

 Monitoring report form for CDM programme of activities (version 01.0)		
Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form for CDM programme of activities" at the end of this form.		
MONITORING REPORT		
Title of the programme of activities (PoA)	PoA: Clean Cook Stoves in Sub-Saharan Africa by ClimateCare Limited	
UNFCCC reference number of the PoA	PoA: 8438	
Version number(s) of the PoA-DD(s) applicable to this monitoring report	06	
Coordinating/managing entity (CME)	ClimateCare Limited	
Version number of this monitoring report	01	
Completion date of this monitoring report	06/07/2017	
Monitoring period number and dates covered by this monitoring report	Fourth monitoring period 01/07/2016 to 30/06/2017 (first and last days are included)	
Monitoring report number for this monitoring period	01	
Host Party(ies)	Host Party(ies) of the PoA	Is this a host Party to a specific-case CPA covered in this monitoring report?(yes/no)
	Ghana	Yes
	Kenya	No
Sectoral scope(s)	3 : Energy demand	
Selected methodology(ies)	AMS-II.G. ver. 4 - Energy efficiency measures in thermal applications of non-renewable biomass	
Selected standardized baseline(s)	N/A	
Total amount of GHG emission reductions or net GHG removals by sinks for all specific-case CPAs in the PoA covered in this monitoring report	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	CPA001 0 tCO ₂ e CPA002 0tCO ₂ e Total 0 tCO₂e	CPA001 162,289 tCO ₂ e CPA002 88,303 tCO ₂ e Total 250,592 tCO₂e

PART I - Programme of activities**SECTION A. Description of PoA****A.1. Brief description of the PoA**

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1. Policy/measure or stated goal of the SSC-PoA

The SSC-PoA has the goal of introducing wide-scale adoption of efficient charcoal cooking to kitchens in Ghana, and later, in Sub-Saharan Africa through the design or adoption of a design, manufacture, distribution, sale and after-sale support of efficient charcoal stoves over the next 28 years from 2012. This will constitute a market transformation, reducing global greenhouse gas emissions, reducing pressure on forests and woody biomass resources. Initially, the PoA will cover Ghana, with the possibility of gradually spreading to other countries of Sub-Saharan African.

Each CPA within the PoA will develop/adopt cooks stove designs, which address the product-specific factors such as safety, indoor smoke, usage cost and stove prices, which have been largely disregarded but are significant, in determining the uptake of improved cook stoves at the household level together with significant public education component. Raising awareness through information provided with products, as well as targeted media campaigns will further promote the benefits of efficient or improved charcoal stoves (ECS) in Ghana and Sub-Saharan Africa. The messaging will promote behavioural change, encourage further energy savings while reducing deforestation and indoor air pollution.

2. General operation and implementing framework of PoA

The purpose of this PoA is to reduce the greenhouse gas emissions from this source, by promoting the design, manufacture, distribution and use of ECS which provide the same service with significantly less fuel than traditional charcoal stoves in common use. The adoption and usage of the improved cook-stoves by Ghanaian, and later Sub-Saharan African, users therefore constitutes the project scenario.

During the life of the SSC-PoA, the number of CPAs implemented will increase and be monitored according to the monitoring plan. Different CPAs may be installed in the same areas, but can always be distinguished by a sales record keeping system with a unique serial number for every ECS sold, which will ensure that each ECS can be traced to one specific CPA to avoid double counting

The PoA and each CPA will be implemented and managed by the Coordinating/Managing Entity (CME), in collaboration with Programme Activity Implementers (PAIs). The CME for the PoA is ClimateCare Limited (ClimateCare), who is acting as the focal point for the Executive Board of the CDM in all aspects relating to validation, verification, registration and issuance of carbon credits generated by the programme.

The CME will verify the Sales Database and prepare monitoring reports. The CME will facilitate the verification processes while advising the PAI on the carbon asset development activities.

Implementation of the CPAs is under the responsibility of the PAIs. Each PAI will prepare and manage a single CDM programme activity (CPA). PAIs will sell ECSs on a commercial basis through appropriate agents developed by the PAIs themselves. Each PAI will be responsible for the manufacture, awareness creation, marketing and distribution of stoves for their respective CPAs. The PAIs will also be responsible for collecting and storing stoves Sales Database and maintaining the Sales Database (as described below) while providing the after sales service to the users. Each PAI will act individually, running the project in accordance with the demand of the local market.

Accordingly, the PAIs will use the CER proceeds to reduce costs of ECS to users, provide maintenance and to recoup associated costs for the dissemination of stoves, such as training of supply chain personnel, marketing activities and building new manufacturing units.

A.1.1. Generic CPA(s)

Title, identification/reference number and/or version number of the generic CPA(s) of the PoA	Sectoral scope(s)	Applied methodology(ies) or combination of methodologies and/or standardized baseline(s)
Title: Clean Cook Stoves in Sub-Saharan Africa by ClimateCare Limited “CPA-[add CPA number]” Reference Number: Not given Version Number of the generic CPA of the PoA: Version 6	3: Energy Demand	Methodology: AMS-II.G. “Energy efficiency measures in thermal applications of non-renewable biomass” (version 04). Tools: Not used

A.1.2. Specific-case CPA(s) covered in this monitoring report

Reference number of the specific-case CPA included in the PoA as of the end of this monitoring period	Title, identification/ reference number and version number of the generic CPA to which the specific-case CPA applies	Crediting period dates of the specific-case CPA	Is this specific-case CPA covered in this monitoring report? (yes/no)
CPA: 8438-0001, version 04	Title: CookClean Ghana Limited “CPA-[add CPA number]” Reference Number: Not given Version Number of the generic CPA of the PoA: Version 6	01/01/2013 to 31/12/2019 (start date and End date included)	Yes
CPA: 8438-0002, version 01	Title: CookClean Ghana Limited “CPA-[add CPA number]” Reference Number: Not given Version Number of the generic CPA of the PoA: Version 6	12/02/2016 – 11/02/2023 (start date and End date included)	Yes
CPA: 8438-0003, version 05	Title: Improved Jikos Project “CPA-[add CPA number]” Reference Number: Not given Version Number of the generic CPA of the PoA: Version 6	26/10/2016 – 25/10/2023 (start date and End date included)	No

