Revision to "Technologies and Practices to displace decentralized thermal energy consumption" methodology"

Please Note:

Revision to the methodology now allows for inclusion of technologies with different designs under a single project scenario as long as their thermal efficiency or their specific energy consumption fall within +/-5% difference in **absolute** terms instead of relative terms, as previously applied.Revision to the Annex A (safe water supply) allow project developers to choose between the following two options with respect to the consideration of raw water boiled in the project situation:a. Apply the current provisions of the methodology whereby data is collected on 'raw water boiled after introduction of water treatment technology' and a cap of 7.5 l/p/d is applied on the total amount of treated water for consumption per person per day, including water needed for cooking. In this situation the definitions of Lbl,i,y and Lpj,i,y remain as described in the methodology.b. Do NOT monitor the raw water boiled in the project situation and apply a cap of 6 l/p/d is applied on the amount of water treated by the water treatment technology for drinking water, hand washing and food washing. The 6 l/p/d cap is set so as to account for the crediting of water used for hand and food washing, in the absence of figures from WHO on minimum service level for hand and food washing (basic hygiene). In such a case, the definitions of Lbl,i,y and Lpj,i,y are therefore revised. Lbl,i,y is defined as the total amount of raw water treated with the water treatment technology. Lpj,i,y is defined as the total amount of treated water that is still boiled.Note also the

Guidelines for carrying out usage survey for projects implementing household water filtration technologies – http://www.goldstandard.org/files/documents/rule-update-guidelines-for-carrying-out-water-usage-surveys.pdf

Clarification on Annex 3 of the "Technologies and Practices to displace decentralized thermal energy consumption" methodology"

Households with piped water supply can be excluded from the Cj factor (as defined in TPDDTEC methodology) when it can be clearly demonstrated that piped water supply is not a safe water source. The water quality of the piped water supply should be established as unsafe through testing over a representative period of time or relevant third party studies for project area for the purpose of validation and registration of the project. Households that boil water or would have boiled water (suppressed demand situation) in the baseline situation and use zero emission water treatment technologies in the project situation are in such case eligible and can be included in the calculation of baseline emissions from boiling of water. Baseline surveys should be conducted to show that households do actually boil water or would indeed have boiled water to make it safe for use.

Technologies and Practices to Displace Decentralized Thermal Energy Consumption

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SECTION I: SOURCE AND APPLICABILITY

This methodology is applicable to programs or activities introducing technologies and/or practices that reduce or displace greenhouse gas (GHG) emissions from the thermal energy consumption of households and non-domestic premises[1].

Examples of these technologies include the introduction of improved biomass or fossil fuel cook stoves, ovens, dryers, space and water heaters (solar and otherwise), heat retention cookers, solar cookers, bio-digesters[2], safe water supply and treatment technologies[3] that displace water boiling, thermal insulation in cold climates, etc.

Examples of practices include the improved application of such technologies, shift from non-renewable to renewable fuel (e.g. shift to plant oil fired stoves)[4], humidity control through improved storage and drying of fuels, etc. Project activities claiming emission reductions from improved practices only (no installation of improved devices) are expected to provide a particularly detailed discussion of the chosen monitoring approach so as to demonstrate in a convincing way that the emission reductions indeed result from the practices introduced by the project activity.

Throughout the methodology the term technology refers to single or multiple technologies and/or practices.

Shifts in technology may occur in a gradual manner and adoption can increase over the project period. The project activity is implemented by a project proponent and potentially with additional project participants. The individual households and institutions do not act as project participants.

The following conditions apply:

1. The project boundary can be clearly identified, and the technologies counted in the project are not included in another voluntary market or CDM project activity (i.e. no double counting takes place). Project proponents must have a survey mechanism in place together with appropriate mitigation measures so as to prevent double-counting in case of another similar activity with some of the target area in common.
2. The technologies each have continuous useful energy outputs of less than 150kW per unit (defined as total energy delivered usefully from start to end of operation of a unit divided by time of operation). For technologies or practices that do not deliver thermal energy in

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[1] e.g., residential institutional, industrial, or commercial facilities

[2] See Annex 6 "Application of the methodology to bio-digesters including animal waste management" for specific guidance in such case.

[3] See Annex 3 "Application of the Methodology to Safe Water Supply Project Activities" for specific guidance.

[4] See Annex 7 for specific guidance in the case of plant oil fired stoves. Annex 7 can potentially be used as a model for new annexes that would be developed for other fuels derived from dedicated biomass feedstock (e.g. bioethanol, green charcoal).

the project scenario but only displace thermal energy supplied in the baseline scenario, the 150kW threshold applies to the displaced baseline technology.

3. The use of the baseline technology as a backup or auxiliary technology in parallel with the improved technology introduced by the project activity is permitted as long as a mechanism is put into place to encourage the removal of the old technology (e.g discounted price for the improved technology) and the definitive discontinuity of its use. The project documentation must provide a clear description of the approach chosen and the monitoring plan must allow for a good understanding of the extent to which the baseline technology is still in use after the introduction of the improved technology, whether the existing baseline technology is not surrendered at the time of the introduction of the improved technology, or whether a new baseline technology is acquired and put to use by targeted end users during the project crediting period – see section III. The success of the mechanism put into place must therefore be monitored, and the approach must be adjusted if proven unsuccessful[5]. If an old technology remains in use in parallel with the improved technology, corresponding emissions must of course be accounted for as part of the project emissions – see section II.5.

4. The project proponent must clearly communicate to all project participants the entity that is claiming ownership rights of and selling the emission reductions resulting from the project activity. This must be communicated to the technology producers and the retailers of the improved technology or the renewable fuel in use in the project situation by contract or clear written assertions in the transaction paperwork, If the claimants are not the project technology end users, the end users should be notified that they cannot claim for emission reductions from the project[6].

5. Project activities making use of a new biomass feedstock in the project situation (e.g. shift from non-renewable to green charcoal, plant oil or renewable biomass briquettes) must comply with relevant Gold Standard specific requirements for biomass related project activities, as defined in the latest version of the Gold Standard rules[7]. If the biomass feedstock is sourced from a dedicated plantation, these criteria must apply to both plantations established for the project activity AND existing plantations that were established in the context of other activities but will supply biomass feedstock. Furthermore, the following conditions apply:

    a. Adequate evidence is supplied to demonstrate that indoor air pollution (IAP) levels are not worsened compared to the baseline, and greenhouse gases (as listed in section II.1) emitted by the project fuel/stove combination are estimated with adequate precision[8]. The project fuel/stove combination may include instances in which the project stove is a baseline stove.

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[5] The removal and continued non-use of three stone fires and other easily constructed traditional devices is in many cases unlikely and impractical to monitor.

[6] For example, leaflets distributed with the products alerting end-users to the waiving of their carbon rights in exchange for pricing of the improved technology which discounts its true cost (waiver forms signed by end users are another example).

[7] Gold Standard Toolkit, Annex C, and rule updates released prior to the time of first submission of the project activity to the Gold Standard.

[8] The project proponent 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.

b. Records of renewable fuel sales may not be used as sole parameters for emission reduction calculation, but may be used as data informing the equations in section II of this methodology if correlated to data on distribution[9] and results of field tests and surveys confirming (a) actual use of the renewable fuel and usage patterns such as average fraction of non-renewable fuels used in mixed combustion or seasonal variation of fuel types, (b) GHG emissions, (c) evidence of CO levels not deteriorating (d) any further factors effecting emission reductions significantly.

SECTION II: BASELINE METHODOLOGY

1. Project Boundary

Project proponents must 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 and potentially of the baseline and project fuel collection and production (e.g. charcoal, plant oil), as well as solid waste and effluents disposal or treatment facilities associated with fuel processing.

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

c.   In cases where woody biomass (including charcoal) is the baseline fuel, the fuel production and collection area is the area within which this woody biomass can reasonably be expected to be produced, collected and supplied. In cases the project activity introduces the use of a new biomass feedstock in the project situation, the fuel production and collection area is the area within which the biomass is produced, collected and supplied.

Emissions sources included in the project boundary

Emissions from fuels can occur during fuel production, transport, and consumption.
Baseline emissions from any gases marked below may be omitted for simplification.
All project emissions from any of the gases marked below must be accounted for, unless arguably negligible or not applicable to the individual project.
Emissions must be well documented and based on publicly available and verifiable data. 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:
•   when they occur in the baseline, omitting those emissions or including an incontrovertibly low estimate, or
•   when they occur in the project scenario, including an incontrovertibly high estimate

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[9] Systematic records of volumes and weights transacted by distributors and retailers must be collected and monitoring conducted of end user sales

	Source	Gas	Included?	Justification / Explanation
Baseline	Heat delivery, production of fuel, and transport of fuel	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Can be significant for some fuels

	Source	Gas	Included?	Justification / Explanation
Project	Heat delivery, production of fuel, and transport of fuel	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Can be significant for some fuels

2. Selection of baseline scenarios and project scenarios

Baseline Scenario

A baseline scenario is defined by the typical baseline fuel consumption patterns in a population that is targeted for adoption of the project technology. Hence, this "target population" is a representative baseline for the project activity.

The project proponent may identify multiple baseline scenarios that are applicable in relation to the different project technologies in the project activity, depending on local fuel and technology use patterns. For example, one baseline scenario may represent rural end users predominantly using inefficient wood stoves, while a second baseline scenario may represent a target population predominantly using inefficient charcoal stoves.

Furthermore, a new baseline scenario is not necessarily required for comparison to each technology in the project activity. For example, different improved wood stove models in the project activity could be compared to the same wood baseline scenario, and different improved charcoal stove models in the project activity could be compared to the same charcoal baseline scenario, as appropriate. The baseline scenario must be adequately characterized with all relevant technologies included. It is not legitimate to compare the project to only the most inefficient technology being used in the baseline.

In many projects the improved technology is adopted progressively through the crediting period of the project. The baseline situation therefore does not occur at the same time for all technology purchasers.
In project activities where all units are installed at the start or in project activities targeting non-industrial applications, the baseline is considered by-default fixed in time during the considered crediting period. It therefore does not require continuous monitoring. In project activities targeting industrial applications where the emission reductions occur within the industrial

premises, such a fixed baseline can only be considered for the expected remaining lifetime of the baseline devices and must be reassessed if emission reductions are claimed for the rest of the considered crediting period, unless convincing evidence is provided to justify a fixed baseline.[10] In all cases, whenever the project proponents apply for a renewable crediting period, the baseline must be reassessed as per the Gold Standard rules on renewal of crediting period.

Project Scenario

A 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 a project scenario to the applicable baseline scenario.

The project proponent may identify multiple project scenarios given the different types of project technologies included in a project activity. Independent project scenarios can be credited by comparison to the same baseline scenario if 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.

Project technologies with similar design and performance characteristics may be included under a single project scenario. For example, 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%. Similarly, comparable project technologies may share the same monitoring procedures. Project technologies with significantly different performance characteristics (e.g. fuel consumption characteristics in the case of stoves) are treated as independent project scenarios and hence monitored and credited separately.

Additional Baseline and Project Scenarios

Project proponents must consider distinct baseline and project scenarios when the project activity targets end user populations that consume significantly different fuels[11] or when different technologies are considered in a given project.

All expected baseline and project scenarios shall be defined in the project documentation on time for validation and registration review. Additional baseline and project scenarios can still be added to a project activity at any time during the project crediting period upon approval of a request for design changes, as per Gold Standard rules. 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 (see sections II.4 and II.5).

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[10] 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).

[11] 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.

Alternatively, adjustment factors, discussed in section II.7, can be applied to existing baseline and project scenarios to account for less significant variability in fuel consumption or technology, without the need to create a new baseline or project scenario.

Suppressed Demand

In many 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. This concept is known as suppressed demand and is described in Annex 2.
The methodology allows for a baseline scenario to be assessed in terms of suppressed demand, if evidence is provided that the project technology users, or a "cluster" of such users within the project population, are otherwise deprived of a reasonable level of human development (or humanely acceptable benchmark) in comparison to their peers and provided that there is likelihood of avoided future emissions as for example if the standard of living is increasing for some of the project population or their peers outside of the project boundary. In such case, 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.

Project Preparation and Monitoring Schedule

Annex 6 provides a schedule for the project preparation and monitoring process. This schedule takes into account a key feature of projects displacing decentralized thermal energy consumption: precise measurements of energy saved are needed prior to verification, and are only possible once a reasonable volume of project technologies are in use.
Precise measurements (findings of performance field tests) can therefore be submitted post-registration, on time for the verification and prior to the request for issuance. In such case, the project documentation submitted for validation and registration review must provide a Project Estimation of projected emission reductions, supported by appropriate and credible sources of information.

3. Additionality

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

The most recent version of the UNFCCC "Tool for the Demonstration and Assessment of Additionality[12]", or of an approved Gold Standard VER additionality tool must be applied prior to registration. The CDM "Guidelines for Demonstrating Additionality of Renewable Energy Projects =<5 MW and Energy Efficiency Projects with Energy Savings <=20 GWh per year" [13]can be applied to non-retroactive project activities, if eligible.

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[12] http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

[13] EB 54 Report, Annex 15

In situations where it can be shown that the project technology has been adopted by less than 20% of the population in the target area (as defined in section II, 1.b), the technology can be qualified as "first of its kind" and hence a realistic and credible barrier due to prevailing practice can be claimed[14]. The demonstration must rely on existing credible sources of information or on a survey conducted specifically for the occasion by a third party within a sample representative enough of the overall population in the target region.

4. Baseline Studies

As described in section II.2, a baseline scenario is defined by typical fuel consumption among the target population prior to adopting the project technology, and a project activity may have more than one applicable baseline scenario for end users with different fuel consumption characteristics.

