Monitoring report form for CDM programme of activities

(Version 03.0)

MONITORING REPORT		
Title of the PoA	Man and Man Enterprise Improved Cooking Stoves CDM Programme in Ghana supported by Republic of Korea	
UNFCCC reference number of the PoA	UNFCCC Reference number: 10430	
Version numbers of the PoA-DD applicable to this monitoring report	2.0	
Version number of this monitoring report	2.1~~0~~	
Completion date of this monitoring report	~~07/01~~05/03/2020	
Monitoring period number	1	
Duration of this monitoring period	30/11/2018 - 13/12/2018	
Monitoring report number for this monitoring period	1	
Coordinating/managing entity	AERA GROUP S.A.S.	
Host Parties	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	Ghana	Yes
Applied methodologies and standardized baselines	AMS-II.G. : “Energy efficiency measures in thermal applications of non-renewable biomass” (Version 08.0)	
Sectoral scopes	Sectoral Scope 3 – Energy Demand	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	-	~~653~~611
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs covered in this monitoring report	885	

PART I Monitoring of programme of activities (PoA)

SECTION A. Description of PoA

A.1. General description of PoA

The purpose of the PoA and its Component Project Activities (CPAs) is to mitigate climate change and contribute to sustainable development in Ghana.

According to the information gathered by Ghana's National Energy Commission (2017), biomass accounts for 39% of final energy consumption in the country, being a predominant cooking fuel in households and small industries.[1] Ghanaians depend on solid fuels for domestic and commercial use, which has been a dominant pattern over the years - 73% of households still using wood fuels for cooking[2].

CPA implementers sell affordable Improved Cooking Stoves (ICSs) to end-users in Ghana in replacement of traditional cooking stoves using non-renewable wood fuel. Because ICSs are more efficient than traditional cooking stoves, users save non-renewable wood fuel during cooking seasons leading to greenhouse gas (GHG) emission reductions and mitigating climate change.

Since there are neither laws nor regulations in Ghana that require the distribution and use of ICS whatsoever, the PoA is a voluntary action.

As ICS is relatively more expensive than traditional stoves, most households can't afford to buy ICSs. In order to implement this program, stove subsidy and operational cost support are vital.Ecoeye Co., Ltd., and other Korean Companies have fully financed all improved cooking stoves distributed to the households.

A.1.1. Corresponding generic component project activities (CPAs)

Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Sectoral scopes	Applied methodologies and standardized baselines
Title: Man and Man Enterprise Improved Cooking Stoves CDM Programme in Ghana supported by Republic of Korea – Generic CPA [XXX] Reference number of the corresponding generic CPA: Generic CPA[XXX]	2.0	Sectoral Scope 3 – Energy Demand	AMS-II.G. "Energy efficiency measures in thermal applications of non-renewable biomass" Version 08.0

A.1.2. CPAs included in the PoA

Title and UNFCCC reference number of the CPA	Version of the PoA-DD	Title and reference number of the corresponding generic CPA	Crediting period type and duration	Covered in this monitoring report? (yes/no)
Man and Man Enterprise Improved Cooking Stoves CDM Programme in Ghana supported by	2.0	Title: Man and Man Enterprise Improved Cooking Stoves CDM Programme in Ghana supported by Republic of Korea – Generic CPA [XXX]	Type: Renewable Duration: 7 years (84 months)	Yes

[1] *Cf. Energy Commission of Ghana 2017: National Energy Statistics 2007 - 2016 (Revised), p.1 http://energycom.gov.gh/files/ENEERGY_STATISTICS_2017_Revised.pdf*

[2] *according to the latest Ghana Living Standards Survey (GLSS) in 2014*

Republic of Korea – CPA001 Ref.: 10430-P1-0001-CP1		Reference number of the corresponding generic CPA: Generic CPA[XXX]		

A.2. Coordinating/managing entity

AERA GROUP S.A.S.

SECTION B. Implementation of PoA

B.1. Description of implemented PoA

Management System

The operational and management system for the implementation of the CDM PoA includes the following:

(a) Definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies

Table 1: *Personnel, responsibilities and competencies*

Personnel	Responsibilities in inclusion process	Competencies
PoA manager/ CME	-Contact with CPA implementer -Review CPA according to PoA eligibility criteria -Prepare and sign agreement for CPA inclusion between CMA and CPA implementer -Notify CPA implementer of submission of CPA-DD to DOE for inclusion -Decide on CPA inclusion and notify CPA implementer -Assess additionality and eligibility of CPA against documents provided by CPA implementer -Control work of all subcontractors undertaking critical activities on behalf of CME	-Competencies • to check and apply relevant principles, procedures, techniques and all features for CPA inclusion, verification, review and approval • to ensure that each CPA meets all requirements and eligibility criteria for inclusion of CPAs in the proposed PoA before its inclusion • to plan and make effective use of resources; • to organise work effectively -Knowledge of specific technical and methodological CDM aspects -Ability to obtain from third parties the desired outcomes
CPA Implementer(s)	-Carry out Local Stakeholder Consultation (LSC) -Provide evidence for CPA eligibility under the PoA including CPA-DD and emission reduction calculations -Implement CPA -Facilitate, support and cooperate the CME and Carbon Consultant during CPA inclusion and verification process	-Understanding of CME and carbon consultant needs -Knowledge of all technicalities of CPA and general CDM technical and methodological aspects
Carbon consultant	-Assist CME and CPA implementer to reach CPA inclusion through the following, among others, • carry out LSC • draft CPA-DD and emission reduction calculations • organize CDM on-site visit with DOE and stakeholder consultation • follow up	-Knowledge of specific CDM technical and methodological aspects -Ability to plan and organize the work effectively and in the agreed timeframe, to prioritize and focus on matters of significance -Ability to prepare the relevant reports and handle all follow up actions

	- Assist CME and CPA implementer to reach verification of emission reductions after CPA inclusion, including • conduct training in monitoring of data, • write monitoring reports	
Monitoring team (after CPA inclusion)	On behalf of the CPA implementer: -Implement monitoring plan -Collect and check monitoring data -Implement a monitoring database.	-Competencies on monitoring equipment, data collection, recording and reporting.

Besides the responsibilities mentioned in the table above, AERA GROUP as the CME was responsible for
- contracting the DOE to conduct validation of CPA and verification of emission reductions,
- finding and contracting CER buyers and distributing CER revenues to CPA implementers (if applicable),
- contracting CPA implementers.

Current CPA implementer has signed an agreement with the CME (AERA GROUP), in which they cede rights to sell CERs generated by their respective CPA to the CME. The standard contract also outlines the conditions of participation in the PoA and the CDM procedures that have to be respected in this regard, so that the CPA implementer was aware of and agreed to the inclusion of the project activity in the PoA.

Finally, all end-users have signed sales agreement, which contains user information, rights and commitments (cf. sub-section (e) for details).