A.2. Contact information of the coordinating/managing entity (CME) and/or responsible persons(s)/entity(ies)

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ClimateCare Limited (CME)
 Riverside Lane, Off Riverside Drive
 P.O. Box 14878-00800, Nairobi, Kenya
 Telephone: +254 (0) 20 2133604
mail@climatecare.org

SECTION B. Implementation of PoA**B.1. Implementation of the management system of the PoA**

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The PoA does not require a specific monitoring equipment to be used during monitoring. A monitoring system which is being implemented ensures that it is the real, measurable and long term GHG emission reductions for the proposed project activity are monitored and reported. In accordance with the paragraph 17 of Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities the management system for the PoA covers the following:

- a) Clear definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs;
- b) Records of arrangements for training and capacity development for personnel;
- c) Procedure for technical review of inclusion of CPAs;
- d) Procedure to avoid double counting;
- e) Records and documentation control process for each CPA under the PoA;
- f) Measures for continuous improvements of the PoA management system;

The management system in place and their operationalisation are explained in detail in Section F below.

(a) Information on the implementation status of the project activity during this monitoring period

During this monitoring period, three CPAs (CPA-0001, CPA-0002 and CPA-0003) are included in the PoA. However, for the purposes of monitoring and issuance of CERs under this monitoring period, only one monitoring report has been prepared covering the two CPAs i.e. CPAs (CPA-0001 and CPA-0002). A separate monitoring report will be prepared for CPA-0003. The CPAs are in operation and continues to manufacture and sell stoves to users as designed. The CPA implementer is responsible for managing the supply chain of stove manufacture, sale and for offering after-sales service to the stove users.

The CPAs follows the CME's monitoring plan and procedures for identifying CookClean stoves manufactured and sold during the course of the project and those that are still in use. The data collected is tabulated and analysed before it's used for the calculation of emission reductions.

Each stove produced has a serial number engraved on it for identification. During sale, the serial number of the stove, the date of sale, buyers contact details and the place of sale are captured. The records are then forwarded to the main office for recording and safe keeping.

(b) Project implementation status

The project has been in operation since November 2012 and it continues to operate with up-scaling of the production of stoves. The project also continues to expanded and recruit retailers within the registered PoA-DD boundary.

The project manufactures three stove sizes i.e. Size 9", Size 11" and Size 12". The number of stoves manufactured and sold are show in the table below:

CPA01

Month	Stoves Manufactured and Sold	Cumulative Stoves
2012	202	202
2013	9,983	10,185
2014	18,120	28,305
01 January 2015-12 December 2015	18,939	47,244
Total	47,244	47,244

CPA02

Month	Stoves Manufactured and Sold	Cumulative Stoves
12 February 2016-31 Dec 2016	28,042	28,042
Total	28,042	28,042

The CookClean stove is manufactured in Ghana where the project implementer has set up a factory to manufacture the stoves. The stoves are manufactured and sold under the brand name CookMate.

(c) Information regarding PoAs

This monitoring monitoring report is being submitted to cover two CPAs i.e. CPA01 and CPA02.

No events have had an impact on the applicability of the applied methodology and there has not been any requests for prior approval submitted to the Board with regard to this PoA.

B.2. Implementation of single sampling plan(s)

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The sampling plan has been implemented as outlined in the monitoring plan.

The main objective of the sampling was to determine the efficiency of the stove for the purposes of calculating the ER from the project.

CPA Sampled

During sampling, a sample was drawn from the project master database which contains both CPAs' sales records. Sampling was done randomly in order to ensure that each stove in the population had an equal chance of being sampled in order to determine the drop-off rate. Since sampling was done randomly, the resultant survey finding value was applied for both CPAs. Therefore, for the purposes of this monitoring report, the PP used a drop-off valued determined from the survey to calculate the drop-off for both CPA001 and CPA002.

Target population

The sampling targeted all the CookMate stove users who are included in the project database maintained by project proponent and CME.

Target population

The target population for the application of monitoring procedure was the households, commercial stove users and institutional stove users of the efficient cook stoves as identified through the centralised record-keeping database managed by the CME.

Sampling method

Stratified random sampling was applied, since there are three non-homogeneous categories or strata. A simple random sample was then applied to select the stoves.

A sample of 27 households was randomly selected using random number generator. Water Boiling Test (WBT) were utilised to determine the thermal efficiency of the CookMate stove.

In line with annual efficiency tests, a WBTs were conducted by a third party contracted by the project developer in 2017.

Sample size

A total of 27 stoves were sampled and tested for WBT and 400 users were surveyed for stove drop off study.

Sampling Frame

The sample was drawn from the stoves sales CPA database randomly from the. Once a sample was selected, the owner whose details are captured in the warranty were contacted and requested if they were willing to participate in the exercise.

Data Collection

All data collected were entered into excel sheet for easy of analysis and archiving. The data was collected by project proponent staff who have received training on the type of data required and collection techniques. The data checked for consistency to ensure its of high quality and there are no errors and was shared with CME for archiving.

Analysis of Data

The analysis of the data was done using the protocol tool developed by the Global Alliance for Clean Cookstoves water Boiling Protocol. The stoves were tested and an average efficiency established for both stoves sizes.

In calculating the emission reductions by the project, and based on the calculation steps adopted by the project developer whereby the emission are calculated by number of days the stove has been in operation, allocation efficiency by age of stove and number of days the stove is in operation in each age bracket was considered to complicated.

This approach was simpler and conservative, even though the overall actual CERs for the project reduced.

SECTION C. Post-registration changes to the PoA (including the generic CPA(s))**C.1. Corrections**

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None

C.2. Inclusion of a monitoring plan to the registered PoA-DD (including its generic CPA-DD(s)), if a monitoring plan was not included at the time of registration

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None

C.3. Permanent changes to the monitoring plan as described in the registered PoA-DD, applied methodology, or applied standardized baseline

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None

C.4. Changes to the programme design of the registered PoA-DD (including corresponding changes to project design of the generic CPA-DD(s)) and updates to the eligibility criteria for inclusion of specific-case CPAs in the PoA

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None

C.5. Types of changes specific to afforestation and reforestation activities

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None

PART II - Specific-case component project activity(ies)**SECTION D. Description of specific-case CPA(s)**

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D.1. Brief description of implemented specific-case CPA(s)

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(a) Description of the CPA

The CookClean Ghana Limited—CPA01 and CPA02 are components of the Programme of Activities (PoA); “Clean Cook Stoves in Sub-Saharan Africa by ClimateCare Limited”. The purpose of this CPAs is to promote the use of efficient charcoal stoves (ECS) which provide the same service with significantly less fuel use than the charcoal stoves in common use (Baseline stoves) in Ghana, the project host. The CPAs aims to establish regular use of efficient charcoal stoves (ECS) by distributing ECS in Ghana. The adoption and usage of the improved cook-stoves therefore constitutes the project scenario.

