



**Monitoring report form for CDM programme of activities**  
**(Version 03.0)**

**MONITORING REPORT**

<b>Title of the PoA</b>	Improved Cooking Stove Programme in Burundi supported by Republic of Korea	
<b>UNFCCC reference number of the PoA</b>	UNFCCC Reference number: 10474	
<b>Version numbers of the PoA-DD applicable to this monitoring report</b>	1.2	
<b>Version number of this monitoring report</b>	1.0	
<b>Completion date of this monitoring report</b>	31/10/2019	
<b>Monitoring period number</b>	1	
<b>Duration of this monitoring period</b>	10/09/2019 - 15/09/2019	
<b>Monitoring report number for this monitoring period</b>	1	
<b>Coordinating/managing entity</b>	AERA GROUP S.A.S.	
<b>Host Parties</b>	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	Burundi	Yes
<b>Applied methodologies and standardized baselines</b>	AMS-II.G. : "Energy efficiency measures in thermal applications of non-renewable biomass" (Version 10.0)	
<b>Sectoral scopes</b>	Sectoral Scope 3 – Energy Demand	
<b>Amount of GHG emission reductions or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period</b>	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	-	1,378 tCO <sub>2</sub>
<b>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</b>	8,123 tCO <sub>2</sub>	

## 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 Burundi.

According to the information gathered by Global Forest Watch, from 2001 to 2017, Burundi lost 22,400 ha of tree cover, equivalent to a 4.2% decrease and 1.83Mt of CO<sub>2</sub> emissions<sup>1</sup>. Rapid population growth has been a major contributing factor of deforestation through land use change for farming and because of household dependence on wood for fuel as a source of energy for the vast majority, as poverty reaches nearly 77 percent of the population (living with less than US\$1.90 per day)<sup>2</sup>.

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

Since there are neither laws nor regulations in Burundi 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. As Republic of Korea Emission Trading Scheme (Kr-ETS) would allow CERs from CDM projects directly implemented by Korean Parties from 2018, Korean Companies will provide all the implementation cost including stove subsidy and operation & maintenance cost for this PoA.

#### 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: Improved Cooking Stoves Programme in Burundi supported by Republic of Korea –CPA [XXX]  Reference number of the corresponding generic CPA: Generic CPA [XXX]	1.2	Sectoral Scope 3 – Energy Demand	AMS-II.G. “Energy efficiency measures in thermal applications of non-renewable biomass” Version 10.0

#### 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)
Improved Cooking Stoves Programme in Burundi supported by Republic of Korea – CPA1 Ref.: 0474-P1-0001-CP1	1.2	Title: Improved Cooking Stoves Programme in Burundi supported by Republic of Korea –CPA [XXX]  Reference number of the corresponding generic CPA: Generic CPA [XXX]	Type: Renewable  Duration: 7 years (84 months:	Yes

<sup>1</sup> [www.globalforestwatch.org/dashboards/country/BDI](http://www.globalforestwatch.org/dashboards/country/BDI)

<sup>2</sup> World Bank report, 2018

			10/09/2019- 09/09/2026)	
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## A.2. Coordinating/managing entity

ECOEYE CO., LTD.