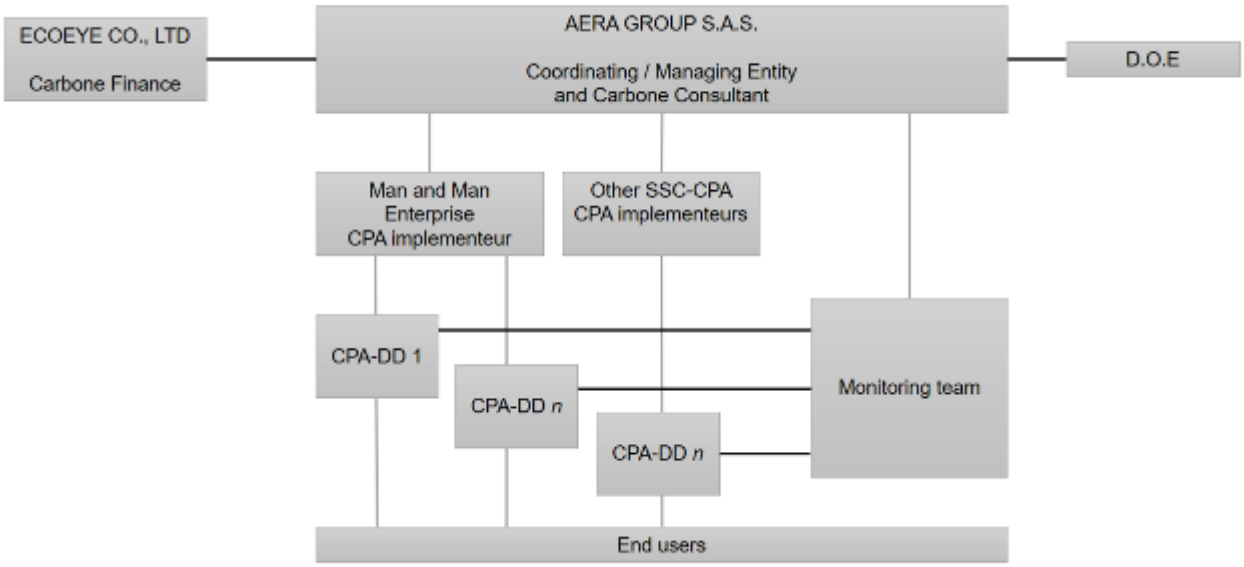

Figure 1: *General organisational structure*

(b) Records of arrangements for training and capacity development for personnel

Training and capacity building has been carried out for thepersonnel of CPA implementers, based on any identified needs, and records of the trainings kept.

(c) Procedures for technical review of inclusion of CPAs

The technical review procedure by the CME for CPA inclusion included the following main steps:

1. Verify that all eligibility criteria for inclusion in the PoA are met and all corresponding document evidence is provided.
2. Check the procedure to avoid double counting (see below).
3. Check if all supporting documentation quoted in CPA-DD is in accordance with PoA-DD.

4. Check emission reduction calculation.
5. Approve/refuse draft CPA-DD.
6. Deliver CME approval and agreement /refusal for CPA inclusion.
7. Submit CPA-DD to the DOE and CDM Executive Board.
8. Inform about inclusion of the CPA in the PoA as per DOE and CDM Executive Board decision.

(d) Procedure and system to avoid double accounting

The PoA is not registered under any other carbon credit certification scheme than the CDM.

Prior to the implementation of each CPA, the CPA implementer enters into a binding general contract with the CME concerning their relationship. By signing the contract, the CPA implementer also approves a clause, which states that the CPA under consideration is neither registered as a CDM project activity, included or in the process of being included under another PoA, nor a deregistered project activity (cf. eligibility criteria in section K). The CME reviews the fulfilment of this criterion during the technical review of CPA inclusion. The CPA implementer also affirms that CPA staff is aware of and has agreed that their activity participates in the PoA and that they cannot sell the emission reductions of the CPA under another PoA.
Before including a CPA in the PoA, the eligibility criteria require the CPA implementer to prove that the sold ICS is uniquely marked by a ICS serial number and/or logo and recorded electronically as described in sub-section (e) below. The serial number assigned to the stove belongs to one end user only, and shall be uniquely attributed to every stove as per below format:

CDM.10430.CPA[#].XXXX

Where:
10430 = Man and Man PoA UNFCCC unique ID
CPA[#] = CPA number (e.g. CPA001)
XXXX = Unique stove ID (e.g. 1391)

The recording and documentation procedures allow the CME to check the materiality of the claimed sales.

The unique serial numbers also ensure that no confusion arises with other projects in the country using same ICSs, while the CPA number ensures that ICSs from different CPAs within this PoA are not confounded (besides the fact that subsequent CPAs in this PoA shall not cover the same geographical boundaries to avoid any infringement).

Original sales agreements (with ICS serial number and buyer contact details) are stored and used to crosscheck the electronic database transmitted by the CPA implementers. It allows the CME to check periodically the materiality of the claimed sales and identify buyers of stoves.

In case an ICS is broken, the user commits to replace the stove and a replacement agreement is signed to avoid double counting.[3]

Finally, during technical review of CPA, compliance team consulted the UNFCCC website in order to make sure that the considered CPA is neither included under another PoA with similar scope within the borders of the PoA, nor in the process of being included. CME also verifies that no individual CPA project activity bearing the same name and covering the same scope as the proposed CPA is neither registered, nor requesting registration.

(e) Controlling of records and documentation for each CPA under the PoA

[3] *Users may benefit from an after-sales service. In the sales agreement, ICSs users could agree to call the service team as soon as the ICSs in not operating anymore. When the user called the service team, the service team would visit the user and either replace the ceramic liner of the ICS (for a lower price than a complete ICS) or replace the old ICS with a new one (at comparable sales conditions).*

For every ICS sold, sales records are kept. These records enable third parties to verify that sales have indeed occurred and stoves are used by target end users (households, communities, or small and medium enterprises) in specific areas targeted by the CPAs throughout Ghana. Records consist of sales agreementsbetween the CPA implementer and the end user or the retailer which contain at least the following information:

- Name of PoA or CPA
- User group membership (if applicable, e.g. household)
- Date (and location) of purchase
- Stove model
- Unique serial number or logo of the stove
- Name of customer/retailer and contact details (address & phone number if applicable)
- Clauses to transfer carbon rights from user to the CPA implementer[4], to scrap the previously used traditional cooking stove. The agreement also contains clauses to renew any broken ICS by either repairing/replacing the ceramic liner[5] or purchasing a new ICS at favourable conditions if not provided for free under warranty.[6]

The CPA implementer collects this data through sales persons or retailers, compiles it in an electronic database, which he regularly transmits to the CME. The CPA implementer also transmits electronic copies of the sales agreements to the CME, who archives them in a safe location while the CPA implementer keeps the hard copies. The CME cross-checks the electronic database with transmitted sales agreements, in particular to avoid double-counting.

(f) Measures for continuous improvements of the PoA management system

Regular meetings are held on:
-Review of latest developments and events,
-Recurring issues related to the inclusion process,
-Feedback from the CPA implementers,
-Potential improvements to be implemented until next meeting.

Furthermore if a CPA is internally approved for inclusion and yet finds itself rejected by a DOE, an extraordinary meeting shall be convened by the CME, in which the reasons of such outcome shall be analysed and provisions for improvements of the technical review process shall adopted.

Sampling Approach
A sampling approach was applied for monitoring the CPA covered in this monitoring period. Please refer to section E.3 for details.

Installed technology, technical processes and equipment
Compared to the replaced traditional cooking stove used by the end-user[7], ICSs are more efficient while providing the same service. They allow better heat retaining, i.e. quicker heating-up and longer cooking times with less wood fuel (and combustion fumes), curbing deforestation.

The type of technology/measures and know-how transferred to the host country depend on the specific ICS type disseminated under each CPA and is thus further described in each CPA-DD. ICS produced by Man and Man Enterprise are typically produced in Ghana, applying a Jiko-type design originally used in Kenya and already prevalent in Ghana.

[4] The carbon rights transfer is a non-negotiable condition of participation in the PoA, which is continuously communicated to ICS purchasers from local stakeholder consultation through sales agreements with end-users to sales modalities with retailers.