Baseline Studies

The project proponent must conduct the following baseline studies for each baseline scenario:

- Baseline non-renewable biomass (NRB) assessment, if biomass is one of the baseline fuels
- Baseline survey (BS) of target population characteristics
- Baseline performance field test (BFT)[15] of fuel consumption (e.g. kitchen performance test (KPT) in case of cook stoves)

Findings of the performance field tests can be submitted post-registration, on time for the verification and prior to the request for issuance. In such case, the project documentation submitted for validation and registration review must provide a Project Estimation of expected baseline emissions, supported by appropriate and credible sources of information.

A. Baseline Non-Renewable Biomass Assessment

Project activities employing a non-renewable biomass (NRB) baseline must identify the fractional non-renewability of biomass. As appropriate, multiple scenarios may use the same NRB assessment. The approach to calculating the NRB is defined in Annex 1. The NRB assessment may be updated prior to verification if further analysis and or surveys are conducted after the baseline study. Project proponents applying for a renewal of the crediting period must reassess the NRB based on most recent information available.

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[14] Conversely, this criteria *does not* suggest that adoption rates higher than 20% are grounds for non-additionality. If adoption rates are higher, additionality may still be proven through full application of the applicable additional tool.

[15] Under specific circumstances, baseline default factors may be used instead: see section on Baseline Performance Field Test.

B. Baseline Survey

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

Baseline Survey 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.

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

Data Collected

The data collected is specific to the characteristics of each baseline scenario, and should be tailored to each scenario in a given project to gather information about each of the following:

1. User follow up
   a. Address or location
   b. Mobile telephone number and/or landline telephone number (when possible)

2. End user characteristics
   a. Number of people served by baseline technology
   b. Typical baseline technology usage patterns and tasks (commercial, institutional, domestic, etc.)

3. Baseline technology and fuels
   a. Types of baseline technologies used and estimated frequency
   b. Types of fuels used and estimated quantities
   c. Seasonal variations in baseline technology and fuel use
   d. Sources of fuels; (purchased or hand-collected, etc) and prices paid or effort made (e.g. walking distances, persons collecting, opportunity cost)
   e. Renewability and non-renewability indicators as required by Annex 1

C. Baseline Performance Field Test

See section 7 and Annex 4.

5. Project Studies

As described in section II.2, a project scenario is defined by end users within a target population that adopt project technologies that cause specific emission reductions in the project area.

The project proponent must conduct the following project studies for each project scenario according to the schedule set out in Annex 6:

- Project non-renewable biomass (NRB) assessment, if biomass is one of the project fuels
- Project survey (PS) of target population characteristics[16]
- Project performance field test (PFT) of fuel consumption – see section 7 and Annex 4.

These three project studies have the same requirements as the baseline studies, but the project survey and PFT are conducted with end users representative of the project scenario target population and currently using the project technology.

Findings of the PFT can be submitted post-registration, on time for the verification and prior to the request for issuance. In such case, the project documentation submitted for validation and registration review must however provide a Project Estimation of expected project emission, supported by appropriate and credible sources of information.

6. Leakage

The project proponent should investigate the following potential sources of leakage:

a) The displaced baseline technologies are reused outside the project boundary in place of lower emitting technology or in a manner suggesting more usage than would have occurred in the absence of the project.
b) The non-renewable biomass or fossil fuels saved under the project activity are used by non-project users who previously used lower emitting energy sources.
c) The project significantly impacts the NRB fraction within an area where other CDM or VER 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 heating or by retaining some use of inefficient technology[17].
e) By virtue of promotion and marketing of a new technology with high efficiency, the project stimulates substitution within households who commonly used a technology with relatively lower emissions, in cases where such a trend is not eligible as an evolving baseline.

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[16] In cases where renewable fuels are disseminated by the project for use in baseline technology (such as traditional stoves), the project study must establish the degree to which the new fuel displaces GHG from the baseline fuel, such that quantities of new fuel sold can be conservatively and reliably converted to quantities of GHG avoided.

[17] Baseline and project performance field tests would subsume this potential for leakage, but the later would not be addressed in case of a single sample performance test and efficiency ratio multiplier.

If the leakage assessment quantifies an increase in fuel consumption by the non-project households/users attributable to the project activity, then calculations must be adjusted to account for the quantified leakage. Leakage is either calculated as a quantitative emissions volume (tCO_2e) or as a percentage of total emission reductions.

The project documentation should contain a projection of leakage based on available data and general observation. The project proponent must conduct a leakage investigation every two years using relevant survey methods that can be combined with monitoring surveys as is applicable. Leakage risks deemed very low can be ignored as long as the case for their insignificance is substantiated.
When appropriate, these sources of leakage should be assessed in the context of suppressed demand and satisfied level of service. If relevant conditions as defined in Annex 2 are demonstrated to apply, the leakage may not exist or may be diminished.

7. Performance Field Tests and Calculation of Emission Reductions

The baseline and project performance field tests (BFT and PFT) measure real, observed technology performance in the field. Consumption must be measured with a representative sample of end users under each defined baseline scenario (in the absence of the project technology) and project scenario.

In general a FT 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 independent sampling (different subjects, and usually different sample sizes, for baseline and project scenarios).
However, in some case a single sample test may be conducted; this would most typically occur when a baseline default factor is used, such that a PFT is required without any comparative BFT (as allowed for in the case of micro or small-scale project activities – see section below on cases with a single sample test).

The approach taken to conduct the performance tests must in any case 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.

Any sampling methods can be used[18], provided that the sample is selected randomly. However, whenever another method than Simple Random Sampling is used, the statistical analysis becomes more complicated than the approach described in Annex 4 and must be carried out by a statistician whose curriculum vitae and contact details must be provided as part of the project documentation submitted for review.

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

Representativeness

The FT must include a sample of potential end users that are typical of end users in the project activity. The surveys and FT can be conducted concurrently with the same subjects.

The project proponent must design the FT to ensure monitoring is representative of typical technology and fuel use practices. It must be made explicit to the households/institutions that they must behave and consume fuel normally, using whatever technologies they normally use. For example, in the case of improved cook stove activities, participants must be asked to cook typical meals during the duration of the study, include secondary stoves and fuels, exclude large parties or infrequent cooking events, and match cooking tasks in the BFT or those in the PFT. Participants should never be influenced to use a specific stove or fuel during the monitoring period, nor deviate from typical stove and fuel practices.

In situations where the baseline technology still operate as backups or complementary units in parallel with project technologies, the fuel consumption implications must be accounted for in the PFT.

PFTs are always required in the project situation even in cases where a 'zero emission' project technology[19] (e.g. solar stoves) is introduced, so as to capture the potential use of the baseline technology as backup or auxiliary units, or the potential introduction of an emitting backup or auxiliary project technology introduced in parallel with the 'zero emission' 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).

Sample Sizing and Statistical Estimate of the Fuel or Emission Savings

The baseline and project FT data must be analysed in combination to estimate the average annual emission reductions or average fuel savings per unit. Whenever the baseline fuel and project fuel are the same (e.g. deployment of improved cook stove for the reduction of non-renewable biomass use), the statistical analysis can be conducted with respect to fuel savings per unit. In cases where baseline fuel and project fuel are different (different emission factors), the statistical analysis must be conducted with respect to emission savings per unit.

There are two valid options for the statistical analysis. In all cases, sample sizes must be greater than 20:

     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.

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[19] Zero emission technology' refers here to emissions generated by technologies once installed within the targeted premises and operational – it does not refer not to life cycle emissions such as upstream emissions associated with the production or delivery of the technology.

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[20], i.e. the LOWER BOUND of the one-sided[21] 90% confidence interval.

It is not allowed to apply the rules to estimate baseline and project average emissions or average fuel use separately, with the exception of cases involving a single set of data, e.g. test data from a field test sampling project fuel consumption, in a case where a default factor is being used to define a baseline – see sub-section below on the case of a single sample test.

Recommended guidance is provided in Annex 4 for the example of Kitchen Performance Tests applied to improved cook stove activities. It can be adapted to different eligible technologies and/or local situations while ensuring representativeness.

Project scenario crediting in relation to the appropriate baseline scenario

Emission reductions are verified and credited by comparing the emissions for a given project scenario to the emissions for the applicable baseline scenario. As explained in section II.2, multiple project scenarios can be credited in comparison to different baseline scenarios, and multiple project scenarios can be credited in comparison to the same baseline scenario, as is applicable.

The initial emissions profile of each baseline scenario and project scenario is determined by the results of the respective baseline studies and project studies. Over the project period the results are updated and adjusted depending on results of the ongoing monitoring studies. Sections II.4 and II.5 describe requirements for the baseline studies and project studies required respectively for baseline and project scenarios, and section III.1 describes the requirements for ongoing monitoring studies.

When the baseline fuel and the project fuel are the same and the baseline emission factor and project emission are considered the same, the overall GHG reductions achieved by the project activity in year y are calculated as follows:

$$ER_y = \sum_{b,p} (N_{p,y} * U_{p,y} * P_{p,b,y} * NCV_{b,\text{ fuel}} * (f_{NRB,b,y} * EF_{fuel, CO2} + EF_{fuel, nonCO2})) - \sum LE_{p,y} \quad \textbf{(1)}$$

Where:

$\sum_{b,p}$	Sum over all relevant (baseline b/project p) couples
$N_{p,y}$	Cumulative number of project technology-days included in the project database for project scenario p against baseline scenario b in year y

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

[21] 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.

$U_{p,y}$	Cumulative usage rate for technologies in project scenario p in year y, based on cumulative adoption rate and drop off rate revealed by usage surveys (fraction)
$P_{p,b,y}$	Specific fuel savings for an individual technology of project p against an individual technology of baseline b in year y, in tons/day, as derived from the statistical analysis of the data collected from the field tests
$f_{NRB,b,y}$	Fraction of biomass used in year y for baseline scenario b that can be established as non-renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)
$NCV_{b,fuel}$	Net calorific value of the fuel that is substituted or reduced (IPCC default for wood fuel, 0.015 TJ/ton)
$EF_{b,fuel,CO2}$	CO_2 emission factor of the fuel that is substituted or reduced. 112 tCO_2/TJ for Wood/Wood Waste, or the IPCC default value of other relevant fuel
$EF_{b,fuel,nonCO2}$	Non-CO_2 emission factor of the fuel that is reduced
$LE_{p,y}$	Leakage for project scenario p in year y (tCO_2e/yr)

EF can include a combination of emission factors from fuel production, transport, and use. CO2 and non-CO2 emissions factors for charcoal may be estimated from project specific monitoring or alternatively by researching a conservative wood to charcoal production ratio (from IPCC, credible published literature, project-relevant measurement reports, or project-specific monitoring) and multiplying this value by the pertinent EF for wood.

When the baseline fuel and the project fuel are different and/or the emission factors are different, the overall GHG reductions achieved by the project activity in year y are calculated as follows:

$$ER_y = \sum_{b,p} N_{p,y} * U_{p,y} * \left(f_{NRB,b,y} * ER_{b,p,y,\,CO2} + ER_{b,p,y,\,non\text{-}CO2} \right) - \sum LE_{p,y} \qquad \textbf{(2)}$$

Where:

$\sum_{b,p}$	Sum over all relevant (baseline b/project p) couples
$N_{p,y}$	Cumulative number of project technology-days included in the project database for project scenario p against baseline scenario b in year y
$U_{p,y}$	Cumulative usage rate for technologies in project scenario p in year y, based on cumulative adoption rate and drop off rate (fraction)
$ER_{b,p,y,\,CO2}$	Specific CO_2 emission savings for an individual technology of project p against an individual technology of baseline b in year y, in tCO_2/day, and

	as derived from the statistical analysis of the data collected from the field tests
$ER_{b,p,y,\text{non-CO2}}$	Specific non-CO_2 emission savings for an individual technology of project j against an individual technology of baseline b in year y, converted in tCO_2/year, and as derived from the statistical analysis of the data collected from the field tests
$f_{\text{NRB,b,y}}$	Fraction of biomass used in year y for baseline scenario b that can be established as non-renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)
$LE_{p,y}$	Leakage for project scenario p in year y (tCO_2e/yr)

Adjustment factors

Adjustment factors can be applied during emission reduction crediting to allow for realistic comparisons of project technologies to the baseline scenarios. Adjustment factors fine tune the baseline and project scenarios to account for variability in fuel savings due to differences in project technology type, size, usage pattern, and other pertinent variables, without requiring project proponents to independently monitor new baseline and project scenarios.

Appropriate adjustment factors are developed through quantitative assessment and analysis of baseline and project monitoring studies, as well as through additional targeted lab and field monitoring.

For example, a project proponent may have conducted a PFT for an improved charcoal stove with a 500 cm^3 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. Similarly, the same wood stove may be used by some end users for domestic cooking and others for commercial cooking. Fuel consumption in the baseline and project scenario could be measured for the domestic users who comprise the large majority of customers, then adjusted based on measurements of cooking frequency and fuel use differences from usage surveys and monitoring surveys that capture information sufficient to compare domestic and commercial end users.

Adjustment factors cannot be used to estimate the consumption of one type of fuel based on the observed consumption for a different fuel. Representative sampling with appropriate weighting must be conducted in pertinent monitoring studies to ensure adjustments within scenarios and across scenarios are realistic. For example, 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.

Project estimation - Emission reductions estimated for the PDD

The project proponent must estimate emission reductions in the project documentation prior to validation using conservative assumptions for baseline and project scenario variables such as: fuel consumption, NRB, default or project-specific emissions factors, typical useful lifetimes for the improved technologies, and project size and duration. The baseline studies are used to estimate baseline fuel consumption and NRB. Project scenario fuel consumption and fuel savings is estimated from pertinent literature, lab testing and appropriate discounting factors, manufacturer specifications, or other viable sources of information on the project technology performance in relation to the baseline fuel consumption estimate from the baseline studies.

