10 Minimum 50 households	Continuous distribution
$\Psi_{Survey,y}$	Percent of project households with cookstoves present and used at least once per week	Percentage	Project usage survey	95/10 Minimum 200 households	Proportional distribution

Sample Size Guidance: Continuous Variables

<u>Estimation of Required Sample Size</u>
To estimate the required sample size for continuous variables, users must first determine the coefficient of variation (CoV), which represents the variability of the data relative to the mean. The lookup table provided applies only to simple random sampling and assumes a normally or skew-normally distributed variable. If users do not have prior data to estimate CoV, they should conduct a small pilot study to generate an approximation. Additionally, users should plan for oversampling to account for potential data loss due to non-responses, measurement errors, or incomplete records, ensuring that the final sample size meets the precision requirement.

For cluster sampling, where participants are grouped into clusters such as villages or communities, the required sample size will be larger than in simple random sampling due to intra-cluster correlation. This means that the effective sample size is smaller than the actual number of observations. In such cases, design effects must be accounted for, and sample size determination should be conducted with the assistance of a statistician.

Simple Random Sampling: CI: 95%	
CV(%)	***Relative Precision***
	10%
5	25
10	25
15	25
20	25
25	30
30	40
35	55
40	75
45	90
50	110
55	135
60	160
65	190
70	215
75	250
80	285
85	320
90	355
95	400
100	440

Determination of Meeting Precision Guidelines

Once data collection is complete, users must verify whether the achieved sample size meets the 95/10 precision guideline. This requires calculating the actual CoV from the collected data and confirming that the confidence interval is within 10% of the mean estimate. Project proponents should utilize the **sample size calculator** to determine whether their sample meets the required precision and the 95% confidence bounds that result in lower emission reductions estimates if precision guideline is not met.

For **cluster sampling**, meeting the precision requirement is more complex due to the need to adjust for design effects. In such cases, a statistician should evaluate whether the collected data meets the required confidence and precision levels. If the required precision is not met, the conservative confidence bound must be applied, or additional sampling may be needed.

Sample Size Guidance: Proportional Variables

Estimation of Required Sample Size

To estimate the sample size for proportional variables (e.g., the proportion of homes using primary fuel), users must first determine an expected proportion for the population. This can be based on prior research, survey data, or a pilot study. The lookup table provided is only applicable to simple random sampling and assumes a binomial distribution.

95% CI: Simple Random Sampling	
Prevalence (%)	**Precision**
	10%
10	35
15	49
20	61
25	72
30	81
35	87
40	92
45	95
50	96
55	95
60	92
65	87
70	81
75	72
80	61
85	49
90	35

As with continuous variables, oversampling is necessary to account for expected data loss due to incomplete responses or participant dropouts. For cluster sampling, the required sample size will be larger due to intra-cluster correlation, meaning the actual number of surveyed participants must exceed the effective sample size. In such cases, a statistician should be consulted to correctly adjust for design effects.

Determination of Meeting Precision Guidelines

Once the survey is completed, users must verify that the achieved sample meets the 95/10 precision requirement by calculating the actual proportion and confirming that the confidence interval remains within 10% of the estimated proportion. Project proponents should utilize the **sample size calculator** to determine whether their sample meets the required precision and the 95% confidence bounds that result in lower emission reductions estimates if precision guideline is not met.

For cluster sampling, verification of precision must account for the design effect, which reduces the effective sample size. This requires statistical expertise, and a statistician should be involved in determining whether the collected sample meets the required confidence and precision levels. If precision is not met, additional sampling or conservative confidence bounds should be applied.