[5] Every replacement of liner or ICS is documented, registered in the electronic database and reflected in the monitoring report.

[6] The CPA implementer replaces the information on the broken ICS in the electronic database by the information on the new stove.

[7] According to Hedon (2012), coal pots have an efficiency range from 15 to 18%. Three stone fires have an efficiency of 10% (AMS-II.G. default value).

To achieve an effective reduction in non-renewable biomass consumption and to ensure a proper and durable ICS use, the CPA implementer may need to build users' capacity to adopt the new technology. After-sale services may thus comprise suitable awareness raising, training, follow-up or maintenance for users.

B.2. Post-registration changes to PoA

B.2.1. Corrections

n/a

B.2.2. Inclusion of monitoring plan

n/a

B.2.3. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

a) Changes that have been approved by the Board prior to the submission of this monitoring repor

1) Determination of ex-ante national f_{NRB} value at PoA-DD level (section I.6.1) (instead of monitoring and determination at CPA-level) and related modifications (sections I.6.2, I.7.1). The PoA-DD is made coherent in terms of guidance used, which is solely the "Information note: Default values of fraction of non-renewable biomass for least developed countries and small island developing states" (deletion of any reference to "Methodological tool: Calculation of the fraction of non-renewable biomass").

2) Removal of the specification of 'Source of data' in the ex-ante parameter table of $B_{old,i,j}$ of the generic CPA (section I.6.2 of PoA-DD). Related modifications in the explanation of methodological choices (section I.6.1 of PoA-DD) and the ex-ante parameter tables of the generic CPA-DD (section I.6.2 of PoA-DD), such as reintroduction of parameter tables $B_{old,p}$ and $N_{p,HH}$.

3) Update of approach to determine monitored parameter $N_{d,HH}$ (and related modifications in sections I.6.1 and I.7.1 of PoA-DD). Instead of determining $N_{d,HH}$ through the monitoring survey, it is be determined through data in the user database.

Effective approval date: 15 December 2019
Reference number: PRC-10430-001

b) Changes that are being submitted with this monitoring report as part of the request for issuance (post-registration change -issuance track)

n/a

B.2.4. Changes to programme design

n/a

B.2.5. Changes specific to afforestation or reforestation activities

n/a

PART II Monitoring of CPAs

Man and Man Enterprise Improved Cooking Stoves CDM Programme in Ghana supported by Republic of Korea – CPA001

SECTION C. Implementation of CPAs

C.1. Description of implemented CPAs

The purpose of the proposed CPA "Man and Man Enterprise Improved Cooking Stoves CDM Programme in Ghana supported by Republic of Korea – CPA001", hereafter referred to as 'CPA001', is to combat climate change and contribute to sustainable development of Ghana.

In the baseline scenario, *households* continue to using non-renewable biomass in traditional cooking stoves. An ICS combusts wood fuel more efficiently, i.e. requires less charcoal than a traditional stove. This reduces CO_2 emissions.

CPA001 thus aims to reduce non-renewable wood fuel consumption and greenhouse gas (GHG) emissions of *households* (hereafter also "end-users") in the *urban and peri-urban Brong-Ahafo region* of Ghana.

The ICS distributed under CPA001 is the so-called Jiko-type ICS. It is also known as the "Holy cook", which is the brand name of the Jiko-type ICS produced by Man and Man Enterprise (M&M), a Ghana-based ICS producer and seller. Compared to coal pots, which have an efficiency of 15%-18%, Holy Cooks have an efficiency of about 30% while providing the same service. This allows better heat retaining, i.e. quicker heating-up and longer cooking times with less wood fuel (and combustion fumes). ICSs work on a simple but mature technology for efficient energy conversion of biomass to heat.

Figure 2: *Jiko-type ICSs from above*

M&M has been manufacturing and selling 15,518 medium-sized ICS under CPA001 since the starting date of the CPA on 20/10/2017.[8] It is thus also the CPA implementer. stoves have been being disseminated since and are still active under CPA001. While there are different ICS sizes, only *medium-sized* ICSs targeting households are sold under this CPA.

Indicative specifications of a medium-sized charcoal ICS are provided in the table below. All ICSs are new.

Table 2: *Manufacturer specifications of a medium-sized ICS*

Weight	7 kg

[8] This corresponds to the first formal sales agreement signed (stove ID CDM.MM.CPA001.11). Only one stove was distributed on this date for test purposes and no emission reduction is claimed for this stove. No other stoves have been distributed in 2017.Effective start of distribution has been on 4 June 2018.

Efficiency	30 % (new)
Type of fuel	Charcoal
Adoption	Traditional cooking styles and posture
Height	Approx. 25 cm
Width	Approx. 30.5 cm
Average lifetime	5 years

The annual thermal energy savings from the CPA is 4.53 MWh_{th}/year per stove, i.e. the CPA qualifies as a microscale project type II which CDM units aims to achieve energy savings at a scale of no more than 600 MWh per year, which is equivalent to 1,800 MWh_{th} of annual energy savings per appliance. Total energy savings are 70,297 MWh_{th} per year.

Each cook stove has been uniquely identified during manufacturing phase, which prevents any issue of double-counting with other cookstove projects or among different CPAs. This is achieved by identifying each stove by a ICS serial number and/or logo and recorded electronically. The serial number assigned to the stove belongs to one end user only, and has been uniquely attributed to every stove with a specific format.

Ecoeye Co., Ltd., and other Korean Companies have fully financed all improved cooking stoves distributed to the households, and the total project cost per stove is EUR 10 including approximately EUR 5.50 manufacturing cost per stove.

C.2. Location of CPAs

CPA001 is implemented in the Brong-Ahafo region of Ghana consisting of 21 districts.

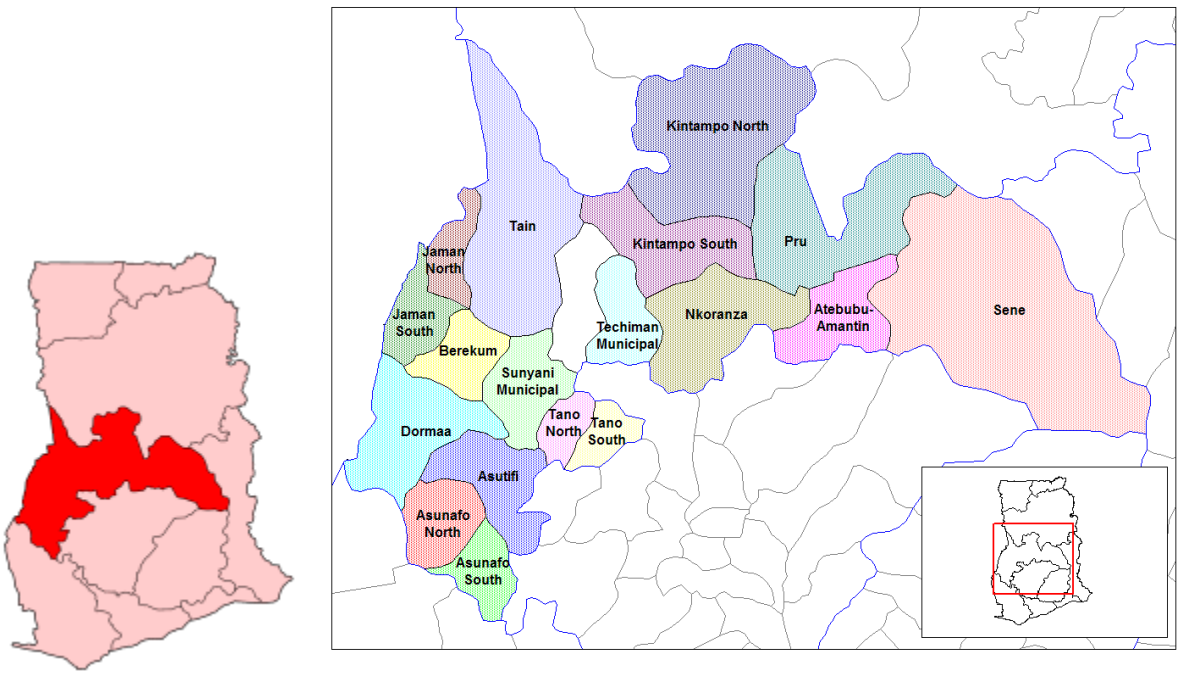

Figure 3*: Maps of Brong-Ahafo Region in Ghana (left) and its districts (right)*

The GPS coordinates of the capital Sunyani in the Sunyani Municipal district are 7° 44 60'' N, -1° 29' 60'' W.

