 <b>Monitoring report form</b> <b>(Version 04.0)</b>	
Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.	
MONITORING REPORT	
<b>Title of the project activity</b>	PoA Title: African Improved Cooking Stoves Programme of Activities CPA1 Title: African Improved Cooking Stoves Programme of Activities – CPA No. 00001 (Ghana) CPA2 Title: African Improved Cooking Stoves Programme of Activities CPA 00002 (Ghana) CPA3 Title: African Improved Cooking Stoves Programme of Activities CPA 00003 (Ghana)
<b>Reference number of the project activity</b>	PoA reference number: 5342 CPA00001 ref number 5342-0001 CPA00002 ref number 5342-0002 CPA00003 ref number 5342-0003
<b>Version number of the monitoring report</b>	3.0
<b>Completion date of the monitoring report</b>	17/03/2015
<b>Registration date of the project activity</b>	Registration date for PoA: 06/12/2012 Registration date for CPA00001: 06/12/2012 Registration date for CPA00002: 21/10/2013 Registration date for CPA00003: 08/11/2013
<b>Monitoring period number and duration of this monitoring period</b>	Monitoring period: 01 15/12/2012 - 14/12/2013
<b>Project participant(s)</b>	Envirofit International Ltd.
<b>Host Party(ies)</b>	Ghana, Nigeria, Liberia
<b>Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)</b>	Sectoral scope: 3: Energy demand Methodology: AMS-II.G ver 3.0: Energy efficiency measures in thermal applications of non-renewable biomass
<b>Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD</b>	CPA00001 GHG emission reductions: 15,477 tCO <sub>2</sub> eq CPA00002 GHG emission reductions: 5,666 tCO <sub>2</sub> eq CPA00003 GHG emission reductions: 1,803 tCO <sub>2</sub> eq
<b>Actual GHG emission reductions or net</b>	CPA00001 GHG emission reductions: 12,472 tCO <sub>2</sub>

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<b>anthropogenic GHG removals by sinks achieved in this monitoring period</b>	eq CPA00002 GHG emission reductions: 0 tCO <sub>2</sub> eq CPA00003 GHG emission reductions: 0 tCO <sub>2</sub> eq
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)</b>	CPA00001 GHG emission reductions: 458 tCO <sub>2</sub> eq CPA00002 GHG emission reductions: 0 tCO <sub>2</sub> eq CPA00003 GHG emission reductions: 0 tCO <sub>2</sub> eq
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).</b>	CPA00001 GHG emission reductions: 12,014 tCO <sub>2</sub> eq CPA00002 GHG emission reductions: 0 tCO <sub>2</sub> eq CPA00003 GHG emission reductions: 0 tCO <sub>2</sub> eq

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity

#### a) Purpose

The purpose of this Programme of Activities (PoA) is the dissemination of improved biomass cooking stoves (ICS) in Ghana, Nigeria and Liberia. The Programme will promote stove categories that replace existing less efficient cooking stoves using woody-biomass (wood-fuel and/or charcoal).

The ICS distributed under the programme are more efficient in transferring heat from the fuel to the pot when compared to the stoves typically being used in the baseline. By replacing inefficient baseline stoves, the PoA saves on consumption of woody biomass (either wood or charcoal made from wood) which is the dominant fuel used for cooking in project households. The ICSs applied in this PoA have been designed to match the traditional utensils and cooking habits of the target consumers in host countries. At the time of first publication of the Monitoring Report on UNFCCC, the PoA had three CPAs included in the PoA namely CPA00001, CPA00002 and CPA00003, all in Ghana. During this monitoring period, stoves have been distributed in CPA00001 only therefore only CPA00001 has been monitored.

The purpose of these three CDM Component Project Activities is the dissemination of improved cooking stoves (ICS) in the Republic of Ghana (Ghana). In this first monitoring period, the stoves distributed and monitored, all under CPA00001 only, replaced traditional cooking stoves using charcoal fuel.

#### b) Brief description of the technology implemented

The technology implemented is that of improved cookstoves (ICS), which are portable, and use charcoal as the source of fuel. These ICSs are more efficient in transferring heat from the fuel to the pot, thus saving charcoal compared to the traditional charcoal stoves currently used by the Ghanaian households. Furthermore, the ICSs applied in this CPA have been designed not only to increase heat transfer, but also to match traditional utensils and cooking habits of the people in Ghana.

Stoves, distributed under CPA00001 only, included the following charcoal stove models:



CH2200



CH2300

#### c) Relevant dates for the project activity CPA00001

Start date of CPA00001: The project activity started on 03/01/2012, which was the day when the first shipment of the stoves to be distributed under the CPA was made.

Date first stove distributed under CPA00001: 23/02/2012

Start date of crediting period of CPA00001: 15/12/2012

No stoves were distributed under CPA00002 and CPA00003 till the end of the monitoring period.

d) Total GHG emission reductions or net anthropogenic GHG removals by sinks.

For the period of the first monitoring period, the PoA has achieved 12,472 tCO<sub>2</sub>eq emission reductions, all under CPA00001.