Under this PoA, CookClean Ghana Limited, acting as the Programme Activity Implementer (PAI), has adapted an appropriate ECS design, the CookMate, which it manufactures, creates market awareness of it, distributes and sells on a commercial basis through appropriate agents developed by the company in Ghana. The company also collects and stores stoves sales data and maintains the Sales Database (as described in the registered PoA-DD and CPA-DD) while providing the after sales service to the users. The PAI acts individually, running the project in accordance with the demand of the local market.

CookClean Ghana Limited has set up and applies procedures, appropriate records and documentation control process to assert legal rights of the carbon credits generated and to avoid double counting. Through a Warranty Card system, CookClean Ghana Limited transfers the information of each ECS sold to the Sales Database, and this ensures that no ECS is counted more than once under the CPA as per the registered PoA-ADD. The Sales Database also serves as the basis for the calculation of CERs.

Accordingly, the PAI will use the CER proceeds to reduce costs of ECS to users, provide maintenance and recoup associated costs for the dissemination of the stoves, such as the development of the supply chain personnel and systems, marketing activities and building new manufacturing units.

There are no laws, policies or mandatory requirements in Ghana, stipulating the adoption of efficient charcoal cook-stoves. This CPAs are voluntary action by CookClean Ghana Limited.

(b) Technical description of the CPA

The principal design of the CookMate stove features a pot-skirt and a conical grate, or some other technologically equivalent design feature that improves charcoal stoves efficiency and their demand.

The main stove design is an adaptation of the Pulamusa stove developed by ProBEC in Zambia after extensive research into the manufacturing of energy efficient stoves and other thermal technologies. The stoves are constructed by local trained technicians working mostly in centralised manufacturing workshops operated and managed by CookClean Ghana Limited. For durability (up to 4 years average lifetime), the stoves are made of Galvanised/Mild Steel Plate and are produced in three sizes.

The ECSs are more efficient than traditional charcoal stoves as they reduce the heat loss.

During the life of the project, research and development work may result in more efficient ECS designs, subject to the appropriate tests proving real and measurable quantity of charcoal saved.

Figure 1: The CookMate Design



Size	Diameter (cm)	Circumference (cm)	Height (cm)
1	24	74	28
2	27	80	28
3	30	92	28

During this monitoring period, CPA01 had the maximum number of stoves reaching small-scale threshold of 47,244 ECSs and the annual energy saving per stove is estimated at 0.0039GWh, therefore this CPA01 has contributed to a total energy saving of 180 GWhth during the monitoring period. The total energy saved by the small scale project is therefore equal to the 180 GWhth energy small scale energy saving threshold. CPA02 in its part has 28,042 ECs stoves during this monitoring period.

The baseline scenario is the same as the existing scenario where the same amount of household energy needs is met through the traditional coal pot, used in most urban areas of Ghana.

(c) Relevant dates for the project activity

The following are the key relevant milestones of the project activity.

1. Programme of activity (PoA) registered: 30/11/2012
2. Installation of stove manufacturing equipment: October 2012
3. Stove production: November 2012
4. Factory relocation and equipment upgrade: December 2013
5. Cutting and punching machine breakdown: January 2014
6. First Monitoring period: 01/01/2013 to 31/03/2014
7. Second Monitoring period: 01/04/2014 to 31/07/2015
8. Third Monitoring period: 01/08/2015 to 30/06/2016
9. Second CPA02 added to the PoA on 12/02/2016
10. Third monitoring period: 01/08/2015 to 30/06/2016

(d) Total GHG emission reductions achieved in this monitoring period.

During this monitoring period, the PoA achieved reductions of 250,592 tCO₂e.

(e) Double Counting

There is no double counting of stoves. All the stoves manufactured by the project are assigned a unique serial number which is engraved into the body of the stove. The use of serial number which is recorded are manufacturing time and at sales time ensures that only stoves which has been manufactured and sold through their project distribution channels are entered into the database and this are the stoves which are used to calculate the emission reductions. This process ensures that other stoves from outside the project can not form part of the project, hence double counting is avoided.

D.2. Geographical references or other means of identification of the location of the specific-case CPA(s)

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- a) Host Party(ies): Ghana
- b) Region/ State/ Province: Geographical boundary of the country of Ghana
- c) City/ Town/ Community: Geographical boundary of the country of Ghana
- d) Physical/ Geographical location: 8° 00' N, 2° 00' W

SECTION E. Post-registration changes to specific-case CPA(s)**E.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline**

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None

E.2. Corrections

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None

E.3. Changes to the start date of the crediting period of the specific-case CPA(s)

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None

E.4. Inclusion of a monitoring plan into the specific-case CPA(s) that was not included at registration

>>

None

E.5. Permanent changes to the monitoring plan as described in the registered specific-case CPA-DD(s), applied methodology or standardized baseline

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None

E.6. Changes to project design of the specific-case CPA(s)

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None

E.7. Types of changes specific to afforestation and reforestation specific-case CPA(s)