C.3. Post-registration changes to CPAs

C.3.1. Temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies or standardized baselines or other methodological regulatory documents

n/a

C.3.2. Corrections

n/a

C.3.3. Changes to the start date of the crediting period

n/a

C.3.4. Inclusion of monitoring plan

n/a

C.3.5. Permanent changes to the included monitoring plans, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

a) *Changes that have been approved by the Board prior to the submission of this monitoring report*

The following changes have been proposed to streamline the CPA-DD with the revised PoA-DD V. 1.7:

1) Update of the ex-ante parameter tables (section B.4.2) to reintroduce a table for f_{NRB} and deletion of the 'monitored parameter' table of f_{NRB} (section B.5.1) following the determination of ex-ante national f_{NRB} value at PoA-DD level (instead of monitoring and determination at CPA-level). The CPA-DD is made coherent in terms of guidance used, which is solely the "Information note: Default values of fraction of non-renewable biomass for least developed countries and small island developing states" (deletion of any reference to "Methodological tool: Calculation of the fraction of non-renewable biomass").

2) Revision of $B_{old,HH}$ and $B_{old,i,j}$ parameter tables following introduction of parameter tables $B_{old,p}$ and $N_{p,HH}$ and specification of new 'Source of data' (FAO 2017) in the ex-ante parameter table $B_{old,p}$ of the CPA (section B.4.2) (instead of "Energy Commission 2017"). Related modifications in the explanation of methodological choices (section B.4.1).

3) Update of approach to determine monitored parameter $N_{d,HH}$ (and related modifications in sections B.4.1 and B.5.1). Instead of determining $N_{d,HH}$ through the monitoring survey, it is be determined through data in the user database.

Effective approval date: 15 December 2019
Reference number: PRC-10430-002

b) Changes that are being submitted with this monitoring report as part of the request for issuance (post-registration change -issuance track)

n/a

C.3.6. Changes to project design

n/a

C.3.7. Changes specific to afforestation or reforestation CPA

n/a

SECTION D. Description of monitoring system of CPAs

The CME is responsible for overall monitoring organization. The sampling plan, data collection & consolidation and results analysis are implemented by an adequately trained monitoring team, well aware of CDM requirements and supervised by the CME. The monitoring team consists of one monitoring manager and one data manager. If external expertise or support in management or controlling is needed or to avoid conflict of interest, the CME may contract local third-party experts (e.g. NGOs) assist the monitoring team.

A compensation system, possibly based (in parts) on objective performance criteria, may be introduced in order to encourage workers.

Table 3: *Monitoring team,responsibilities and identities*

Role	Responsibilities	Identity
Monitoring manager	- In general, ensure that all CPAs follow the monitoring plan - Ensure that the equipment and measurements are in line with the measurement methods, recording frequency and archiving approaches in monitoring plan - Ensure that monitoring data collected is consolidated and entered in electronic database - Ensure that monitoring team receives proper training	Mr. Agyei Michael Yaw, Mr. Alexandre Dunod (aera group)

	- Ensure a coherent and standard monitoring report for each CPA	
Data manager	- Collect monitoring data - Enter data in electronic database and archive hardcopies[9] - Carry out sample size determination and emission reduction calculations	Mr. Ernest Nyanteh, Mr. Alexandre Dunod (aera group)

Before the commencement of monitoring works, the CME ensured that the monitoring staff / CPA implementers (if applicable) received *training* according to their responsibilities in the monitoring. For all staff, it involves information on the general PoA management system so that roles, responsibilities and communication channels are clear.

SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

Data/Parameter	**$B_{old,p}$**
Data unit	tonnes/person/year
Description	Annual quantity of woody biomass that would have been used per person in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices.
Source of data	UN Food & Agriculture Organization (FAO 2017): The Charcoal Transition. Greening the charcoal value chain to mitigate climate change and improve local livelihoods. p. 139 (http://www.fao.org/3/a-i6935e.pdf)
Value(s) applied	180 kg/capita/year
Choice of data or Measurement methods and procedures	Cf. section B.4.1 of CPA-DD
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	**$N_{p,HH}$**
Data unit	Number
Description	Average number of persons served per household prior to project implementation.
Source of data	Table 2.1 of Ghana Statistical Service 2014: Ghana Living Standards Survey Round 6 (GLSS 6). Main report. (http://www.statsghana.gov.gh/gssmain/fileUpload/Living%20conditions/GLSS6_Main%20Report.pdf)
Value(s) applied	4.0
Choice of data or Measurement methods and procedures	Cf. section B.4.1 of CPA-DD
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	**$B_{old,HH}$**

[9] *Data monitored and required for verification and issuance are kept and archived for at least two years after the end of the final crediting period or the last issuance of CERs, whichever occurs later.*

Unit	tonnes/household/year
Description	Annual quantity of woody biomass that would have been used in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices
Source of data	Determined ex ante at CPA-level
Value(s) applied	4.32
Choice of data or measurement methods and procedures	$B_{old,p}$ times $N_{p,HH}$
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**$B_{old,i,j}$**
Unit	tonnes/year
Description	Annual quantity of woody biomass that would have been used in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project device type *i* and batch *j*
Source of data	Determined ex ante at CPA-level.
Value(s) applied	4.243
Choice of data or measurement methods and procedures	$B_{old,i,j}$ is calculated as $B_{old,HH}$ / $N_{d,HH}$ $B_{old,i,j}$ equals $B_{old,HH}$ when only one project device per household is taken account of.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	$N_{d,HH}$= 1.02, please refer to its specific Data / Parameter table.

Data/Parameter	**$\eta_{old,i,j}$**
Unit	fraction
Description	Efficiency of the device being replaced
Source of data	The average value for baseline efficiency is based on Ghana case study – Growing Inclusive Markets (UNDP, 2010) : https://bit.ly/2R8pYAs
Value(s) applied	18%
Choice of data or measurement methods and procedures	Only charcoal stoves are replaced.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Weighted average values are used if more than one type of system is being replaced. Option 3 is used of AMS-II.G. is applied for determining $B_{y,savings,i,j}$.