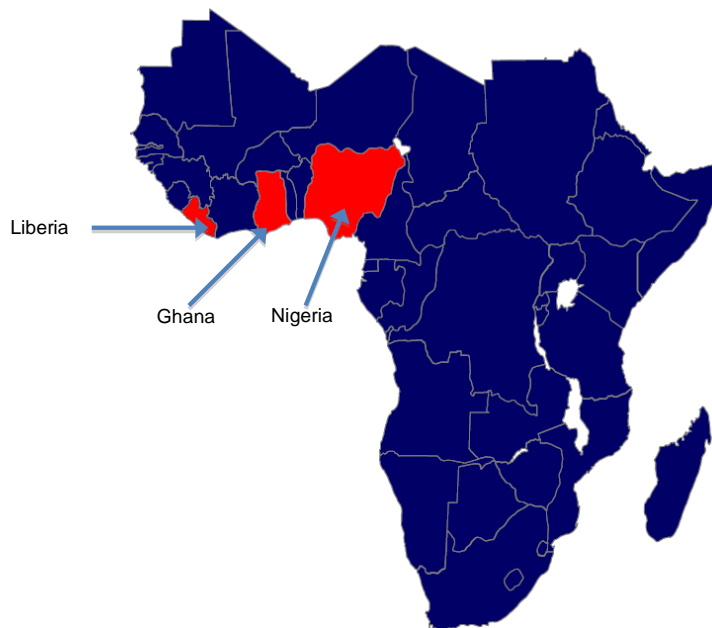
## A.2. Location of project activity

Host Parties: Ghana, Nigeria and Liberia

Region/State/Province: All across Ghana, Nigeria and Liberia

City/Town/Community: All across Ghana, Nigeria and Liberia

Physical Geographical location: The geographical locations of Ghana, Nigeria and Liberia are depicted by the map below.



**Figure 1: Countries included in PoA boundary**

For the three CPAs included at the end of this first monitoring period, only Ghana is the host party.

**A.3. Parties and project participant(s)**

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ghana (host)	Envirofit International Ltd.	No
Nigeria (host)	Envirofit International Ltd.	No
Liberia (host)	Envirofit International Ltd.	No
United Kingdom of Great Britain and Northern Ireland	Envirofit International Ltd.	No

Only Ghana is host party for the three specific CPAs (CPA00001, CPA00002, CPA00003) under this monitoring period.

**A.4. Reference of applied methodology and standardized baseline**

Methodology: AMS-II.G "Energy efficiency measures in thermal applications of non-renewable biomass" version 03  
(<http://cdm.unfccc.int/methodologies/DB/UFM2QB70KFMWLVO7LJN8XD1O2RKHEK>)

**A.5. Crediting period of project activity**

CPA00001

Type of crediting period	Start date of crediting period	Length of this crediting period
Fixed	15/12/2012	10 years

CPA00002

Type of crediting period	Start date of crediting period	Length of this crediting period
Fixed	01/11/2013	10 years

CPA00003

Type of crediting period	Start date of crediting period	Length of this crediting period
Fixed	01/12/2013	10 years

**A.6. Contact information of responsible persons/ entities**

Organization: Carbon Africa Ltd.  
Name: Carlos Guerrero Lucendo  
Email: carlos (at) carbonafrica.co.ke

Carbon Africa Ltd. is not a Project Participant. For more information see Appendix 1.

**SECTION B. Implementation of project activity****B.1. Description of implemented registered project activity***a. Description of the technology and implementation of the CPAs*

By the end of the first monitoring period, three CPAs have been included in the PoA and all of them in Ghana. Technologies under these three CPAs are slightly different regarding the type of fuel used. While for CPA00001 and CPA00003 the stoves disseminated or to be disseminated use charcoal as fuel, CPA00002 disseminates stoves that utilize firewood as a source of fuel. No

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stoves have been disseminated by the end of the first monitoring period under either CPA00002 or CPA00003. Thus, in this monitoring period only stoves under CPA00001 have been monitored.

### Technology

The technology distributed under CPA00001 are charcoal stoves with higher thermal efficiency and a reduced production of toxic gases, compared to the tradition stoves hence the improved cook stoves burn charcoal fuel more efficiently. The higher thermal efficiency of the stoves has been achieved by taking the following into consideration during the design of the stoves, 1) charcoal surface temperature and 2) thermal sinks. Initially three stove models were included in this CPA, the Envirofit CH2200, the CH2300 and the CH4400. For this first monitoring period only the Envirofit CH2300 and the CH2200 are monitored since no stoves of models type CH4400 have been distributed.

The figures below show the stoves that were monitored under CPA00001:



All the stoves depicted above have been tested in accordance with the "Emissions and Performance Test Protocol", with emissions measurements based on the stove testing protocol developed by Colorado State University (available at [www.eecl.colostate.edu](http://www.eecl.colostate.edu)). The average CO emissions results show a per cent improvement above 60% in all cases, compared to a metal stove (charcoal stoves).

### Implementation

Up to the end of the first monitoring period, three batches of stoves had been distributed under CPA00001 as follows:

Batch Sales Order number	Stove model included	Date of first stove sold	Date of last stove sold	Number of stoves sold
SO1330	CH2200	23/02/2012	04/10/2012	2,148
SO1377	CH2300	06/08/2012	07/06/2013	5,039
SO1545	CH2300	06/03/2013	04/11/2013	2,259
<b>Total</b>				<b>9,446<sup>1</sup></b>

<sup>1</sup> Section A.2, page 2 of the registered CPA-DD, version 3.2 dated 27/11/2012 clearly mentions the following:

*"The CPA will have a maximum energy saving of less than or equal to 60 GWh<sub>th</sub>/year, thus staying within the micro-scale threshold. Based on the estimated energy savings, it is envisaged that around 4,500 stoves will be distributed under the CPA."*

*Thus, the CPA-DD does not restrict/limits the number of stoves implemented under the CPA and 4,500 is only an indicative number. As long as the micro scale threshold is respected, the number of cookstoves under the CPA can change ex-post during the crediting period based on monitored performance.*

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As it can be observed from the dates, stoves from different batches were sold concurrently. The provisioning of unique serial number on each stove and the identification in the sales database ensures unique identification of each stove to its batch of origin and the CPA it belongs and ensures no double-counting in any case.