## 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
<b>PoA manager/ CME &amp; carbon finance investor</b>	<ul style="list-style-type: none"> <li>- Finance the implementation of the PoA</li> <li>-Contact with CPA implementer</li> <li>-Review CPA according to PoA eligibility criteria</li> <li>-Prepare and sign agreement for CPA inclusion between CME and CPA implementer</li> <li>-Notify CPA implementer of submission of CPA-DD to DOE for validation and inclusion</li> <li>-Decide on CPA inclusion and notify CPA implementer</li> <li>-Assess additionality and eligibility of CPA against documents provided by CPA implementer</li> <li>-Control work of all subcontractors undertaking critical activities on behalf of CME</li> </ul>	-Competencies <ul style="list-style-type: none"> <li>• to check and apply relevant principles, procedures, techniques and all features for CPA inclusion, verification, review and approval</li> <li>• to ensure that each CPA meets all requirements and eligibility criteria for inclusion of CPAs in the proposed PoA before its inclusion</li> <li>• to plan and make effective use of resources;</li> <li>• to organise work effectively</li> </ul> -Knowledge of specific technical and methodological CDM methodological aspects -Ability to obtain from third parties the desired outcomes
<b>CPA Implementer(s)</b>	<ul style="list-style-type: none"> <li>-Carry out Local Stakeholder Consultation (LSC)</li> <li>-Provide evidence for CPA eligibility under the PoA including CPA-DD and emission reduction calculations</li> <li>-Implement CPA</li> <li>-Facilitate, support and cooperate the CME and Carbon Consultant during CPA inclusion and verification process</li> </ul>	-Understanding of CME and carbon consultant needs -Knowledge of all technicalities of CPA and general CDM technical and methodological aspects
<b>CPA carbon consultant</b>	<ul style="list-style-type: none"> <li>-Assist CME and CPA implementer to reach CPA inclusion through the following, among others,               <ul style="list-style-type: none"> <li>• carry out LSC</li> <li>• draft CPA-DD and emission reduction calculations</li> <li>• organize CDM on-site visit with DOE and stakeholder consultation</li> <li>• follow up</li> </ul> </li> <li>- Assist CME and CPA implementer to reach verification of emission reductions after CPA inclusion, including               <ul style="list-style-type: none"> <li>• conduct training in monitoring of data,</li> <li>• write monitoring reports</li> </ul> </li> </ul>	-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

<b>Monitoring team (after CPA inclusion)</b>	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.
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Besides the responsibilities mentioned in the table above, the CME is 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.

Potential CPA implementers have to sign an agreement with the CME, 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 is aware of and agrees to the inclusion of the project activity in the PoA.

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

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

The CME shall support training and capacity building for its own personnel and CPA implementers, based on any identified needs, and keeps records of the trainings.

(c) Procedures for technical review of inclusion of CPAs

The technical review procedure by the CME for CPA inclusion includes 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) 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 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:

O[#PROD].XXXXXX

Where:

O = OBEN CDM-PoA

[#PROD] = production site identification number (e.g. 1BUJ : Bujumbura site 1, 3NGO : Ngozi site 3, 2GIT : Gitega site 2 etc.)

XXXXXX = unique stove ID (e.g. 139120)

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

The unique serial numbers should also ensure that no confusion arises with other projects in the country involving ICSs, (besides the fact that subsequent CPAs in this PoA shall not cover the same geographical boundaries or disseminate stoves from the same production sites 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.

Finally, during technical review of CPA, compliance team shall consult 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.

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

For every ICS sold, sales records are kept. These records shall enable third parties to verify that sales have indeed occurred and stoves are used by target end users (households communities) in specific areas targeted by the CPAs throughout Burundi.

Sales agreements between the CPA implementer and the end user or the retailer shall 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<sup>3</sup>, to scrap the previously used traditional cooking stove.

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 for correctness and 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.

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<sup>3</sup> 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 and sales modalities with retailers.

**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 methodological regulatory documents**

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****Improved Cooking Stoves Programme in Burundi supported by Republic of Korea – CPA1****SECTION C. Implementation of CPAs****C.1. Description of implemented CPAs**

The purpose of the CPA is to combat climate change and contribute to sustainable development of Burundi, by reducing non-renewable wood fuel consumption and greenhouse gas (GHG) emissions of household users in rural and/or peri-urban areas of Burundi by selling affordable Improved Cooking Stoves (ICSs) in replacement of traditional wood stoves.

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 firewood than a traditional stove. This reduces CO<sub>2</sub> emissions.

CPA001 thus aims to reduce non-renewable wood fuel consumption and greenhouse gas (GHG) emissions of *households* (hereafter also “end-users”) in the *rural and peri-urban regions* of Burundi.