Data/Parameter	**$EF_{projected\_fossilfuel}$**
Unit	tCO_2/TJ
Description	Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	81.6

Choice of data or measurement methods and procedures	As per AMS-II.G., this value represents the emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis. It is assumed that the mix of present and future fuels used would consist of a solid fossil fuel (lowest in the ladder of fuel choices), a liquid fossil fuel (represents a progression over solid fuel in the ladder of fuel use choices) and a gaseous fuel (represents a progression over liquid fuel in the ladder of fuel use choices). Thus a 50% weight is assigned to coal as the alternative solid fossil fuel (96 tCO_2/TJ) and a 25% weight is assigned to both liquid and gaseous fuels (71.5 tCO_2/TJ for Kerosene and 63.0 tCO_2/TJ for Liquefied Petroleum Gas (LPG).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**m_{wood}/ $m_{charcoal}$**
Unit	kg biomass/kg charcoal
Description	Conversion factor wood/charcoal
Source of data	AMS II.G, para. 23
Value(s) applied	6
Choice of data or measurement methods and procedures	As per in AMS II.G. para 23, where charcoal is used as the fuel by baseline (old) or project (new) devices, the quantity of woody biomass shall be determined by using a default wood to charcoal conversion factor of 6 kg of firewood (wet basis) per kg of charcoal (dry basis) Credible local conversion factors determined from a field study or literature may be applied, alternatively
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**$Leakage_{adj}$**
Unit	Fraction
Description	Net to gross adjustment factor to account for leakages
Source of data	AMS-II.G.
Value(s) applied	0.95
Choice of data or measurement methods and procedures	In case this leakage adjustment factor is applied, it is not required to survey the use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources.
Purpose of data/parameter	Calculation of baseline emissions

Additional comments	B_{old} is multiplied by a net to gross adjustment factor of 0.95 to account for leakages according to AMS-II.G..

Data/Parameter	**$f_{NRB,y}$**
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 data and other sources of information (as per Information note: Default values of fraction of non-renewable biomass for least developed countries and small island developing states, version 01.0 (EB 67, Annex 22)).
Value(s) applied	0.9884
Choice of data or measurement methods and procedures	As per para. 27 to 30 of AMS-II.G.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

E.2. Data and parameters monitored

Data/Parameter	***$N_{y,i,j}$***
Unit	-
Description	Number of project devices of type i and batch j operating during year y
Measured/calculated/ default	Calculated
Source of data	CPA database
Value(s) of monitored parameter	~~16,208~~15,120
Monitoring equipment	No equipment involved. The CPA implementer (Man and Man Enterprise) keeps an electronic database of all stoves sold.
Measuring/reading/recording frequency	As per paragraph 22 of AMS II.G: Monitoring shall consist of checking of all devices or a representative sample thereof, at least once every two years (biennial) to determine if they are still operating; those devices that have been replaced by an equivalent in-service device can be counted as operating.
Calculation method (if applicable)	$N_{y,i,j}$ is determined by multiplying all devices sold (N) with the proportion of cooking stoves found to be operating in a representative sample, i.e. $p_{op\_stoves,y}$.
QA/QC procedures	Sampling is conducted by applying the 90/10 confidence precision for the sample size calculation.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	In addition to operating status, information regarding continued baseline stove use by target end user is recorded. If the replacement of a baseline stove is not considered under the specific CPA, the new device is counted as not operating, i.e. no emission reductions are claimed. For the subsequent monitoring sessions of the same CPA, the previously monitored value of $p_{op\_stoves,y}$ shall be used for ex-ante purposes such as sample size calculation. In case of two subsequent monitoring sessions the efficiency of stoves of an age group is determined at respectively $p_{op\_stoves,1}$ and $p_{op\_stoves,2}$, $p_{op\_stoves,y} = \frac{p_{op\_stoves,1}+p_{op\_stoves,2}}{2}$

Data/Parameter	μ_y
Unit	Fraction
Description	Adjustment to account for any continued use of pre-project devices during year y
Measured/calculated/ default	Measured
Source of data	Since equation 6 of AMS II.G is applied, it is a fraction based on monitoring results.
Value(s) of monitored parameter	0.86
Monitoring equipment	No equipment involved. During the annual monitoring campaign, CME-mandated field agents inquire if the baseline stove that was supposed to be replaced by the ICS is still used. Field agents estimate the usage rate of the pre-project stove(s) by formulating questions to determine the frequency of usage of both the project devices and baseline devices.
Measuring/reading/recording frequency	At least once every two years (biennial)
Calculation method (if applicable)	In case of two subsequent monitoring sessions the efficiency of stoves of an age group is determined at respectively $\mu_{y,1}$ and $\mu_{y,2}$, $\mu_y = \frac{\mu_{y,1}+\mu_{y,2}}{2}$
QA/QC procedures	-
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	For the subsequent monitoring sessions of the same CPA, the previously monitored value of μ_y shall be used for ex-ante purposes.

Data/Parameter	$\eta_{new,i,j}$
Unit	Fraction
Description	Efficiency of the device of each type *i* and batch *j* implemented as part of the project activity
Measured/calculated/ default	Measured
Source of data	Stove Performance test results.
Value(s) of monitored parameter	24.06%
Monitoring equipment	Option 2 of AMS II.G: Sampling and monitoring is implemented per batch (age class)
Measuring/reading/recording frequency	Annual monitoring as default option c) is chosen to adjust for the loss in efficiency as per paragraph 25 of AMS II.G.

Calculation method (if applicable)	Weighted mean of 3 tests for each of the two cook stoves (from 2018 vintage batch) carried out between 05/02/2019 and 12/02/2019*:* **average efficiency** 29.97% Standard deviation 0.0132 Sample size 2 Total population size 15,518 Required precision 90% t-value at 90% confidence 6.31 Confidence interval (+/-) 0.0591 Lower bound of the interval 24.06% Higher bound of the interval 35.88% Maximum error (precision) 10% Sample precision 20% Conclusion: Precision not reached Applying the standard deviation for 3x2 cook stove tests, precision is not reached, i.e. the lower bound of the interval (24.06%) is applied. Stove numbers: 752 (stove 1), 350 (stove 2) In case of two subsequent monitoring sessions the efficiency of stoves of an age group is determined at respectively $\eta_{i,j,1}$ and $\eta_{i,j,2}$, $\eta_{i,j} = \frac{\eta_{i,j,1}+\eta_{i,j,2}}{2}$.
QA/QC procedures	The sampling test of stoves by such certification bodies/agents or manufacturers shall be conducted following a 90/10 precision in accordance with the "Standard for sampling and surveys for CDM project activities and programme of activities, and 90/10 precision was met Tests were performed by third party (KNUST Technology & Consultancy Center, a partner of the Global Alliance for Clean Cookstoves) and cross-checked with manufacturer information. WBT equipment is calibrated as per section B.5.2 of CPA-DD or section I.7.2 of PoA-DD, respectively. Since the KNUST test center was established in Oct Nov 2014 by the Aprovecho Research Center with state-of-the art automated equipment funded by UNDP, no further calibration of electronic scales or thermocouples is applicable.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	$\eta_{new,i,j}$ is monitored since option 3 (Water Boiling Test) in para. 20 of AMS-II.G. is chosen for determining $B_{y,savings,i,j}$.