The Field Performance Test (FT)s, which provide the technology performance parameter values used during crediting, are required prior to verification, not validation. This allows the project to develop and evolve before the tests are conducted, resulting in more representative results. However, the project proponent does have the option to conduct FTs prior to registration.

Case of a Single Sample Test

There are two valid options for the statistical analysis. In all cases, the sample size must be greater than 20:

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 annual emission reduction per unit or MEAN fuel annual savings per unit.

b. 90% confidence rule. When the sample sizes are such that the "90/10 rule" is not complied with, the emission or fuel saving result is not the mean (or average) test result, but a lower value[22], i.e. the LOWER BOUND of the one-sided[23] 90% confidence interval.

The statistical analysis is performed on a single data set obtained from performance field tests in the project scenario, and the baseline emission calculations are conducted as follows:

$$BE_{b,y} = B_{b,y} * ((f_{NRB, y} * EF_{b,fuel, CO2}) + EF_{b,fuel, nonCO2}) * NCV_{b, fuel} \qquad \textbf{(3)}$$

Where:

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

[23] 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.

$BE_{b,y}$ — Emissions for baseline scenario b during the year y in tCO_2e

$B_{b,y}$ — Quantity of fuel consumed in baseline scenario b during year y, in tons, as per by-default factors[24] (cases with project performance field test only)

$f_{NRB,,y}$ — Fraction of biomass used during year y for the considered scenario that can be established as non-renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)

$NCV_{b,fuel}$ — Net calorific value of the fuel that is substituted or reduced (IPCC default for wood fuel, 0.015 TJ/ton)

$EF_{b,fuel,CO2}$ — CO_2 emission factor of the fuel that is substituted or reduced. 112 tCO_2/TJ for Wood/Wood Waste, or the IPCC default value of other relevant fuel

$EF_{b,fuel,nonCO2}$ — Non-CO_2 emission factor of the fuel that is substituted or reduced

EF can include a combination of emission factors from fuel production, transport, and use. CO_2 and non-CO_2 emissions factors for charcoal may be estimated from project specific monitoring or alternatively by researching a conservative wood to charcoal production ratio (from IPCC, credible published literature, project-relevant measurement reports, or project-specific monitoring) and multiplying this value by the pertinent EF for wood.

$$B_{b,y} = N_{p,y} * P_{b,y} \qquad (4)$$

Where:

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[24] As long as this is discussed in the project documentation on time for validation and regardless of the scale of the project activity, it is legitimate to use proxy field test results if enough survey data is available to demonstrate that the service delivered (e.g. amount of cooking in person-meals for cook stove activities) and specific fuels used for delivering this service are highly similar. The proxy field tests must be convincingly demonstrated as representative and in line with precision requirements of this methodology. Uncertainty of fuel or emissions reductions must then be estimated based on the independent sampling approach. For micro and small-scale improved cook stove project activities, and in cases where the monitoring plan ensures with sufficient confidence that the baseline technology is not in use anymore or that kitchen performance tests (KPT) in the project situation are conducted so as to allow for fuel consumed by retained baseline stoves, a default quantity of fuel may be used. It shall be based on: 1) 10% thermal efficiency for primitive stoves (those without chimney and grate) or 20% thermal efficiency for more advanced baseline stoves, 2) the thermal efficiency of the improved stove (as per appropriate lab test sampling), and 3) the fuel consumption of the project situation as measured by a KPT; thus $Fuel_{baseline} = \eta_{project}/\eta_{baseline} \times Fuel_{project}$). Where relevant, this avoids penalizing people who are malnourished, under cooking, or using unfavorable fuels due to poverty, as per Annex 2 on suppressed demand. Alternatively, the value of baseline fuel consumption in the considered target area (or in the relevant peer group if a suppressed demand approach is taken), may be found from credible literature such as a credible and validated report from a survey by a third party. All technologies in use in the considered premises in the baseline situation must be accounted for (it is not legitimate to only consider the most inefficient technology in use).

$N_{p,y}$	Project technology-days in the project database for project scenario p through year y
$P_{b,y}$	Specific fuel consumption for an individual technology in baseline scenario b during year y converted to tons/day

Project emission calculations are conducted as follows:

$$PE_{p,y} = B_{p,y} * ((f_{NRB,y} * EF_{p,fuel, CO2}) + EF_{p,fuel, nonCO2}) * NCV_{p, fuel} \qquad (5)$$

Where:

$PE_{p,y}$	Emissions for project scenario p during year y in tCO_2e
$B_{p,y}$	Quantity of fuel consumed in project scenario p during year y, in tons, and as derived from the statistical analysis conducted on the data collected during the project performance field tests (cases when no baseline performance field test are performed, e.g. by-default baseline factors)
$f_{NRB,y}$	Fraction of biomass used during year y that can be established as non-renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)
$NCV_{p,fuel}$	Net calorific value of the project fuel (IPCC default for wood fuel, 0.015 TJ/ton). This is equal to the baseline fuel NCV in projects which use the same fuel.
$EF_{p,fuel,CO2}$	CO_2 emission factor of the project fuel. This is equal to the baseline fuel EF in projects which use the same fuel, 112 tCO_2/TJ for Wood/Wood Waste, or the IPCC default value of other relevant fuel
$EF_{p,fuel,nonCO2}$	Non-CO_2 emission factor of the project fuel. This is equal to the baseline fuel EF in projects which use the same fuel.

EF can include a combination of emission factors from fuel production, transport, and use. CO_2 and non-CO_2 emissions factors for charcoal may be estimated from project specific monitoring or alternatively by researching a conservative wood to charcoal production ratio (from IPCC, credible published literature, project-relevant measurement reports, or project-specific monitoring) and multiplying this value by the pertinent EF for wood.

$$B_{j,y} = N_{p,y} * ((P_{p,y} * U_{p,y}) + (P_{b,y} * (1 - U_{p,y}))) \qquad (6)$$

Where:

$N_{p,y}$ Project technology-days in the project database for project scenario p through year y

$P_{p,y}$ Specific fuel consumption for an individual technology in project scenario p during year y converted to tons/day

$P_{b,y}$ Specific fuel consumption for an individual technology in baseline scenario b during year y converted to tons/day

$U_{p,y}$ Cumulative usage rate for technologies in project scenario j during year y, based on cumulative installation rate and drop-off rate.

The overall GHG reductions achieved by the project activity are then calculated as follows:

$$ER_y = \sum BE_{b,y} - \sum PE_{p,y} - \sum LE_{p,y} \qquad \textbf{(7)}$$

Where:

ER_y Emission reduction for total project activity in year y (tCO$_2$e/yr)

$BE_{p,y}$ Baseline emissions for baseline scenario b in year y (tCO$_2$e/yr)

$PE_{b,y}$ Project emissions for project scenario p in year y (tCO$_2$e/yr)

$LE_{p,y}$ Leakage for project scenario p in year y (tCO$_2$e/yr)

8. Data and Parameters not monitored over the crediting period

Data / Parameter:	$EF_{b,CO2}$
Data unit:	tCO$_2$/TJ or tCO$_2$/t_fuel
Description:	CO$_2$ emission factor arising from use of fuels in baseline scenario
Source of data:	IPCC defaults, credible published literature, project-relevant measurement reports, or project-specific field tests prior to first verification.[25]

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[25] **Criteria for deriving emissions factors from project-specific tests:**

1. Minimum sample size of 15 technology-use (for example, cooking) events per technology-fuel combination that are representative of local practices.
2. The 90/30 rule must be applied,, such that the mean emission factor may only be used if there is 90% confidence that the observed mean is within 30% of the true population value, otherwise a 90% CI adjustment must be applied
3. Baseline and project technologies monitored must be the same models/types as those monitored during the Performance Tests.
4. Technology operators must be from the project region or replicate local practices and techniques. Fuel type and condition must be representative of the project region, including factors such as fuel type and species (if wood), size, and moisture content. Technology-use events must be either uncontrolled tasks (such as normal daily cooking in homes) or be based on typical practice (such as cooking a typical meal) from the project area.

Any comment:	If EF is in units of tCO2/t_fuel, remove NCV term from emission calculations. Term can include a combination of emission factors from fuel production, transport, and use[26].

Data / Parameter:	$EF_{b, nonCO2}$
Data unit:	tCO_2/TJ or tCO_2/t_fuel
Description:	Non-CO2 emission factor arising from use of fuels in baseline scenario
Source of data:	IPCC defaults, credible published literature, project-relevant measurement reports, or project-specific field tests prior to first verification[20]
Any comment:	Term can include a combination of emission factors from fuel production, transport, and use.

Data / Parameter:	$EF_{p,CO2}$
Data unit:	tCO_2/TJ or tCO_2/t_fuel
Description:	CO_2 emission factor arising from use of fuels in project scenario
Source of data:	IPCC defaults, credible published literature, project-relevant measurement reports, or project-specific field tests prior to first verification. In the case of project fuels being renewable biomass, project-relevant or project-specific field tests are mandatory (project –relevant field tests are those not undertaken for the proposed project but which directly reflect project conditions).[27]
Any comment:	If EF is in units of tCO2/t_fuel, remove NCV term from emission calculations. Term can include a combination of emission factors from fuel production, transport, and use[28]. This has same value as EFbaseline in projects which reduce use of the same fuel.

Data / Parameter:	$EF_{p, nonCO2}$
Data unit:	tCO_2/TJ or tCO_2/t_fuel
Description:	Non-CO2 emission factor arising from use of fuels in project scenario
Source of data:	IPCC defaults, credible published literature, project-relevant measurement reports, or project-specific field tests prior to first verification. In the case of project fuels being renewable biomass, project-relevant or project-specific field tests are mandatory (project –relevant field tests are those not undertaken for the proposed project but which directly reflect project conditions).[20]
Any comment:	Term can include a combination of emission factors from fuel production, transport, and use. This has same value as EFbaseline in projects which reduce use of the same fuel.

Data / Parameter:	NCV_b
Data unit:	TJ/ton
Description:	Net calorific value of the fuels used in the baseline
Source of data:	IPCC defaults, project-relevant measurement reports, or project-specific testing
Any comment:	If EF is in units of tCO2/t_fuel, remove NCV term from emission calculations.

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[26] CO_2 and non-CO_2 emissions factors for charcoal may be estimated as above or alternatively by researching a conservative wood to charcoal production ratio (from IPCC, credible published literature, project-relevant measurement reports, or project-specific monitoring) and multiplying this value by the pertinent EF for wood.

[27] Same footnote as per baseline. In the case of renewable fuels and fuel-switch projects, the guidance given in Section I may be followed as an alternative to these criteria.

[28] Same footnote as per baseline

Data / Parameter:	NCV_p
Data unit:	TJ/ton
Description:	Net calorific value of the fuels used in the project
Source of data:	IPCC defaults, project-relevant measurement reports, or project-specific testing
Any comment:	If EF is in units of tCO2/t_fuel, remove NCV term from emission calculations. This has same value as NCVbaseline in projects which reduce use of the same fuel.

SECTION III: MONITORING METHODOLOGY

1. Monitoring Procedure

A total sales record and project database are maintained continuously. For each project scenario a monitoring survey and usage survey is conducted annually while a leakage assessment is conducted every two years to update monitoring parameters over time.
For each baseline scenario and project scenario the BFT and PFT is updated every two years, respectively, except in cases of fixed baseline implying no need for a BFT.

A. Total Sales Record

The project proponent must maintain an accurate and complete sales record[29]. The record should be backed up electronically.

The required data are:
1. Date of sale[30]
2. Geographic area of sale
3. Model/type of project technology sold
4. Quantity of project technologies sold
5. Name and telephone number (if available), and address:
    a. Required for all bulk purchasers, i.e., retailers and industrial users
    b. All end users except in cases where this is justified as not feasible[31]. In such cases the number of names/telephone numbers/addresses collected must be as many as commensurate with representative sampling, i.e. the number of end user names and addresses (and phone numbers where possible) within sales record shall be large enough so that surveys and tests can be based on representative,

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[29] The sales record is substituted by a "dissemination record" or "installation record" in projects with non-commercial distribution or dissemination of a practice. In the case of sale of a renewable fuel, the record tracks quantities of the fuel sold and must be accompanied by suitable evidence that the fuel quantities replaced the assigned baseline fuel.

[30] Date of sale should be associated with conservative assessment as to date of installation and commencement of use of the technology.

[31] Such as cases of distributed sales of small items (such as portable cook stoves, heat retention cookers, water filters) sold in market stalls or shops where the retailer cannot reasonably be expected to collect customers names and addresses during busy times.

purely randomly selected samples. In all cases this should not be less than 10 times the survey and field test sample sizes (including usage surveys for each age of product), in order to ensure an adequate end user pool to which random sampling can be applied.

6. Mode of use: domestic, commercial, other:
   a. As many as commensurate with representative sampling

B. Project Database

The project database is derived from the total sales record (or dissemination record in case of non-commercial distribution) with project technologies differentiated by different project scenarios. The differentiation of the project database into sections is based on the results of the applicable monitoring studies for each project scenario, in order that ER calculations can be conducted appropriately section by section Technologies aged beyond their useful lifetime, as established in the usage survey, are removed from the project database and no longer credited.

C. Ongoing Monitoring Studies

The following ongoing monitoring studies are conducted for each project scenario following verification of the associated initial project studies. These monitoring studies investigate and define parameters that could not be determined at the time of the initial project studies or that change with time.

a) **Monitoring Survey** – Completed annually, beginning 1 year after project registration

The monitoring survey investigates changes over time in a project scenario, and in a baseline scenario in case of industrial applications (or renewal of crediting period), by surveying end users with project technologies (and baseline technologies in case on industrial applications) on an annual basis. It provides critical information on year-to-year trends in end user characteristics such as technology use, fuel consumption and seasonal variations.