The ICS distributed under CPA001 is the so called Jiko Matawi stove, a Tanzanian-design moulded from fermented clay which is dried through high temperatures in a kiln to reinforce its properties including high thermo efficiency and durability. It is a multi-purpose stove capable of using both firewood and charcoal depending on the preference of the user at the time of cooking. The stove is available in entry cost levels via a stand-alone ceramic model (that can also be installed in a fixed hearth within the kitchen of their home; see image at left below) and as a metal clad version.



**Table 2:** Technical manufacturer specifications of a typical Matawi<sup>4</sup>

<i>Weight</i>	5.1 kg (stand-alone)
<i>Efficiency</i>	32.1% <sup>5</sup> (new)
<i>Type of fuel</i>	Wood/Charcoal
<i>Height x Width</i>	23 x 26 cm
<i>Recommended pots diameter</i>	12 inches
<i>Durability</i>	Approx. 8 years

Compared to the replaced traditional cooking stove used by the end-users, ICSs are more efficient while providing the same service. Currently the common systems used for cooking are the traditional open fire (3-stone) system and traditional stoves which are still dominant in most of the households. These stoves are notoriously wasteful, with an efficiency level of 10-15% (EAC, 2008).

The annual thermal energy savings from the CPA is 14.47 MWh<sub>th</sub>/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<sub>th</sub> of annual energy savings per appliance. Total energy savings are 463,167 MWh<sub>th</sub> per year.<sup>6</sup>

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.

## C.2. Location of CPAs

The geographical boundaries of the CPA comprise rural and/or peri-urban areas of the whole Republic of Burundi (18 administrative provinces; geographic coordinates 3°23' S, 29°55' E).

<sup>4</sup> <https://uganda.lutheranworld.org/content/matawi-eco-stove-cooks-and-protects-environment-106>

<sup>5</sup> July 2019 CREEC test report

<sup>6</sup> 33,230 stoves x 14.47 MWh/stove = 480,838 MWh<sub>th</sub>



Rural population represents 90% of Burundi total population as per §2.4 of Central Census Bureau analysis conducted in 2008<sup>7</sup>.

### **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**

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**

n/a

#### **C.3.6. Changes to project design**

n/a

#### **C.3.7. Changes specific to afforestation or reforestation CPA**

n/a

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<sup>7</sup> <https://www.usaid.gov/documents/1866/2008-burundi-population-census-status-and-structure-population>



## 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 and responsibilities**

Role	Responsibilities	Identity
<b>Monitoring manager</b>	<ul style="list-style-type: none"> <li>- In general, ensure that all CPAs follow the monitoring plan</li> <li>- Ensure that the equipment and measurements are in line with the measurement methods, recording frequency and archiving approaches in monitoring plan</li> <li>- Ensure that monitoring data collected is consolidated and entered in electronic database</li> <li>- Ensure that monitoring team receives proper training</li> <li>- Ensure a coherent and standard monitoring report for each CPA</li> </ul>	Mr. Claver NDIZEYE
<b>Data manager</b>	<ul style="list-style-type: none"> <li>- Collect monitoring data</li> <li>- Enter data in electronic database and archive hardcopies<sup>8</sup></li> <li>- Carry out sample size determination and emission reduction calculations</li> </ul>	Mr. Christian Bob NYABUZANA

## 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:	Country-specific, conservative literature as detailed in PoA-DD section I.6.1: [urban] EAC Strategy to Scale-Up Access to Modern Energy Services - Burundi Country Report (Godefroy Hakizimana, 2008) [rural] Rapport d'étude sur les données du bois-énergie au Burundi (François Nkurunziza, 1999)
Value(s) applied	1.07
Choice of data or Measurement methods and procedures	For households situated in rural areas
Purpose of data	Calculation of baseline emissions
Additional comment:	The proposed values have been compared to alternate sources, and deemed further conservative considering that per capita GDP in the country has doubled in the last decade, thus more frequent cooking related to higher purchasing power for cooking fuels.

