METHODOLOGY

REDUCED EMISSIONS FROM COOKING AND HEATING:

Technologies and Practices to Displace Decentralized Thermal Energy Consumption (TPDDTEC)

SDG 13

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SUMMARY

This methodology is applicable to project activities that introduce technologies and/or practices that reduce or displace greenhouse gas (GHG) emissions from the thermal energy consumption of households and/or residential, institutional, industrial, or commercial facilities. It is a revised version of the Technologies and Practices to Displace Decentralized Thermal Energy Consumption (TPDDTEC) v3.1 methodology.

This methodology shall be used in conjunction with the GHG Emissions Reduction & Sequestration Product Requirements and projects and programmes applying this methodology may be issued with GSVERs.

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1| Definition

1.1.1 | For the purpose of this methodology, the following definitions apply:

a. **Continuous useful energy output**: 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, divided by the time of the operation of the cooking task.

b. **Double counting**: Occurs when the same emission reduction is used more than once to achieve mitigation obligations, as a result of double-issuance, double-use, or double-claiming.

c. **Technical life**: Average time for which the project technology may continue to be operated for an extended period in a safe manner and with minimal loss of performance.

d. **Technology**: In this methodology, the single or multiple technologies and/or practices applied in the project activity that result in emission reduction.

2| Scope, Applicability, and entry into force

2.1 | Scope

2.1.1 | This methodology is applicable to project activities that introduce technologies and/or practices that reduce or displace greenhouse gas (GHG) emissions from the thermal energy consumption of households and/or residential, institutional, industrial, or commercial facilities. Throughout the methodology the term 'technology' should be read as the single or multiple technologies and/or practices applied in the project activity. Refer to Table 1 for examples of applicable technologies and practices.

2.1.2 | Where there is no installation of improved devices and project claims emission reductions from improved practices only, project shall provide a detailed discussion of the chosen monitoring approach to demonstrate that quantified emission reductions result exclusively from the practices introduced by the project activity.

2.1.3 | Project may involve progressive distribution of technology where implementation of the technology may occur in a gradual manner and adoption can increase over the project's crediting period.

Table **1** : Examples of applicable technologies and practices

Technology	Applicable emission reduction calculation Method (refer to Section 3.10 below for details)
Improved biomass cookstoves	Method 1, 2
Improved solid fossil fuel cookstoves or other improved fossil fuel cookstoves meeting certain conditions[1], where only emission reductions from efficiency improvement are eligible;	Method 3
Ovens, dryers, space heaters (solar);	Method 3
Ovens, dryers, space heaters (non-solar);	Method 1 or 3
Water heaters (solar);	Method 3
Water heaters (non-solar);	Method 1 or 3
Heat retention cookers;	Method 1 or 3
Solar cookers;	Method 3
Practice	
The improved application of the technologies in the above rows, for example improved storage and drying of fuels leading to better efficiency of cookstoves due to lower humidity fuels.	Method 1

2.2 | Applicability

2.2.1 | The methodology is applicable under the following conditions:

a. Project shall choose a technology design that has predictable performance in that it is proven to be efficient and durable under field conditions; for cookstoves, the rated thermal efficiency shall be at least 20% (see Parameters ICS 1).

b. The technology shall have continuous useful energy output of less than 150kW per unit, where "continuous useful energy output" is defined above (see Parameter ICS 2).

c. The project activity is implemented by a project developer and can include additional project participants listed in Appendix 2 of the PDD template. The individual households and institutions may be represented collectively

[1] Only applicable to liquid and gaseous fossil fuel cookstoves when these pertain to Gold Standard projects that were submitted for Gold Standard Design Certification prior to the date of publication of this methodology. Existing projects that were already registered may continue using this methodology until the end of their crediting period.

by community organizations, etc., but do not individually act as project participants.

d. The project developer must design incentive mechanism(s), which should be effective as fast as possible, for the elimination of inefficient baseline stoves that are replaced by the project cooking devices and describe the incentive mechanism(s) in the PDD/VPA-DD at the time of validation.

e. To avoid double counting or double claiming, the project developer must:

   i. clearly communicate its ownership rights and intention of claiming the emission reductions resulting from the project activity to the following parties by contract or clear written assertions in the transaction paperwork: all other project participants; project technology manufacturers; and retailers of the project technology or the renewable fuel in use; and

   ii. inform and notify the end users that they cannot claim emission reductions from the project, and

   iii. exclude from the project activity, cooking devices included in any other voluntary market or CDM project activity/PoA, and strive not to displace the cooking devices of another CDM or voluntary project/PoA. See data and parameters not monitored, Avoidance of double counting or double claiming with other mitigation actions, for details on this demonstration.

f. Project activities making use of solid fossil fuel in the project scenario or other improved fossil fuel cookstoves meeting certain conditions described in the footnote to Table 1 (e.g. switch from three-stone fire biomass stoves to LPG stoves) may only claim emission reductions for energy efficiency improvement aspect and shall assume the same baseline and project fuel for emission reduction calculations.

g. Project activities making use of a new solid biomass feedstock in the project situation (e.g. switch to green charcoal or renewable biomass briquettes) must comply with relevant specific requirements for biomass related project activities, as defined in the latest version of the Community Services Activity Requirements. The specific requirements apply to both plantations established for the project activity and/or existing plantations that will supply biomass feedstock.

h. Adequate evidence is supplied to demonstrate that indoor air pollution (IAP) levels are not worsened compared to the baseline, and greenhouse gases emitted by the project fuel/stove combination are estimated with adequate precision[2]. Furthermore, for projects where cooking will move from outdoor to indoor or where the project technology reduces ventilation (for example, changing from a stove with chimney to improved stove with no chimney), indoor air pollution (IAP) levels shall not worsen in the project compared to the baseline, including PM 2.5 and carbon monoxide (CO) emissions. This may be demonstrated before project Design Certification or during project operation using the certification resulting from of a manufacturer's test, report of field testing of the technology's PM 2.5 and carbon monoxide (CO) emissions, report of lab testing of the technology, or results of modelling of the technology's operation under field conditions. If none of these are available, reference from published literature or report by independent agencies may be used as evidence, provided it is not more than 5 years old.

To make claims on SDG 3.9.1 contributions, the project developer may apply the Gold Standard Methodology to Estimate and Verify ADALYS from Clean Household Air.

2.3 | Safeguards

2.3.1 | The project shall not undermine or conflict with any national, sub-national or local regulations or guidance for thermal energy supply or fuel supply or use. The project shall document the national, regional and local regulatory framework for provision of thermal energy services of the type the project provides in the project boundary (parameter ICS 7).

2.3.2 | If the expected technical life of project technology (parameter ICS 3) is shorter than the crediting period, the project developer shall describe measures to ensure that end users are provided replacement technology of comparable quality at the end of the technical life, by either replacing with comparable or better technology, or retrofitting essential parts with performance guarantee. If neither of the prior conditions can be demonstrated, no emission reductions can be claimed for the technology after its technical life has ended.

2.4 | Entry into force

2.4.1 | The date of entry into force of this methodology is 07 January 2022.

[2] The project developer must provide protocols for comparative field tests, which credibly reflect (to similar level of precision as required in this methodology otherwise) the baseline and project scenarios in respect of IAP and GHG levels.

3| Baseline Methodology

3.1 | Project Boundary

3.1.1 | Project developer shall provide clear definitions of project boundary, target area, and fuel production and collection area:

a. The project boundary is the physical, geographical sites of the project technologies/practices including the fuel collection and production area.

i. Where the baseline fuel is woody biomass (including charcoal), the project boundary also includes the area within which this woody biomass is grown and collected.

ii. For projects using processed fuels, this boundary also includes the baseline and project fuel production (e.g. charcoal, plant oil) and solid waste and effluents disposal or treatment facilities associated with fuel processing.

iii. In cases where the project activity introduces the use of a new biomass feedstock into the project situation, the fuel production and collection area is the area within which this new biomass is produced, collected and supplied.

b. The target area is the region(s) or town(s) where the considered baseline scenario(s) are deemed to be uniform across political borders. This area could be within a single country, or across multiple adjacent countries. The target area provides an outer limit to the project boundary in which the project has a target population.

3.2 | Emissions sources included in the project boundary

3.2.1 | Emissions from fuels can occur during fuel production, transport and consumption.

a. Baseline emissions from any gases marked below may be omitted for simplification.

b. All project emissions from any of the gases marked below must be accounted for, unless demonstrably negligible or not applicable to the individual project.

c. Project emissions from transportation of fuel/biomass shall be accounted if the transportation distance (including both long-distance and home delivery transport) is more than 200 km; otherwise they can be neglected.

Table 2 : Emissions sources included in or excluded from the project boundary

Scenario	Source	Gas	Included	Justification/Explanation
Baseline scenario	Delivery of thermal energy	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Can be significant for some fuels
		CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions

	Production of fuel, transport of fuel	N_2O	Yes	Can be significant for some fuels
Project scenario	Delivery of thermal energy	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Can be significant for some fuels
	Production of fuel, transport of fuel	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Important source of emissions

3.3 | Demonstration of additionality

3.3.1 | The project developer must show that the project could not or would not take place without the presence of carbon finance. Possible reasons for the need for carbon finance may be that the initial investment or the on-going marketing, distribution, quality control and manufacturing costs are unaffordable for the target population.

3.3.2 | The project developer shall demonstrate additionality prior to project registration by conforming to additionality requirements of one of the options below,

a. Applicable GS4GG Activity Requirements;

b. CDM Tool 01 - Tool for the Demonstration and Assessment of Additionality;

c. CDM Tool 19- Demonstration of additionality of microscale project activities; (not applicable to Gold Standard microscale projects)

d. CDM Tool 21 – Demonstration of additionality of small-scale project activities; (applicable to small-scale projects only)

e. An approved Gold Standard VER additionality tool

3.4 | Baseline scenario

3.4.1 | The project developer shall define the baseline scenario as the existing baseline technology/practice use and fuel consumption patterns for the type of service provided by the project technology in the population targeted for adopting the new project technology, i.e., "target population".

3.4.2 | The selection and description of the baseline scenario must be informed by the **Baseline Scenario Survey** (see parameter ICS 1).

3.4.3 | All expected baseline and project scenarios shall be defined in the project documentation prior to validation and registration review.

3.5 | Selection and justification of the baseline scenarios

3.5.1 | The selection of the baseline scenario must be adequately described, with *all* technologies that may be replaced by the project technology considered, such as the presence and usage practices of multiple baseline technologies by the target population ("stove-stacking"). It is not legitimate to compare the project to only the most inefficient technology being used by the target population.

3.5.2 | Project developers must consider distinct baseline scenarios when the project activity targets end user populations that consume significantly different fuels. For example, end users cooking predominantly with wood are significantly different from end users cooking predominantly with charcoal and would thus warrant a different baseline scenario.

3.5.3 | When the project includes different project technology types, the project developer must analyse whether multiple baseline scenarios are applicable in relation to the different project technologies, depending on fuel type and baseline technology use patterns in target population. For example, one baseline scenario may represent rural end users predominantly using inefficient wood stoves, while a second baseline scenario may represent an urban target population predominantly using inefficient charcoal stoves.