Data/Parameter	***NCV$_{biomass}$***
Unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass used in project devices.
Measured/calculated/ default	Default (for wood fuel based on the gross weight of the wood that is 'air-dried.)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) of monitored parameter	0.015
Monitoring equipment	No equipment involved.
Measuring/reading/recording frequency	Yearly

Calculation method (if applicable)	IPCC default for wood fuel, 0.015 TJ/tonne, based on the gross weight of the wood that is 'air-dried.'
QA/QC procedures	-
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	***Date of commissioning of batch j***
Unit	Date
Description	To establish the date of commissioning, the Project Participant opts to group the devices in "batches" and the latest date of commissioning of a device within the batch shall be used as the date of commissioning for the entire batch
Measured/calculated/ default	-
Source of data	Internal records
Value(s) of monitored parameter	Excel spreadsheet provided to the DOE
Monitoring equipment	No equipment involved. Every time an ICS is sold a sales agreement is filled. The information is entered in the CPA's electronic database afterwards. Based on the database, the date of commissioning is determined, assuming conservative lead times between sale, construction/installation and commissioning.
Measuring/reading/recording frequency	Fixed and recorded at the time of commissioning/distribution of the last project device in the batch.
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	***Date of commissioning of project device i***
Unit	Date
Description	Actual date of commissioning of the project device.
Measured/calculated/ default	-
Source of data	Internal records
Value(s) of monitored parameter	See ER calculations.
Monitoring equipment	No equipement involved Every time an ICS is sold a sales agreement is filled. The information is entered in the CPA's electronic database afterwards. Based on the database, the date of commissioning is determined, assuming conservative lead times between sale, construction/installation and commissioning.
Measuring/reading/recording frequency	Recorded at the time of commissioning/distribution of project devices
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data/parameter	Calculation of baseline emissions

Additional comments	-

Data/Parameter	***N***
Unit	Number
Description	Number of project devices distributed
Measured/calculated/ default	Calculated
Source of data	Internal records (Electronic database used for registering all ICS's sold)
Value(s) of monitored parameter	15,518
Monitoring equipment	No equipement involved Every time an ICS is sold a sale agreement is filled and an electronic database is filled. Based on the information collected into this electronic database, the number of ICSs distributed is determined.
Measuring/reading/recording frequency	Recorded at the time of commissioning/distribution of project devices
Calculation method (if applicable)	Sum of all project devices distributed.
QA/QC procedures	-
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	$N_{d,HH}$
Unit	Number
Description	Number of project devices distributed per household
Measured/calculated/ default	Measured
Source of data	Internal records
Value(s) of monitored parameter	1.02
Monitoring equipment	No equipment involved.
Measuring/reading/recording frequency	Recorded at the time of commissioning/distribution of project devices
Calculation method (if applicable)	All stoves in the database divided by number of households in the database. Identification of number of households is based on the combination of name and/or first name, address and town of a stove user, as provided in the sales agreement.
QA/QC procedures	Verified during monitoring campaign.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	If a household purchases more than one cooking stove, the user database will account for any additional project device, which will be reflected in adjustment factor $N_{d,HH}$. Ex-ante estimation of $N_{d,HH}$ = 1.

E.3. Implementation of sampling plan

For CPA0001, which is the only CPA, to which the sampling plan was applied, monitored emission reductions generated over all ICS batches (age classes) are determined by:

1. Calculating the amount of emission reductions generated by each batch of ICSs based on the monitored number of distributed ICSs, quantity of woody biomass saved per ICS type (via ICS efficiency or fuel use) and taking account of the overall proportion of operating ICSs, the residual consumption of baseline stoves and the specific size of the age class.

2. Summing up the emission reductions obtained for each age class.

Aside from the directly measured number of project devices distributed (per household) and corresponding dates of commissioning of project devices/batches, all monitored parameter values are measured through a representative sample of recorded ICSs own by *households*.

(a) Sampling Design

Objectives and reliability requirements

The sampling objective is to provide unbiased and reliable estimates of these parameter values during the crediting period with the confidence/precision level required by AMS-II.G. and summarized in the table below. This would be achieved through a representative sample of distributed ICS, as compared to the study of the total population of cooking stoves distributed.

Target population and sampling frame

The *target population* is the totality of ICSs (sampling unit) distributed, among which sampling is performed to monitor $p_{op\ stoves,y}$ and $\mu_{,y}$.

For the monitoring of parameter $\eta_{new,i,j}$, which is sensitive to the aging of stoves, all cooking stoves sold are grouped in batches (age classes) and efficiency parameter values are estimated for each batch [10] as a separate population.

The *sampling frame* is the data on ICS sales entered and/or available in the CPA's electronic database.

The electronic database records information for each sale at least on the following:

- Sales date (age class)/date of replacement of the ICS
- Project stove serial number(s)
- Type and size of ICS(s)
- Customer name
- Contact details of customer
- User type (household)

Sampling Method

Due to the homogeneity requirement for grouping CPAs/PoAs under one sampling plan, the sampling method is simple random sampling[11] for all parameters monitored through sampling at all times.

Sample Size

A sample size is calculated in order to meet reliability requirements.

The project proponent has the possibility of:

- sampling of a group of CPAs and PoAs under one sampling plan,
- sampling of each CPA individually.

➔ Project proponent samples only CPA001.

[10] In case of option (c) (drop of efficiency rate), efficiency test sampling approach is unchanged from other options of yearly efficiency determination yet only applied among first batch's representative sample throughout the years of monitoring, and this rate of loss in efficiency will be applied correspondingly to all batches.

[11] *E.g. through a program generating random numbers selecting sampled cooking stoves before the start of each monitoring or sales period to prepare participating cooking stove owners well in advance.*

Parameter values are estimated by sampling in accordance with the requirements in AMS-II.G. separately and independently.

The sample size for estimating the proportional parameters $p_{op\_stoves,y}$ and $\mu_{,y}$ (or their reverse) is calculated using the formula provided in the "Guideline: Sampling and surveys for CDM project activities and PoAs" para 12 of Appendix 1:

$$n_p \geq \frac{z_{\alpha/2}^2 \mathrm{N_y} \times p(1-p)}{(\mathrm{N_y}-1)\cdot 0.1^2 \times p^2 + z_{\alpha/2}^2 (1-p)}$$

Equation (1)

With:

$z_{\alpha/2}$	*z values equal to 1.96 in the case when 95% confidence interval and a 10% margin of error are required and value; equal to 1.645 in the case when 90% confidence interval and a 10% margin of error are required*
N_y	*Size of the population of stoves considered for the monitoring session*
p	*Expected proportion*

The monitoring of $p_{op\ stoves,y}$ and $\mu_{,y}$ is based on the same sample, which is the sample with the larger sample size of the two.

and

If it is not possible to meet the 90/10 confidence/precision, then:

- for $\mu_{,y}$, the higher bound of the 90%/10% confidence/precision requirements shall be used as the correct value.
- for $p_{op\ stoves,y}$, the lower bound of 90%/10% confidence/precision shall be used as the correct value.

AMS-II.G. provides four options to determine $B_{y,savings,i,j}$. As per section B.4.1, option 3 has been chosen.

Accordingly, for $\eta_{new,i,j}$[12] the sample size is calculated using the formula mentioned in the "Guideline: Sampling and surveys for CDM project activities and PoAs" (simple random sampling, para.51, Appendix 1) applicable to the determination of the sample size of a mean value parameter at base:

$$\mathrm{n_\eta} \geq \frac{\mathrm{z_{\alpha/2}^2 N_{age,y} V}}{(\mathrm{N_{age,y}}-1)\cdot 0.1^2 + \mathrm{z_{\alpha/2}^2 V}}$$

Equation (2)

Where:

$$\mathrm{V} = \left(\frac{\text{standard deviation}}{\text{mean}}\right)^2$$

$N_{age,y}$	Number of stoves distributed belonging to the age class y
$z_{\alpha/2}$	z-values

Since the sample size calculation returns a value of less than 30 (n_η = 1 without oversampling, n_η = 2 with oversampling) and the parameter of interest is a numeric mean value (i.e. not a proportion or percentage) the student's t-distribution shall be used if the resulting sample size is less than 30.