As it will be observed later on in section D when the parameter  $Stove_{year}$  is described, some stoves under CPA00001 were already distributed by the time of inclusion of this CPA on 06/12/2012. However, no stove was distributed before the start date of the PoA on 13/12/2011.

The Centre of Energy, Environment and Sustainable Energy (CEESD) has distributed all these three batches as the Distributing Organization (DO) and CPA Implementing Entity for CPA00001.

### *b. Information regarding PoAs*

Only one monitoring report is being submitted for this monitoring period covering CPA00001, CPA00002 and CPA00003. Only CPA00001 has been monitored.

### *c. Event with an impact on the applicability of the applied methodology*

No events have had an impact on the applicability of the applied methodology.

### *d. Request for prior approval by the Board*

No requests for prior approval by the Board had been submitted.

## **B.2. Post registration changes**

### **B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline**

No temporary deviations.

### **B.2.2. Corrections**

No corrections.

### **B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline**

No permanent changes.

### **B.2.4. Changes to project design of registered project activity**

No changes

### **B.2.5. Changes to start date of crediting period**

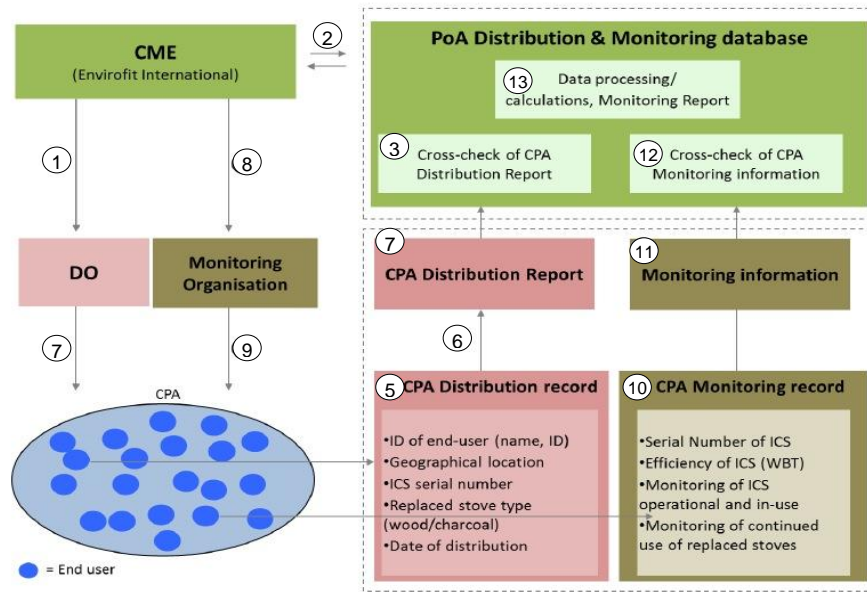
No changes

### **B.2.6. Types of changes specific to afforestation or reforestation project activity**

Not applicable.

## SECTION C. Description of monitoring system

The monitoring system has followed the registered PoA-DD and the subsequent registered CPA00001, which is the only CPA for which stoves have been distributed under. The figure below depicts roles and responsibilities of the different organization, while showing the different relationship among them and the data collected during distribution phase and the monitoring exercise. The numbers in the graph match the roles and responsibilities as explained in the paragraph subsequent to the figure.



PoA organizational structure, with roles and responsibilities

### Monitoring procedures used while distributing the ICS

#### CME's responsibilities during the distribution of the ICS

1. Coordinating activities undertaken by the Distributing Organization (DO) involved in the PoA, in this case CEESD. Suitable training was conducted for DOs taking part in new CPAs to make them aware of the rules of the CDM and the PoA and their requirements in terms of distribution and data collection. Guidance was provided to the DO on the correct procedures to be followed during distribution.
2. Keeping a record of the serial numbers of the ICS units distributed by the DO. This was used to enable cross-checking of the individual units claimed to have been distributed by the DO during the proposed PoA, therefore avoiding double counting.
3. Performing cross-checks on the distribution information received from the DO. The CME maintained a secure database, the PoA Distribution and Monitoring Database, covering the CPAs within the PoA. The unique serial number linked to each stove and the unique CPA ID number eliminates any risk of double-counting of ICSs between CPAs.

#### DO's responsibilities during the distribution of the ICS

4. Implementation of the distribution programme within the specific CPAs. Stoves were either distributed to end-users by the DO directly or via technicians, retailers, agents or other third



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parties that are sub-contracted by the DO. Any such third parties were trained by the DO responsible for ensuring correct procedures according to the PoA are fulfilled.

5. Making sure that necessary data was correctly obtained from the customer and recorded in the CPA Distribution Record, firstly to avoid double counting and secondly to enable tracking of the ICS for monitoring purposes. This data captured included:
  - Name/Identification of end user that will be using the stove
  - Geographical location of stove, which was determined by a fixed address/location
  - Stove unique serial ID number
  - Type of old stove which the ICS replaced, i.e. the fuel type – wood or charcoal.
  - Stove distribution date

Any additional information was recorded in the case of each individual CPA if deemed necessary to ensure effective tracking of stoves, accurate emissions reduction calculations and effective monitoring procedures under the particular circumstances of that CPA (for example, where applicable a phone number was collected). The CME's logo was clearly displayed on each CPA Distribution Record, with a copy retained by the customer on-site and additional copies retained by the CME and DO. Therefore it was possible to identify each stove with its unique serial ID number has been distributed under this PoA managed by the CME, Envirofit. This avoided the potential for other PoAs to claim emissions reductions associated with the stoves to be distributed under this PoA.