3.5.4 | A different baseline scenario is not necessarily required for each different technology in the project activity. For example, different improved wood stove models in the project activity could be compared to the same wood stove baseline scenario, and different improved charcoal stove models in the project activity could be compared to the same inefficient charcoal stove baseline scenario.

3.5.5 | In a project activity where all units are installed at the start, or in a non-industrial project activity with gradual technology adoption, the baseline is considered fixed in time during the considered crediting period. It therefore does not require continuous monitoring or updating.

3.5.6 | In project activities targeting industrial applications [3] where the emission reductions occur within the industrial premises, a fixed baseline can only be considered for the expected remaining lifetime of the baseline devices as per the CDM tool 10 – Tool to determine the remaining lifetime of equipment. This baseline must be reassessed if emission reductions are claimed for the rest of the considered crediting period.

3.5.7 | In project activities targeting multiple distributed technologies e.g. improved cookstoves and oven technologies, cross-effect between the baseline and project scenarios including potential leakage must be accounted for. The purpose and scope of each technology shall be defined in the PDD, the

[3] Industrial applications are those having to do with the business of manufacturing products and involving a sale and distribution chain (e.g. food & beverage processing is considered an industrial application as long as the food or beverage are not sold and consumed at the production site as in the case for restaurants).

baseline scenario surveys should be carried out at the same time, and the baseline scenario shall be defined such that baseline fuel use is divided appropriately between the technologies.

a. For example, in case a Safe Drinking Water Supply (SWS) project were to be implemented in a household where an improved cookstove (ICS) had already been implemented, the baseline of the SWS project would have to consider the efficiency of the ICS in its baseline determination.

b. For example, in case an ICS is implemented in a household where a SWS project has already been implemented, then the SWS project should update its baseline to take into account the change in cooking technology.

3.6 | Project scenario

3.6.1 | The project scenario is defined by the fuel consumption of end users within a target population that adopt a project technology. Emission reductions are credited by comparing fuel consumption in the project scenario to the corresponding baseline scenario.

3.7 | Selection and justification of the project scenarios

3.7.1 | When different project technologies are included in a project activity, the project developer must analyse whether multiple project scenarios should be identified.

3.7.2 | The project developer may identify multiple project scenarios given the different types of project technologies included in a project activity. Also, different project scenarios can be credited against the same baseline scenario if it is deemed applicable. For example, the same baseline scenario for inefficient wood stoves could be compared to separate project scenarios for two different improved wood stove models in the project activity.

3.7.3 | Project technologies with similar design and performance characteristics may be included under a single project scenario. For example, different improved cook stoves can be considered similar if they are based on the same fundamental combustion technology and their respective thermal efficiencies or specific consumptions do not differ by more than +/-5% in absolute terms from that of the design to be implemented most frequently in the project activity.

3.7.4 | Project technologies with significantly different performance characteristics, more than +/-5% in absolute terms, (e.g. fuel consumption characteristics in the case of stoves) are treated as independent project scenarios and are monitored and calculated separately.

3.8 | Changes to the baseline and project scenarios

3.8.1 | New baseline and project scenarios can be added to a project during the crediting period, by following the Design Change Requirements. When a new baseline or project scenario is created, the baseline and/or project studies, respectively, must be conducted prior to verification and crediting with respect to the new scenario. Emission reductions cannot be credited for a new project scenario, or in relation to a new baseline scenario, until the respective project studies or baseline studies have been conducted and the request for design change has been approved.

3.8.2 | When minor differences in the existing baseline and project scenarios (less than +/-5% in absolute terms from the expectation) occur during the crediting period, adjustment factors can be applied to account for minor variability in fuel consumption or technology design parameter, without the need to create a new baseline or project scenario. In this case, the project developer shall refer to the discussion in section 3.12.

3.9 | Suppressed demand baseline scenario

3.9.1 | The methodology allows for a baseline scenario to take into account suppressed demand. The large scale[4] project or commercial and/or institutional premises, applying this methodology is not allowed to claim suppressed demand baseline. Refer to Annex 1 for suppressed demand description.

3.9.2 | For suppressed demand baseline scenario, the project developer shall provide evidence[5] that the project technology users, or a “cluster” of such users within the project population, are deprived of a reasonable level of human development or humanely acceptable benchmark in comparison to their peers.

3.9.3 | When the suppressed demand baseline is applied, the level of thermal energy consumption in the baseline scenario will not correspond to the pre-project situation but to a satisfied demand level, which will be equal to or lower than the project level of satisfied demand. Annex 1 provides more guidance and examples.

3.9.4 | Projects applying a suppressed demand baseline shall, at the time of crediting period renewal, apply any general rules or guidelines for suppressed demand published under GS4GG at the time of registration and crediting period renewal, as applicable.

3.10 | Emission reductions calculation

3.10.1 | The methods for calculating emission reductions vary depending on the characteristics of the project activity. One of the following three methods applies to most improved biomass cookstoves, ovens, water heaters, solar

[4] For the purpose of this methodology, the project is considered large scale activity when aggregate energy savings of the project activity exceeds 60 GWh per year or 180 $GWh_{thermal}$ per year in fuel input.

[5] In the form of project-specific field studies, project-relevant reports by qualified entities, official government data, or credible published literature for the project area.

cookers, and improved practices, as summarised in Table 1 Examples of applicable technologies and practices.

a. Method 1. Baseline and project fuel(s) are identical and emission reductions are exclusively from improved efficiency

b. Method 2. Baseline and project fuel(s) are identical, emission reductions are exclusively from improved efficiency, and the default baseline fuel consumption is applied

c. Method 3. Baseline and project fuel(s) are not identical and emission reductions are from fuel switch and efficiency gains

The emission reduction calculation methods for other project technology types applicable under previous version of this methodology (improved fossil fuel cookstoves where fossil fuel is measured, electric cooking technology, biogas stoves, bio-digesters, plant oil fired stoves, and renewable fuel fired stoves where fuel is measured) have been excluded from this methodology. A specific methodology, namely 'Methodology For Metered & Measured Energy Cooking Devices' for these activity types has been released as a new methodology.

3.10.2 |Emissions must be well documented and based on verifiable data that is either publicly available or primary data collected by the project developer. If such data is not available (for example in the case of production of a fuel) then care must be taken to ensure a conservative result, either by:

a. omitting those emissions or including an incontrovertibly low estimate when they occur in the baseline; or

b. including an incontrovertibly high estimate when they occur in the project scenario.

Method 1. Baseline and project fuel(s) are identical and emission reductions are exclusively from improved efficiency

3.10.3 |This method is applicable to the **projects of all scales**.

3.10.4 |When the baseline fuel and the project fuel are the same, the GHG emissions reduction achieved by the project activity in year y shall be calculated as follows:

$$ER_y = \sum_{b,p} (N_{b,p,y} \times U_{p,y} \times SFS_{p,b,y} \times NCV_{b,fuel} \times (f_{NRB,b,y} \times EF_{b,f,CO2} + EF_{b,f,nonCO2})) - \sum LE_{p,y} \quad \text{Eq. 1}$$

Where:

ER_y	=	Emission reduction for total project activity in year y (tCO_2e/yr)
$\sum_{b,p}$	=	Sum over all relevant baseline b/project p pairs
$N_{b,p,y}$	=	Number of project technology-days included in the project database for baseline b/project p pair in year y (days)

$U_{p,y}$	=	Cumulative Usage rate for technologies in project scenario p in year y (fraction)
$SFS_{p,b,y}$	=	Specific fuel savings for an individual project technology of baseline b/project p pair in year y (mass or volume units/technology*day) (Refer to Section 4.1 | below for further details)
$NCV_{b,fuel}$	=	Net calorific value of the fuel(s) that is substituted or reduced in baseline b (TJ/mass or volume units)
$f_{NRB,b,y}$	=	Fractional non-renewability status of woody biomass fuel during year *y* (fraction). For biomass, it is the fraction of woody biomass that can be established as non-renewable. This parameter is omitted when *f* is a fossil fuel.
$EF_{b,f,CO2}$	=	CO_2 emission factor from use of fuel *f* (tCO_2/TJ)
$EF_{b,f,nonCO2}$	=	Non-CO_2 emission factor arising from use of fuel *f*, when the baseline fuel *f* is biomass or charcoal (tCO_2e/TJ). This parameter is omitted when *f* is a fossil fuel.
$LE_{p,y}$	=	Leakage for project scenario p in year y (tCO_2e/yr)

Method 2. Baseline and project fuel(s) are identical, emission reductions are exclusively from improved efficiency, and the default baseline fuel consumption is applied

3.10.5 |This method is **only applicable to micro[6] or small-scale projects[7]** where the identical baseline and project fuel i.e., woody biomass is used by end users.

3.10.6 |The GHG emissions reduction achieved by the project activity in year y shall be calculated as follows:

$$ER_y = N_{b,p,y} \times U_{p,y} \times \left(SFC_{b,y} - SFC_{p,y}\right) \times \left((f_{NRB,y} \times EF_{b,f,CO2}) + EF_{b,f,nonCO2}\right) \times NCV_{b,fuel} - \sum LE_{p,y} \qquad \textit{Eq. 2}$$

Where:

[6] Project activities that generate less than or equal to 10,000 tCO_2eq emission reduction in each year of the crediting period.

[7] Project activities that reduce energy consumption, on demand side, with a maximum energy saving of 60 GWh per year (or an appropriate equivalent) in any year of the crediting period. In the context of this methodology, for project activities that improve thermal energy efficiency, the maximum energy saving of 60 GWh(e) per year is equivalent to 180 GWh(th) per year saving.

ER_y	=	Emission reduction for total project activity in year y (tCO_2e/yr)
$N_{b,p,y}$	=	Number of project technology-days included in the project database for baseline b/project p pair in year y (days)
$U_{p,y}$	=	Cumulative usage rate for technologies in project scenario p during year y (fraction)
$SFC_{b,y}$	=	Specific fuel consumption for an individual baseline technology in baseline scenario b during year y converted to tons/baseline technology*day, based on default factor of 0.5 tonnes/capita*year of fuelwood
$SFC_{p,y}$	=	Specific fuel consumption for an individual project technology in project scenario p during year y converted to tons/technology*day (Refer to Section 4.1 | below for further details)
$NCV_{b,fuel}$	=	Net calorific value of the fuel that is substituted or reduced; IPCC default for wood fuel, 0.0156 TJ/ton
$f_{NRB,b,y}$	=	Fractional non-renewability status of woody biomass fuel during year *y* (fraction). For biomass, it is the fraction of woody biomass that can be established as non-renewable. This parameter is omitted when *f* is a fossil fuel.
$EF_{b,f,CO2}$	=	CO_2 emission factor of the fuel that is substituted or reduced; IPCC default for Wood/Wood Waste, 112 tCO_2/TJ
$EF_{b,f,nonCO2}$	=	Non-CO_2 emission factor of the fuel that is substituted or reduced; IPCC default for Wood, 9.46 tCO2e/TJ (AR5 GWP) or 8.692 tCO2e/TJ (AR4 GWP)
$LE_{p,y}$	=	Leakage for project scenario p in year y (tCO_2e/yr)

Method 3. Baseline and project fuel(s) are different and emission reductions are from fuel switch and efficiency gains

3.10.7 |This method is applicable to the projects of all scales.