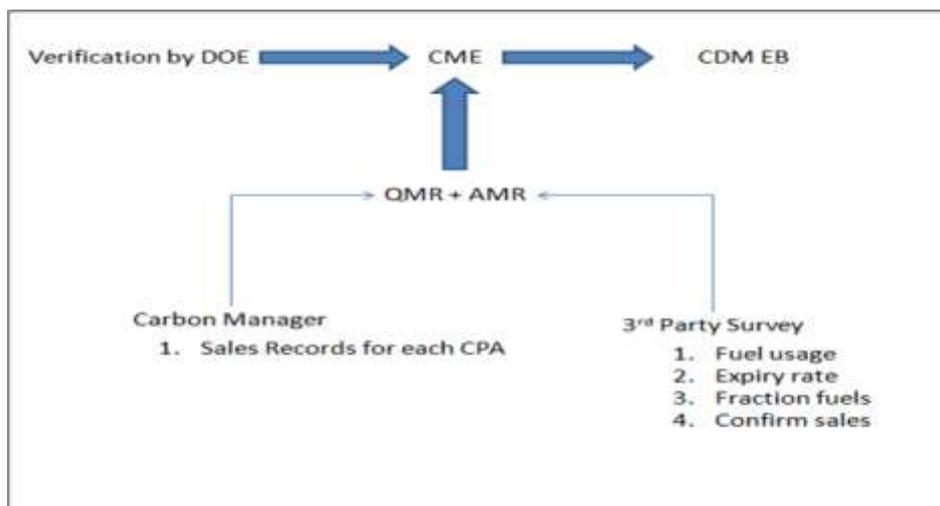
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None

SECTION F. Description of the monitoring system of specific-case CPA(s)

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The monitoring of the operations of the CPA follows guidance outlined in the PoA. The CME is the overall coordinator and all the information flows thorough to CME as outlined in the diagram below:



The monitoring system in place established by the project follows the guidance provided in the “Standard for sampling and surveys for CDM project activities and Programme of Activities”, Version 02.0 and the applied methodology AMS II.G, version 04.0. The step-wise monitoring system employed is discussed below:

(a) Sales Records

The number of stoves manufactured and sold are monitored through the Sales Database. The database is maintained electronically (excel file) by CookClean Ghana Limited and is periodically checked by the CME to ensure that no double counting occurs. The database contains the following information:

1. Customer/Client name
2. Stove size
3. Stove sale date
4. Stove serial number
5. CPA number
6. Agent/retailer name and location
7. User location
8. Contact details of user

The above information is further maintained by the CME who verify the reported sales with the number of stoves produced by the manufacturer. Since the unique code (serial number) inscribed on the cook stoves correspond to its CPA, it's possible to trace the stove from the users back to the production process and this assures against the occurrence of double counting.

(b) Monitoring Efficiency

The efficiency of representative sample of all stoves under the CPA has been determined by sampling and testing the sampled CPA stoves for efficiency in order to ensure that the stoves are still operating at the specified efficiency or that they are replaced by an equivalent service stove. This is done as per paragraph 15 of the methodology. In addition, the number of stoves which are in operation are also monitored every 2 years as per paragraph 16 of the methodology through a representative sample.

The responsibility for monitoring the efficiency of the stoves for the CPA lies with CookClean Ghana Limited (project implementer) with close supervision by the CME (ClimateCare). During this monitoring period, the average efficiencies of High Power (Cold Start), High Power (Hot Start) and Low Power (Simmer) were determined during the WBTs carried out by a third party consultant.

The findings of the study shows that there is no much drop in efficiency of the stoves as they age and the efficiency of the stove is almost constant. Only environmental factors such changes in weather patterns and location of the kitchen or cooking area which can affect the stove performance.

The stoves which are being distributed by the project are manufactured as per the design registered in the CPA-DD and the manufacturing is done in the factory which was established by the project developer. The factory manufactures the CookMate stove only under very stringent quality control conditions and all the stoves manufactured to a standard specification. The material used are of a specified standard and the production process is well controlled. As a result, no significant variation is expected in the product quality and stove efficiency. Because of the tight design specifications and quality assurance systems at the factory, the performance of the stove is expected to be the same and there would be no significant variations from stove to stove.

(c) Monitoring quantity of woody biomass that is consumed by baseline stoves

As per the registered CPA-DD, the project applied option 2, equation 3 in determining the fuel savings, whereby the quantity of woody biomass that is consumed by baseline stoves in year y (B_{old}) is determined once for the CPA and the value is fixed ex-ante.

(d) Monitoring Ongoing Stove Usage

The percentage of CookMate stoves sold by the CookClean Ghana Limited which are no longer in use (Drop-Out Rate, (DO_y)) is determined through sampling on a biennial basis. The number of stoves in use have been adjusted by the Drop-Out Rate in order to determine the number of project stoves in use, (N_y) and to calculate the emission reductions. The drop off monitoring will be the responsibility of the CME.

To ensure compliance with paragraph 16 of the methodology, during this monitoring period, the project developer surveyed 400 stove users through home visits. Initially, stratified random sampling was carried out from the sales database but since most of the stoves sold in the monitoring period were for household use, all the samples were therefore treated as one stratum (household). The sample users were asked if they still used the efficient stove and also if they used any other stove in the household.

With regard to monitoring of continued use of the baseline stoves, the survey to determine whether baseline stoves are being used by project stove customers was carried at the same time the drop-off survey was being carried out as explained in the paragraph above. The drop off sample was also used as the sample for determining the continued usage of baseline stoves.

During the survey, customers were visited in their homes and the following were established:

1. The continued usage of the project stove in order to determine the drop off whose results were analysed and used in the ER calculations
2. The usage of the baseline stove which was found to be negligible as most of the respondents either did not have the baseline stove in their kitchens or they did not use them due to the high fuel consumption associated with them. This was established through interview of the stove user and followed by physical observation of the kitchens and the stoves where found.

Therefore the survey established that the households sampled do not use the baseline stoves and its continued usage is there for negligible.

The sample survey established that baseline stoves are still in use and use of any complete/partial use of baseline stove was accounted as a drop-off.. Overall, it can be seen that any change in usage has been accounted as a drop-off and partial usage of the project stove has been used as a drop-off conservatively. From the observations made, the CME decided that for any use of baseline stoves, that corresponding project stoves was considered drop-off and accounted as drop-off and its emissions are discounted. The project stoves was therefore no longer claiming emissions even if its under use by a household.

The results were analysed statistically for 95% confidence interval and 5% precision and lower bound values were applied. Through this, the DO_y (the usage of alternative stove or who are no longer using the cookmate stove) in the household was established as shown in G.2.