Obtaining the customer's approval during distribution to exclusively assign carbon rights to the CME.

6. Ensuring that the data contained in each individual CPA Distribution Record was complete and accurate. The report was compiled in an appropriate format which is an excel spreadsheet.
7. Providing a CPA Distribution Report to the CME on a regular basis. Copies of the CPA Distribution Records were provided to the CME while the DO archived the records too.

### ***Monitoring procedures used during monitoring phase***

#### ***CME's responsibilities in the monitoring procedures***

8. Coordinating all ex-post monitoring activities in the PoA. In addition the CME was responsible for;
  - I. Implementing the monitoring plan,
  - II. Ensuring the quality of data obtained
  - III. Using of this data for emissions reduction calculations. The actual field measurements conducted during monitoring (e.g. testing of ICS selected during sampling) were performed by the Monitoring Organization contracted by the CME. For this first monitoring period, CEESD was the Monitoring Organization.
  - IV. Overseeing that the procedures were followed by CEESD in the field measurements.
  - V. Setting up procedures and providing oversight and training to the contractors.
9. Monitoring activities involved selecting a sample of stoves from the PoA Distribution and Monitoring Database and monitor the required parameters as part of the PoA Sampling Plan.
10. Performing cross-checks on the data provided to it by the Monitoring Organisation to ensure that the sampling plan has been followed. This data is contained in a secure database that will form part of the PoA Distribution and Monitoring Database, which is maintained by the CME.

*Responsibilities of the monitoring organisation*

11. Carrying out the monitoring activities on behalf of the CME. This followed the instructions provided during training, to check and record the following key parameters in a CPA Monitoring Record, which was provided in a standardised format by the CME. Key monitored parameters were:
- Efficiency of project stoves ( $\eta_{\text{new}}$ )
  - Check if project stoves are operational and in use (SOF)
  - Check fraction of end users continuing to use replaced stoves ( $f_{\text{old}}$ )
  - If replaced stoves are being used, the consumption accounted for by the old stoves ( $\mu_{\text{old}}$ ) will be excluded from  $B_{\text{old}}$
12. Ensuring that the data contained in each individual CPA Monitoring Record is provided to the CME by collating the data and uploading it in an Excel spread sheet or similar format provided by the CME. Either the originals of the individual CPA Monitoring Records or scanned copies of each Record were also provided to the CME to prove the authenticity of the data. The CME maintains archives of past CPA Monitoring Records and make these available during verification.
13. The PoA Distribution & Monitoring Database provide the necessary data for emissions reduction calculations and provides the outputs, which form the basis of the Monitoring Report to be produced by the CME at the end of each monitoring period. The data contained in the database is made available to the DOE during verification.

**SECTION D. Data and parameters****D.1. Data and parameters fixed ex ante or at renewal of crediting period**

<b>Data / Parameter:</b>	<b><math>Q_{\text{biomass}}</math></b>
Unit:	Tonnes/year
Description:	Annual average biomass consumption per appliance
Source of data:	Historical data from literature, as allowed by the methodology
Value(s) applied:	4.36
Purpose of data:	Calculation of baseline emissions
Additional comment:	Used for calculation of $B_{\text{old}}$ as per paragraph 7 (a) of methodology. Applicable for CPA00001, which includes all monitored stoves.

<b>Data / Parameter:</b>	<b><math>f_{\text{NRB},y}</math></b>
Unit:	Fraction
Description:	Fraction of woody biomass saved by the project activity in year $y$ that can be established as non-renewable biomass.
Source of data:	FAO and IPCC
Value(s) applied:	0.99
Purpose of data:	Calculation of baseline emissions
Additional comment:	Applicable for CPA00001, which includes all monitored stoves.

<b>Data / Parameter:</b>	<b><math>NCV_{\text{biomass}}</math></b>
Unit:	TJ/tonne
Description:	Net calorific value of the non-renewable biomass that is substituted

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Source of data:	AMS-II.G version 03
Value(s) applied:	0.015
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

<b>Data / Parameter:</b>	<b>EF<sub>projected_fossilfuel</sub></b>
Unit:	tCO <sub>2</sub> /TJ
Description:	Emission factor for the substitution of non-renewable biomass by similar consumers
Source of data:	AMS-II.G version 03
Value(s) applied:	81.6
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

<b>Data / Parameter:</b>	<b>η<sub>old</sub></b>
Unit:	Efficiency
Description:	Efficiency of the system being replaced
Source of data:	AMS-II.G version 03
Value(s) applied:	0.101
Purpose of data:	Calculation of baseline emissions
Additional comment:	Applicable for CPA00001, which includes all monitored stoves.