Data / Parameter:	$N_{p,HH}$
Data unit:	Number

<sup>8</sup> 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.

Description:	Average number of persons served per household prior to project implementation
Source of data:	Determined ex ante at CPA level
Value(s) applied	4.7
Choice of data or Measurement methods and procedures	USAID 2008: Burundi Population Survey: Status and Structure of Population (p.34) <sup>9</sup>
Purpose of data	Calculation of baseline emissions
Additional comment:	-

<b>Data/Parameter</b>	<b>B<sub>old,HH</sub></b>
Data 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	5.03
Choice of data or Measurement methods and procedures	Option 1. $B_{old}$ , times $N_{p,H}$
Purpose of data	Calculation of baseline emissions
Additional comment	-

<b>Data/Parameter</b>	<b>B<sub>old,i,j</sub></b>
Data 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	5.03
Choice of data or Measurement methods and procedures	$B_{old,HH}$ divided by $N_{d,HH}$
Purpose of data	Calculation of baseline emissions
Additional comment	$B_{old,i,j}$ equals $B_{old,HH}$ when only one project device per household is taken account of; ex-ante $N_{d,HH}$ equals 1; please refer to its specific Data / Parameter table.

<b>Data/Parameter</b>	<b><math>\eta_{old,i,j}</math></b>
Data unit	Fraction
Description	Efficiency of the device being replaced
Source of data	Determined ex ante at CPA-level, based on AMS-II.G. for default values and/or baseline survey literature, statistics etc.
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	Efficiency of pre - project device, which is a three stone fire using firewood (not charcoal), or a conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney; for other types of devices, a default value of 0.2 may be optionally used. Weighted average values (amount of woody biomass consumed by each device as the weighting factor) will be used if more than one type of device is being replaced.

<sup>9</sup> <https://www.usaid.gov/documents/1866/2008-burundi-population-census-status-and-structure-population>

Purpose of data	Calculation of baseline emissions
Additional comment	Use weighted average values if more than one type of system is being replaced.

<b>Data/Parameter</b>	<b>Leakage</b>
Data 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	Calculation of baseline emissions
Additional comment	B <sub>old</sub> is multiplied by a net to gross adjustment factor of 0.95 to account for leakages according to AMS-II.G.

<b>Data/Parameter</b>	<b><math>f_{NRB,y}</math></b>
Data 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	National or local statistics or other sources of information (following TOOL30: Calculation of the fraction of non-renewable biomass).
Value(s) applied	81.83%
Choice of data or Measurement methods and procedures	As per para. 44-45 of AMS-II.G.
Purpose of data	Calculation of baseline emissions
Additional comment	Fixed ex-ante at the beginning of each crediting period.