3.10.8 |When the baseline fuel and the project fuel or energy source are different and the emission factors are different, this method applies. In any case, where the project introduces fossil fuels, only emission reductions from efficiency improvement are eligible, i.e. the baseline and project fuel emission factor must be assumed to be the same. The GHG reductions achieved by the project activity in year y shall be calculated as follows:

$$BE_y = \sum_{b,p} (N_{b,p,y} \times U_{p,y} \times (f_{NRB,b,y} \times SE_{b,y,CO2} + SE_{b,y,nonCO2})) \quad \text{Eq. 3}$$

Where:

BE_y	=	Baseline emissions for total project activity in year y (tCO_2e/yr)

$\sum_{b,p}$ = Sum over all relevant baseline b/project p pairs

$N_{b,p,y}$ = Number of project technology-days included in the project database for baseline b/project p pair year y (days)

$U_{p,y}$ = Cumulative usage rate for technologies in project scenario p in year y (fraction)

$SE_{b,y,CO2}$ = Specific CO_2 emissions for a baseline b technology in year y (tCO_2/technology*day) (Refer to Section 4.1 | below for further details)

$SE_{b,y,non-CO2}$ = Specific non-CO_2 emissions for a baseline b technology in year y (tCO_2e/technology*day) (Refer to Section 4.1 | below for further details)

$f_{NRB,b,y}$ = Fraction of biomass used in year y for baseline scenario b that can be established as non-renewable biomass (fraction). This term is included when the baseline practice was use of biomass, even if a fossil fuel baseline emission factor must be applied due to the project activity introducing fossil fuel.

$$PE_y = \sum_{b,p} (N_{b,p,y} \times U_{p,y} \times (f_{NRB,b,y} \times SE_{p,y,CO2} + SE_{p,y,nonCO2})) \qquad \text{Eq. 4}$$

Where:

PE_y = Project emissions for total project activity in year y (tCO_2e/yr)

$SE_{p,y,CO2}$ = Specific CO_2 emissions for a project p technology in year y (tCO_2/technology*day) (Refer to Section 4.1 | below for further details)

$SE_{p,y,non-CO2}$ = Specific non-CO_2 emissions for a project p technology in year y (tCO_2e/technology*day) (Refer to Section 4.1 | below for further details)

$f_{NRB,b,y}$ = Fraction of biomass used in year y for baseline scenario b that can be established as non-renewable biomass (fraction). This term is excluded from the equation when the project is using a fossil fuel.

$$ER_y = BE_y - PE_y - \sum_{p} LE_{p,y} \qquad \text{Eq. 5}$$

Where:

ER_y = Emission reduction for total project activity in year y (tCO_2e/yr)

$LE_{p,y}$ = Leakage for project scenario p in year y (tCO_2e/yr)

3.11 |Leakage emissions

3.11.1 |For all of the preceding methods, leakage emissions, $LE_{p,y}$, shall be determined following one of two options below.

Option 1:

3.11.2 |Apply a default adjustment factor of 0.95 to the emission reductions to approximate leakage emissions. In this case, the term "$-\sum LE_{p,y}$" in equations 1, 2 or 3 changes to "* 95%".

Option 2:

3.11.3 |The project developer must evaluate the following potential sources of leakage and provide an evidence-based description and preliminary quantification of each potential source and its relevance for the project:

a. The displaced baseline technologies are reused outside the project boundary in place of lower emitting technology or with a higher intensity than would have occurred in the absence of the project.

b. Members of the population who do not participate in the project, and previously used lower emitting energy sources, instead use the non-renewable biomass or fossil fuels saved under the project activity.

c. The project significantly reduces the NRB fraction within an area where other GHG mitigation project activities account for NRB fraction in their baseline scenario.

d. The project population compensates for loss of the space heating effect of inefficient technology by adopting some other form of space heating or by retaining some use of inefficient technology.

e. By virtue of promotion and marketing of a new technology with high efficiency, the project stimulates substitution with this technology by households who commonly used a technology with relatively lower emissions.

3.11.4 |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.

3.11.5 |The project developer 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.

3.11.6 |When appropriate, the potential sources of leakage should be assessed in the context of suppressed demand and satisfied level of service. If suppressed demand conditions as defined in Annex 1 are demonstrated to apply, the evaluation may consider whether the leakage may not exist or may be diminished.

3.11.7 |Leakage risks that are deemed very low can be ignored as long as the case for their insignificance is substantiated.

3.12 |Adjustment factors

3.12.1 |In case, during the crediting period, it is observed that baseline and/or project scenarios vary slightly, affecting fuel savings, due to differences in project technology type, size, usage pattern, and other pertinent variables, adjustment factors may be applied to allow for realistic comparisons of project technologies to the baseline scenarios. Adjustment factors fine tune the baseline and/or project scenarios without requiring project developers to independently monitor new baseline and project scenarios.

3.12.2 |In such a case, project developers shall develop appropriate adjustment factors through quantitative assessment and analysis of baseline and project monitoring studies, as well as through additional targeted lab and field monitoring.

3.12.3 |Representative sampling with appropriate weighting must be conducted in pertinent monitoring studies to ensure adjustments within scenarios and across scenarios are realistic.

3.12.4 |Adjustment factors cannot be used to estimate the consumption of one type of fuel based on the observed consumption for a different fuel.

3.12.5 |Indicative examples of when and how to apply adjustment factors:

a. A project developer may have conducted a PFT for an improved charcoal stove with a 500 cm3 fuel chamber. Fuel consumption in the baseline and project scenario could be adjusted to credit similar improved charcoal stove models of different sizes based on a ratio of the difference in fuel chamber volumes, as long as clear correlations between stove size and standard adult-meals are identified and demonstrated.

b. Monitoring two sizes of the same stove model could show that the larger stove cooks food for more people, but is not more efficient per person-meal. In this case a size adjustment factor for person-meals cooked would be appropriate but an efficiency adjustment factor would not be appropriate.

3.13 |Changes required for methodology implementation in 2nd and 3rd crediting periods

3.13.1 |When the project developers apply for crediting period renewal, the baseline fuel consumption must be reassessed, in addition to other relevant methodological parameters as per the latest version of the methodology available at the time submission of renewal of crediting period and GS4GG crediting period renewal requirements.

3.14 |Data and parameters not monitored

Data/parameter ID	ICS 1
Data / Parameter:	Baseline scenario survey results
Data unit:	NA
Description:	Report of the results of the baseline scenario survey
Source of data:	The report presents the results of the Baseline Scenario Survey, described in section 3.4 | above, relevant for the baseline scenario definition.
Any comment:	Undertake at the start of the first crediting period, or more frequently if the project activity targets industrial applications (see 3.4, Baseline Scenario).

Data/parameter ID	ICS 2
Data / Parameter:	Project technology description
Data unit:	NA
Description:	The detailed description of the project technology shall include as a minimum: - Manufacturer name, - product name (if applicable), - technology type, - capacity characteristics, - continuous useful energy output demonstration, - rated thermal efficiency, for the following cases: - improved biomass cookstoves, fuel-based ovens, water heaters, improved fossil fuel cookstoves (solid fuel or existing liquid & gaseous fuel projects), and renewable fuel fired stoves. - Any performance certifications from National Standards body or certification body recognised by national standards body also shall be provided.
Source of data:	Any of the following sources shall be used: - Manufacturer specifications - Certifications by national standards body or an appropriate certification party recognised by national standards body - Commercial guarantee - Technical reports from the installer

	- For stoves built on-site at the end user location, reports of Standard WBT by stove manufacturer or installer Professional opinion or expert opinion is not accepted as a source for this parameter.
Any comment:	For any information not available at the time of validation, validating VVB shall include a FAR. Project developer shall provide this information to verifying VVB before completion of verification report. No issuance shall be requested for project technologies for which the project technology details are not verified by the verifying VVB prior to completion of verification report.

Data/parameter ID	**ICS 3**
Data / Parameter:	Expected technical life of project technology
Data unit:	Operating hours (e.g. "5,500 hours") or time period (e.g. "five years")
Description:	The expected technical life of an individual project technology shall be defined in the PDD.
Source of data:	Fixed and recorded at the time of registration or distribution Any of the following sources shall be used: - Manufacturer specifications - Certification by national standards body or an appropriate certification party recognised by national standards body - Commercial guarantee or Guarantee from the installer - For stoves built on-site at the end user location, field reports, which comply with the general requirements for sampling (Section 4.4), of average technical life of the same stove type operated under similar conditions (socioeconomic and cultural). Simulation modelling may be applied together with such field reports to estimate the average technical life. Professional opinion or expert opinion is not accepted as a source for this parameter.
Any comment:	If the expected technical life of project technology is shorter than the crediting period, describe measures to

	ensure that end users are provided replacement technology of comparable or higher quality at the end of the technical life, by either - replacing with comparable or better technology, or - retrofitting essential parts with performance guarantee. The project shall ensure that the units are replaced or retrofitted at the end of their technical life within a crediting period to continue claiming emission reductions. However, a new project or programme cannot be registered for replacement/retrofitted project devices. If project devices are retrofitted/repaired before or at the end of the device's estimated technical life, emission reductions may be claimed for these devices during the extended lifetime only if the details of the retrofits/repairs undertaken (e.g. parts replaced, specifications followed, personnel conducting the repairs and date of retrofitting) on each device are documented and in addition, one of the following options is implemented: a. Extended lifetime is demonstrated through a warranty from the original manufacturer, or a guarantee from a company with demonstrated experience in cookstove repair that assures the performance of the stove in its entirety comparable to the original device including with regard to efficiency, safety and indoor emissions; or b. Extended lifetime or the durability of the retrofitted device is demonstrated through a durability test performed according to requirements in ISO 19867-1 for durability or a comparable national standard. Certification by a relevant national standards body or an appropriate certifying agent recognized by that body may be supplied based on sample tests specified by the standard applied.

Data/parameter ID	**ICS 4**
Data / Parameter:	Indoor air pollution (IAP) levels of the project technology
Data unit:	NA
Description:	For projects where cooking will move from outdoor to indoor or where the project technology reduces ventilation (for example, changing from a stove with chimney to

	improved stove with no chimney), demonstration that Indoor air pollution (IAP) levels are not worsened in the project scenario compared to the baseline, including PM 2.5 and carbon monoxide (CO) emissions.
Source of data:	For the description of IAP level of the project technology, any of the following sources shall be used: - certification resulting from of a manufacturer's test, - report of field testing of the technology, - report of lab testing of the technology, or - results of modelling of the technology's operation under field conditions. - For stoves built on-site at the end user location, existing reports of lab or field testing of similar technology. For the IAP level of the baseline scenario, the following sources shall be used: - certification resulting from of a manufacturer's test, - report of field testing of the technology, - report of lab testing of the technology, - results of modelling of the technology's operation under field conditions, or - Expert opinion For both project and baseline technologies, if none of these are available, reference from published literature or report by independent agencies may be used as evidence, provided it is not more than 5 years old.
Any comment:	Any information not available at validation shall be included as a FAR and provided before completion of verification report. Only for project types where this evidence is required, no issuance shall be requested for project technologies for which IAP levels have not been verified by the verifying VVB prior to completion of verification report.