Monitoring Survey Representativeness:

End users from a given project scenario are selected using representative sampling techniques to ensure adequate representation of users with technologies of different ages. Common sampling approaches such as clustered random sampling are allowed and geographic distribution should be factored into selection criteria[32]. End users can be surveyed at any time(s) throughout the year with care taken to collect information pertaining to seasonal variations in technology and fuel use patterns.

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

Monitoring Survey sample sizing and data collection:

The monitoring survey has the same sample sizing and data collection guidelines as the baseline survey described in Section II.4, but for non-industrial applications, the monitoring survey is 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). Monitoring surveys can be conducted with usage survey participants that are currently using the project technology.

b) **Usage Survey** – Completed annually, or more frequently, and in all cases on time for any request of issuance. The usage survey provides a single usage parameter that is weighted based on drop off rates that are representative of the age distribution for project technologies in the total sales record.[33]

A usage parameter must be established to account for drop off rates as project technologies age and are replaced[34]. Prior to a verification, a usage parameter is required that is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario. For example, if only technologies in the first year of use (age_{0-1}) are being credited, a usage parameter must be established through a usage survey for technologies age_{0-1}. If an equal number of technologies in the first year of use (age_{0-1}) and second year of use (age_{1-2}) are credited, a usage parameter is required that is weighted to be equally representative of drop off rates for technologies age_{0-1} and age_{1-2}.

The minimum total sample size is 100, with at least 30 samples for project technologies of each age being credited[35]. The majority of interviews in a usage survey must be conducted in person and include expert observation by the interviewer within the kitchen in question, while the remainder may be conducted via telephone by the same interviewers on condition that in-kitchen observational interviews are first concluded and analyzed such that typical circumstances are well understood by the telephone interviewers.

The usage parameter must be applied when calculating the quantity of fuel consumed in project scenario p during year y ($B_{P,y}$). Unless proven otherwise, it should be assumed that any drop off in the use of the project technology is replaced by fuel consumption in the applicable baseline scenario. The usage survey will establish a useful lifetime for

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[33] To ensure conservativeness, 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 longer than 0.5 years. For technologies in the second year of use (age_{1-2}), the usage survey must be conducted with technologies that have been in use on average at least 1.5 years, and so on.

[34] It may be the case that the drop off rate is lower in the second year than in the first year, reflecting possible difficulties in the early adoption of a new technology.

[35] Thus if technologies of age 1-5 are credited, the usage survey must include 30 representative samples from each age for a total of 150 samples. The resulting usage parameter should be weighted based on the proportion of technologies in the total sales record of each age.

technologies after which they are removed from the project database and no longer credited[36].

    c) **Project FT Update** – Completed every other year, or more frequently.

The PFT update is an extension of the project PFT and provides a fuel consumption assessment representative of project technologies currently in use every two years. Hence the PPT update accounts for changes in the project scenario over time as project technologies age and new customers are added, also as new models and designs are introduced. It is legitimate to apply an Age Test instead of a PFT, to project technologies which remain materially the same year after year.

    d) **Baseline FT Update –** Completed every other year, or more frequently, except in cases where a fixed baseline is adopted. The BFT update requirements are the same as for the PFT update.

    e) **Leakage Assessment** – Completed every other year, starting on time for the first verification. Guidance provided in section II.6.

    f) **Non-Renewable Biomass Assessment Update**

The non-renewable biomass fraction is fixed based on the results of the NRB assessment. Over the course of a project activity the project proponent may at any time choose to re-examine renewability by conducting a new NRB assessment. In case of a renewal of the crediting period and as per Gold Standard rules, the NRB fraction must be reassessed as any other baseline parameters and updated in line with most recent data available.

2. Adding a New Baseline or Project Scenario

As explained in section II.2, although all expected baseline and project scenarios shall be defined in the project documentation on time for validation and registration review, new baseline and project scenarios can be added to a project activity at any time during the project period upon approval of a request for design changes, as per Gold Standard rules. 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. When a new baseline or project scenario is created, the baseline or project studies, respectively, must be conducted prior to verification and crediting with respect to the new scenario. The monitoring requirements in section III are applicable to a new scenario once the baseline or project studies are complete and the scenario is verified.

For example, a stove technology representing a new project scenario may be disseminated starting at the beginning of year 3 of a project activity. A sales record must be maintained and project studies conducted prior to verification of emission reductions from this new project

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[36] The corresponding household may of course then acquire a new improved stove in which case emission reductions will be claimable under another technology vintage.

scenario at the end of year 3. Ongoing monitoring studies are required for the new project scenario starting in year 4.

3. Quality Assurance and Quality Control

The project proponent 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.

Contact information in the total sales record must allow a project auditor to easily contact and visit end users. An auditor must also be able to cross reference pertinent project documentation, which must include 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.

4. Data and Parameters monitored over the crediting period

Data / Parameter:	$f_{NRB,i,y}$
Data unit:	Fractional non-renewability
Description:	Non-renewability status of woody biomass fuel in scenario i during year y
Source of data:	Applicable NRB assessment
Monitoring frequency:	Fixed by baseline study for a given crediting period, updated if necessary as specified in section III.1
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	As applicable, NRB assessment may be used for multiple scenarios

Data / Parameter:	$P_{b,y}$
Data unit:	kg/household-day, kg/person-meal, etc.
Description:	Quantity of fuel that is consumed in baseline scenario b during year y
Source of data:	Baseline FT, baseline FT updates, and any applicable adjustment factors
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	A single baseline fuel consumption parameter is weighted to be representative of baseline technologies being compared for project crediting.

Data / Parameter:	$P_{p,y}$
Data unit:	kg/household-day, kg/person-meal, etc.
Description:	Quantity of fuel that is consumed in project scenario p during year y
Source of data:	Total sales record, Project FT, project FT updates, and any applicable adjustment factors
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	A single project fuel consumption parameter is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario

Data / Parameter:	$U_{p,y}$
Data unit:	Percentage
Description:	Usage rate in project scenario p during year y
Source of data:	Annual usage survey

Monitoring frequency:	Annual or more frequently, in all cases on time for any request for issuance
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	A single usage parameter is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario.

Data / Parameter:	$N_{p,y}$
Data unit:	Project technologies credited (units)
Description:	Technologies in the project database for project scenario p through year y
Source of data:	Total sales record
Monitoring frequency:	Continuous
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	The total sales record is divided based on project scenario to create the project database

Data / Parameter:	$LE_{p,y}$
Data unit:	t_CO_2e per year
Description:	Leakage in project scenario p during year y
Source of data:	Baseline and monitoring surveys
Monitoring frequency:	Every two years
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	Aggregate leakage can be assessed for multiple project scenarios, if appropriate

SECTION IV: ANNEXES

Annex 1: Non-Renewable Biomass (NRB) Assessment

In projects where woody biomass is a component of either the baseline or project scenario, project proponents must specify the extent to which the CO_2 emissions of that biomass are not offset by re-growth in the fuel collection area.

The non-renewable biomass (NRB) assessment is conducted following the CDM EB 23 Annex 18 definition of "renewable biomass" (by inversion) and by collecting evidence through field surveys, literature review and resource/population mapping studies. Depending on the depth and quality of information available on biomass supply and growth in the collection area, project proponents may or may not be able to pursue a quantitative approach. If possible, project proponents should adopt the quantitative approach below; otherwise the qualitative approach should be used. The best method is to combine both approaches and include conservative estimates.

NRB Assessment Options

Project proponents may choose one of the following two options to estimate the fractional non-renewability of woody biomass fuels (f_{NRB}):

a) Adoption of the approach described in sections A1.1 and A1.2 below;

b) Adoption of the approach similar to CDM-approved methodology AMS II.G v02, as developed in section A1.3 below.

Both options (a) and (b) assume it is possible to estimate the locations and extent of the areas from which woody biomass fuel[37] used by the project participants is collected. If estimating the collection area is difficult, project proponents can aggregate all reachable woody biomass fuel collection areas within the relevant country and apply a single fraction derived from all collection areas in the country, with respect to the options above.

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[37] The term woody biomass fuel is used here to mean both firewood and charcoal produced from wood

A1.1 Quantitative NRB Assessment

A. Specify the geographic area from which woody biomass fuel is or could reasonably be expected to be collected by or for the project population, and adopt whichever is the larger. This is termed the fuel collection area or reachable collection area (A). This area is not only forest but any area where woody biomass is present, effectively a combination of forest and so-called "invisible forest" which includes grasslands.

B. Use credible information sources, field surveys, or both, to ascertain the amount of woody biomass that is regenerating each year in this area. This is the mean annual increment (MAI).

C. Quantify the amount of non-renewable biomass (NRB) drawn from the fuel collection area (A) as follows:

$$NRB \;=\; H \;-\; MAI \tag{8}$$

Where:

H   Annual harvest of woody biomass, including forest clearance, timber extraction, consumption of wood fuels, drawn from fuel collection area A

MAI   sum of mean annual increments of the wood species, or "re-growth" in area A

NRB   non-renewing biomass or excess harvest over and above re-growth, which is the amount of woody biomass removed with attendant CO_2 emissions which are not absorbed by re-growth
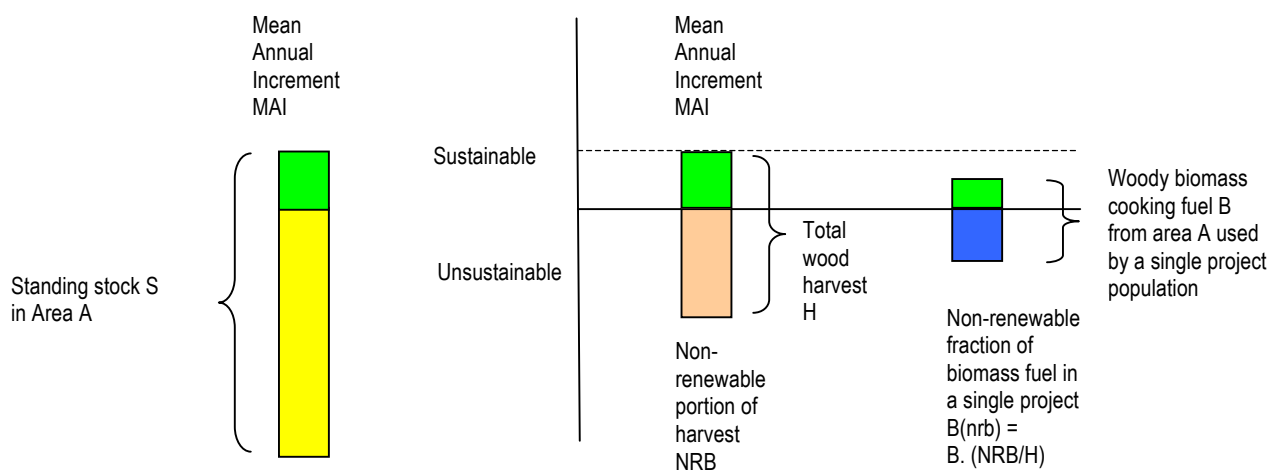
The diagram illustrates sustainable and unsustainable woody biomass extracted from fuel collection area A. MAI is a percentage of the total standing stock S, and NRB is the harvest taken from area A, net of MAI. The fraction of the harvest which is non-renewable is NRB/H.

D. Ascertain the fraction of extracted woody biomass that is non-renewable, denoted f_{NRB}. If a quantity of woody biomass supplied from fuel collection area A is used as a fuel for thermal energy production, the fraction f_{NRB} is assumed to be non-renewable with CO_2 emissions that are not reabsorbed by re-growth:

$$f_{NRB} = (NRB/H) \tag{9}$$

The fraction f_{NRB} should be assessed for the different types of reachable collection areas, for example forest and grassland. If it is not possible to take a quantitative approach in all area types, it should be taken wherever possible, and a qualitative approach taken for the other area types.

A1.2 Qualitative NRB Assessment

Satellite imagery, combined with field surveys, pertinent literature reviews, and expert consultations can provide sufficient evidence of non-renewability and lead to an acceptable conservative estimate of f_{NRB}.

The project proponent can use satellite imagery to link population centres with a demand for biomass fuel to associated reachable biomass harvesting areas from which fuel is sourced.

The project proponent can use field surveys to identify reachable collection areas for population groups, and ascertain the history of collection in each area. For example, interviews and field evidence may show that over recent years collection distance is increasing and that the harvest of fuel wood is exceeding the sustainable supply. This can apply both to manual woody biomass fuel collection in relatively small areas involving walking distances, and to urban woody biomass fuel consumption with nationwide collection areas. Literature study and consultations with experts with long-standing knowledge of the areas in question will also provide important evidence.

A qualitative assessment should conclude with an estimate of f_{NRB}, using a combination of the above sources of information to substantiate the conclusion.

A1.3 NRB Assessment similar to approach of CDM methodology AMS-II.G

Differentiation between Non-renewable and Renewable woody biomass

Project proponents should determine the share of renewable and non-renewable woody biomass using data from surveys, reports, published literature, and government records that is reliable and credible. The following principles should be taken into account:

Demonstrably[38] Renewable woody Biomass (DRB):

Woody biomass or its derivatives (such as charcoal) is renewable if any one of the following two conditions is satisfied:

I.   The woody biomass is originating from land areas that are forests where:

      (a) The land area remains a forest; and

      (b) Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and

      (c) Any national or regional forestry and nature conservation regulations are complied with.

II. The biomass is woody biomass and originates from non-forest areas (e.g., croplands, grasslands) where:

      (a) The land area remains as non-forest or is reverted to forest; and

      (b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and

      (c) Any national or regional forestry, agriculture and nature conservation regulations are complied with.