(e) Monitoring leakage:

The leakage calculation for the project applies the default adjustment factor of 0.95 as provided by the methodology, thereby eliminating the need for monitoring surveys

SECTION G. Data and parameters

G.1. Data and parameters fixed ex ante, at registration, inclusion or renewal of crediting period

Data / Parameter:	η_{old}
Unit:	Fraction
Description:	Efficiency of the system being replaced, measured using representative sampling methods or based on referenced literature values (fraction)
Source of data:	Default value in AMS-II.G, vers 04.0
Value(s) applied):	0.10
Choice of data or measurement methods and procedures	<p>According to the methodology, 0.10 default value may be optionally used if the replaced system is the three stone fire or a conventional system lacking improved combustion air supply mechanism and flue gas ventilation system i.e. without a grate and without a chimney.</p> <p>The replaced systems in the project area will be conventional system lacking improved combustion air supply mechanism and flue gas ventilation system.</p>
Purpose of data:	Calculation of baseline emissions
Additional comment:	<p>According to the methodology, 0.10 default value may be optionally used if the replaced system is the three stone fire or a conventional system lacking improved combustion air supply mechanism and flue gas ventilation system i.e. without a grate and without a chimney.</p> <p>The replaced systems in the project area is conventional system lacking improved combustion air supply mechanism and flue gas ventilation system.</p> <p>-</p>

Data / Parameter:	L_{POA}
Unit:	-
Description:	Net-to-gross adjustment factor for PoA Leakage
Source of data:	AMS-II.G; Version 04.0
Value(s) applied):	0.95

Choice of data or measurement methods and procedures	As per the methodology AMS II.G, vers. 04.0, a default value as provided under par. 22 can be optionally used to account for PoA leakage, in which case estimates of the leakage are not required. See Part II, Section B.6.1 of this document for details.
Purpose of data:	Calculation of leakage emissions
Additional comment:	The 0.95 PoA leakage factor will be applied to all CPAs

Data / Parameter:	$EF_{projected_fossilfuel}$
Unit:	tCO ₂ /TJ
Description:	Emission factor for the substitution of non-renewable biomass by similar consumers
Source of data:	AMS-II.G; vers. 04.0
Value(s) applied:	81.6
Choice of data or measurement methods and procedures	This is the IPCC default value as provided by AMS II.G (vers. 04.0), paragraph 5
Purpose of data:	Calculation of baseline emissions
Additional comment:	This is the IPCC default value specified in AMS II.G (vers. 04.0), paragraph 5

Data / Parameter:	$NCV_{biomass}$
Unit:	TJ/tonne
Description:	Net calorific value of the non-renewable woody biomass that is substituted
Source of data:	AMS-II.G; vers. 04.0
Value(s) applied:	0.015
Choice of data or measurement methods and procedures	This is the IPCC default value as provided by AMS II.G (vers. 04.0), paragraph 5
Purpose of data:	Calculation of baseline emissions
Additional comment:	This is the IPCC default value for non-renewable woody biomass that is substituted as specified in AMS II.G (vers. 04.0), paragraph 5.

Data / Parameter:	$B_{old, appliance, survey}$
Unit:	Tonnes per stove
Description:	Quantity of charcoal used in the absence of the project activity per appliance(stove)
Source of data:	A survey of local baseline stove usage
Value(s) of monitored parameter:	0.72
Choice of data or measurement methods and procedures	Determined once for each region as stated in the additional comment of registered CPA-DD. $B_{old, appliance, survey}$ is determined at 90/10 precision through appropriate sampling methods for the Kitchen Performance Test (KPT) protocol. B_{old} is calculated from $B_{old, appliance, survey}$
Purpose of data:	Calculation of baseline emissions

Additional comment:	<p>This parameter is determined once for each region where the stoves are to be sold as per the registered CPA-DD. According to the registered CPA-DD, the parameter $B_{old, appliance, survey}$ is determined once and not monitored on a continuous basis, but stays constant throughout the crediting period.</p> <p>The determination of the parameter was done through a KPT during validation and covered the geographic region of Ghana, where the CPA is being implemented.</p>
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G.2. Data and parameters monitored

Data / Parameter:	Annual energy saving per appliance
Unit:	GWh
Description:	Annual energy saving per appliance
Measured/Calculated / Default:	Calculated
Source of data:	Calculated from average charcoal saving per stove ($B_{y, saving, appliance}$) and $NCV_{charcoal}$
Value(s) of monitored parameter:	0.0039
Monitoring equipment:	-
Measuring/Reading/Recording frequency:	Once, at the time of inclusion of a CPA into the PoA.
Calculation method (if applicable):	Calculated as product of $B_{y, saving, appliance}$, and $NCV_{charcoal}$ (taken as 0.0295 TJ/t) divided by the conversion factor (TJ/GWh taken as 3.6 from IPCC 2006 Tables)
QA/QC procedures:	Use of nationally approved source of data
Purpose of data:	Calculation of baseline emissions
Additional comment:	Used to verify that the de-bundling requirements are met

Data / Parameter:	Annual number of appliances to reach small scale threshold
Unit:	Number
Description:	Annual number of appliances to reach small scale threshold
Measured/Calculated / Default:	Calculated
Source of data:	Calculated from the annual energy saving per appliance
Value(s) of monitored parameter:	46,181
Monitoring equipment:	-
Measuring/Reading/Recording frequency:	Once, at the time of inclusion of a CPA into the PoA.
Calculation method (if applicable):	Calculated as 180 divided by annual energy saving per appliance
QA/QC procedures:	Use of nationally approved source of data
Purpose of data:	Calculation of baseline emissions
Additional comment:	Used to verify that the small scale threshold limit is not exceeded.