[12] *For ICS other than medium-size, $\eta_{new,i,j}$ is determined for a representative sample of corresponding operative ICSs.*

Accordingly, achieved relative precision E at given confidence level of 90% with a sample size of 1 cook stove and based on z-values is determined and redetermined based on student's t-distribution via the following equations, as per "Guideline: Sampling and surveys for CDM project activities and PoAs" (para. 8 and para. 11, Appendix 4) :

$$E = t * SE$$ Equation (3)

Where:

E	Relative precision (e.g. 0.1 for 10% precision)
t	t-value
SE	Standard error

$$\sqrt{(1-f)\frac{s^2}{n}}$$ Equation (4)

Where:

SE	Standard error
f	sampling fraction (n/N)
n	Sample size
s^2	variance (square root of SD)
t	t value

The t-value depends on (i) the level of confidence (90%) and (ii) the size of the sample (n=2, with oversampling). The exact figure is derived in Microsoft Excel using the TINV function, as per para. 13 of the "Guideline: Sampling and surveys for CDM project activities and PoAs."

The z-value depends on the level of confidence. For 90% confidence it is 1.6449, as per footnote 2 of the "Guideline: Sampling and surveys for CDM project activities and PoAs", and for 95% confidence it is 1.96 as per para. 116 of the aforementioned guideline.[13]

Please refer to the ER calculations for a detailed calculation.

The following minimum sample sizes have been calculated:

Table 4: Calculation of sample size of proportions (90/10 confidence/precision)

Parameter	$z_{\alpha/2}$	N_y	p	Sample size
$p_{op\ stoves,y}$	1.645	15,518	0.9448	16
$\mu_{,y}$	1.645	15,518	0.8780	38

Table 5: Calculation of sample size of means (90/10 confidence/precision)

Parameter	$z_{\alpha/2}$/ $t_{\alpha/2}$	$N_{2018,y}$	SD	mean	Sample size
$\eta_{new,i,j}$	1.645 / 6.314	15,518	0.016	0.30	1

[13] One may also refer to tables such as https://en.wikipedia.org/wiki/Standard_normal_table .

(b) Data collected

The table below summarizes the variables to be measured and the main specifications and modalities required for data collection including confidence/precision level to assure and control for quality of the sampled data (QA/QC). Furthermore, the implementation plan below and section I.7.3 of PoA-DD reveal additional QA/QC measures.

Table 6: *Monitored parameters and specifications for monitoring*

Para-meter	Description	Confidence/ Precision level[14]	Source of data (and method)	Grouped CPAs/PoAs	Frequency	Seasonality [15]	Option selected to determine $B_{y,savings,i,j}$ in AMS-II.G.
$N_{y,i,j,}$ / ($p_{op\_stoves,y}$) [16]	Proportion of distributed ICS still operating in year y	95/10 (biennial) 90/10 (annual) --> 90/10 (annual) applied.	Monitoring (Visual inspection, field measurement)	Simple random sampling for all CPAs with the same boundary (or for each CPA)	At least once every two years (biennial)	Unlikely to be affected by seasonal influences	Option 3 selected
$\mu_{,y}$	Proportion of pre-project stoves still in use in year y	95/10 (biennial) 90/10 (annual) --> 90/10 (annual) applied.	Monitoring results (Interview of end-user, field measurement)	Simple random sampling for all CPAs with the same boundary (or for each CPA)	At least once every two years (biennial)	Unlikely to be affected by seasonal influences	Option 3 selected
$\eta_{new,i,j}$	Efficiency of the device being deployed as part of the project activity in year y	90/10	Water Boiling test (laboratory)	Simple random sampling for all CPAs with the same boundary (or for each CPA)	Annually	Not affected by seasonal influences	Option 3 Equation (5) Sub-options c) selected requiring measurement of efficiency losses;

c) Analysis of collected data

In total, a sample of 54 user households has been randomly drawn from the population of 15,518 stoves sold. The CPA implementer carried out the surveys on 14/12/2018 and 15/12/2018.

[14] *As per Tables 8 and 11 as well as para. 40 of AMS-II.G..*

[15] *The assessment is based on a study carried out in the neighbouring Togo by the Cristo (2007) demonstrates that seasons do not affect the wood fuel consumption of users.*

[16] *$N_{y,i}$ is not directly monitored. The parameter $p_{op\_stoves,y}$ is monitored in order to determine $N_{y,i}$. If more convenient, the project proponent may choose to monitor reverse proportions such as 1-$p_{op\_stoves,y}$ or 1-$\mu_{,y}$., as per Standard for "Sampling and surveys for CDM project activities and programme of activities" para. 11 (a). If the project proponent decides to monitor the reverse (1-$p_{op\_stoves,y}$ and/or 1-$\mu_{,y}$) he can receive the value of $p_{op\_stoves,y}$ and $\mu_{,y}$ as follows: 1-(1-$p_{op\_stoves,y}$) or 1-(1-$\mu_{,y}$).*

Table 7: Sampled parameter values compared to ex ante values

Parameter	Ex ante	Sample
$p_{op\_stoves,y}$	0.900	0.9815
$\mu_{,y}$	0.800	0.8589
$\eta_{new,i,j}$	0.275	0.2997[17]

The analysis of the sampled mean parameter values reveals that all conservative ex ante assumptions were exceeded in the sample. As concerns the functioning rate and efficiency of the stove, all sample user households had been purchasing their stoves only a few months, weeks or days before the survey (first batch sale: 04/06/2018), i.e. high values could expected as the product was still in relatively good shape. The rate of other stoves used has been found lower than expected and include traditional coal pots (17), gas stoves (7), improved cook stoves (5), and three stone fire fires (3). In all cases only one other stove is used. The large majority, 25 of the 58 households, does not use any other stove. Most of households with another stove tend to used it either very often (e.g. each day) or exceptionally for specific meals (e.g. once a week).

Only one of the 54 households complained about a poor ventilation of the stove. All other households were satisfied with their purchase or did not make any comment.

d) Demonstration that the required confidence/precision level has been met

The demonstration has been performed in the ER calculation sheet. Please refer to the ER calculation for detailed calculation.

Table 8: Demonstration of confidence/precsion level

Parameter	f_op	1-μ,y
Batch average	98.15%	14.11%
Sample size	54	54
Total population size	15,518	15,518
Required precision	90%	90%
z-value at 90% confidence	1.64	1.64
Confidence interval (+/-)	3%	7.8%
Lower bound of the interval	95%	6%
Higher bound of the interval	101%	22%
Maximum error (precision)	10%	10%
Sample monitoring precision	3%	9%
Conclusion	**Precision OK**	**Precision OK**

SECTION F. Calculation of emission reductions or net anthropogenic removals

F.1. Calculation of baseline emissions or baseline net removals

Emission reductions are calculated as:

$$ER_y = \sum_i \sum_j ER_{y,i,j} - LE_y$$ Equation (1)

[17] The lower bound of the confidence interval is applied (24.06%) since precision has not been reached.