<b>Data / Parameter:</b>	<b>LAF</b>
Unit:	Fraction
Description:	Net to gross adjustment factor to account for leakages
Source of data:	AMS-II.G version 03
Value(s) applied:	0.95
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

## D.2. Data and parameters monitored

<b>Data / Parameter:</b>	<b>η<sub>new</sub></b>								
Unit:	Efficiency								
Description:	Efficiency of the system being deployed as part of the project activity								
Measured/ Calculated / Default:	Measured								
Source of data:	As determined through sample testing of stoves by performing WBTs								
Value(s) of monitored parameter:	<table border="1"> <tr> <th>Stove model</th><th>%</th></tr> <tr> <td>CH2200</td><td>33.06%</td></tr> <tr> <td>CH2300</td><td>32.57%</td></tr> <tr> <td><b>Weighted Average</b></td><td><b>32.70%</b></td></tr> </table>	Stove model	%	CH2200	33.06%	CH2300	32.57%	<b>Weighted Average</b>	<b>32.70%</b>
Stove model	%								
CH2200	33.06%								
CH2300	32.57%								
<b>Weighted Average</b>	<b>32.70%</b>								

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Monitoring equipment:	<p>Mini-thermometer: Brand: Omega Model: Omegaette HH308 Type K S/N:130707120 Accuracy: +/- 0.3% reading +1°C</p> <p>Moisture measuring meter Brand: Lignomat Model: mini-LIGNO Accuracy: +/- 1%</p> <p>Mass balance Brand: TREE Model: LCT-33 S/N: LC1305074 Accuracy: +/- 2 division, +/- 0.002 lbs</p> <p>Those items were newly bought so no calibration was needed. Besides, those are self-calibrating equipment so measurements were done with the necessary guarantees.</p>
Measuring/ Reading/ Recording frequency:	WBTs were carried out for a sample of installed ICSs in operation in line with the PoA Sampling Plan on an annual basis.
Calculation method (if applicable):	n/a
QA/QC procedures:	WBTs were conducted in line with the guidance provided by the CME and according to a methodology supported by PCIA. Documentation can be found on PCIA website <a href="http://www.pciaonline.org/testing">http://www.pciaonline.org/testing</a>
Purpose of data:	Calculation of baseline emissions
Additional comment:	Weighted average has been calculated based on the number of stoves and the days in operation of each stove. For the details on this calculation please see the ER calculations, cell AG33.

<b>Data / Parameter:</b>	<b>N<sub>all</sub></b>
Unit:	Number
Description:	Total number of stoves installed
Measured/ Calculated / Default:	Calculated
Source of data:	CPA Distribution Records and logbooks
Value(s) of monitored parameter:	<p>9,375 Corresponding to: CH2200: 2,131 stoves CH2300: 7,244 stoves</p> <p>All these stoves are distributed under CPA00001</p>

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Monitoring equipment:	n/a
Measuring/ Reading/ Recording frequency:	<p>The DO maintained CPA Distribution Records which provided the data used to calculate this parameter. This data was uploaded to the PoA Distribution and Monitoring Database maintained by the CME.</p> <p>The recording of the sales was done in a regular basis during the crediting period and the monitoring in a yearly basis.</p>
Calculation method (if applicable):	Sum of all stove records in the CPA Distribution Records.
QA/QC procedures:	The CME supervised the activities of the DO, and provided training, guidelines and distribution templates to facilitate accurate record keeping during the ICS distribution. The CME also maintained a record of the stove serial numbers supplied to the DO, and was able to cross-check these against the CPA Distribution Reports it receives back from the DO.
Purpose of data:	Calculation of baseline emissions
Additional comment:	Initially, the CPA Distribution Record had 9,446 stoves distributed under the CPA. During monitoring, the information of 71 stoves could not be verified. Therefore, those 71 were considered as a Non Response for the survey records and for conservative purposes the stoves were excluded from the CPA so they do not credit for this or any future crediting periods. This is a conservative assumption since those stoves are likely to still be in operation.

<b>Data / Parameter:</b>	<b>SOF</b>
Unit:	Fraction
Description:	Stove Operation Fraction – used to determine the share of distributed stoves that are still operating, measured ex-post through sampling
Measured/ Calculated / Default:	Measured
Source of data:	Survey of end user behaviour as part of the PoA Sampling Plan
Value(s) of monitored parameter:	0.6534
Monitoring equipment:	No specific monitoring equipment has been used for the surveys.
Measuring/ Reading/ Recording frequency:	<p>The actual value applied for emissions reduction calculations and request for issuance of CERs was measured ex-post by investigation of the number of ICS installations within the sampled ICS which are operational.</p> <p>This was done on an annual basis as per the PoA monitoring requirements</p>
Calculation method (if applicable):	<p>Since 125 out of 190 stoves have been found to be in operation, SOF has been calculated as 125 divided by 190.</p> <p>Additionally, a discount factor of three times the difference of the sample precision with the required minimum precision level of 10% has been applied since precision has not been achieved.</p>
QA/QC procedures:	The CME provided training, guidelines and monitoring templates to ensure that the Monitoring Organization responsible for monitoring followed appropriate procedures.
Purpose of data:	Calculation of baseline emissions

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Additional comment:	-
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<b>Data / Parameter:</b>	$\mu_{old}$
Unit:	kg/year
Description:	The amount of woody biomass consumption that is consumed through the continued use of old stoves
Measured/ Calculated / Default:	Measured
Source of data:	Data from survey of end user behaviour as part of PoA Sampling Plan combined with the same source of data as for $Q_{biomass}$
Value(s) of monitored parameter:	2,657 kg/year
Monitoring equipment:	No specific monitoring equipment has been used for the surveys.
Measuring/ Reading/ Recording frequency:	<p>The actual value applied for emissions reduction calculations and request for issuance of CERs was measured ex-post by estimation of a representative sample of end users using the deployed ICS, as conducted in line with the PoA Sampling Plan.</p> <p>During the survey, the interviewer conducted an interview with the end user to identify how much the baseline (replaced) stove as being used. The value of <math>\mu_{old}</math> will be estimated by comparing the number of meals per month before and after ICS distribution.</p> <p>This was done on an annual basis as per the PoA monitoring requirements</p>
Calculation method (if applicable):	<p>Based on the registered CPA-DD, this parameter has been calculated by multiplying the Total Annual Fuel Consumption, 4,360 kg/year, by the ratio of meals cooked by the traditional stove in operation before and after purchasing the Envirofit Stove.</p> <p>The higher confidence interval that is the conservative interval has been selected since precision has not been achieved.</p>
QA/QC procedures:	The CME provided training, guidelines and monitoring templates to ensure that the Monitoring Organization responsible for monitoring followed appropriate procedures
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