Data/parameter ID	**ICS 5**
Data / Parameter:	Avoidance of double counting or double claiming among project participants
Data unit:	NA
Description:	Evidence of avoidance of double counting or double claiming with other parties directly involved with the

	project or programme.
Source of data:	Written assertions with the project developer of the ownership rights and intention of selling the emission reductions resulting from the project activity directed at or signed with all the applicable parties of the following: - all other project participants; - project technology producers; and - retailers of the project technology or the renewable fuel.
Any comment:	Any written assertions not available at validation shall be included as a FAR and be provided and verified at the time of first verification.

Data/parameter ID	**ICS 6**
Data / Parameter:	Avoidance of double counting or double claiming with other mitigation actions
Data unit:	NA
Description:	Review and analysis of mitigation actions in other voluntary market or UNFCCC/compliance mechanisms
Source of data:	Using publicly available information from Gold Standard and other voluntary standards, at a minimum Verra and any recognized national or regional standards in the project location, and UNFCCC CDM project & PoA database: - identify and list any mitigation actions of similar technology, i.e. that provide the same kind of output and use the same kind of equipment or conversion process, operating in overlapping spatial boundaries. If one or more are identified: - describe the practices that will be implemented to ensure that the programme or project activity quantifies emission reductions only from technology it has implemented, - describe the practices to avoid that the programme or project activity implementation displaces technology of other mitigation actions, and - design a method to discount emission reductions in case the programme or project activity is found to displace or operate alongside another mitigation action.
Any comment:	Undertake at the time of project design review and VPA inclusion review.

	VVB shall validate the information reported by the project and report findings and opinion specifically on this point in the validation or verification report.

Data/parameter ID	**ICS 7**
Data / Parameter:	Regulatory framework for provision of thermal energy services
Data unit:	NA
Description:	Evidence that the project does not undermine or conflict with any national, sub-national or local regulations or guidance for thermal energy supply/devices or fuel supply or use
Source of data:	List and provide a summary of any national, sub-national and local regulations or guidance for provision of thermal energy services/devices of the type the project provides in the project boundary, including any tariff requirements. Describe how the project complies with the regulatory framework.
Any comment:	Undertake at the start of each crediting period.

Data/parameter ID	**ICS 8**
Data / Parameter:	$EF_{b,f,CO2}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor arising from use of fuels in baseline scenario
Source of data:	**Wood**: Methodology default, 112 tCO_2/TJ **Charcoal**: Methodology default, 112 tCO_2/TJ (combustion only) Methodology default, 165.22 tCO_2/TJ (includes charcoal production emissions) Methodology cap, 197.15 tCO_2/TJ (includes charcoal production emissions) **Other fuels**: IPCC defaults When emissions from fuel production, transport, and similar are included to determine a project-specific emission factor, then the following shall apply as well: - The project boundary must include these processes

	- Avoidance of double counting considerations (see two parameter tables) must cover all steps in the project boundary - The determination of the specific emissions from these sources is fully documented and evidenced in the PDD These provisions may be applied to include the actual GHG emissions happening upstream in charcoal production in the charcoal emission factor; however, emission factors higher than the methodology cap are not permitted.
Any comment:	Charcoal should apply the emission factor for charcoal fuel. For Method 3, this parameter is used to calculate $SE_{b,y,CO2}$

Data/parameter ID	**ICS 9**
Data / Parameter:	$EF_{b,f,nonCO2}$
Data unit:	tCO_2/TJ
Description:	Non-CO2 emission factor arising from use of fuels in baseline scenario
Source of data:	**Wood**: Methodology default: - 9.46 tCO2e/TJ (AR5 GWP) or - 8.692 tCO2e/TJ (AR4 GWP) **Charcoal**: Methodology defaults: - 5.865 tCO2e/TJ (AR5 GWP) (combustion only) - 44.83 tCO2e/TJ (AR5 GWP) (includes charcoal production emissions), - Methodology cap: 92.29 tCO2e/TJ (AR5 GWP) (includes charcoal production emissions) - or - 5.298 tCO2e/TJ (AR4 GWP) (combustion only) - 40.26 tCO2e/TJ (AR4 GWP) (includes charcoal production emissions) - Methodology cap: 82.90 tCO2e/TJ (AR4 GWP) (includes charcoal production emissions) **Other fuels**: Any of the following, in order of preference: - IPCC defaults - project-specific field tests prior to first verification by a qualified entity that is certified or accredited by National Standards body

	- project-relevant measurement reports by qualified entities - national defaults - credible published literature for the project area If either project-specific or project-relevant results are used, these must be cross-checked with IPCC defaults and differences shall be justified using evidence. When emissions from fuel production, transport, and similar are included to determine a project-specific emission factor, then the following shall apply as well: - The project boundary must include these processes - Avoidance of double counting considerations (see two parameter tables) must cover all steps in the project boundary - The determination of the specific emissions from these sources is fully documented and evidenced in the PDD These provisions may be applied to include the actual GHG emissions happening upstream in charcoal production in the charcoal emission factor; however, emission factors higher than the methodology cap are not permitted.
Any comment:	In Method 3, this parameter is used to calculate $SE_{b,y,non-CO2}$ If the emission factor is expressed in tonnes of CH4 or N2O, it shall be converted to tCO2e using the applicable GWP and this shall be documented in the PDD.

Data/parameter ID	**ICS 10**
Data / Parameter:	$EF_{p,f,CO2}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor arising from use of fuels in project scenario
Source of data:	**Wood**: Methodology default, 112 tCO_2/TJ **Charcoal**: Methodology default, 112 tCO_2/TJ (combustion only) Methodology default, 165.22 tCO_2/TJ (includes charcoal production emissions) Methodology cap, 197.15 tCO_2/TJ (includes charcoal production emissions) **Other fuels**:

	- IPCC defaults When emissions from fuel production, transport, and similar are included to determine a project-specific emission factor, then the following shall apply as well: - The project boundary must include these processes - Avoidance of double counting considerations (see two parameter tables) must cover all steps in the project boundary - The determination of the specific emissions from these sources shall be fully documented and evidenced in the PDD These provisions may be applied to include the actual GHG emissions happening upstream in charcoal production in the charcoal emission factor; however, emission factors higher than the methodology cap are not permitted. If emissions of this nature are included in the baseline emission factor, then they shall also be included in the project emission factor.
Any comment:	In Method 3, this parameter is used to calculate $SE_{p,y,CO2}$ This has same value as $EF_{b,f,CO2}$ in projects which reduce use of the same fuel.

Data/parameter ID	**ICS 11**
Data / Parameter:	$EF_{p,f,nonCO2}$
Data unit:	tCO_2/TJ
Description:	Non-CO_2 emission factor arising from use of fuels in project scenario
Source of data:	Wood: Methodology default: - 9.46 tCO2e/TJ (AR5 GWP) or - 8.692 tCO2e/TJ (AR4 GWP) Charcoal: Methodology defaults: - 5.865 tCO2e/TJ (AR5 GWP) (combustion only) - 44.83 tCO2e/TJ (AR5 GWP) (includes charcoal production emissions), - Methodology cap: 92.29 tCO2e/TJ (AR5 GWP) (includes charcoal production emissions) - or - 5.298 tCO2e/TJ (AR4 GWP) (combustion only) - 40.26 tCO2e/TJ (AR4 GWP) (includes charcoal production emissions) - Methodology cap: 82.90 tCO2e/TJ (AR4 GWP) (includes charcoal production emissions)

	Other fuels: Any of the following, in order of preference: - IPCC defaults, - project-specific field tests prior to first verification by a qualified entity that is certified or accredited by National Standard body - project-relevant measurement reports by qualified entities, - national defaults - credible published literature for the project area, If either project-specific or project-relevant results are used, these must be cross-checked with IPCC defaults and differences shall be justified using evidence. When emissions from fuel production, transport, and similar are included to determine a project-specific emission factor, then the following shall apply as well: - The project boundary must include these processes - Avoidance of double counting considerations (see two parameter tables) must cover all steps in the project boundary - The determination of the specific emissions from these sources is fully documented and evidenced in the PDD - The determination of the specific emissions from these sources shall be fully documented and evidenced in the PDD. These provisions may be applied to include the actual GHG emissions happening upstream in charcoal production in the charcoal emission factor; however, emission factors higher than the methodology cap are not permitted. If emissions of this nature are included in the baseline emission factor, then they shall also be included in the project emission factor.
Any comment:	In Method 3, this parameter is used to calculate $SE_{p,y,non-CO2}$ -

Data/parameter ID	ICS 12
Data / Parameter:	$NCV_{b,fuel}$
Data unit:	TJ/ton
Description:	Net calorific value of the fuels used in the baseline
Source of data:	Wood: Methodology default, 0.0156 TJ/ton Charcoal: Methodology default, 0.0295 TJ/ton

	Other fuels: - IPCC defaults - project-specific testing by a qualified entity that is certified or accredited - project-relevant measurement reports by a qualified entity If either project-specific or project-relevant results are used, these must be cross-checked with IPCC defaults and differences shall be justified using evidence.
Any comment:	The methodology default emission factor must be applied when the methodology default NCV is applied. In Method 3, this parameter is used to calculate $SE_{b,y,CO2}$ and $SE_{b,y,non-CO2}$

Data/parameter ID	**ICS 13**
Data / Parameter:	$NCV_{p,fuel}$
Data unit:	TJ/ton
Description:	Net calorific value of the fuels used in the project
Source of data:	Wood: Methodology default, 0.0156 TJ/ton Charcoal: Methodology default, 0.0295 TJ/ton Other fuels: - IPCC defaults - project-specific testing by a qualified entity that is certified or accredited - project-relevant measurement reports by a qualified entity If either project-specific or project-relevant results are used, these must be cross-checked with IPCC defaults and differences shall be justified using evidence.
Any comment:	The methodology default emission factor must be applied when the methodology default NCV is applied. In Method 3, this parameter is used to calculate $SE_{p,y,CO2}$ and $SE_{p,y,non-CO2}$

Data/parameter ID	**ICS 14**
Data / Parameter:	$SFC_{b,y}$
Data unit:	Tons/baseline technology*day
Description:	Specific fuel consumption for an individual baseline technology in baseline scenario b during year y

Source of data:	Based on default factor of 0.5 tonnes/capita*year of fuelwood Provide evidence that this is coherent with the information on target population characteristics, baseline technology use & fuel consumption using evidence from at least one of the following sources: - baseline survey, - Credible published literature for project region, - Studies by academia, NGOs or multilateral institutions, or - Official government publications or statistics Source applied must not be more than 3 years old; further, cross-check with older sources may be used provided they give conservative results (for example, an older source shows that in the past, there was a higher per-capita fuel consumption).
Any comment:	

4| Monitoring methodology

4.1 | Monitoring data and information requirements

4.1.1 | Following data shall be monitored and recorded during project crediting period. Annex 3 provides monitoring schedule for and monitoring process for a typical project.

4.1.2 | **Total sales or dissemination record:** The project developer must maintain an accurate and complete sales record. In projects with non-commercial distribution or dissemination practice, maintain an accurate and complete "dissemination record" or "installation record." In the case the project involves sale of a renewable fuel, the record tracks quantities of the fuel sold. The record must be maintained continuously and backed up electronically.