Data / Parameter:	B_{old}				
Unit:	Tonnes				
Description:	Quantity of woody biomass used in the absence of the project activity				
Measured/Calculated / Default:	Measured and Calculated				
Source of data:	Calculated				
Value(s) of monitored parameter:	<table border="1"> <tr> <td>CPA00 1</td> <td>180,566</td> </tr> <tr> <td>CPA00 2</td> <td>98,309</td> </tr> </table>	CPA00 1	180,566	CPA00 2	98,309
CPA00 1	180,566				
CPA00 2	98,309				
Monitoring equipment:	-				
Measuring/Reading/ Recording frequency:	Within the monitoring period				
Calculation method (if applicable):	B_{old} is Calculated as the summation of the product of the average daily consumption of woody biomass per baseline stove ($B_{old, appliance}$) and the number of days the stove has been in use (Ref Excel sheet calculations)				
QA/QC procedures:	-				
Purpose of data:	Calculation of baseline emissions				
Additional comment:	This parameter is determined once for each region where the stoves are to be sold				

Data / Parameter:	$f_{NRB,y}$
Unit:	%.
Description:	Fraction of woody biomass saved by the project activity in period y that can be established as non-renewable biomass
Measured/Calculated / Default:	Calculated
Source of data:	FAO (2011): Global Forest Resource Assessment 2011, Country Reports (for the PoA participating Sub-Saharan Country); http://www.fao.org/forestry/country/en/
Value(s) of monitored parameter:	99%
Monitoring equipment:	N/A
Measuring/Reading/ Recording frequency:	Once, at the time of inclusion of a CPA into the PoA.
Calculation method (if applicable):	Calculated as provided for in AMS-II.G, version 04.0
QA/QC procedures:	Use of nationally approved source of data
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	N_y				
Unit:	<table border="1"> <tr> <td>CPA001</td> <td>46,181</td> </tr> <tr> <td>CPA002</td> <td>27,411</td> </tr> </table>	CPA001	46,181	CPA002	27,411
CPA001	46,181				
CPA002	27,411				
Description:	Adjusted total number of stoves deployed until period y				
Measured/Calculated / Default:	Calculated				
Source of data:	Sales Database				

Value(s) of monitored parameter:	Refer spreadsheet
Monitoring equipment:	Sales records
Measuring/Reading/Recording frequency:	Continuous
Calculation method (if applicable):	The total number of stoves in use during the monitoring period multiplied by the correction factor for non-usage of stoves (Ref Excel sheet calculations).
QA/QC procedures:	Data is collected using the standard procedures and kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.
Purpose of data:	Calculation of baseline emissions
Additional comment:	Type of the stove is also monitored via sampling approach or documented evidences, and in case any deployed ICS type will be found not in line with the methodology requirement, those ICS will not be counted for emission reduction calculations

Data / Parameter:	<i>DO_y</i>
Unit:	%
Description:	Statistically adjusted drop out from total population of appliances in period y
Measured/Calculated / Default:	Calculated from sample survey
Source of data:	Sample survey of local project stove usage
Value(s) of monitored parameter:	2.25%
Monitoring equipment:	Sampling
Measuring/Reading/Recording frequency:	Biennially for each CPA in the PoA
Calculation method (if applicable):	<p>Monitoring of the statistically adjusted drop out involves two steps:</p> <p>Step 1: Sample survey amongst stoves of the same type deployed under CPAs of the PoA as specified in Part II, section B.7.2 below.</p> <p>Step 2: Calculation of the adjusted drop-out rate at confidence level and precision as required by the methodology (AMS II.G. ver. 04.0) for the inspection frequency chosen, following the statistical standard approach for a homograde test of independent units that have a standard normal distribution.</p> <p>The Drop outs were determined through interviews and household visits where users were sampled.</p>
QA/QC procedures:	<p>All formulas applied to determine the statistical precision are standard formula. According to AMS II.G (version 04.0), paragraph 21, if the required precision is not achieved, the lower bound of the required confidence interval of the parameter value is to be chosen.</p> <p>Data was collected using the standard procedures and will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.</p>
Purpose of data:	Calculation of baseline emissions
Additional comment:	Drop out means that the ECS are either not used, outside of the project boundary as defined in the CPA or damaged beyond repair.

Data / Parameter:	η_{new}
Unit:	%
Description:	Efficiency of the project stoves deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol.
Measured/Calculated / Default:	Measured and Calculated
Source of data:	Water boiling Tests
Value(s) of monitored parameter:	41.28% for Small household stoves 42.03% for Medium household stoves 37.98% for Large commercial stoves
Monitoring equipment:	Laboratory Testing
Measuring/Reading/ Recording frequency:	Annually, as per of AMS II.G version 04.0
Calculation method (if applicable):	Water Boiling Test (WBT) protocol. Since three different stoves are to be distributed, a weighted average value has been applied.
QA/QC procedures:	Sampling and survey to be carried out with 90% confidence interval and a 10% margin of error. If results show that 90/10 precision is not achieved, the lower bound of 90% confidence interval of this parameter value will be applied.
Purpose of data:	Calculation of project emissions
Additional comment:	The smaller value of yearly efficiencies is applied in order to maintain conservativeness.

G.3. Implementation of specific-case CPA level sampling plan

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The PoA-DD contains a description of the sampling methodology to be applied during any sampling activity in consideration with the most recent General Guidelines for sampling and surveys for small-scale CDM project activities. The sampling to be done was statistically sound and as robust as the approaches presented in the registered PoA-DD. The CME applied simple random sampling method in line with both the PoA-DD/CPA-DD.

All sampling efforts was conducted by third party(ies) as described in Section B.2 above. All the samplers were hired locally and spoke the local language which enabled fully understanding of any responses given by users, and any questions therein.

Some monitoring was conducted annually and biennially, depending on the approach chosen in the CPA.

Sampling was undertaken as part of a Sampling Plan that is in line with the requirements of:

1. "Standard for sampling and surveys for CDM project activities and Programme of Activities", Version 03.0.
2. The methodology AMS-II.G, Version 04.0

The sample size achieved was 27 which was large enough to meet 90/5 precision since the sampling was done annually. In cases where such precision is not achieved, the lower bound of a 90%/95% confidence interval of the parameter value will be used as allowed by the methodology. Since the CPA distributes three stove sizes, each size formed a strata from where simple random sample was applied to choose the samples to be included in the survey. The analysis was done and the efficiency of each stove size was established and applied in the ER calculation.

In the PoA, it is planned that individual verifications shall be done for each CPA. Although some CPAs will be owned by same PAI, most CPAs shall be owned by different companies (PAIs) and shall be verified separately. Thus PoA level sampling has not been considered as it is not applicable.

To determine the average annual consumption of woody biomass per appliance ($B_{old,appliance}$), a survey of local charcoal usage is carried out from where the average annual consumption of charcoal per baseline appliance ($B_{old,appliance,survey}$) is determined. This parameter was introduced to facilitate the conversion from charcoal to woody biomass per appliance and the correction for leakages and the parameter is fixed.