<b>Data / Parameter:</b>	$f_{old}$
Unit:	Fraction
Description:	The fraction of end users that are still using baseline (replaced) stoves
Measured/ Calculated / Default:	Measured
Source of data:	Survey data of end user behaviour as part of the PoA Sampling Plan
Value(s) of monitored parameter:	53.62%

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Monitoring equipment:	No specific monitoring equipment has been used for the surveys.
Measuring/ Reading/ Recording frequency:	<p>The actual value applied for emissions reduction calculations and request for issuance of CERs was measured ex-post by estimation of a representative sample of end users using the deployed ICS, as conducted in line with the PoA Sampling Plan.</p> <p>Sampling estimated the value of this parameter through monitoring the fraction of end users not using baseline stoves (<math>f_{\text{non,old}}</math>),</p> <p>This was done on an annual basis as per the PoA monitoring requirements</p>
Calculation method (if applicable):	<p>Based on the registered CPA-DD, the fraction of users not using the baseline stoves (<math>f_{\text{non,old}}</math>) has been monitored. Then <math>f_{\text{old}}</math> has been calculated as <math>1 - f_{\text{non,old}}</math></p> <p>The lower confidence interval of <math>f_{\text{non,old}}</math> has been selected since precision level has not been achieved.</p>
QA/QC procedures:	The CME provided training, guidelines and monitoring templates to ensure that the Monitoring Organization responsible for monitoring followed appropriate procedures.
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

<b>Data / Parameter:</b>	<b>Stove<sub>year</sub></b>
Unit:	Year
Description:	Calculated average stove operation years in the monitoring period.
Measured/ Calculated / Default:	Calculated
Source of data:	PoA Distribution and Monitoring Database
Value(s) of monitored parameter:	0.87
Monitoring equipment:	No specific monitoring equipment has been used for the surveys.
Measuring/ Reading/ Recording frequency:	<p>Each ICS entered into the PoA Distribution and Monitoring Database was linked to a distribution date (recorded during distribution). Thus for any monitoring period it is possible to calculate the period of time that the stoves included in the emissions reduction calculations for that period have been operating..</p> <p>The recording of the sales date was done in a regular basis during the crediting period and the monitoring on an annual basis.</p>
Calculation method (if applicable):	Average of all stove records in the CPA Distribution Records.
QA/QC procedures:	The CME was responsible for overseeing the collection of data by DOs during distribution, training the DOs in correct data recording practices, maintaining a secure Database, and back up of files contained in the Database.
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

### D.3. Implementation of sampling plan

Due to the large number of ICS distributed as part of the CPA it was not economically feasible to monitor each individual ICS unit distributed. Therefore, representative sampling was undertaken as part of a PoA-wide Sampling Plan. Following the methodology AMS-II.G version 3 and applying the equations outlined in Section E.6.2 of the PoA-DD, the sampling plan consisted of monitoring the following four parameters mentioned in section D.2.:

Parameter	Description of parameter
$\eta_{\text{new}}$	The thermal efficiency of the ICS distributed (%)
SOF	The Stove Operating Fraction, i.e. the fraction (up to 1.0) of users using the ICS
$f_{\text{old}}$	The fraction of stove users still using baseline (replaced) stoves (up to 1.0)
$\mu_{\text{old}}$	The amount of woody biomass that continues to be used in the replaced stoves (kg)

#### *Description of implemented sampling design*

The objective of sampling is to obtain a reliable estimate of the parameters to be monitored over the course of the crediting period and to meet the indicated confidence/precision levels. Based on the registered CPA-DD, 95/10 reliability level was selected for cross-CPA sampling for the four parameters under sampling.

The initial target population were all the stoves distributed and recorded under CPA00001, in this case 9,446 stoves. The Sample Method chosen was Simple Random Sampling for each of the parameters as defined by the CPA-DD. This method was proven to be appropriate since most of the distributed stoves were in the region of Kumasi, Ghana, where the DO has its operations. The Sample Size depends on each of the parameters estimated as is explained in detail below. Since both models of stoves distributed under the CPA, CH2300 and CH2200, are very similar in design and were distributed to homogenous end users that is households, it was decided based on the experience from the field that one single sampling frame would be appropriate in terms of stove operation (SOF), fraction of traditional stoves still in operation ( $f_{\text{old}}$ ) and amount of woody biomass that continues to be used by the replaced stoves ( $\mu_{\text{old}}$ ). Following the provision in the registered PoA-DD, the population was proven to be homogeneous under the following conditions;

- Geographical area of the project: Both models are being distributed in the same geographical area, Ghana.
- Fuel type: both stoves use charcoal
- End users: all stoves are for domestic (household) usage as per their design.
- Stove type: the two stove models (CH2200 and CH2300) are considered sufficiently homogeneous since their thermal efficiencies are in a similar range as being with +/- 10% of each other, and they have common features. As for the efficiency, CH2200 has 33.06% and CH2300 32.57%. This is a difference of only 0.49%, much below the required 10%. As for the common features, both stoves share the exact same structure and only differ in the grate, which is different so it can accommodate better different types of pots depending on the local preferences, but users of these stoves models share the same behaviour towards the use of the stoves. For these two reasons, it was understood both stoves models can be considered as for the same type.