## E.2. Data and parameters monitored

<b>Data/Parameter</b>	<b><math>N_{y,i,j}</math></b>
Unit	-
Description	Number of project devices of type i and batch j operating during year y
Measured/calculated/default	Calculated
Source of data	CPA monitoring database
Value(s) of monitored parameter	33,230
Monitoring equipment	No equipment involved.  The CPA implementer keeps an electronic database of all stoves sold.
Measuring/reading/recording frequency	At least once every two years (biennial).  As per paragraph 22 of AMS II.G: Monitoring shall consist of checking of all devices or a representative sample 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)	<p><math>N_{y,i,j}</math> is determined by multiplying all devices sold (N) with the proportion of cooking stoves found to be operating in a representative sample, i.e. <math>p_{op\_stoves,y}</math> (= 94.44%).</p> <table border="1"> <tr> <td>Batch average</td><td>94.44%</td></tr> <tr> <td>Sample size</td><td>18</td></tr> <tr> <td>Total population size</td><td>35,185</td></tr> <tr> <td>Required precision</td><td>90%</td></tr> <tr> <td>z-value at 90% confidence</td><td>1.64</td></tr> <tr> <td>Confidence interval (+/-)</td><td>9%</td></tr> <tr> <td>Lower bound of the interval (1-p)</td><td>86%</td></tr> <tr> <td>Higher bound of the interval (1-p)</td><td>103%</td></tr> <tr> <td>Maximum error (precision)</td><td>10%</td></tr> <tr> <td>Sample monitoring precision</td><td>9%</td></tr> <tr> <td>Conclusion</td><td>Precision OK</td></tr> </table>	Batch average	94.44%	Sample size	18	Total population size	35,185	Required precision	90%	z-value at 90% confidence	1.64	Confidence interval (+/-)	9%	Lower bound of the interval (1-p)	86%	Higher bound of the interval (1-p)	103%	Maximum error (precision)	10%	Sample monitoring precision	9%	Conclusion	Precision OK
Batch average	94.44%																						
Sample size	18																						
Total population size	35,185																						
Required precision	90%																						
z-value at 90% confidence	1.64																						
Confidence interval (+/-)	9%																						
Lower bound of the interval (1-p)	86%																						
Higher bound of the interval (1-p)	103%																						
Maximum error (precision)	10%																						
Sample monitoring precision	9%																						
Conclusion	Precision OK																						
QA/QC procedures	<p>Sampling standard shall be used for determining the sample size to achieve 90/10 confidence precision (or 95/10 confidence precision) for the sample size calculation (if conducted biennially).  → 90/10 applicable for this MP.</p>																						
Purpose of data/parameter	Calculation of baseline emissions																						
Additional comments	<p>In addition to operating status, if baseline stove is not included under baseline defined under the specific CPA, the new device is counted as not operating, i.e. no emission reductions are claimed.</p> <p>For ex-ante purposes, <math>p_{op\_stoves,y}</math> = 95% can be considered at CPA-level based on average monitored values of other cookstove project activities in the sub-region.<sup>10</sup> For the subsequent monitoring sessions of the same CPA, the previously monitored value of <math>p_{op\_stoves,y}</math> shall be used for ex-ante purposes such as sample size calculation.</p>																						

Data/Parameter	$\mu_y$
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	0.9779
Monitoring equipment	<p>No equipment involved.</p> <p>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.</p>
Measuring/reading/recording frequency	At least once every two years (biennial)

<sup>10</sup> [http://cdm.unfccc.int/ProgrammeOfActivities/poa\\_db/QMD6V3B5IHFRYW4NLX0JTKOAE21ZGS/view](http://cdm.unfccc.int/ProgrammeOfActivities/poa_db/QMD6V3B5IHFRYW4NLX0JTKOAE21ZGS/view)

Calculation method (if applicable)	The proportion of continued use of pre-project stoves is calculated as $1 - \mu_{y,k}$ .																							
	<table><tr><td>Batch average</td><td>2.21%</td></tr><tr><td>Sample size</td><td>18</td></tr><tr><td>Total population size</td><td>35,185</td></tr><tr><td>Required precision</td><td>90%</td></tr><tr><td>z-value at 90% confidence</td><td>1,64</td></tr><tr><td>Confidence interval (+/-)</td><td>6%</td></tr><tr><td>Lower bound of the interval (1-p)</td><td>-3%</td></tr><tr><td>Higher bound of the interval (1-p)</td><td>8%</td></tr><tr><td>Maximum error (precision)</td><td>10%</td></tr><tr><td>Sample monitoring precision</td><td>6%</td></tr><tr><td>Conclusion</td><td>Precision OK</td></tr></table>		Batch average	2.21%	Sample size	18	Total population size	35,185	Required precision	90%	z-value at 90% confidence	1,64	Confidence interval (+/-)	6%	Lower bound of the interval (1-p)	-3%	Higher bound of the interval (1-p)	8%	Maximum error (precision)	10%	Sample monitoring precision	6%	Conclusion	Precision OK
	Batch average	2.21%																						
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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 values of $\mu_y$ shall be used for ex-ante purposes.																								