The drop outs were determined through household home visits where the customers were randomly selected from the database using random sampling, visited in their homes and asked if they are still using their stoves or not.

A total of 400 households were sampled randomly from the database using excel work sheet random number formula. The project implementer having selected the samples, telephoned those selected and asked them if they were willing to participate in the survey and asked them to provide directions to where their homes located (gave directions). During the survey, a total of 385 users were visited in their homes by the survey team, where they were asked about the stove and if they were still using it or not. The remainder, 15 were not reachable to give their consent to participate on the survey because for various reasons including mobile phones being switched off, or not within mobile network reach, too busy or relocated.

From the findings of the survey, the data was aggregated and analysed statistically. It was established that a total of 5 users of the sampled households are not using the stoves due to any of the following reasons:

1. The household replaced stove with LPG cooker due to rise in income
2. Stopped commercial cooking
3. The stove was “donated” to a relative who resides upcountry.

The total drop-out percentage therefore for the monitoring period is 2.25% which is lower than the value of 5% applied in the registered CPA-DD.

SECTION H. Calculation of GHG emission reductions or net GHG removals by sinks

H.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

The emission reduction realised by the project is calculated based on the formula below:

$$ER_y = B_{y,savings} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossilfuel} \times N_{y,i}$$

Where:

- ER_y = Emission reductions during year y in t CO₂e
- $B_{y,savings}$ = Quantity of woody biomass that is saved in tonnes per device
- $f_{NRB,y}$ = Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass using survey methods or government data or default country specific fraction of non-renewable woody biomass (f_{NRB}) values available on the CDM website
- $NCV_{biomass}$ = Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne, wet basis)

$EF_{projected_fossilfuel}$ = Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 t CO₂/TJ

$N_{y,i}$ = Number of project devices of type i operating in year y ,

$B_{y,savings}$ is estimated using Option 2, equation 3 as shown below:

$$B_{y,savings} = B_{old} \times \left(1 - \frac{\eta_{old}}{\eta_{new,y}}\right)$$

Where:

B_{old} = Quantity of woody biomass used in the absence of the project activity in tonnes per device

η_{old} = 1. Efficiency of the device being replaced (fraction); measured using representative sampling methods or based on referenced literature values use weighted average values if more than one type of device is being replaced;
 2. A default value of 0.10 may be optionally used if the replaced device is a three stone fire, or a conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney; for other types of devices, a default value of 0.2 may be optionally used. This option has been applied.

$\eta_{new,y}$ = Efficiency of the device being deployed as part of the project activity (fraction), as determined annually¹² using the water boiling test (WBT) protocol carried out in accordance with national standards (if available) or international standards or guidelines. Use weighted average values if more than one type of system is being introduced by the project activity

For clarity and in order to derive B_{old} from the baseline fuel use survey, parameters representing the average annual consumption of woody biomass per baseline appliance ($B_{old, appliance}$) and the average annual consumption of charcoal per baseline appliance ($B_{old, appliance, survey}$) have been introduced as per registered CPA_DD. Also the following “own” equation were introduced to account for the leakages due to the NRB (L_{NRB}) and the PoA (L_{PoA}) and also to convert from quantity of charcoal to quantity of biomass (multiply by 6)¹

$$B_{old, appliance} = B_{old, appliance, survey} * 6 * L_{NRB} * L_{PoA} \tag{3.1}$$

Where:

$B_{old, appliance}$ The average quantity of woody biomass used in the absence of the project activity by each appliance in tonnes.

$B_{old, appliance, survey}$ The average quantity of charcoal used in the absence of the project activity by each appliance in tonnes (as determined by the baseline survey).

L_{NRB} Leakage factor as per Clause 13(a) of AMS-II.G, Version 04.0. Use a value of 0.95 There will be no transfer or use of old equipment from outside the project boundary.

¹ To determine B_{old} , the baseline charcoal consumption is multiplied by 6. This is based on last paragraph of page 1.45 of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual¹, which states as follows: “If no local information is available, 6 kg of wood input per kg of charcoal may be used as default (FAO, 1990)”.

L_{POA} Leakage factor as per Clause 22(c) of AMS-II.G, Version 04.0. Use a value of 0.95 There will be no transfer or use of old equipment from outside the project boundary.

In determining the number of appliances in use within the monitoring period y (N_y) for post calculations, and the drop-out rate (DO_y) of 2.25% is applied. The Drop-off rate was statistically determined through a survey. To compensate for the actual operating days for a given stove, N_y is further adjusted for the proportion of the year during which the stoves are in use using the factor, $mp_{length}/365$ (where mp_{length} is the number of days the stove is in use during the year). The number of stoves in use, assuming a 4-year life, ($N_{y,no-adjusted}$) is then adjusted for the drop using the equation:

$$N_y = N_{y,no-adjusted} * (1 - DO_y) * mp_{length}/365 \quad (3.2)$$

To simplify the spreadsheet calculation, N_y has been determined with $mp_{length}/365$ taken as 1 to provide the correction factor for drop-off, in this case is 0.9775. This has been used to correct for the drop out and the actual stove days have been calculated for each stove in order to calculate ERs.

The quantity of woody biomass that is saved by the CPA in period y in tonnes is then calculated from the equation (3.3) below in order to correct for drop-out rate and days of use for each stove sold

$$B_{y, savings} = B_{y, savings, appliance} * N_y \quad (3.3)$$

Where:

- $B_{y, savings}$ Quantity of woody biomass that is saved by the CPA in period y in tonnes.
- $B_{y,saving appliance}$ The average quantity of woody biomass that is saved by each project appliance in period y in tonnes.
- $N_{y, non-adjusted}$ The number of ECS in operation in year y before adjustment for the stoves not in use. The value of $N_{y, non-adjusted}$ depends on the sales rate and the expiry rate of the project stoves and is designed to ensure that the number of operational stoves does not exceed the energy-saving threshold prescribed for Type II methodologies. $N_{y, non-adjusted}$ will be adjusted according to the share of users found not to use the project stoves by applying a Drop-Out Rate Factor (DO_y) as in equation (3.2) to determine N_y .
- N_y The number of ECS in operation in year y adjusted for the stoves not in use.
- DO_y The percentage of stoves sold by the PAI which are no longer in use (Drop-Out Rate). As per paragraph 16 of AMS IIG, the percentage of stoves sold by the PAI which are no longer in use (the Drop-Out Rate, DO_y), will be found by sampling. This sample will be biennial
- mp_{length} Length of monitoring period. For ex-ante calculations, a value 365 days per year is assumed.