Non-renewable biomass:

Non-renewable woody biomass (NRB) is the quantity of wood fuel used in the absence of the project activity minus the quantity designated as DRB, as long as either:

    (a) Survey results, national or local statistics, studies, maps or other sources of information such as remote sensing data show that carbon stocks are depleting in the project area;

    or,

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[38] Renewability must be demonstrated by providing incontrovertible evidence of management of biomass resources (for example regular records of harvesting, combined with credible observations of commensurate re-growth) and evidence of likely continuation of management. Project proponents should not designate DRB if there is contrary evidence or cause to doubt reliability of records.

at least two of the following supporting indicators are shown to exist (or one of the following combined with (a) above):

(b) Trend showing increase in time spent or distance travelled by users (or fuel wood suppliers) for gathering fuel wood or trend showing increase in transportation distances for the fuel wood transported into the project area;

(c) Increasing trends in fuel wood price indicating scarcity

(d) Trends in the type of cooking fuel collected by users, suggesting scarcity of woody biomass

(e) Inadequate access to energy for cooking, or scarcity of wood fuel resources, are significant components of poverty

Under these conditions, the fraction of woody biomass saved by the project activity in year y that can be established as non-renewable is given by:

$$f_{NRB} = NRB / (NRB + DRB) \qquad\qquad\qquad (10)$$

Should these conditions not apply, f_{NRB} cannot be estimated on the basis of this approach. f_{NRB} must either be designated as zero (concluding that all wood fuel in the project is renewable although not demonstrated as such as required for designation as DRB) or it can be assessed by application of the alternative estimation options provided above.

Annex 2 Suppressed demand and satisfactory level of service

When a group of people are deprived of a reasonable level of human development in comparison to their peers, and the opportunity to achieve a satisfactory level of service is available through carbon finance calculated from the baseline level of service of their peers or from the project level of service achievable, then project proponents can adjust the baseline scenario accordingly.

This principle implies that the equations presented above for emission reduction calculation must be adapted for cases of suppressed demand on a case-by-case basis.

The target population in a baseline scenario can experience poverty-related under cooking and resulting malnourishment due to insufficient access to cooking fuels. The project activity corrects this by virtue of introducing more efficient cooking devices. The amount of energy delivered to the pot (the 'cooking energy utilized' or CEU) increases in the project scenario compared to the baseline scenario, as the affected population achieve a satisfactory level of service.

A similar situation can arise in cold climates due to space heating needs. Populations may lack sufficient fuel to satisfy space heating needs, resulting in substandard living conditions. If a project introduces a new technology that enables improved energy access, then the total kitchen CEU (including cooking and space heating needs) in the project scenario can exceed that in the baseline scenario the project having achieved a satisfactory level of service.

One possible case is that cooking system efficiency in the baseline does not change, but the delivered energy is equal to the project delivered energy, thus giving rise to a hypothetical baseline fuel quantity (of the same type as in the baseline). In the project scenario, one uses the measured efficiency and fuel amount. In such instances, evidence should suggest that project level was satisfactory but not excessive and that the previous level was unsatisfactory according to universally accepted living standard benchmarks.

Another case is that the hypothetical baseline is set to a proxy technology based on the standard of living achieved by peers. This may be appropriate in some cases where project scenarios are feature renewable energy. The project scenario, in some cases, may also be taken as a proxy technology.

Such cases should first be analysed in terms of increasing living standards, in which case they are addressed in the methodology as a changing trend in a baseline scenario. The "increasing living standards" argument may require the replacement of a biomass baseline with a proxy of 100% fossil fuel and a project-level of satisfactory service would be used to estimate CEU. If such trends increase emission reductions, trends must be justified with evidence.

If increasing standards of living are not directly apparent in the population examined, the project proponent may nevertheless provide a plausible argument that the project-level value of CEU is appropriate for the baseline used to calculate emission reductions. In such cases, observed rising living standards of peers are not being realized by the population in question and are therefore suppressed.

Annex 3: Application of the methodology to safe water supply project scenarios

The methodology allows project technologies and practices that reduce the amount of CO_2-emitting fuel consumed by changing kitchen practice from water boiling as a purification technique to the introduction of new 'zero emission technology'[39] that provides safe water, e.g. gravity household water filters, borehole pumps (not fossil fuel-driven) and their repair/maintenance/operation, ultraviolet radiation treatment, chlorine tablets, etc.[40].

Special attention is required, as throughout all technologies encompassed by this methodology, to the level of GHG emissions arising from production, transport, installation and delivery of the clean water supply or treatment options[41]. Whenever such emissions are expected to be material (5% or more of the overall emissions), these must in any case be accounted for in the project situation as part of the project emissions. In the baseline situation, the project proponent has the option to take them into account, or to neglect them altogether (as this latter case implies a conservative result).

Only end users that boil water or are currently using unsafe water are eligible for crediting. The baseline scenario is the existing practice of treating water for consumption by boiling using high emission fuels including non-renewable biomass and fossil fuels. Suppressed demand can be applied in instances where inadequate safe water is available or where treatment is not practiced.

The diagram below provides an overview of how the application of the methodology results in emission reductions per person per day for the safe water provision project activity[42] (the diagram assumes that water boiling with non-renewable biomass is the baseline practice but can easily be generalized).

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[39] Zero emission technology' refers here to emissions generated by technologies once installed within the targeted premises and operational – it does not refer not to life cycle emissions such as upstream emissions associated with the production or delivery of the technology. This prohibits technologies which when operating, use fossil fuels.

[40] Project proponents must include in project documents, evidence that the technologies promoted are sustainable in the project areas.

[41] For example, the materiality of upstream emissions associated with the production of chemicals must be discussed in the context of water chemical treatment activities

[42] The equation is simplified to emissions per person per day for illustrative purposes. The figure must be multiplied by the average number of household members and by 365 days to equal the annual emission reductions per clean water supply technology (or by the number of days in any given monitored period). Actual safe water consumption is determined by monitoring surveys for each project scenario.

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┌─────────────────────────────────────┐
│  Emission Reductions per person per  │
│              day                     │
└─────────────────────────────────────┘

                  =

┌─────────────────────────────────────┐            ┌──────────────────────────────────────┐
│         Baseline Emissions           │     =      │     Non-renewability of biomass (%)  │
└─────────────────────────────────────┘            │                   x                  │
                                                    │       Fuel used to Treat Water (T/L) │
                                                    │                   x                  │
                                                    │   Total Safe Water consumed in Project│
                                                    │           Scenario (L/p/d)           │
                  -                                 │                   x                  │
                                                    │       Emissions Factor (tCO2/T)      │
                                                    └──────────────────────────────────────┘


                                                    ┌──────────────────────────────────────┐
┌─────────────────────────────────────┐            │     Non-renewability of biomass (%)  │
│          Project Emissions           │     =      │                   x                  │
└─────────────────────────────────────┘            │       Fuel used to Treat Water (T/L) │
                                                    │                   x                  │
                                                    │   Raw Water Still Boiled in project  │
                                                    │    scenario and clean water boiled   │
                                                    │              (L/p/d)                 │
                  -                                 │                   x                  │
                                                    │       Emissions Factor (tCO2/T)      │
                                                    └──────────────────────────────────────┘

┌─────────────────────────────────────┐
│              Leakage                 │
└─────────────────────────────────────┘
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A3.1   Baseline and Project Scenario Emissions Calculations

Quantities of fuel consumed in the baseline and project scenarios, $B_{b,y}$ and $B_{p,y}$, respectively, are calculated as shown below. Fuel consumption is calculated (or "back-calculated" in the case of the baseline scenario) by multiplying the safe water consumption of end users observed in the project scenario by the amount of fuel required to boil a specific quantity of water[43].

Baseline Scenario Fuel Consumption Calculation

The total safe water consumed in the project scenario is the amount of safe water supplied by the project technology and consumed in the project scenario, plus the amount of raw water boiled after introducing the project technology (respectively represented below as $Q_{p,y} + Q_{p,rawboil,y}$). This total is assumed to be equivalent to water boiled[44] in the baseline. *If the total of these two volumes exceed the cap of 7.5 L/p/d stipulated in the section on suppressed demand below[45], the project proponent's claim for emission reductions may not exceed the cap[46].*

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[43] Water consumption is typically measured as volume per person per day. Other metrics can be applied as is applicable in a given project scenario, such as volume per unit per day. Consumption is determined by random sampling surveys representative of the considered scenario.

[44] Water consumed in the baseline scenario that is already from a safe source or treated effectively (e.g., water from boreholes, or water treated by with chemicals) should be excluded from the crediting baseline. This is done using a "C factor" as introduced in the equation 10 below.

[45] For avoidance of doubt, the value of the cap cannot be used instead of a monitored value of this parameter. If the monitored value is less than the cap, the measured value must be used to calculate emission reductions.

[46] It is immaterial how much of the clean water is used for drinking and how much for human washing and cooking.

$B_{p,y}$ = Number of person-days x Baseline Fuel used to Treat Water (T/L) x Total Safe Water consumed in project scenario (L/p/d)

$$B_{p,y} = (1 - C_j) * N_{j,y} * W_{i,y} * (Q_{j,y} + Q_{j,rawboil,y}) \qquad (11)$$

Where:

$N_{j,y}$ Number of person.days consuming water supplied by project scenario p through year y[47]

C_j Expressed as a percentage, this is the portion of users of the project technology j who in the baseline were already consuming safe water without boiling it

$B_{b,y}$ Quantity of fuel consumed in baseline scenario b during the year y in tons

$Q_{p,y}$ Quantity of safe water in litres consumed in the project scenario p and supplied by project technology per person per day

$Q_{p,rawboil,y}$ Quantity of raw water boiled in the project scenario p per person per day

$W_{b,y}$ Quantity of fuel in tons required to treat 1 litre of water using technologies representative of baseline scenario b during project year y, as per Baseline Water Boiling Test.

Project Scenario Fuel Consumption Calculation

$B_{p,y}$ = Number of person.days x Project Fuel used to boil water (T/L) x Total volume of water boiled in project scenario (L/p/d)

$$B_{p,y} = (1 - C_j) * N_{p,y} * W_{b,y} * (Q_{p,rawboil,y} + Q_{p,cleanboil,y}) \qquad (12)$$

Where:

$N_{p,y}$ Number of person.days consuming water supplied by project scenario p through year y

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[47] In cases where safe water or water treatment chemicals for home use are acquired by end users at distribution points instead of at home (e.g. bulk water chemical treatment activity), project proponents must propose appropriate monitoring procedures so as to evaluate in a conservative way the amount of water actually consumed per person and per day and account for the share of this water which would end up being boiled anyway.

C_j Expressed as a percentage, this is the portion of users of the project technology j or who in the baseline were already consuming safe water without boiling it

$B_{p,y}$ Quantity of fuel consumed in project scenario p during the year y in tons

$Q_{p,rawboil,y}$ Quantity of raw water boiled in the project scenario p per person per day

$Q_{p,cleanboil,y}$ Quantity of safe water boiled in the project scenario p per person per day

$W_{p,y}$ Quantity of wood fuel or fossil fuel in tons required to treat 1 litre of water using technologies representative of the project scenario p during project year y

Emission Reductions

$$BE_{b,y} = B_{b,y} * ((f_{NRB,b,y} * EF_{b,fuel, CO2}) + EF_{b,fuel, nonCO2}) * NCV_{b\ fuel}$$

$$PE_{p,y} = B_{p,y} * ((f_{NRB,p,y} * EF_{p,fuel, CO2}) + EF_{p,fuel, nonCO2}) * NCV_{p,\ fuel}$$

Where the parameters are defined as in section II above.

The overall GHG reductions are calculated as follows:

$$ER_y = (\sum BE_{b,y} - \sum PE_{p,y}) * U_{p,y}\ - \sum LE_{p,y} \tag{13}$$

Where:

$U_{p,y}$ Cumulative usage rate for technologies in project scenario p during year y, based on cumulative installation rate and drop off rate.

A3.2   Suppressed Demand for Potable Water

The principles of suppressed demand outlined in annex 2 can be applied to safe water shortages. Purifying water normally requires users to collect or purchase biomass fuel and boil water for 10 minutes. In many circumstances, energy poverty barriers result in less than the minimum required amount of potable water (e.g., by boiling less water or not being able to boil water).

To account for suppressed demand of safe water, project proponents can define the baseline scenario on the basis of the quantity of safe water used in the project scenario for all purposes where contaminated water would imply a health or livelihood risk. This is measured in the project scenario (after the introduction of the safe water supply technology) as the sum of the amount of safe water supplied and the amount of raw water still boiled. This represents the amount of safe water that would provide households with a satisfactory level of service.

In order to ensure that this amount is conservative and does not exceed the definition of a satisfactory level of service, the baseline quantity is capped at the WHO's "basic needs" for

treated water[48]. This is a conservative figure when one considers that developed world safe water access is the appropriate point of comparison and that access to safe water is a basic human right[49].

Also, if the most likely scenario for the satisfied demand situation is the use of a modern fuel (e.g. kerosene, LPG) to boil water rather than non-renewable biomass, this should be taken into account in the evaluation of the baseline emissions.

A3.3 Application of the Monitoring Methodology for Water Treatment Project Scenarios

Project Studies for a Water Treatment Project Scenario

The project proponent must conduct project studies for each clean water project scenario prior to verifying emission reductions associated with the given project scenario. This approach uses ex-post project studies from which fuel consumption in the baseline scenario is back-calculated.

The project proponent must conduct the following project studies for each project scenario:

A. Project non-renewable biomass (NRB) assessment, if biomass is one of the fuels consumed[50]
B. Project survey (PS) of end user characteristics
C. Baseline water boiling test (BWBT)
D. Water consumption field test (WCFT) of safe water provision by project technologies and of water boiled in project scenario

The baseline living standard is captured in the project survey and reflected in the water consumption field test.

A. Project Non-Renewable Biomass Assessment

As described in section II.4.A and appropriate annex

B. Project Survey

The safe water project survey has the same requirements as the baseline survey (see section II.4), but it is conducted with end users representative of the project scenario target population and currently using the safe water project technology. Guidance on representativeness and sample sizing is the same.