The required data for each project unit is:

1. Date of installation
2. Geographic area of sale
3. Model/type of project technology sold
4. Quantity of project technologies sold
5. Name, telephone number (if available), and address and/or GPS coordinates:
    a. Required for all bulk purchasers, i.e., retailers and industrial users;
    b. Required for all end users, e.g. households

6. Mode of use: domestic, institutional commercial, other.

4.1.3 | **Project Database:** The project database lists all the project technology units that have been sold or distributed by the project and have not surpassed their technical life. It is derived from the total sales record (or dissemination record in case of non-commercial distribution) and must be maintained continuously.

Within the database, project technologies units are labelled, at a minimum, with their corresponding project scenario p and their date of sale/dissemination.

Technologies aged beyond their technical life, and not replaced or retrofitted, are removed from the project database and no longer credited.

4.1.4 | **Project Surveys:** The project surveys include the usage survey ($U_{p,y}$), Usage Survey- use of other stoves (ICS 16), and the baseline and project performance field tests (BFT and PFT). The general requirements for these are described here.

4.1.5 | The project surveys have the same sample sizing and data collection guidelines as the baseline scenario survey. Refer to section 4.3.

4.1.6 | The project surveys are only conducted with end users representative of the project scenario and currently using the project technology (except for the case of a renewal of the crediting period which requires a re-assessment of the baseline fuel consumption).

4.1.7 | **Usage Survey ($U_{p,y}$):** The objective of the usage survey is to provide a single usage parameter that is weighted based on the age distribution for project technologies in the Project Database, $U_{p,y}$. This usage parameter must be established to account for drop off rates as project technologies age and are replaced, or for reduced use by end users for other motives. The usage parameter may be monitored using remote monitoring with the application of Continuous Stove Monitors (CSMs). For more details, please refer to the Requirements and Guidelines: Usage Rate Monitoring.

4.1.8 | The usage survey determines the usage proportion for each age cohort of technologies being credited for each project scenario p. The age cohorts in the survey are established as follows:

- Participants in a usage survey with technologies in the first year of use (age_{0-1}) must have technologies that have been in use on average at least 0.5 years or longer.
- Participants in a usage survey with technologies in the second year of use (age_{1-2}) must be conducted with technologies that have been in use on average at least 1.5 years, and so on.

Since the parameter of interest is the usage proportion for each age cohort, the sample size is defined for each age cohort following the general requirements for sampling (Section 4.4) with a minimum of 30 samples for project technologies of each age cohort being credited, except where the age cohort comprises fewer than 30 units, in which case all units shall be sampled.

4.1.9 | The usage survey must be conducted in line with the requirements and guidelines of Requirements and Guidelines: Usage Rate Monitoring for further details and example. VVB shall refer to the checklist for assessment of reported data provided in Requirements and Guidelines: Usage Rate Monitoring.

4.1.10 | **Usage Survey- use of other stoves (ICS 16):** As part of the usage survey, the project developer must also collect data on the presence and usage practices of baseline and other non-project technology by project technology end users and prepare descriptive statistics of these practices. The same method of in person interviews and expert observation within the kitchen in question is suitable to collect these data. Where the usage survey indicates usage of other non-project technology, this must be addressed in line with the requirements for parameter ICS 20.

4.1.11 | **Field Tests:** The baseline and project performance field tests (BFT and PFT) measure real, observed technology performance in the field.

- When method 1 or 3 is applied, a field test is carried out both for baseline and project scenarios, either by testing a paired sample (baseline and project performance measured for same subjects) or by testing an independent sample (different subjects for baseline and project scenarios).
- When method 2 is applied, a PFT is required without any comparative BFT since a default value is used for baseline fuel consumption.

4.1.12 | The approach taken to conduct the performance tests must be such that:

- it is transparent and can easily be replicated,
- it is evidently conservative,
- the sample is randomly selected so as to not introduce a material bias,
- and the impact of daily and seasonal variations on the expected average fuel consumption savings is accounted for.

4.1.13 | The project developer must design the field test to ensure monitoring is representative of technology and fuel use practices. It must be made explicit to the households/institutions that they must behave and consume fuel normally, using the technologies they normally use.

- For example, in the case of improved cook stove activities, participants must be asked to cook typical meals during the study period, include secondary stoves and fuels, exclude large parties or infrequent cooking events, and match cooking tasks in the BFT and the PFT. Participants should never be influenced to use a specific stove or fuel during the study, nor deviate from typical stove and fuel practices.

4.1.14 | The detailed instructions and requirements for BFT and PFT are found in Annex 2, Kitchen Performance Test.

4.1.15 |**Baseline Fuel Consumption:** To calculate SFS under method 1, or SE under method 3, the project developer must determine *Pb,y*, Quantity of fuel that is consumed in baseline scenario b during year y in units of kg/household-day, kg/person-meal, etc.

4.1.16 |The baseline fuel consumption is determined using project specific Baseline Performance Field Tests (BFT). The BFT are completed once ex-ante, and at crediting period renewal.

4.1.17 |The following requirements apply for selecting the end user locations of the Baseline Performance Field Tests:

- The BFT must reflect the average household size within the project area.
- The BFT must take place in those households where improved devices have not yet been disseminated and where baseline technology is still in use in the project area.
- Where all households in the project area already use exclusively improved devices, the BFT is performed in households in the vicinity of the project target area that exhibit the same socio-economic circumstances as the households that have already received the improved devices in the project target area and are operating devices that are similar to the baseline technology in the project activity.

4.1.18 |**Project Fuel Consumption:** To calculate SFS under method 1, SFC under method 2, or SE under method 3, the project developer must determine *Pp,y*, Quantity of fuel that is consumed in project scenario p during year y in units of kg/household-day, kg/person-meal, etc.

4.1.19 |The project fuel consumption is determined using a project specific Project Performance Field Test (PFT). The PFT is completed every other year, or more frequently, and the first PFT must be completed before the first verification of the project.

4.1.20 |Alternatively, Project Developers can determine *Pp,y* by monitoring the degradation in the performance of cookstove efficiency following the Water Boiling Test and accordingly adjust the project fuel consumption level by following the requirements of Annex 4 below. The following requirements apply for selecting the end user locations of the Project Performance Field Tests:

- PFT are conducted with end users representative of the project scenario target population and currently using the project technology.
- The PFT is not just a test of the operation of the project technology. It is a study of the fuel consumption of the cooking practices of project technology end users during the crediting period. The PFT must evaluate whether the project technology provides the same services at the same/similar frequency as the baseline technology. As such, when the project technology does not replace or reduce the entire baseline fuel consumption, the calculation of SFS or SE must

adjust the baseline fuel consumption downward based on the cooking services replaced by the project stove.

- As well, where the baseline technology or other non-project technologies operate as backups or complementary units in parallel with project technologies ("stove stacking"), the project fuel consumption implications must be accounted for in the PFT.
- PFTs are required in the project situation even in cases where a 'zero emission' project technology is introduced, so as to capture the potential use of the baseline technology as backup or auxiliary units; the potential introduction of an emitting backup or auxiliary project technology introduced in parallel with the project technology; or the use of a suitable non-renewable fuel in the project technology at times when the supply of a renewable fuel is disrupted or for preheating (e.g. plant oil stoves).

4.2 | Data and parameters monitored

Data/parameter ID	ICS 15
Data / Parameter:	Avoidance of double counting or double claiming among project technology end users
Data unit:	NA
Description:	Evidence of avoidance of double counting or double claiming with project technology end users
Source of data:	Evidence of informing / notification of end users, such as: - leaflets distributed with the warranty card of the product alerting end-users to the waiving of their carbon rights in exchange for discount pricing of the improved technology below its true cost, - carbon title waiver forms signed by end users, etc.
Monitoring frequency:	Monitored whenever project technology is sold or otherwise disseminated
QA/QC procedures:	Cross check using general internet search and search of public records of Gold Standard and other voluntary market and UNFCCC mechanisms
Any comment:	-

Data/parameter ID	ICS 16
Data / Parameter:	Presence of stove stacking
Data unit:	NA
Description:	Descriptive statistics of the presence and usage practices of baseline- and other non-project-technology by project technology end users

Source of data:	Use one of the following methods: - Measurement campaigns shall be undertaken using data loggers such as stove utilization monitors (SUMs) which can log the operation of all devices in order to determine the average device utilization intensity, or - Usage Survey- use of other stoves, to capture cooking habits and stove usage of households in the region, including quantification of use of baseline devices, by formulating questions and/or collecting evidences to determine the frequency of usage of both the project devices and baseline devices, or monitoring surveys to capture the number of meals cooked. The surveys may be integrated with the usage survey.
Monitoring frequency:	Annual
QA/QC procedures:	The calculation of $SFS_{p,b,y}$, $SFC_{p,y}$, $SE_{b,y,CO2}$ and/or $SE_{b,y,non\text{-}CO2}$ shall be cross-checked with the observed presence of stove stacking. Ensure any stove stacking is considered so that emission reductions are calculated only from real reduction of, or replacement of, baseline fuel use. Cross-check results of this survey with independent studies that are specific to the project region (or to the project country, if regional studies are not available), including but not limited to National publications, peer-reviewed literature, third party assessments (for example – WISDOM, FAO, UN and similar organizations) and/or official data or statistics about cooking technologies, not older than 5 years old.
Any comment:	Whether or not the existing baseline technology is surrendered, when an old technology remains in use in parallel with the improved technology, or another technology is put in use in parallel, the corresponding emissions must be accounted for so that emission reductions are not overestimated. For example: - if the baseline fuel consumption was defined based on the total fuel used for cooking by the user, determine the percentage of meals or cooking performed on the project technology and multiply the baseline fuel usage by this percentage; - adjust the baseline fuel consumption to be defined based only on the use of the cooking technology that is directly replaced by the project technology.

Data/parameter ID	**ICS 17**
Data / Parameter:	$fNRB_{,i,y}$
Data unit:	percentage
Description:	Fractional non-renewability status of woody biomass fuel during year *y*, in case the baseline fuel is biomass or charcoal
Source of data:	Determined by following the CDM TOOL30[8], Calculation of the fraction of non-renewable biomass
Monitoring frequency:	One of two options, with the option defined and fixed at project design certification stage: 1. Determined ex-ante and fixed for a given crediting period (if it is fixed ex-ante, then include $fNRB_{,b,y}$ in the "data and parameters fixed ex ante" section of the PDD), or 2. Updated biennially or at each monitoring and verification
QA/QC procedures:	Requirements of the CDM TOOL30
Any comment:	Project developers applying for a renewal of the crediting period must reassess the NRB based on most recent information available.

Data/parameter ID	**ICS 18**
Data / Parameter:	$P_{b,y}$
Data unit:	mass or volume units/household-day, mass or volume units/person-meal, etc.
Description:	Quantity of fuel that is consumed in baseline scenario b during year y
Source of data:	Baseline performance field tests - see section 4.1.
Monitoring frequency:	At the start of crediting period (fixed for one crediting period) In case the project involves the progressive installation, the baseline values shall be representative of new end

[8] Default values endorsed by designated national authorities and approved by the CDM available at http://cdm.unfccc.int/methodologies/standard_base/index.html, can be applied, if default value is valid at the time of project submission for design review.

	users cooking practices included in the projects after registration. If there are changes to the characteristics of the end users (cooking practices and/or living standards), the project developer shall conduct baseline KPTs for new end-users and include as a new scenario or adjust the values that have been provided at the time of project registration.
QA/QC procedures:	Compliance with the general requirements for sampling (Section 4.4), general requirements for QA/QC (Section 4.5) and Annex 2 Kitchen performance test. If the values resulting from the baseline KPTs are higher than the following **threshold value** (on equivalent terms), then the results shall be further substantiated by independent third-party studies that are specific to the project region, including but not limited to government publications, peer-reviewed literature, third party assessments (for example – WISDOM, FAO, UN and similar organizations) and/or official data or statistics about cooking technologies and fuel use. In any case, the value applied shall not be higher than the **cap value** (on equivalent terms). **Threshold value**: 0.75 tonnes/person*year of fuelwood **Cap value**: 0.95 tonnes/person*year of fuelwood
Any comment:	Used to calculate SFS under method 1, and SE under method 3. Applicable adjustment factors may be applied.