For the thermal efficiency of the stoves, it was decided to have two sampling frames, one for each model, since this is the first monitoring period and no field data on thermal efficiencies were



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available to confirm that both stove models are indeed very similar as well on their thermal efficiency. This decision was done in order to ensure reliability of the results.

The required sample sizes for each parameter was selected based on the following conservative estimates and the recommended oversampling of 10% for non-response:

Parameter	Total population (N)	Expected results	Reliability	Sample Size (+10%) (n)
$\eta_{\text{new}}$ (CH2200)	2,148	38.2% (4% standard deviation)	95/10	9
$\eta_{\text{new}}$ (CH2300)	7,298	39.4% (4% standard deviation)	95/10	9
SOF	9,446	80%	95/10	105
$f_{\text{old}}$	9,446	80%	95/10	105
$\mu_{\text{old}}$	9,446	217.8 (21.78 standard deviation)	95/10	8

Based on these results, it was decided to draw an initial sample of 100 stoves for SOF,  $\mu_{\text{old}}$  and  $f_{\text{old}}$ , and 10 stoves of each model for thermal efficiency testing. These stoves were selected by randomly assigning a number to each stove and later selecting in increasing order from lower to higher number. Since each stove was assigned a random number and sorted in increasing order, selecting further stoves from the buffer was done easily. This was proven necessary since more stoves needed to be selected after the first initial survey efforts due to lower results and higher non-response than initially expected, as will be explain in detail below.

#### Collected data

Data was collected for SOF,  $\mu_{\text{old}}$  and  $f_{\text{old}}$  following a specially design survey form. The information collected was introduced into an electronic database, the CPA Monitoring Record. This survey form was design in a way that would allow the surveyor first to check the validity of the records from the CPA Distribution Records, and secondly to collect the necessary information for the ER calculations.

As explained above, after the initial 100 surveys the results were lower than initially estimated and the non-response higher. In order to achieve the 95/10 reliability level for cross-CPA sampling additional stoves were selected from the database to cover the reliability levels for the three parameters sampled. Another of the reasons to select additional number of samples was that collecting data on the "amount of woody biomass that continues to be used in the replaced stoves" is only possible with those users which are still using or were using the traditional stove, and therefore only a small part of additional samples were expected to provide data for  $\mu_{\text{old}}$ .

As for the thermal efficiency of the stoves, the initial selection of 10 stoves for each model to be collected was also not sufficient due to non-responses. Therefore, and following the order in the random list, stoves were selected until collecting 10 samples for CH2300 and 9 samples for CH2200 stoves to be analysed in the lab under the Water Boiling Test (WBT) procedures.

Initially, the CPA Distribution Record had 9,446 stoves distributed under the CPA00001. During monitoring, the information of 71 stoves could not be verified. Therefore, those 71 were considered as a Non Response for the survey records and for conservative purposes the stoves were excluded from the CPA so they do not credit for this or any future crediting periods. This is a conservative assumption since those stoves are likely to still be in operation.

#### Analysis of the collected data and demonstration on whether the required confidence/precision has been met

The following table summarizes the results for each sampled parameter:

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Parameter	Valid responses	Total Population	Survey results	Precision	Final Results
$\eta_{\text{new}}$ (CH2200)	9	2,131	33.06%	1.17%	33.06%
$\eta_{\text{new}}$ (CH2300)	10	7,244	32.57%	1.71%	32.57%
SOF	190	9,375	65.79%	10.15%	65.34%
$f_{\text{old}}$	96	9,375	43.75% ( $f_{\text{non,old}}$ 56.25%)	17.55%	53.62%
$\mu_{\text{old}}$	34	9,375	2,253 kg/year	17.91%	2,657 kg/year

As mentioned before, the two models of stoves are very similar in design and therefore their thermal efficiency results ( $\eta_{\text{new}}$ ) are very similar, differing only 0.49% from each other. The thermal efficiency has been calculated based on the WBT protocol as per the methodology. Both stove models have achieved the 95/10 confidence/precision levels. For CH2200, with a total population of 2,131 stoves, the standard deviation has been calculated at 0.50% and the standard error of the mean at 0.17%. Since the sample size is below 30 samples, the t-student distribution has been used resulting in a precision of the sample of 1.17%, below the 10% required. For CH2300, with a total population of 7,244 stoves, the standard deviation has been calculated at 0.78% and the standard error of the mean at 0.25%. Since the sample size is below 30 samples, the t-student distribution has been also used resulting in a precision of the sample of 1.71%, also below the 10% required.