In the guidance on data collected, questions about end user characteristics and baseline technology and fuels should be treated as specific to safe water supply and boiling. These

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48 This cap is 7.5 L/p/d.

49 "The human right to water is indispensable for leading a life in human dignity", The right to water (arts. 11 and 12 of the International Covenant on Economic, Social and Cultural Rights), UN 2003

50 As appropriate, multiple project scenarios may use the same NRB baseline, which may be the same as that used in the baseline scenario.

questions should be asked twice, first in regards to the baseline scenario water supply and water treatment, including boiling technologies, and second in regards to the project scenario clean water supply, including treatment and boiling technologies.

C. Baseline Water Boiling Test

The baseline water boiling test (BWBT) is conducted to calculate the quantity of fuel required to purify by boiling one litre of water for 10 minutes using technologies and fuels representative of the baseline scenario ($W_{b,y}$). The BWBT should be conducted using the 90/30 rule for selection of samples[51], accounting for variability in the types of prevalent baseline technologies.

If the monitoring surveys reveal that the same water boiling technologies are prevalent in the baseline and project scenarios, $W_{b,y}$ and $W_{p,y}$ are equal. The BWBT should be updated if monitoring surveys show that water boiling technologies change over time.

D. Water Consumption Field Test

The water consumption field test (WCFT) is similar to the FT, except project-supplied clean water consumption volumes and boiling is measured rather than fuel consumption. The WCFT is conducted with end users representative of the project scenario target population and currently using the project technology. Guidance from section II.4.C on FT representativeness, sample sizing, and variability is applicable.

Three different volumetric variables are measured, as indicated by the equations above:

$Q_{p,y}$ Quantity of safe water in litres consumed in the project scenario p and supplied by project technology per person per day

$Q_{p,rawboil,y}$ Quantity of raw or unsafe water boiled in the project scenario p per person per day

$Q_{p,cleanboil,y}$ Quantity of safe (treated, or from safe supply) water boiled in the project scenario p per person per day

E. Ongoing Monitoring Studies: Usage rates, leakage, water quality

The ongoing monitoring requirements are as prescribed in section III of the methodology for monitoring surveys, usage surveys, leakage assessment, and updating baseline scenarios and NRB baselines.

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[51] The endpoints of the 90% confidence interval lie within +/- 30% of the estimated mean.

Monitored parameters in FTs in the case of safe water provision include the three volumetric parameters listed above, and also include the parameter of project water quality. Water quality testing may be conducted either in the field or by transportation to laboratories; in all cases the testing approach must be described fully in monitoring reports, credible 3rd party endorsement must be included, and the appropriateness of the testing approach must be justified.

In cases where the effectiveness of project technologies may be indicated reliably through proxies, such as reliable evidence that they are being maintained and used correctly in accordance with manufacturers' or installers' , then the FTs may capture such evidence of water quality in pace of chemical and biological indicator tests. Again, credible 3rd party endorsement of FT reports are required.

Under certain circumstances the baseline scenario may require updating, in which case new baseline water boiling test and water consumption field tests may be necessary.

A3.4   Data and Parameters Not Monitored over the crediting period

As in section II.8, and also:

Data / Parameter:	C
Data unit:	Percentage
Description:	Portion of users of project safe water supply who were already in baseline using a non-boiling safe water supply
Source of data:	Baseline study. Credible literature, studies, survey, reports,, relevant to the project target area.
Monitoring frequency:	
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	$W_{b,y}$
Data unit:	Kilograms/Litre
Description:	Quantity of wood fuel or fossil fuel required to boil 1 litre of water using technologies representative of baseline scenario b during project year y
Source of data:	Baseline water boiling test BWBT; either conducted freshly or as reported/published in reliable literature relevant to project target population
Monitoring frequency:	Baseline only; Should be updated if ongoing monitoring surveys show that baseline water boiling technologies change over time
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	$W_{p,y}$
Data unit:	Kilograms/Litre
Description:	Quantity of wood fuel or fossil fuel required to boil 1 litre of water using technologies representative of the project scenario p during project year y
Source of data:	Project water boiling test following same procedure as BWBT
Monitoring frequency:	Should be updated whenever new water boiling technologies are introduced over time.
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

A3.5 Data and Parameters Monitored over the crediting period for Water Treatment Project Scenarios

Data / Parameter:	$Q_{p,y}$
Data unit:	Litres per person per day
Description:	Quantity of safe water supplied in the project scenario p during the year y, using the 'zero or low" emissions' clean water supply technology
Source of data:	Water consumption field test WCFT
Monitoring frequency:	As per FT updates
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	$Q_{p,rawboil,y}$
Data unit:	Litres per person per day
Description:	The raw or unsafe water that is still boiled after installation of the water treatment technology.
Source of data:	Water consumption field test WCFT
Monitoring frequency:	As per FT updates
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	$Q_{p,cleanboil,y}$
Data unit:	Litres per person per day
Description:	Quantity of safe (treated, or from safe supply) water boiled in the project scenario p, after installation of project technology
Source of data:	Water consumption field test WCFT
Monitoring frequency:	As per FT updates
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	Quality of the treated water
Data unit:	As appropriate in alignment with QA/QC procedures
Description:	Performance of the treatment technology
Source of data:	FT updates
Monitoring frequency:	As per FT updates
QA/QC procedures:	Water quality testing may be conducted either in the field or by transportation to laboratories; in all cases the testing approach must be described fully in monitoring reports, credible 3rd party endorsement must be included, and the appropriateness of the testing approach must be justified. In cases where the effectiveness of project technologies may be indicated reliably through proxies, such as reliable evidence that they are being maintained and used correctly in accordance with manufacturers' or installers', then the FTs may capture such evidence of water quality in pace of chemical and biological indicator tests. Again, credible 3rd party endorsement of FT reports are required.
Any comment:	

Data / Parameter:	$U_{p,y}$
Data unit:	Percentage
Description:	Usage rate in project scenario p during year y
Source of data:	Annual usage survey
Monitoring frequency:	Annual or more frequently, in all cases on time for any request for issuance
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	A single usage parameter is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario – see section III.1 of the core methodology

Data / Parameter:	$N_{p,y}$
Data unit:	Person.days
Description:	Number of persons consuming water supplied by project scenario p through year y
Source of data:	Water consumption field test WCFT
Monitoring frequency:	As per FT updates
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	$LE_{p,y}$
Data unit:	t_CO2e per year
Description:	Leakage in project scenario p during year y
Source of data:	Baseline and monitoring surveys
Monitoring frequency:	Every two years
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	Aggregate leakage can be assessed for multiple project scenarios

Annex 4: Kitchen Performance Test: Procedure for fuel consumption measurements for improved cook stove activities

This annex addresses one specific type of performance test, the measurement of fuel saved when cooks switch from inefficient to efficient stoves. This is known as the Kitchen Performance Test (KPT), also known as the Kitchen Test (KT).

The principles of the KPT also apply to performance testing of other decentralized energy-saving devices. This annex and associated KPT guidelines[52] may be used as a preliminary guide to field performance tests (FTs) for the other technologies. Proponents of other decentralized thermal energy technologies may adapt these principles appropriately to achieve accurate and conservative results.

The baseline KPT should include a sample of end users without project technologies that are representative of end users targeted in the project activity[53]. The baseline survey and baseline KPT can be conducted concurrently with the same end users. Any sampling methods can be used, provided that the sample is selected randomly. Guidance here assumes that simple random sampling is used – if another method is used the analysis can become complicated and must be carried out by a statistician.

To prepare and conduct a KPT, follow these steps:

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 0.5-1.0). 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)[54]. Note that this assumes simple random sampling (if you use another method of sampling you will need to increase the sample size). If you choose a COV which is smaller than the real COV, it is likely

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[52] Further guidance on KPTs can be found in the protocols (a) *Guidelines for Performance Tests of Energy Saving Devices and Kitchen Performance Tests (KPTs),* Dr Adam Harvey and Dr Amber Tomas*,* http://www.climatecare.org/media/documents/pdf/ClimateCare_Guidelines_for_Performance_Tests_and_KPTsx.pdf and (b) *Kitchen Performance Test*, Dr Rob Bailis University California, Berkeley, http://ehs.sph.berkeley.edu/hem/content/KPT_Version_3.0_Jan2007a.pdf

[53] A baseline KPT is not necessary if a default efficiency is applied to baseline stoves. In this case the only test needed is a project stove KPT. This is a "SINGLE-SAMPLE" KPT.

[54] 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.

that once you have finished the tests, you will need to increase the sample size[55]. 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 8 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 in some way. If previous experience shows a dropout or attrition rate of 10% is likely, launch 10% more tests than suggested in the tables here.

Table 1: 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 2 : 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 3: 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

1. 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[56].

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[55] 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

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

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 (possibly 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. Also consider whether reversing the sequence for half the subjects is wise, to avoid biases that might occur due to time passing (i.e. run half the test in sequence AFTER then BEFORE, and half the other way). 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.

2. 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[57], and 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 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).

3. 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. You are obliged to design into the project incentives for the elimination of inefficient stoves, which must be effective as fast as possible. Nevertheless remember that 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

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[57] The KPT should exclude large parties or infrequent cooking events, and match cooking tasks in the baseline KPT to those in the project KPT.

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.

4. 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.

5. During the tests, also 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.

6. 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 are paying for fuel, or have an incentive to conserve it, otherwise they may use excessive amounts due to the free hand-out. Subjects can be told they will be rewarded for their effort and time at the end of the test, once it is successfully completed.

7. 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[58]. 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

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[58] 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.

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 90/15 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.

- 90% confidence rule (Lower bound of the one-sided[59] 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[60]. 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. The options in 8a and 8b can then be applied. It is not allowed to apply the rules to estimated baseline and project fuel-use separately.

In cases of single samples, 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

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[59] 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.

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

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 (Lower bound of the one-sided[61] 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 fuel saving result is not the mean (or average) test result, but a lower value[62]. This estimate is very conservative, and it will probably be worthwhile to augment the sample size instead in cases when augmentation is practically possible.

8. 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.

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[61] 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.

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

Annex 5: Project Preparation and Monitoring Schedule (for one crediting period)

Project preparation and monitoring schedule	Prior to validation	Prior to first verification[63]	Annual: after first verification	Every two years: after first verification
ER estimation for PDD	✔			
Baseline studies				
NRB assessment	✔			
Baseline survey	✔			
Baseline FT (except where default applied)		✔		
Project studies				
Preliminary estimation – ER, NRB, etc.	✔			
Project survey		✔		
Project FT		✔		
Ongoing monitoring tasks				
Maintenance of total sales record and project database	Continuous			
Usage survey			✔	
Monitoring survey			✔	
FT updates				✔
Leakage assessment				✔
Updating NRB assessments	As proposed by project proponent			

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

Annex 6 Application of the methodology to bio-digesters, including animal waste management.

Bio-digester project activities generally assess fuel savings but can also account for emission reductions from the waste management activity. The requirements of the core methodology must be complied with, and the guidance below must be used to calculate, for each facility considered in the baseline and project samples, the emissions associated with animal waste management so as to identify overall emission savings per household or facility.

In such cases, the statistical analysis conducted to derive the average annual emission reductions for the overall targeted population (mean or lower bound of confidence interval depending on precision achieved) must be performed on the basis of the overall emission reductions per facility (equation 2), since these do not only result from fuel consumption savings.

A6.1 Additional applicability conditions:

This annex is applicable under following conditions:

- If more than one climate zone is included in the project activity, a distinction per climate zone must be considered. The distinct geographical boundary of each project area i must be clearly documented in the project documentation, using representative GPS data.

A6.2. Baseline emission calculation:

The baseline emissions from the handling of animal waste can be determined by using one of the following approaches, as appropriate:
- IPCC TIER 1 approach
- IPCC TIER 2 approach

IPCC TIER 1 approach

This approach is applicable to situations, where baseline data required for an estimation of the methane emission factor per category of livestock are NOT available. Examples for such a situation are when livestock is not kept at the premises or in the very near vicinity and/or the animal waste is partially collected for utilization. The methane emission factor per category of livestock shall be obtained from the IPCC guidelines, 2006. The following equation is applied to estimate the baseline emissions from the animal waste management system:

$$BE_{awms,h} = GWP_{CH4} * \sum_{T} \left(EF_{awms(T)} * N_{(T),h} \right) \qquad (14)$$

Where:

BE$_{awms,h,}$ The baseline emission from handling of animal waste in premise h (tCO2e per year)

GWP$_{CH4}$ Global Warming Potential (GWP) of methane (tCO$_{2e}$ per tCH$_4$): 21 for the first commitment period. It shall be updated according to any future COP/MOP decisions.

N$_{(T)h}$ The number of animals of livestock species per category T

EF$_{awms,T,}$ Emission factor for the defined livestock population category T, (ton$_{CH4}$ per head per yr). The relevant *Default methane emission factor for livestock* for default animal waste methane emission factors by temperature and region can be found in tables 10.14, 10.15 & 10.16 in Chapter 10: Emissions from Livestock and Manure Management, Volume 4 - AGRICULTURE, FORESTRY AND OTHER LAND USE, 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

IPCC TIER 2 approach

This approach is applicable to situations, where baseline data for an estimation of the methane emission factor per category of livestock are available. Examples for such a situation are when animals are kept in a confined area and the manure is collected following a specifically designed system. If animals leave the confined area, the percentage manure collected has to be estimated as a percentage of the total amount of manure they produce.

$$BE_{awms,h} = GWP_{CH4} * \sum_{T} \left(EF_{awms(T)} * N_{(T),h} \right) \qquad \textbf{(15)}$$

Where,

BE$_{awms,h}$ The baseline emission from handling of animal waste in for premise h (tCO$_{2eq}$ per year)

N$_{(T)h}$ Number of animals of livestock category T in premise h

EF$_{awms,T,}$ Emission factor for the defined livestock category T, (ton$_{CH4}$per animal per year)

GWP$_{CH4}$ Global Warming Potential (GWP) of methane (tCO$_{2e}$ per tCH$_4$): 21 for the first commitment period. It shall be updated according to any future COP/MOP decisions.