Data/parameter ID	**ICS 19**
Data / Parameter:	$P_{p,y}$
Data unit:	mass or volume units/household-day, mass or volume units/person-meal, etc.
Description:	Quantity of fuel that is consumed in project scenario p during year y
Source of data:	Project performance field tests - see section 4.1
Monitoring frequency:	Updated every two years, or more frequently The KPT values are valid for two years and may be applied for before or after period, however the gap between start date of first KPTs and second KPTs shall not be more than two years.
QA/QC procedures:	Compliance with the general requirements for sampling

	(Section 4.4), general requirements for QA/QC (Section 4.5) and Annex 2 Kitchen performance test.
Any comment:	Used to calculate SFS under method 1, SFC under method 2 and SE under method 3 Applicable adjustment factors may be applied.

Data/parameter ID	**ICS 20**
Data / Parameter:	$SFS_{b,p,y}$
Data unit:	mass or volume units/technology*day
Description:	Specific fuel savings for an individual project technology of baseline b/project p pair in year y
Source of data:	Calculated from $P_{b,y}$, $P_{p,y}$ and other information to obtain the savings in the required units
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	The calculation method, inputs and their sources shall be described in detail in the PDD and monitoring report. Cross-check with proportional efficiency of baseline and project technology. For example, if the baseline stove efficiency is 10% and the project rated efficiency is 25%, the savings should reflect a factor of 2.5 approximately in the first year of the crediting year and not more. If it is more, then the value is capped based on the proportional efficiency.
Any comment:	Applies when using Method 1 The baseline and project field test data must be analysed in combination to estimate the average fuel savings per technology unit. Whenever the baseline fuel and project fuel are the same, the statistical analysis can be conducted with respect to fuel savings per technology unit. Where the project distributes more than one technology unit per household, special attention must be given to ensure the savings per technology are calculated conservatively.

Data/parameter ID	ICS 21
Data / Parameter:	$SFC_{p,y}$
Data unit:	tons/technology*day
Description:	Specific fuel consumption for an individual project technology in project scenario p during year y
Source of data:	Calculated from $P_{p,y}$ and other information to obtain the consumption in the required units
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	The calculation method and inputs shall be described in detail in the PDD and monitoring report. Cross-check baseline and project emission results with proportional efficiency of baseline and project technology. For example, if the baseline stove efficiency is 10% and the project rated efficiency is 25%, the savings should reflect a factor of 2.5 approximately in the first year of the crediting year and not more. If it is more, then the SFCp,y value set at a floor value based on the proportional efficiency.
Any comment:	Applies when using Method 2 Where the project distributes more than one technology unit per household, special attention must be given to ensure the savings per technology are calculated conservatively.

Data/parameter ID	ICS 22
Data / Parameter:	$SE_{b,y,CO2}$
Data unit:	tCO_2/technology*day
Description:	Specific CO_2 emissions for a baseline b technology in year y
Source of data:	Calculated from $P_{b,y}$, $EF_{b,f,CO2}$ and other information to obtain the emissions of the required units
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	The calculation method and inputs shall be described in detail in the PDD and monitoring report. Cross-check the ratio of specific emissions of the baseline and project ($SE_{p,y,CO2}$) on energy terms with proportional efficiency of baseline and project technology and/or proportional emission factors of the two different fuels. If the purported savings is more than efficiency and emission factors improvements explain, then the baseline

	value is capped based on the proportional efficiency or proportional emission factors, whichever is more appropriate to the project technology.
Any comment:	Applies when using Method 3 Where the project distributes more than one technology unit per household, special attention must be given to ensure the savings per technology are calculated conservatively.

Data/parameter ID	**ICS 23**
Data / Parameter:	$SE_{p,y,CO2}$
Data unit:	tCO_2/technology*day
Description:	Specific CO_2 emissions for a project p technology in year y
Source of data:	Calculated from $P_{p,y}$, $EF_{p,f,CO2}$ and other information to obtain the emissions in the required units
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	The calculation method and inputs shall be described in detail in the PDD and monitoring report.
Any comment:	Applies when using Method 3 Where the project distributes more than one technology unit per household, special attention must be given to ensure the savings per technology are calculated conservatively.

Data/parameter ID	**ICS 24**
Data / Parameter:	$SE_{b,y,non-CO2}$
Data unit:	tCO_2e/technology*day
Description:	Specific non-CO_2 emissions for a baseline b technology in year y
Source of data:	Calculated from $P_{b,y}$, $EF_{b,f,nonCO2}$ and other information to obtain the emissions in the required units
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	The calculation method, inputs and their sources shall be described in detail in the PDD and monitoring report.
Any comment:	Applies when using Method 3 Where the project distributes more than one technology unit per household, special attention must be given to

	ensure the savings per technology are calculated conservatively.

Data/parameter ID	ICS 25
Data / Parameter:	$SE_{p,y,non\text{-}CO2}$
Data unit:	tCO_2e/technology*day
Description:	Specific non-CO_2 emissions for a project p technology in year y
Source of data:	Calculated from $P_{p,y}$, $EF_{p,f,nonCO2}$ and other information to obtain the savings in the required units
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	The calculation method, inputs and their sources shall be described in detail in the PDD and monitoring report.
Any comment:	Applies when using Method 3 Where the project distributes more than one technology unit per household, special attention must be given to ensure the savings per technology are calculated conservatively.

Data/parameter ID	ICS 26
Data / Parameter:	$U_{p,y}$
Data unit:	Percentage
Description:	Weighted average usage rate in project scenario p during year y
Source of data:	Usage survey, following the description in section 4.1. Usage survey. The survey result must provide the statistically valid proportion of users actively using the project technology for each project technology age cohort. From the annual usage survey results, calculate the weighted average percent of users actively using the project technology, where the weighting is by the quantity of project technologies of each age cohort being credited in a given project scenario.
Monitoring frequency:	At least annually Optionally, more frequently
QA/QC procedures:	Compliance with the general requirements for sampling (Section 4.4) and general requirements for QA/QC

	(Section 4.5)
Any comment:	Please refer to the Requirements and Guidelines: Usage Rate Monitoring for carrying out usage surveys for projects implementing improved cooking devices.

Data/parameter ID	**ICS 27**
Data / Parameter:	$N_{b,p,y}$
Data unit:	days
Description:	Number of project technology-days included in the project database for baseline b/project p pair in year y
Source of data:	Calculated from the Project database (see section 3.4.B. Project database) as the sum of the number of project technology units times the calendar days during the year y that they were present at the end user locations
Monitoring frequency:	Calculated annually
QA/QC procedures:	Cross check the results of the usage survey with the contents of the project database to confirm whether the project technology units surveyed are present at end user locations as expected, or not. If there is discrepancy, this must be explained or corrected.
Any comment:	-

Data/parameter ID	**ICS 28**
Data / Parameter:	$LE_{p,y}$
Data unit:	tCO_2e per year
Description:	Leakage in project scenario p during year y
Source of data:	Sources established by following section 2.4.A Leakage emissions
Monitoring frequency:	Every two years, or default discount value of 0.95 applied to emission reductions
QA/QC procedures:	Compliance with the general requirements for sampling (Section 3.1) and general requirements for QA/QC (Section 3.2)
Any comment:	Monitoring parameters required for calculating leakage emissions shall be included in the monitoring plan in the PDD as required to monitor and quantify the sources of leakage determined by following section 2.4.A Leakage emissions.

4.3 | Baseline scenario survey

4.3.1 | The baseline scenario survey provides critical information on target population characteristics, baseline technology use, fuel consumption, leakage, and sustainable development indicators.

4.3.2 | **Representativeness:** The baseline survey requires in person interviews with a robust sample of end users without project technologies that are representative of end users targeted in the project activity.

4.3.3 | **Sample Sizing:** The baseline survey should be carried out for each baseline scenario using representative and random sampling, following these guidelines for minimum sample size:

Group size	Minimum sample size
<300	30 or population size, whichever is smaller
300 to 1000	10% of group size
> 1000	100

4.3.4 | **Data Collected:** The data collected is specific to the characteristics of each baseline scenario and should be tailored accordingly. Information on the following needs to be gathered:

1. User follow up	i. Address or location ii. Mobile telephone number and/or landline telephone number (when possible)
2. End user characteristics	iii. Number of people served by baseline technology iv. Typical baseline technology usage patterns and tasks (commercial, institutional, domestic, etc.)
3. Baseline technology and fuels	v. Types of baseline technologies used and estimated frequency vi. Types of fuels used and estimated quantities vii. Seasonal variations in baseline technology and fuel use viii. Sources of fuels; purchased, hand-collected, or etc., and prices paid or effort made, e.g. walking distances, persons collecting, opportunity cost

4.4 | General requirements for sampling

4.4.1 | When sampling is applied to determine mean (average) parameter values or proportion (yes/no) parameter values for both ex-ante and monitored data and parameters, the following guidelines shall always be applied. Furthermore, specific requirements apply for the sampling related to some parameters, and these are described below or in the parameter tables.

4.4.2 | A statistically valid sample can be used to determine parameter values, as per the relevant requirements for sampling in the latest version of the CDM Standard for sampling and surveys for CDM project activities and programme of activities. 90% confidence interval and a 10% margin of error requirement shall be achieved for the sampled parameters unless mentioned otherwise in the methodology. In any case, for proportion parameter values, a minimum sample size of 30, or the whole group size if this is lower than 30, must always be applied.

4.4.3 | Cross-VPA sampling is not allowed across groups larger than 10 VPAs, and cross-VPA sampling is not allowed for large scale PoAs. The requirements described here apply both when sampling is applied to a single VPA and to permissible cross-VPA sampling.

4.4.4 | For guidance, project developers may refer to the latest version of the CDM Guidelines for sampling and surveys for CDM project activities and programmes of activities for the type of sampling approach (simple random, cluster, stratified etc.) applicable to their project context.

4.4.5 | Requirements for Cases where Pairs of Baseline and Project Parameters are Derived through Sampling

4.4.6 | For determination of the parameters $SFS_{p,b,y}$ or $SER_{b,p,y,CO2}$ under emission reduction methods 1 and 3, there are two valid options for the statistical analysis. In all cases, sample sizes must be derived following the general requirements for sampling and be greater than 30. The two options are:

a. 90/30 rule. When the sample sizes are large enough to satisfy the "90/30 rule," i.e. the endpoints of the 90% confidence interval lie within +/- 30% of the estimated mean, overall emission reductions can be calculated on the basis of the estimated MEAN annual emission reduction per unit or MEAN fuel annual savings per unit.

b. 90% confidence rule. When the sample sizes are such that the "90/30 rule" is not complied with, the emission or fuel saving result is not the mean (or average) test result, but a lower value equivalent to the LOWER BOUND of the one-sided 90% confidence interval.