Emission reduction for the CPA is calculated as per AMS II.G Energy Efficiency measures in thermal application of non-renewable biomass; Version 04.0.

The following equation is used to calculate the emission reductions:

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected_fossilfuel} \quad (1)$$

Substituting the known values;

$$ER_y = B_{y,savings} * f_{NRB,y} * 0.015 * 81.6$$

ER_y	Emission reductions during the year y in tCO ₂ e
$B_{y,savings}$	Quantity of woody biomass that is saved by the CPA in period y in tonnes.
$f_{NRB,y}$	Fraction of woody biomass saved by the project activity in period y that can be established as non-renewable biomass in %. Where default values endorsed by designated national authorities and approved by the Board are available at http://cdm.unfccc.int/DNA/fNRB/index.html , is applied.
$NCV_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)
$EF_{projected\ fossilfuel}$	Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO ₂ /TJ

Quantity of woody biomass that is saved by the CPA is calculated using Option 2 as follows:

$$B_{y, savings} = (B_{old} * (1 - \eta_{old} / \eta_{new})) \quad (3)$$

Substituting the known values;

$$B_{y, savings} = (B_{old} * (1 - 0.1 / \eta_{new}))$$

Where:

$B_{y,saving}$	The quantity of woody biomass that is saved by project activity in period y in tonnes.
B_{old}	Quantity of woody biomass used in the absence of the project activity in tonnes

B_{old} is determined as the product of number of appliances in use during the year and the average annual fuel combustion per baseline appliance.

To determine B_{old} , the average annual charcoal consumption of the baseline appliance is multiplied by 6. This is based on last paragraph of page 1.45 of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual*².

η_{old}	Efficiency of the system being replaced, measured using representative sampling methods (fraction). The default value of 0.10 has been applied for the CPA
η_{new}	Efficiency of the system being deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol. Use weighted average values since 3 sizes of stoves are being introduced by the project activity

For clarity and in order to derive B_{old} from the baseline fuel use survey, parameters representing the average annual consumption of woody biomass per baseline appliance ($B_{old, appliance}$) and the average annual consumption of charcoal per baseline appliance ($B_{old, appliance, survey}$) were introduced and they are applied. Also the following “own” equation were introduced to account for the leakages due to the NRB (L_{NRB}) and the PoA (L_{PoA}) and also to convert from quantity of charcoal to quantity of biomass (multiply by 6)³.

$$B_{old} = B_{old, appliance} * N_y \quad (3.1)$$

² See <http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref3.pdf>

³ To determine B_{old} , the baseline charcoal consumption is multiplied by 6. This is based on last paragraph of page 1.45 of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual*³, which states as follows: “If no local information is available, 6 kg of wood input per kg of charcoal may be used as default (FAO, 1990)”.

$$B_{old, appliance} = B_{old, appliance, survey} * 6 * L_{NRB} * L_{POA}$$

Substituting the known values in equations 3.1.1 and 3.1;

$$B_{old, appliance} = B_{old, appliance, survey} * 6 * 0.95 * 0.95 \quad (\text{equation 3.1.1})$$

$$B_{old} = B_{old, appliance, survey} * 6 * 0.95 * 0.95 * N_y \quad (\text{equation 3.1})$$

Where:

$B_{old, appliance}$	The average quantity of woody biomass used in the absence of the project activity by each appliance in tonnes.
$B_{old, appliance, survey}$	The average quantity of charcoal used in the absence of the project activity by each appliance in tonnes (as determined by the baseline survey).
L_{NRB}	Leakage factor as per Clause 13(a) of AMS-II.G, Version 04.0. Use a value of 0.95 There will be no transfer or use of old equipment from outside the project boundary.
L_{POA}	Leakage factor as per Clause 22(c) of AMS-II.G, Version 04.0. Use a value of 0.95 There will be no transfer or use of old equipment from outside the project boundary.

Detailed calculation step are found in the Excel sheet calculations.

H.2. Calculation of project emissions or actual net GHG removals by sinks

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From the methodology, the project emissions or net GHG removals by sinks is taken as 0 t CO₂e.

H.3. Calculation of leakage

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Leakage Adjustment Factor as per the methodology is applied to the project activity to calculate the Emission Reductions during Monitoring Period in accordance with AMS II.G./Version 04. A default value of 95% has been used. See section E.1.

H.4. Summary of calculation of GHG emission reductions or net GHG removals by sinks

Specific-case CPA reference number	Baseline emissions or baseline net GHG removals by sinks (tCO ₂ e)	Project emissions or actual net GHG removals by sinks (tCO ₂ e)	Leakage (tCO ₂ e)	GHG emission reductions or net GHG removals by sinks (tCO ₂ e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
CPA: 8438-0001	162,289	0.0	0.0	0.0	162,289	162,289
CPA: 8438-0002	88,303	0.0	0.00	0.0	88,303	88,303
Total	250,592	0.0	0.0	0.0	250,592	250,592

H.5. Comparison of GHG emission reductions or net GHG removals by sinks with estimates in the included CPA-DD(s)

Specific-case CPA reference number	Value estimated in ex ante calculation in the included CPA-DD(s)	Actual values achieved by the specific-case CPA(s) during this monitoring period
CPA: 8438-0001	151,721	162,289
CPA: 8438-0002	145,451	88,303
Total	297,172	250,592

H.6. Remarks on difference from the estimated value in the included CPA-DD(s)

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The difference in ER realised from the estimated was caused by differences in stove efficiencies from the WBT carried out compared with the value applied during validation. In addition, the estimated CERs are based on phased stove installations which were graduated on estimated sales annually, while the actual CERs achieved are based on actual dates of sale and actual number of days in operation.

Appendix 1. **Contact information of coordinating/managing entity and/or responsible persons/entities**

Coordinating/managing entity and/or responsible person/entity	<input checked="" type="checkbox"/> Coordinating/managing entity <input checked="" type="checkbox"/> Person/entity responsible for completing the CDM-MR-FORM
Organization name	ClimateCare Limited
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