The emission factor (EFawms$_{(T)}$) for tier 2 approach is calculated as follows,

$$EF_{awms(T)} = VS_{(T)} * 365 * \left[Bo_{(T)} * D_{CH4} * \sum_{k} \frac{MCF_{BL,k}}{100} * MS_{(T,k)} \right] \qquad \textbf{(16)}$$

Where:

EF$_{awms(T)}$ CH$_4$ emission factor for livestock category T, (tCH$_4$per animal per year)

VS$_{(T)}$ Daily volatile solid excreted for livestock category T, (kg dry matter per animal per day)

365   Basis for calculating annual VS production, (days per year)

Bo$_{(T)}$ Maximum methane production capacity for manure produced by livestock category T, (m^{3}CH$_4$ per kg of VS excreted)

D$_{CH4}$ CH$_4$ density (0.00067 t per m^3 at room temperature (20 ºC) and 1 atm pressure)

MCF$_{(BL,k)}$ Methane conversion factors for the animal waste handling system in the baseline situation by climate zone k, (%)

MS$_{(T,S,k)}$ Fraction of livestock category T's manure treated in the animal waste management system, in climate region k (dimensionless)

If country-specific data are NOT available for all these variables, project participants must calculate country-specific emission factors using the data in Tables 10A-4 through 10A-9 from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Default methane conversion factors (MCFs) are provided in Table 10.17 from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for different manure management systems and by annual average temperatures.

A6.3 Project emissions:

The project emissions involve emissions from the bio-digester, which include physical leakage and incomplete combustion of biogas, as well as emissions from the animal waste not treated in the bio-digester.
The first two components are calculated as a percentage of the methane produced, as per the following equation:

$$PE_{awms,h,y} = GWP_{CH4} * \sum (N_{(T),h,y} \cdot EFawms_T) \cdot PL_y + \sum (N_{(T),h,y} \cdot EFawms_T) \cdot (1 - \eta_{biogastove})(1 - PL_y) \qquad (17)$$

Where:
N$_{(T),h,y}$ Number of animals of livestock category T in year y in premise h

EFawms$_T$ Emission factor for the defined livestock category T, (ton$_{CH4}$ per animal per year). Estimated using the IPCC TIER 2 approach. Formula (3) needs to be applied for the situation of the bio-digester in the project situation.

PL$_y$ The physical leakage of the bio-digester system. Estimated using IPCC guidelines, i.e. 10% of total methane production or project-specific data. Where project participants use lower values or percentage of physical leakage, they should provide measurements proving that this lower value is appropriate for the project activity.

GWP$_{CH4}$ Global Warming Potential (GWP) of methane (tCO$_{2eq}$ per tCH$_4$): 21 for the first commitment period. It shall be updated according to any future COP/MOP decisions.

PL$_y$ Physical Leakage of the biodigester in year y (%)

η$_{biogastove}$ Combustion efficiency of the used type of biogas stove to account for incomplete combustion resulting in emission of methane post-combustion.

Project emissions from the animal waste not treated in the bio-digester in project scenario shall be calculated using equation 3 and with the following changed definition of parameters:

MCF$_{(P,S,k)}$ Methane conversion factors for the animal waste handling system used in addition to bio-digester in the project scenario by climate zone k, (%)

MS$_{(P,s,k)}$ Fraction of livestock category T's manure not treated in bio-digester, in climate region k, (dimensionless)

A6.4 Data and parameters not monitored over the crediting period:

Data / Parameter:	VS$_{(T)}$
Data unit:	kg dry matter per animal per day
Description:	Daily volatile solid excreted for livestock category T
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	365 = basis for calculating annual VS production, days per year

Data / Parameter:	Bo$_{(T)}$
Data unit:	m^{3}CH$_4$ per kg of VS excreted
Description:	Maximum methane production capacity for manure produced by livestock category T
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	

Data / Parameter:	MCF$_{(k)}$
Data unit:	[-] %
Description:	Methane conversion factors for each manure management system by climate region k
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	

Data / Parameter:	$EF_{awms,T}$
Data unit:	$kgCH_4$ per animal per year for livestock type T
Description:	Animal waste methane emission factor by average temperature
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	

Data / Parameter:	$\eta_{biogastove}$
Data unit:	[-] %
Description:	Combustion efficiency of the biogas stove
Source of data:	Literature, manufacturer data
Any comment:	

Data / Parameter:	GWP_{CH4}
Data unit:	tCO2e per tCH4
Description:	Global Warming Potential (GWP) of methane
Source of data:	IPCC
Any comment:	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions.

A6.5 Data and parameters monitored over the crediting period:

The following parameters must be monitored over the crediting period in addition to the relevant parameters discussed in the core methodology.

Data / Parameter:	$MS_{(T,S,k)}$
Data unit:	[-] %
Description:	Fraction of livestock category *T*'s manure fed into the bio-digester, *S* in climate region *k*
Source of data:	Survey
Measurement procedures (if any):	
Monitoring frequency:	Annual
QA/QC procedures:	
Any comment:	

Data / Parameter:	$MS_{(P,S,k)}$
Data unit:	[-] %
Description:	Fraction of livestock category *T*'s manure not fed into the bio-digester, *S* in climate region *k*
Source of data:	Survey
Measurement procedures (if any):	
Monitoring frequency:	Annual
QA/QC procedures:	
Any comment:	

Data / Parameter:	$N_{(T)}$
Data unit:	[-]
Description:	Number of animals of livestock category T
Source of data:	Survey
Measurement procedures (if any):	
Monitoring frequency:	Annual
QA/QC procedures:	
Any comment:	The PDD should describe the system on monitoring the number of livestock population.

Data / Parameter:	**PL**
Data unit:	%
Description:	Physical leakage of the bio-digester
Source of data:	IPCC
Measurement procedures (if any):	
QA/QC procedures:	
Any comment:	The PDD should describe the system on monitoring the physical leakage of the bio-digester.

Data / Parameter:	**Usage rate**
Data unit:	Fraction
Description:	Percentage of bio-digester in use in year y
Source of data:	Survey
Measurement procedures (if any):	Annual
QA/QC procedures:	Annual survey conducted by PP or 3rd party
Any comment:	

Annex 7 Application of the methodology to plant oil fired technology for the decentralized use of thermal energy.

Whenever the project activity involves the switch from the use of a non-renewable fuel in the baseline situation to plant oil in the project situation, the requirements of the core methodology remain valid but project developers must comply with additional eligibility criteria, consider potential additional leakages, account for project emissions associated with the production of the plant oil, and conduct specific additional monitoring.

The guidance below must be used for this purpose, along with Gold Standard generic requirements for biomass-related project activities[64]. It can be used and adapted to other renewable biomass-derived fuels used in the project situation. In such cases however, a new annex may have to be prepared and submitted for approval before the methodology can be applied in the context of a project activity, as the relevant set of criteria to be complied with may be slightly different. On the other hand, activities such as the use of biomass briquettes or charcoal made of agricultural wastes or sawdust would have to comply with a simpler set of requirements already specified in the Gold Standard rules for biomass-related activities, and would not require the preliminary submission and approval of such an annex[65].

Statistical analysis can be conducted to derive the average annual fuel consumption savings per facility, as described in the core methodology (with further guidance in Annex 4), applying the mean or the lower bound of the confidence interval obtained from sampling to be applied, depending on precision achieved. The average annual fuel consumption monitored for the facilities in the project situation comes from the baseline fuel potentially still in use in the baseline technology that remains in place as an auxiliary or backup unit in all or some of the sampled premises (or potentially from an emitting project technology introduced for this purpose or for the use of a suitable non-renewable fuel in the project technology at times when the supply of plant oil is disrupted[66]).

The emissions associated with the production of the plant oil must however be subtracted to the overall emission reductions obtained from the application of the average annual fuel consumption savings to the overall targeted population.

A7.1 Additional applicability conditions

1. The methodology applies to the use of various plant oils[67] as fuel in technology for cooking and water heating, in households or small enterprises like restaurants or breweries.

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[64] Annex C of Gold Standard Toolkit, and rule updates released prior to the time of first submission of the project activity to the Gold Standard.

[65] Typically the issue of competing use of existing biomass resources or the maximum eligible share of non-renewable fuel in the heat delivered annually by each user.

[66] In the latter case however, the statistical analysis is likely to have to be conducted on the basis of emission reductions and not fuel consumption savings as emission factors will most probably be different in respectively the baseline and the project situations.

[67] Plant oil, or vegetable oil, is oil of plant origin composing of triglycerides. Although many different part of the plants may yield oil, the most often oil is extracted from the seeds or fruits of the plant. Plant oil in contrast to bio-diesel is not trans-esterified but only pressed and filtered from oil seeds.

2. Plant oil is used as pure plant oil.

3. The amount and type of plant oil sold to retailers and distributed by them to each of the final end users must be recorded with an appropriate, certified measuring system (plant oil trading flow).

4. Plant oil must comply with national quality regulations or in absence of the latter with the quality standards stipulated by the CDM small-scale methodology AMS.III.T[68].

5. Emission reductions from kerosene, LPG or other fossil fuels displaced by plant oil are calculated conservatively without upstream emissions related to the production and use of fossil fuel in the baseline.

6. Biomass and/or waste waters generated/used in the cultivation and processing of the oilseeds can be stockpiled, disposed or treated, including anaerobic decay with methane emissions. Emissions related to these waste streams must however be accounted for as project emissions and must be evaluated – see section on Project Emissions. Storage and treatment facilities of feedstock, products and waste must therefore be considered within the project boundaries, including those related to the existing plantations.

7. The project activity must comply with GS specific requirements for biomass related project activities defined in the latest version of the Gold Standard rules. These criteria must apply to both plantations established for the project activity AND existing plantations that were established in the context of other activities but will supply plant oil to the project activity and therefore must be considered within the project activity boundaries. In particular:

- The plant oil is of renewable origin, i.e. it originates from plantations where sustainable management practices are undertaken to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting) and any national or regional forestry, agriculture and nature conservation regulations are complied with.

- The plant oil is not sourced from existing plantations to the detriment of other existing uses for similar or different activities. Project applicant much present convincing evidence that the current users are in agreement with the shift of use, e.g. by inviting representatives of current users to the stakeholder consultation meetings and gauge their consent on the project activity. In the absence of such an agreement, the project applicant must demonstrate ex-ante, at the beginning of each crediting period, that biodiesel has been produced from surplus plant oil (in accordance with the approach defined in the section on Leakage), and shall include this in the Sustainability Monitoring Plan.

- Project applicants shall demonstrate that the project activity makes use of otherwise set aside or marginal land, unless it can be demonstrated that the growing of dedicated energy crops is part of a traditional rotational cropping, and shall include this in the Sustainability Monitoring Plan. This prevents competition with e.g. food cropping or animal grazing and avoids the situation of a shift of pre-project activities.

- The eligibility of project activities making use of palm oil shall be evaluated on a

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[68] Table III.T.1

case-by-case basis by the Gold Standard Foundation in the light of a Pre-feasibility assessment. Project applicants must demonstrate that they have started the process for RSPO compliance at the time of submission for the pre-feasibility assessment.

- Project activities making use of GMOs must declare this in a transparent way. Local stakeholders opinion on GMOs shall prevail and appropriate mitigation measures must be put in place to address their concerns, if any, in a satisfactory way.

8. Project emissions from clearance of land must be addressed in line with clause 15 and Clause 16 of the "General guidance on leakage in biomass project activities"[69]. Furthermore, plantations must not have been established on peat lands subject to CO2 emissions after drainage.

A7.2 Boundaries

The project boundary is the geographical area of the cultivation, production and processing of oil-seeds (production sites), the areas where the plant oil is distributed to the final users (distribution points), where the plant oil is used to generate renewable energy (consumption points), and where biomass and/or waste waters generated/used in the cultivation and processing of the oilseeds is stockpiled, disposed or treated.

A.7.3 Leakages

In addition to the leakages listed in the core methodology, the following aspects need to be addressed when considering plant oil-fired stoves.

When the project activity makes use of plant oil produced by existing plantations, project applicants must either provide convincing evidence that the plant oil considered is surplus plant oil or that the current users are in agreement with the shift of use. Applicants are required to use at least two of the following methods from the four methods defined below to capture the data on leakage (the DOE must check reliability of data sources used during validation and deliver a statement as part of the validation report):

a. Reliable official data from authorities: this option can be used for e.g in cases where information on plant oil generated from industries is available. This information should not be more than three years old from the date when validation started.
b. Scientific publications: this can be a useful source of information for e.g. if research papers or articles have been published and are available in the public domain that provide specific information about current uses of the plant oil used by the project. Such information should not be more than three years old from the date when validation started. This can support other data sources but cannot be the only means to capture the intended data.
c. Interviews with producers and users of plant oil: this can be used as a source of information. Representatives of these companies can be then invited to stakeholder consultation meetings/or separate meetings can be organised to collect information on

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[69] http://cdm.unfccc.int/methodologies/SSCmethodologies/AppB_SSC_AttachmentC.pdf

the current use practice. Customised questionnaires may be designed to collect this information.
d. Third party statistically representative surveys: these surveys can be used to capture quantitative information on plant oil production and use.

In defining the geographical boundary of the region within which the leakage issue must be assessed, project participants must take into account the maximum distance over which plant oil is transported, with as the upper limit the borders of the host country. The geographical boundary can be province(s) or state(s) where the plant oil is produced and distributed, or circular regions defined by a radius equal to the longer distance over which the plant oil is transported with the plantations as the centers. In case the project activity is located in a country where province or state boundaries are not clearly and officially defined, applicants must make use of the radius approach or consider the country as a whole

The plant oil sourced from existing plantations can be considered surplus plant oil if the project participant can demonstrate, ex ante, at the beginning of each crediting period, that the quantity of available biomass in the considered region as per the definition above, is at least 25% larger than the quantity of biomass that is utilised including the project activity. In such case, this source of leakage can be neglected otherwise this leakage shall be estimated and deducted from the emission reductions.