Where:

i	=	Indices for the situation where more than one type of project device is introduced to replace the pre-project devices[18]
j	=	Indices for the situation where there is more than one batch of project device
ER_y	=	Emission reductions during year *y* in t CO_2e
$ER_{y,i,j}$	=	Emission reductions by project device of type *i and* batch *j* during year *y* in t CO_2e
LE_y	=	Leakage emissions in the year *y*

$$ER_{y,i,j} = B_{y,savings,i,j} \times N_{y,i,j} \times \mu_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossil\ fuel} \quad \text{Equation (2)}$$

Where:

$B_{y,savings,I,j}$	Quantity of woody biomass that is saved in tonnes per cook stove of type i and batch j during year y
$f_{NRB,y}$	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 (fNRB) values available on the CDM website[19].
$NCV_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne, based on the gross weight of the wood that is 'air-dried')
$EF_{projected\_fossilfuel}$	Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO_2/TJ
$N_{y,,jj}$	Number of project devices of type i and batch *j* operating during year y
μ_y	Adjustment to account for any continued use of pre-project devices during the year y when applying equations 6 and 8 (fraction). Use 1.0 in other cases

$$B_{y,savings,i,j} = B_{old,i,j} \times (1 - \frac{\eta_{old,i,j}}{\eta_{new,i,j}}) \quad \text{Equation (3)}$$

Where:

$\eta_{old,i,j}$	Efficiency of the old devices being replaced by project devices of type *i* and batch j.
$\eta_{new,i,j}$	Efficiency of the project device *i* and batch j

$B_{old,i,j}$ is determined as follows:

$$B_{old,i,j} = B_{old,HH} \div N_{d,HH} \quad \text{Equation (4)}$$

$$B_{old,HH} = B_{old,p} \times N_{p,HH} \quad \text{Equation (5)}$$

Where:

$B_{old,HH}$	=	Annual quantity of woody biomass that would have been used in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices (tonnes/household/year)
$N_{d,HH}$	=	Number of project devices per household (number)
$B_{old,p}$	=	Annual quantity of woody biomass that would have been used per person in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices (tonnes/person/year)
$N_{p,HH}$	=	Average number of persons per household (number)

[18] *For example, in some instances, full replacement of the pre-project device would require the implementation of more than one project device (e.g. one stove suitable for cooking and the other stove suitable for cooking/boiling water).*

[19] *Default values endorsed by designated national authorities and approved by the Board are available at* http://cdm.unfccc.int/DNA/fNRB/index.html

$B_{old,i,j}$ is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

M&M Jiko ICS Household Medium stove:

Substituting for values for M&M Medium-sized stoves in use for 100% of the time over the monitoring period, the calculation results in the below.

	Value	*Unit*	*Source/reference*
N	15,518	*n/a*	*Section E.2*
$N_{y,i,j}$	~~16,208~~ 15,120	*n/a*	*Section E.2* $N_{y,i,j} = N * p_{op\_stoves,y}$
$\mu_{,y}$	0.86	*fraction*	*Section E.2*
$f_{NRB,y}$	0.9884	*fraction*	*Section E.2*
$NCV_{biomass}$	0.015	*TJ/tonne*	*IPCC Guidelines 2006*
$EF_{projected\_fossilfuel}$	81.6	*tCO_2/TJ*	*IPCC Guidelines 2006*
$B_{y,savings,i,j}$	1.015~~2~~	*tonnes/year*	*ER calculations* $B_{y,savings,i,j} = B_{old,i,j}*(1 - \eta_{old,i,j}/\eta_{new,i,j})*0.95$
$B_{old,i,j}$	4.2~~3~~4	*tonnes/year*	*Section B.4.2 of CPA-DD or section I.6.2 of PoA-DD :* $B_{old,i,j} = B_{old,HH} / N_{d,HH}$ *(=$B_{old,HH}$ when only one project device per household is distributed)*
$B_{old,HH}$	4.32	*tonnes/HH/year*	*Section B.4.2 of CPA-DD or section I.6.2 of PoA-DD :* $B_{old,HH} = B_{old,p} \times N_{p,HH}$
$\eta_{old,i,j}$	18	*%*	*Section B.4.2 of CPA-DD*
$\eta_{new,i,j}$	24.06	*%*	*Section E.2*
Baseline Emissions	611~~53~~	*tCO_2/year*	*ER calculations* $ER_{y,i,j} = B_{y,savings,i,j} \times N_{y,i,j} \times \mu_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossil\ fuel}$
Project emissions (PE_y)	0	*tCO_2/year*	*ER calculations*
Leakage emissions (LE_y)	0	*tCO_2/year*	*Section B.4.3 of CPA-DD or section I.6.1 of PoA-DD: Adjustment factor (0.95) already applied at $B_{y,savings,i,j}$ level*
Emission reductions	611~~53~~	*tCO_2/year*	*ER calculations* $ER_y = \sum_i \sum_j ER_{y,i,j} - LE_y$

After taking account of the effective usage days of each individual stove after the date of sale[20], effective emissions reductions are as follows:

	ER_y (tCO_2e)
30/11/2018 - 13/12/2018	611~~53~~
TOTAL	611~~53~~

F.2. Calculation of project emissions or actual net removals

As per ER calculation, there are no project emissions taken account of.

[20] Direct sales to users took place from 04/06/2018 to 05/12/2018. Cut-off date of this monitoring period is 13/12/2018.

F.3. Calculation of leakage emissions

As per AMS II.G, leakage is already taken account of in the calculation of baseline emissions by multiplying $B_{y,savings,i,j}$ by a net to gross adjustment factor of 0.95 to account for leakages. In such case, surveys to determine leakage ex-post are not required.

F.4. Calculation of emission reductions or net anthropogenic removals

CPA UNFCCC reference number	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
10430-P1-0001-CP1	61153	0	0	-	61153	61153
Total	**61153**	**0**	**0**	**-**	**61153**	**61153**

F.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the included CPA-DDs

CPA UNFCCC reference number	Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante for this monitoring period in the CPA-DD (t CO_2e)
10430-P1-0001-CP1	61153	885
Total	**61153**	**885**

F.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the CPA-DD"

The amount of ex-ante emission reductions in the first calendar (2,213 tCO_2e) is divided by the number of implementation days in the first calendar year (35 days) and multiplied by the number of days of this monitoring period (14 days) to calculate the pars pro toto (885 tCO_2e).

F.6. Remarks on increase in achieved emission reductions

The actual GHG emission reductions achieved is not greater than the amount based on the ex ante estimation in the included CPA.

Emission reduction per stove during the monitoring period is 1.03 tCO_2 per year, which compares to 1.39 tCO_2 per year in the ex-ante calculations.

The difference between the estimated and actual, realized emission reductions is mainly due to a low cook stove efficiency value, which has been "discounted" (24.06% instead of 29.97%) during project verification after the precision of the sample has not been reached.

Without the discounted efficiency value, emission reductions per stove during the monitoring period would have been 1.64 tCO_2 per year. The slightly higher value is due to more favourable monitored usage statistics (less baseline/alternative stoves in use and less broken stoves) and higher efficiency of ICSs as compared to conservative ex-ante projections.

F.7. Remarks on scale of small-scale CPAs

As per Section C of the PoA-DD, "CPAs under this PoA are not limited in size by CPA thresholds a priori, as each of the ICS units contained in the CPAs aims to achieve energy savings at a scale of

no more than 600 MWh/year, which is equivalent to 1,800 MWh_{th} of annual energy savings per appliance."

Document information

Version	*Date*	*Description*
03.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for programmes of activities" (CDM-EB93-A07-STAN); • Add a section on remarks on the observance of the scale limit of small-scale CPAs during the crediting periods; • Add "changes specific to afforestation or reforestation activities/CPA" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R PoAs between two commitment periods; • Make structural and editorial improvements.
02.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for programmes of activities (CDM-EB93-A07-STAN); • Make editorial improvements.
01.0	1 April 2015	Initial publication.

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