4.4.7 | Applying the rules to estimate baseline and project average emissions or average fuel use separately is not permitted. The only exception is for cases involving a single set of data; see the following section.

4.4.8 | Requirements for Cases where only the Project Parameter is Derived through Sampling

4.4.9 | Under emission reductions method 2, where test data from a field test sampling determines project fuel consumption, and a default factor is being used to define a baseline, there are two valid options for the statistical analysis. In all cases, the sample size must be derived following the general requirements for sampling and must be greater than 30. The two options are:

a. 90/10 rule. When the sample size is large enough to satisfy the "90/10 rule," i.e. the endpoints of the 90% confidence interval lie within +/- 10% of the estimated mean, overall emission reductions can be calculated on the basis of the estimated MEAN fuel consumption per unit.

b. 90% confidence rule. When the sample sizes are such that the "90/10 rule" is not complied with, the fuel consumption result is not the mean (or average) test result, but a higher value equivalent to the UPPER BOUND of the one-sided 90% confidence interval.

4.5 | General Requirements for Quality Assurance and Quality Control

4.5.1 | The project developer is responsible for accurate and transparent record keeping, monitoring and evaluation. All supporting documentation and records for the project must be easily accessible for spot checking and cross referencing by a third-party auditor.

4.5.2 | Contact information in the total sales record must allow a project auditor to easily contact and visit end users.

4.5.3 | An auditor must be able to cross reference pertinent project documentation, including archives such as production records (e.g. materials purchases, internal logs), financial accounts and sales records, as well as wholesale customer invoices, observations of retailer activities and sales performance.

ANNEX - 1: SUPPRESSED DEMAND AND SATISFACTORY LEVEL OF SERVICE

In some developing countries the level of energy service is not sufficient to meet human development needs due to lack of financial means and/or access to modern energy infrastructure or resources. When a group of people are deprived of a reasonable level of human development in comparison to their peers, the group of people is considered to experience suppressed demand. I.e., it is assumed their use of energy would be higher – high enough to achieve a satisfactory level of service- if only they had sufficient resources.

When the opportunity to achieve a satisfactory level of service is available through carbon finance, then, in the context of this Gold Standard methodology, project developers can adjust the baseline scenario accordingly. Under such circumstances, the baseline scenario may be determined from the satisfactory level of service achieved by their peers, or from the project level of service achieved, with consideration for conservativeness and trends of increasing living standards.

When the pre-project scenario is biomass use for energy, and a trend of increasing living standards is observed in the population, then the hypothetical baseline scenario may entail the replacement of a biomass baseline with a proxy of 100% fossil fuel. This consideration must be analysed during baseline selection.

Indicative examples of baseline scenario determination under suppressed demand

<u>Example 1</u>

Pre-project scenario: The target population in a baseline scenario experiences poverty-related issues of an inability to cook resulting in malnourishment due to insufficient access to cooking fuels.

Project impact: The project activity corrects this by introducing more efficient cooking devices, making existing access to cooking fuels sufficient to avoid malnourishment.

Potential baseline definition: The amount of energy delivered to the pot (the 'cooking energy utilized' or CEU) of the project scenario permits the affected population to achieve a satisfactory level of service. The measured efficiency and fuel amount are utilized to estimate the hypothetical baseline fuel use using pre-project cooking devices. In such instances, evidence should support that the project level is satisfactory but not excessive and that the previous level was unsatisfactory according to universally accepted living standard benchmarks.

<u>Example 2</u>

Pre-project scenario: In a cold climate, a population lacks sufficient fuel to satisfy space heating needs, resulting in substandard living conditions.

Project impact: A project introduces a new renewable energy technology that enables improved energy access, achieving a satisfactory level of heating service.

Potential baseline definition: The total kitchen CEU (including cooking and space heating supply) in the project scenario exceeds that in the pre-project scenario significantly. The hypothetical baseline is set to a proxy technology based on the standard of living achieved by peers.

ANNEX - 2: COMPLEMENTARY GUIDELINES FOR KITCHEN PERFORMANCE TESTING

Complementary guidelines for fuel consumption measurements

This annex addresses additional guidelines that should be applied when carrying out one specific type of performance test, the measurement of fuel use by inefficient and efficient stoves. This is known as the Kitchen Performance Test (KPT).

The principles of the KPT also apply to performance testing of other decentralized energy-saving devices. This annex and associated KPT protocol[9] may be used as a preliminary guide to field performance tests (FTs) for the other technologies. Developers of other decentralized thermal energy technologies may adapt these principles appropriately to achieve accurate and conservative results.

The baseline survey and baseline KPT can be conducted concurrently with the same end users.

When conducting a KPT following the current KPT protocol, follow these complementary guidelines.

Step 1

Estimate the number of test subjects you will be visiting (your SAMPLE SIZE). Sample sizes need to be larger if there is a lot of variation in the amounts of fuel used and saved, which is often the case in KPTs. One way to start is to simply assume a typical variation, expressed as a Coefficient of Variation or COV (typically in this context COVs are in the range 0.5-2.0). Use the tables here to choose a provisional minimum sample size using that COV estimate (a good starting point is to choose a mid-way value in the range given in the tables)[10]. Note that this assumes simple random sampling (if you use another method of sampling you will need to increase the sample size).

[9] Kitchen Performance Test (KPT) Version 4.0. https://cleancookingalliance.org/binary-data/DOCUMENT/file/000/000/604-1.pdf

[10] The difference between independent, paired and single sampling is explained in the next step of this procedure. Another way to estimate sample size is to find a study that has already been done in similar conditions (same type of socioeconomic and cultural conditions) to your project, and learn from this the MEAN value of tests, and the STANDARD DEVIATION (SD). Dividing, you get the COV (= SD/MEAN), and then you can use the table on this page.

If you choose a COV which is smaller than the real COV, it is likely that once you have finished the tests, you will need to increase the sample size[11]. The validity of this approach depends on a wider range of factors than the COV alone, and therefore a minimum sample size of 30 is recommended (see below). Be sure to allow for "sample size attrition", that is dropouts; if you launch 40 tests for example, you are likely to conclude with more than 30 valid results, even if some of the test subjects make mistakes or some of the tests are incomplete. If previous experience shows a dropout or attrition rate of 10% is likely, launch 10% more tests than suggested in the tables here.

Table 3: Sample sizes in cases of PAIRED samples (households sampled in the baseline and the project situation are the same).

COV	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
90/30 precision	45	53	61	70	80	90	101	112	124

Table 4 : Sample sizes in cases of INDEPENDENT samples (households sampled in the project situation are different from households sampled in the baseline situation). This is the size required for each of the baseline and project samples.

COV	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
90/30 precision	90	105	122	140	159	180	201	224	248

Table 5: Sample sizes in cases of SINGLE samples (where the tests are conducted for either baseline or project scenario but not both).

COV	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
90/10 precision	12	26	45	70	101	137	179	226	279

[11] This approach is legitimate if you can justify it by showing that the supplementary households are ones which could have appeared in the random sample originally or which otherwise qualify as consistent with the aim of a sample which is representative of the project stove users and their behaviour through the year.

Step 2

Select the kitchens sampled using a RANDOM selection method. There are different ways of doing this, and it is up to you to choose an appropriate one that will give test results which reflect the real fuel savings of the project population. [12]

Step 3

Plan your tests so that they give a reliable and conservative result. In general, there are two phases, the BEFORE phase (before the improved stove is adopted, the baseline scenario) and the AFTER phase (after it is adopted, the project scenario). In some cases you may not need to test fuel consumption in both phases (when using default factors for baseline stoves). If you are doing both phases, consider whether it is best to run both phases in the same kitchens (PAIRED sampling), or separate phases in separate sets of kitchens having appropriately similar socio-economic and cultural conditions (INDEPENDENT sampling). Larger sample sizes are required when using two independent samples, but independent sampling may be the only option if a fixed baseline has been established or if it is necessary to conduct the baseline and project tests concurrently. In the case of paired sampling, consider how long you need to give the subjects to get used to the project stoves before launching the AFTER tests, so that your test will reflect real usage patterns in forthcoming years. If a default efficiency is used for baseline stoves, then it is possible to run a KPT on the project stove only, and combine the results with either a value of project stove efficiency or a credible value for delivered cooking energy or for average baseline fuel consumption, so calculating fuel saved. This case is called a SINGLE SAMPLE KPT.

Step 4

Choose an appropriate test period and an appropriate time of year (or multiple times during the year). A recommended minimum test period is 3 days. It is important to avoid times like festivals or holidays when more cooking is done than usual. The KPT shall exclude large parties or infrequent cooking events, and match cooking tasks in the baseline KPT to those in the project KPT. If you do include days of home cooking (for example weekends) when people are not at work and eating more than usual at home, you must make sure that they are balanced by an appropriate number of working days when people eat less at home. The same applies to tests which include cooks who sell their food publicly – these tests must include days when less food is sold as well as days when food sales are high, in an appropriate ratio and erring towards a conservative result. Think of ways of designing the test so that it captures a cooking pattern representative of a whole year. For example, this may involve

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[12] Applicable common sampling approaches are outlined in Section 3.0, Sampling Application Guidance, of the General Guidelines for Sampling and Surveys for Small-Scale CDM Project Activities (EB 50 Report, Annex 30)

carrying out some of the tests in another season of the year when eating patterns or food types are different, or prescribing a representative cooking pattern during a single test (this latter approach is known as a Controlled Cooking Test, a variation on the KPT).

Step 5

Make sure that all test subjects understand they are expected to cook normally during the tests. The aim is to capture their usual behaviour in the kitchen, as if no tests were happening, to feed the usual variation of people with the usual variation of food types. Your tests must measure the fuel saved by the kitchen as a whole not by one individual stove; for example it is common for a cook to use one hob sometimes, and also an extra one or two hobs, at other times. Your project stove may be a two-hob design or a one-hob design, either way there is the possibility that an extra non-project hob or stove is occasionally used, in areas where project stoves are still a novelty and the incentive system for elimination of non-project stoves is still ongoing.

Step 6

To conduct the tests, make sure the cooks use fuel only from a designated stock which you have pre-weighed. Enter key data, such as the mass of the fuel at start of tests as stocked for each subject, in an excel form such as the ones provided in KPT guidelines referenced (see the first footnote of this section). It is recommended to visit the subjects at least once a day to check that they are using only fuel from the weighed stock, and are not adding un-weighed fuel to the stock. If more fuel is needed, weigh before adding and enter the mass added in the data sheet.

For practical reasons, it is often best to provide fuel for the tests (to help control the weighing and use of fuel), rather than have the subjects use fuel they are buying themselves. Nevertheless, it is important that the fuel is typical of the fuel normally used through the year, particularly in terms of **moisture content**. It is also important that the subjects have any commonplace incentives to conserve fuel, for example pay for fuel, if they normally do so, or collect the fuel themselves, if they normally do so, otherwise they may use excessive amounts due to the free hand-out/availability. Subjects may be told they will be rewarded for their effort and time at the end of the test, once it is successfully completed.