If plant oil considered is not surplus plant oil, but current users are in agreement with the shift of use, project applicants must demonstrate that none of these current users will shift to fossil fuel due to implementation of the project activity (using the same approach as above), or this source of leakage shall be estimated and deducted from the emission reductions. A leakage penalty shall be applied as per the approach followed by the GS voluntary methodology 'Biodiesel from waste oil/fat from biogenic origin for use as fuel' (p. 12,13)[70].

A.7.4 Project emissions

Besides emissions from the use of baseline technologies as auxiliary or backup units, project activity emissions are upstream emissions related to the production and processing of the plant oil. Upstream project activity emissions are the emissions related to the cultivation of oil seeds and production of plant oil ("field-to-stove" emissions). These emissions are fully attributed to the plant oil produced and not shared over different co-products.
Also, emissions from preheating have to be accounted if they reach 5% or more of project emissions and not renewable (e.g. fossil spirit).

Project emissions from the cultivation of oil seeds and production of oil plants are:

a) Emissions from energy use for processing (e.g. pressing and filtering) of plant oil;

b) N2O emissions resulting either from fertilizer application and/or from nitrogen in crop residues (above-ground and below-ground).

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[70]

http://www.cdmgoldstandard.org/fileadmin/editors/files/6_GS_technical_docs/manuals_and_methodolgies/Biodiesel_from_waste_oil_and_fat_06_08_2009.pdf

For each oil seed/plant oil type "k" the project emissions shall be calculated separately.

$$PE_{P,y} = \sum_{k} (PE_{PO,k,y} \times OY_{k,y}) \tag{18}$$

where:

Data	Description	Unit	Value	Reference
$PE_{P,y}$	Total project emissions from plant oil production in year "y"	tCO_2e		Calculated (see equation 17)
$PE_{PO,k,y}$	Project emissions from plant oil production of crop "k" in year "y"	tCO_{2e}/ton plant oil "k" produced and consumed		Calculated (see equation 18)
$OY_{k,y}$	Amount of oil from crop "k" produced and consumed in year "y"	tons of plant oil "k" produced and consumed		Value to be monitored by the project activity

$$PE_{PO,k,y} = \frac{PE_{FA,k,y} + PE_{OFP,k,y}}{H_{k,y} \times SOY_{k,y}} \tag{19}$$

where:

Data	Description	Unit	Value	Reference
$PE_{PO,k,y}$	Project emissions from plant oil production of crop "k" in year "y"	tCO_{2e}/ton plant oil "k" produced and consumed		Calculated (see equation 18)
$PE_{FA,k,y}$	Project emissions of N_2O in cultivation of crop "k" in year "y"	tCO_{2e}		Calculated (see equation 19)
$PE_{OFP,k,y}$	Project emissions from energy use for oil-seed processing (e.g. pressing and filtering) of crop "k" in year "y"	tCO_2		Calculated (see equation 20)
$H_{k,y}$	Harvest of crop "k" in year "y"	ton crop "k"		Value to be monitored by the project activity
$SOY_{k,y}$	Specific oil yield of crop "k" in year "y"	ton oil/t crop k		Value to be monitored by the project activity

The N2O emissions from cultivation of oil plants are determined as follows:

$$PE_{FA,k,y} = [(F_{ON,k} + F_{SN,k} + F_{CR,k}) \times EF_{N2O\_direct}] \times \frac{44}{28} \times GWP_{N2O} \qquad (20)$$

where:

Data	Description	Unit	Value	Reference
$PE_{FA,k,y}$	Project emissions of N2O in cultivation of crop "k" in year "y"	tCO2e		Calculated (see equation 19)
$F_{ON,k}$	Amount of organic fertilizer nitrogen applied in crop "k" in year "y"	ton N		Value to be monitored by the project activity
$F_{SN,k}$	Amount of synthetic fertilizer nitrogen applied in crop "k" in year "y"	ton N		Value to be monitored by the project activity
$F_{CR,k}$	Amount of N in residues of crop "k" in year "y". For N-fixing crops like soybean F_{CR} shall be taken into account. For other types of crops F_{CR} can be ignored.	ton N		Calculated in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4, chapter 11
EF_{N20_direct}	N2O emission factor for emissions from N inputs	ton N2O-N/ton N input	0.01	Default value in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4, Table 11.1 p.11.26
GWP_{N2O}	Global warming potential of N2O (tCO2e/tN2O)		310	Default value. Rev. IPCC Guidelines

Project emissions from energy use for processing (e.g. pressing and filtering) of plant oil are determined as follows:

$$PE_{OFP,k,y} = EC_{OFP,k} \times EF_{CO2,ELEC} + \sum_i (FC_{OFP,i,k} \times NCV_i \times EF_{CO2,i}) \qquad (21)$$

where:

Data	Description	Unit	Value	Reference
$PE_{OFP,k,y}$	Project emissions from energy use for oil-seed processing (e.g. pressing and filtering) of crop "k" in year "y"	tCO2e		Calculated (see euqation 20)
$EC_{OFP,k}$	Electricity consumption in processing (e.g. pressing and filtering) for crop "k" in year "y"	MWh		Value to be monitored by the project activity
$EF_{CO2,ELEC}$	Emissions factor for grid electricity	tCO2e/MWh		As per AMS I.D
$FC_{OFP,i,k}$	Consumption of fossil fuel "i" for filtering and pressing for crop "k" in year "y"	tons		Value to be monitoredby the project activity

NCV$_{i,k}$	Net calorific value of fossil fuel "i"	GJ/ton		Value to be monitored by the project activity
EF$_{CO2,i}$	Emissions factor of fossil fuel "i"	tCO$_2$/GJ fuel		Rev. IPCC Guidelines

Project methane emissions from solid waste disposals (BE$_{CH4,SWDS,y}$) or organic waste effluents (BE$_{CH4,OWE,y}$) shall be fully accounted on a CO$_2$e / t plant oil basis and deduced from the project emission reductions.

If solid organic waste (e.g. empty fruit bunches) is disposed to decay under anaerobic conditions resulting methane emissions (tCO2e) are calculated according to the "*Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site*" and small-scale methodology AMS-III.E ("Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment") or AMS-III.F ("Avoidance of methane production from decay of biomass through composting") can be applied. The amount of organic waste per ton of plant oil is determined on the basis of production records, or if such records are not available, on the basis of conservative estimates based on scientific or technical literature.

If organic effluents are treated in anaerobic conditions resulting methane emissions (tCO2e) are calculated according to small-scale methodology AMS-III-H ("Methane recovery in wastewater treatment") or AMS-III-I ("Avoidance of methane in wastewater treatment through replacement of anaerobic lagoons by aerobic systems"). The amount of organic effluents per ton of plant oil is determined on the basis of production records, or if such records are not available, on the basis of conservative estimates based on scientific or technical literature.

The emission reduction achieved by the project activity shall be calculated as the difference between the emission reductions achieved in the premises and evaluated as per the statistical analysis of the sampled fuel consumption savings and the sum of the additional project emissions and leakage evaluated as per the guidance provided in this annex, as follows:

$$ER_{total,y} = ER_y - BE_{CH4,SWD,y} - BE_{CH4,OWE,y} - PE_{P,y} - LE_y \qquad \textbf{(22)}$$

where:

Data	Description	Unit	Value	Reference
ER$_{total,y}$	Total annual project emission reductions in year "y"	tCO$_2$e/y		Calculated (see equation 21)
ER$_y$	Emission reductions as per fuel consumption savings in the premises during year "y"	tCO$_2$e/yr		From performance field tests
BE$_{CH4,SWD,y}$	Project methane emissions from solid waste disposals	tCO$_2$e/yr		Calculated as per relevant CDM methodology referenced above
BE$_{CH4,OWE,y}$	Project methane emissions from organic waste effluents	tCO$_2$e/yr		Calculated as per relevant CDM methodology referenced above
PE$_{P,y}$	Total project emissions from plant oil production in year "y"	tCO$_2$e/yr		Calculated (see equation 17)
LE$_y$	Leakage emissions in year "y"	tCO$_2$e/yr		Value to be monitored/calculated

A7.5 Data and parameters not monitored over the crediting period:

As in section II.8, and also:

Data / Parameter:	NCV_k
Data unit:	TJ/ton
Description:	Net calorific value of the plant oil k used in the project
Source of data:	Project-relevant measurement reports, or project-specific testing (based on direct measurements of a representative sample)
Any comment:	

Data / Parameter:	$F_{CR,k}$
Data unit:	Ton N
Description:	Amount of nitrogen in residues of crop k
Source of data:	Calculated in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4, chapter 11
Any comment:	This should be taken into account for nitrogen fixing crops such as soybeanand be ignored for other crops.

Data / Parameter:	$EF_{N2O\ direct}$
Data unit:	Ton N2O per ton of nitrogen inputs
Description:	N2O emission factor from nitrogen inputs
Source of data:	0.01 In accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4, chapter 11
Any comment:	

Data / Parameter:	GWP_{N2O}
Data unit:	-
Description:	Global warming potential of N2O
Source of data:	310 In accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	

Data / Parameter:	$NCV_{i,k}$
Data unit:	TJ/ton
Description:	Net calorific value of fossil fuel i used for processing of crop k into plant oil
Source of data:	
Any comment:	

Data / Parameter:	$EF_{,CO2,I,k}$
Data unit:	tCO_2/GJ or tCO_2/t_fuel
Description:	CO_2 emission factor for use of fuel i in processing of crop k
Source of data:	IPCC defaults, credible published literature, project-relevant measurement reports, or project-specific monitoring prior to validation.
Any comment:	If EF is in units of tCO2/t_fuel, remove NCV term from emission calculations.

A.7.6 Data and parameters monitored over the crediting period:

The following parameters must be monitored over the crediting period in addition to the relevant parameters discussed in the core methodology. Also, the parameters required to account for emissions from solid waste disposals (BECH4,SWDS,y) or organic waste effluents (BECH4,OWE,y) shall be monitored as per the relevant CDM methodologies referenced above.

Data / Parameter:	$H_{k,y}$
Data unit:	Tons per year
Description:	Crop harvest
Source of data:	The quantity of crop harvested shall be monitored (volumetric or weighed) by the operator taking into account stock changes where applicable. Use calibrated/certified measurement equipment that is maintained regularly and checked for proper functioning.
Monitoring frequency:	Continuously
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	The extent of the area where plant oil is produced should be consistent with crop yield, plant oil extraction and with the amount of plant oil consumed by end-users.

Data / Parameter:	$SOY_{k,y}$
Data unit:	Tons of oil per ton of crop
Description:	Oil yield from crop k in year y
Source of data:	The quantity of oil extracted from crop k shall be monitored (volumetric or weighed) by the operator taking into account stock changes where applicable. Use calibrated/certified measurement equipment that is maintained regularly and checked for proper functioning.
Monitoring frequency:	Continuously
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	The extent of the area where plant oil is produced should be consistent with crop yield, plant oil extraction and with the amount of plant oil consumed by end-users.

Data / Parameter:	$OY_{k,y}$
Data unit:	Tons of oil
Description:	Amount of plant oil produced and consumed per crop source in year y
Source of data:	Project performance field tests
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	The extent of the area where plant oil is produced should be consistent with crop yield, plant oil extraction and with the amount of plant oil consumed by end-users.

Data / Parameter:	ECOFP,k
Data unit:	MWh
Description:	Electricity use for the production of plant oil k
Source of data:	Electricity meter. Use calibrated measurement equipment that is maintained regularly and checked for proper functioning.
Monitoring frequency:	Continuously
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	FCOFP,k
Data unit:	Tons
Description:	Fossil fuel used for the production of plant oil k
Source of data:	The quantity of fuel consumed for the production of biodiesel shall be monitored (volumetric or weighed) by the operator taking into account stock changes where applicable. Use calibrated/certified measurement equipment that is maintained regularly and checked for proper functioning.
Monitoring frequency:	Continuously
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	FON,k
Data unit:	Tons
Description:	Amount of organic fertilizer applied for the cultivation of plant oil k per crop source per production location
Source of data:	The quantity of fertilizer applied shall be monitored (volumetric or weighed) by the operator taking into account stock changes where applicable. Use calibrated/certified measurement equipment that is maintained regularly and checked for proper functioning.
Monitoring frequency:	Continuously
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	FSN,k
Data unit:	Tons
Description:	Amount of synthetic fertilizer applied for the cultivation of plant oil k per crop source per production location.
Source of data:	The quantity of fertilizer applied shall be monitored (volumetric or weighed) by the operator taking into account stock changes where applicable. Use calibrated/certified measurement equipment that is maintained regularly and checked for proper functioning.
Monitoring frequency:	Continuously
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	$EF_{CO2,\ ELEC}$
Data unit:	Ton of CO2equ per MWh
Description:	Grid emission factor
Source of data:	Calculated as per AMS.I.D
Monitoring frequency:	Updated as per AMS.I.D
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	

Data / Parameter:	Plant oil quality
Data unit:	-
Description:	Compliance with plant oil quality requirements
Source of data:	Baseline FT, baseline FT updates, and any applicable adjustment factors
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	Compliance of plant oil with national regulations or in absence of latter, compliance with the quality standards stipulated by the CDM small-scale methodology AMS_III.T.

Data / Parameter:	Leakages
Data unit:	Tons of CO2 per year
Description:	Shift of pre-project activity, absence of biomass feedstock surplus, etc.
Source of data:	Surveys, interviews, most recent official data, most recent credible publications
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures:	Transparent data analysis and reporting
Any comment:	