As for the Stove Operating Fraction, 190 valid surveys were recorded, of which 125 showed that the user was still using the Envirofit stove, 65.79% of the sample. With a total population of 9,375 stoves, the precision achieved by the sample has been set at 10.15%, slightly above the required 10%. Based on the "Standard for Sampling and surveys for CDM project activities and programme of activities" version 04.1, para.16, since the precision has not been met and option (a), perform additional data collection, had already been applied, option (b), (i), (b) and discounted the sample result by three times the percentage of precision points missed. Therefore, 0.15% multiplied by 3, 0.45%, has been discounted resulting into a final conservative value of 65.34%

Out of the 125 surveys with Envirofit stoves still in operation, 96 could provide valid results on the use of baseline stoves along the Envirofit ones. Since most users will not be using the baseline stoves anymore, option B has been selected and the users not using baseline stoves ( $f_{\text{non,old}}$ ) sampled. Of the 96, 54 showed that they were not using the baseline stoves, 56.25% of the total. With a total population of 9,375 stoves, the precision achieved has been 17.55% only, not reaching the 10% minimum required. Therefore, the lower bound of the confidence interval has been selected, 46.38%. Finally, the fraction of users still using the baseline stove has been calculated using the formula  $f_{\text{old}} = 1 - f_{\text{non,old}}$ , bring the final percentage of users still using the baseline stove at 53.62%

For the last parameter sampled, the amount of woody biomass that continues to be used in the replaced stoves ( $\mu_{\text{old}}$ ), data could only be collected out of those sampled users that are still using the baseline stove. Out of those 42 stove users, 34 valid surveys have been recorded. These surveys have recorded the number of meals prepared with the traditional stove before purchasing the Envirofit stove, and after purchasing the Envirofit stove. The resulting fraction has been multiplied by the total annual biomass consumption, 4.36 t biomass/year (or 4,360 kg/year) with a result of 2,253 kg/year. With a total population of 9,375 stoves, the precision achieved was 17.91% which again does not meet the minimum 10% required, Therefore, the higher bound has been selected, 2,657 kg/year, which is conservative.

## **SECTION E. Calculation of emission reductions or GHG removals by sinks**

### **E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

$$ER_y = B_{y,savings} \cdot f_{NRB,y} \cdot NCV_{\text{biomass}} \cdot EF_{\text{projected\_fossilfuel}}$$

Where for the first crediting period:

Parameter	Value	Sources
$B_{y,savings}$	10,242 t <sub>biomass</sub>	Calculated
$f_{NRB,y}$	99 %	Ex ante
$NCV_{biomass}$	0.015 TJ/tonne	Default
$EF_{projected\ fossilfuel}$	81.6 tCO <sub>2</sub> /TJ	Default
<b>ER<sub>y</sub></b>	<b>12,472 tCO<sub>2</sub></b>	

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

Where:

Parameter	Value	Sources
$B_{old}$	14,820 t <sub>biomass</sub>	Calculated
$\eta_{old}$	10.1 %	Ex ante
$\eta_{new}$	32.70 %	Monitored (ex ante estimation)
<b>B<sub>y,savings</sub></b>	<b>10,242 t<sub>biomass</sub></b>	

$$B_{old} = LAF \cdot N_{all} \cdot SOF \cdot (Q_{biomass} - \left(\frac{\mu_{old}}{1000} \cdot f_{old}\right)) \cdot Stove_{year}$$

Where:

Parameter	Value	Sources
LAF	0.95	Default
$N_{all}$	9,375 stoves	Monitored. Sales record
SOF	65.34%	Monitored. Survey
$Q_{biomass}$	4.36 t <sub>biomass</sub>	Ex Ante
$\mu_{old}$	2,657 kg <sub>biomass</sub> /a	Monitored. Survey
$f_{old}$	53.62%	Monitored. Survey
$Stove_{year}$	0.87	Monitored. Calculated
<b>B<sub>old</sub></b>	<b>14,820 t<sub>biomass</sub></b>	

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

n/a

## E.3. Calculation of leakage

n/a

## E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO <sub>2</sub> e)	Project emissions or actual net GHG removals by sinks (t CO <sub>2</sub> e)	Leakage (t CO <sub>2</sub> e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO <sub>2</sub> e)
<b>Total</b>	12,472	-	-	12,472

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD**

Item	Values estimated in ex-ante calculation of registered PDD		Actual values achieved during this monitoring period	
	CPA Number	tCO <sub>2</sub> e	CPA Number	tCO <sub>2</sub> e
Emission reductions or GHG removals by sinks (t CO <sub>2</sub> e)	CPA001	15,477	CPA001	12,472
	CPA002	5,666	CPA002	0
	CPA003	1,803	CPA003	0
	<b>Total</b>	<b>22,946</b>	<b>Total</b>	<b>12,472</b>

**E.6. Remarks on difference from estimated value in registered PDD**

n/a, no increase in the achieved emissions in comparison to the ex-ante estimation.

**E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards**

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO <sub>2</sub> e)	458	12,014

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Appendix 1. Contact information of project participants and responsible persons/ entities

<b>Project participant and/or responsible person/ entity</b>	<input checked="" type="checkbox"/> Project participant <input type="checkbox"/> Responsible person/ entity for completing the CDM-MR-FORM
<b>Organization name</b>	Envirofit International Ltd.
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<b>E-mail</b>	-
<b>Website</b>	www.envirofit.org
<b>Contact person</b>	Nathan Lorenz
<b>Title</b>	Vice-president - Engineering
<b>Salutation</b>	-
<b>Last name</b>	Lorenz
<b>Middle name</b>	-
<b>First name</b>	Nathan
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<b>Project participant and/or responsible person/ entity</b>	<input type="checkbox"/> Project participant <input checked="" type="checkbox"/> Responsible person/ entity for completing the CDM-MR-FORM
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<b>Last name</b>	Tas
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<b>First name</b>	Adriaan
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## Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;</li> <li>• Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>;</li> <li>• Editorial improvement.</li> </ul>
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		