Step 7

During the tests, find out how many people have eaten and how many meals each, so that you can enter into the data sheet the number of “person-meals” (individual meals as opposed to meals shared) cooked with the weighed fuel each day. Note that this count can include meals sold commercially as well as meals consumed in the domestic environment.

Step 8

Run a statistical analysis on the test results, to estimate the mean fuel savings.

If used data that has been collected as part of a separate study, make sure that the sample was selected randomly. If this is not the case, then the data **should not be** used.

Before beginning the analysis, be sure to check for "outliers", i.e. values which are very different to the majority of the sample[13]. Outliers should be examined to check for mistakes with data recording, or investigated to ascertain if there were unusual circumstances which led to that result. If so, then the observation should be removed or corrected before the analysis. The distribution of sample values should also be checked for skewness. If there are extreme outliers or skewness, or the data was not collected by a simple random sample, then methods of analysis which are more complicated than the approaches suggested here may be required.

In cases of paired and independent sampling, there are two valid options for the statistical analysis:

- 90/30 rule. This option allows you to calculate emission reductions on the basis of the estimated MEAN (or average) fuel saved by introduction of the improved stove in one kitchen, or on the estimated MEAN (or average) fuel use in one kitchen if using a single-sample. You can only use the mean if your test results satisfy the 90/30 rule, i.e. the endpoints of the 90% confidence interval lie within +/- 30% of the estimated mean. If this is not the case, then you can use the test data gathered so far to estimate how much larger the sample size needs to be. The mean value will always result in a larger estimate of fuel-savings than the value obtained using the second option below, but in some cases you might choose to analyze using the second option, because it is not practical or too expensive to increase the sample size sufficiently.

[13] One way to identify potential outliers is to produce a box-plot of the data. Most statistical software enables this. Any points which are plotted individually on the box-plot are candidates for outliers and should be investigated. Equivalently, potential outliers can be identified as those points which are either greater than 1.5 times the inter-quartile range (IQR) from the third quartile, or less than 1.5 times the IQR from the first quartile.

- 90% confidence rule (Lower bound of the one-sided[14] 90% confidence interval). This option allows you to obtain a result even if 90/30 precision is not achieved, although in a similar manner to the 90/30 rule, a minimum sample size of 30 is recommended. You can use this approach when the 90/30 rule forces a sample size which is difficult to implement in practice. The disadvantage is that the fuel saving result is not the mean (or average) test result, but a lower value[15]. This estimate is very conservative, and it will probably be worthwhile to augment the sample size instead in cases when augmentation is practically possible.

The baseline and project KT data should be analysed in combination to estimate of the mean fuel saving. It is not allowed to apply the rules to estimate baseline and project fuel-use separately.

In cases of single samples for project KT, there are two valid options for the statistical analysis:

- 90/10 rule. This option allows you to calculate emission reductions on the basis of the estimated MEAN (or average) fuel saved by introduction of the improved stove in one kitchen, or on the estimated MEAN (or average) fuel use in one kitchen if using a single-sample. You can only use the mean if your test results satisfy the 90/10 rule, i.e. the endpoints of the 90% confidence interval lie within +/- 10% of the estimated mean. If this is not the case, then you can use the test data gathered so far to estimate how much larger the sample size needs to be. The mean value will always result in a larger estimate of fuel-savings than the value obtained using the second option below, but in some cases you might choose to analyze using the second option, because it is not practical or too expensive to increase the sample size sufficiently.
- 90% confidence rule (Upper bound of the one-sided[16] 90% confidence interval). This option allows you to obtain a result even if 90/10 precision is not achieved, although in a similar manner to the 90/10 rule, a minimum sample size of 30 is recommended. You can use this approach when the 90/10 rule forces a sample size which is difficult to implement in practice. The disadvantage is that the project fuel use result is not the mean (or average) test result, but a higher

[14] The one-sided confidence interval is appropriate because it is relevant here to specify the confidence that the estimate is conservative, e.g. that the estimated fuel-savings are lower than (or to the low-side of) the true fuel-savings.

[15] Technically, it is the largest value that with a probability of 90% will be less than the true mean.

[16] The one-sided confidence interval is appropriate because it is relevant here to specify the confidence that the estimate is conservative, e.g. that the estimated fuel-savings are lower than (or to the low-side of) the true fuel-savings.

value[17]. This estimate is very conservative, and it will probably be worthwhile to augment the sample size instead in cases when augmentation is practically possible.

Step 9

You may reward the test subjects once the tests are finished, for instance give them one or two project stoves or other compensation. Since you have already analyzed your data, you are in a good position to decide whether to extend the sample size further, or re-run tests that for some reason were invalid.

[17] Technically, it is the largest value that with a probability of 90% will be more than the true mean.

ANNEX - 3: PROJECT PREPARATION AND MONITORING SCHEDULE (FOR ONE CREDITING PERIOD)

Project preparation and monitoring schedule	**Prior to validation**	**Prior to first verification** [18]	**Annual**	**Every two years**
ER estimation for PDD	✔			
Baseline studies				
Indoor air pollution levels	✔			
NRB assessment	✔			
Baseline scenario survey	✔			
Baseline Field Tests (*except where default values applied)		✔		✔*
Project studies				
Usage survey			✔	
Usage survey -use of other stoves			✔	
Project Field Tests (PFT)		✔		✔
Ongoing monitoring tasks				
Maintenance of total sales record and project database	Continuous			
Leakage assessment				✔
Updating NRB assessments (*except where ex-ante value applied)				✔*

[18] Monitoring tasks must be completed prior to the first verification during which the given project or baseline scenario is used for crediting.

ANNEX - 4: AGING TEST APPROACH FOR PROJECT FUEL UPDATES

The approach provided in this Annex is limited to Small-scale projects only (i.e those projects that result in annual energy savings upto 180GWhth as a result of switching to the project technology) and micro-scale projects. This approach is additional to the applicable monitoring requirements and procedures prescribed in section 4 above.

The project fuel consumption ($P_{p,y}$) (parameter ICS 19) shall be updated by carrying out the biennial project KPTs to account for changes in the project scenario over time as project technologies age. This annex provides an alternative method to biennial project KPTs to update project fuel consumption. The project developer shall monitor the degradation in the performance of cookstove efficiency following the Water Boiling Test[19] and accordingly adjust the project fuel consumption level. To apply the Ageing Test approach, following the steps shall be followed;

a. Determine the efficiency of the project cookstove ($\eta_{new,i,1}$) (parameter ICS 29):
The project developer shall carry out the Water Boiling Test to determine the thermal efficiency of the project cookstove type i along with the project KPTs (resulting in project wood consumption value ($SFC_{p,1}$) (parameter ICS 30) prior to 1st issuance. The efficiency of the project cookstove shall be determined in the field or laboratory, following the latest version of Water Boling Test protocol, by an independent expert or entity.

b. Monitor the degradation in the efficiency of project cookstove in year y ($\eta_{new,i,y}$) (parameter ICS 31):
The degradation in the efficiency of the project cookstove type i shall be monitored annually (year y) by carrying out the WBT in the field or laboratory by an independent expert or entity.

c. Update the project fuel consumption level ($SFC_{p,i,y}$):
To update project fuel consumption, the fuel consumption level determined under step a i.e., result of project KPTs prior to 1st issuance, shall be adjusted with the ratio of efficiency level determined under step a. and the efficiency level determined under step b. It would imply adjusting the project fuel consumption value for efficiency degradation.

Ideally, the WBT shall not result in higher efficiency values at 2nd, 3rd or subsequent years as compared to the first WBT results. In cases, where it is higher as compared to the 1st WBT test results, the conservative values shall be applied for emission reductions calculation.

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[19] https://cleancookingalliance.org/binary-data/DOCUMENT/file/000/000/399-1.pdf

$$SFC_{p,i,y} = SFC_{p,1} * (\eta_{new,i,1}/\eta_{new,i,y})$$

Monitoring requirements:

The following table summarises the monitoring requirements and guidance that should be followed for Ageing Test approach:

Data and parameters not monitored

Data/parameter ID	ICS 29
Data / Parameter:	$\eta_{new,i,1}$
Data unit:	Fraction
Description:	Efficiency of the project cookstove type i in year 1
Source of data:	Efficiency shall be measured as per the following: Option 1. The efficiency of the project devices shall be based on certification by a national standards body or an appropriate certifying agent recognized by that body. Option 2. Alternatively, manufacturer specifications on efficiency based on water boiling test (WBT) may be used.
Any comment:	Under Option 2, the Project Developer shall carry out a WBT using the standard procedure (refer to footnote 19).

Data and parameters monitored

Data/parameter ID	ICS 30
Data / Parameter:	$SFC_{p,1}$
Data unit:	tons/day
Description:	Specific fuel consumption for an individual household using project technology in project scenario p in year 1
Source of data:	Calculated from $P_{p,y}$ and other information to obtain the savings in the required units
Monitoring frequency:	Done one time during year 1 (or first issuance) whichever is earlier
QA/QC procedures:	The calculation method and inputs shall be described in detail in the PDD and monitoring report.

	Cross-check baseline and project emission results with proportional efficiency of baseline and project technology. For example, if the baseline stove efficiency is 10% and the project rated efficiency is 25%, the savings should reflect a factor of 2.5 approximately in the first year of the crediting year and not more. If it is more, then the SFCp,1 value set at a floor value based on the proportional efficiency.
Any comment:	N/A

Data/parameter ID	**ICS 31**
Data / Parameter:	$n_{new,i,y}$
Data unit:	Fraction
Description:	Efficiency of project cookstove in year y (after first year/issuance)
Source of data:	1. WBTs 2. A default schedule of linear decrease in efficiency up to the terminal efficiency assumed as 20 per cent shall be applied through the life span of the project device
Monitoring frequency:	Annual
QA/QC procedures:	1. WBTs (when used) shall be carried out in the last three months of the monitoring period provided that is representative of the annual conditions 2. WBTs shall be carried out on a representative sample of each age group with the minimum sample size of each age group complying with 90/10 confidence precision 3. Sample selection shall follow the guidelines for sampling and surveys for CDM project activities and Programme of Activities 4. Where the installations are progressively done over the course of the crediting period, other sampling methods like stratified random sampling may be applicable.
Any comment:	N/A

DOCUMENT HISTORY

<table>
<tr><th>Version</th><th>Date</th><th>Description</th></tr>
<tr><td>4.0</td><td>05/10/2021</td><td>1. Change in title of the methodology from ‘Gold Standard Technologies and Practices to Displace Decentralized Thermal Energy Consumption (TPDDTEC)’ to ‘Reduced Emissions from Cooking and Heating (RECH):TPDDTEC’
2. Making editorial improvements
3. Updated to align the methodology with latest scientific understanding, provide further clarity on key issues, promote consistency between various GS methodologies. A summary of all key changes is available here.</td></tr>
<tr><td>3.1</td><td>25/08/2017</td><td rowspan="3">1. Making editorial improvements
2. Updated to align the methodology version with latest scientific understanding, provide further clarity on key issues, promote consistency between various GS methodologies.</td></tr>
<tr><td>3.0</td><td>10/07/2017</td></tr>
<tr><td>2.0</td><td>24/04/2015</td></tr>
<tr><td>1.0</td><td>11/04/2011</td><td>First version</td></tr>
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