Data/Parameter	$\eta_{new,i,j}$
Unit	%
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	29.75%
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)	Mean of three tests for each of the four cook stoves (from batch 1: stoves sold between 02/11/18 and 26/08/2019) carried out between 16/10/2019 and 19/10/2019:																							
	<table border="1"> <tr> <td>average efficiency</td><td>29,75%</td></tr> <tr> <td>Standard deviation</td><td>0,0247</td></tr> <tr> <td>Sample size</td><td>4</td></tr> <tr> <td>Total population size</td><td>35185</td></tr> <tr> <td>Required precision</td><td>90%</td></tr> <tr> <td>t-value at 90% confidence</td><td>2,35</td></tr> <tr> <td>Confidence interval (+/-)</td><td>0,0291</td></tr> <tr> <td>Lower bound of the interval</td><td>26,84%</td></tr> <tr> <td>Higher bound of the interval</td><td>32,65%</td></tr> <tr> <td>Maximum error (precision)</td><td>10%</td></tr> <tr> <td>Sample precision</td><td>10%</td></tr> <tr> <td>Conclusion</td><td>Precision OK</td></tr> </table>	average efficiency	29,75%	Standard deviation	0,0247	Sample size	4	Total population size	35185	Required precision	90%	t-value at 90% confidence	2,35	Confidence interval (+/-)	0,0291	Lower bound of the interval	26,84%	Higher bound of the interval	32,65%	Maximum error (precision)	10%	Sample precision	10%	Conclusion
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Sample precision	10%																							
Conclusion	Precision OK																							
	Stove numbers: 01BUJ000003, 03CIB045035, 02BUB047990, 01BUJ004499.																							
	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	Tests were performed by third party "Centre de Recherche Universitaire sur les Energies Alternatives (CRUEA)" (University of Burundi) and cross-checked with manufacturer information.  Sampling test have been 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 (see above).																							
Purpose of data/parameter	Calculation of baseline emissions																							
Additional comments	--																							

<b>Data/Parameter</b>	<b>NCV<sub>biomass</sub></b>
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	0.0156
Monitoring equipment	No equipment involved.
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	IPCC default for wood fuel, 0.0156 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	-

<b>Data/Parameter</b>	<b><i>Date of commissioning of batch j</i></b>
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	-

<b>Data/Parameter</b>	<b><i>Date of commissioning of project device i</i></b>
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 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	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	-

<b>Data/Parameter</b>	<b><i>N</i></b>
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	35,185
Monitoring equipment	No equipment 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	-

<b>Data/Parameter</b>	<b><math>N_{d,HH}</math></b>
Unit	Number
Description	Number of project devices distributed per household
Measured/calculated/default	Measured
Source of data	Internal records (database).
Value(s) of monitored parameter	1
Monitoring equipment	No equipment involved.
Measuring/reading/recording frequency	Recorded at the time of commissioning/distribution of project devices
Calculation method (if applicable)	-
QA/QC procedures	It will be verified during monitoring campaign.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Only one cooking stove per household is registered in the electronic database. If a household purchases more than one cooking stoves, monitoring surveys of sampled kitchens' stoves in use will account for any additional project device and be reflected in adjustment factor $N_{d,HH}$ .

### E.3. Implementation of sampling plan

For CPA001, 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) 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 is achieved through a smaller but representative (statistically valid) sample of distributed ICS, as compared to the study of the total population of cooking stoves distributed, which is often not feasible or possible.

### Target population and sampling frame

The *target population* is the totality of ICSs (sampling unit) distributed.

For the monitoring of parameter  $\eta_{\text{new},i,j}$  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 as a separate population.

In case of option (c) (drop of efficiency rate), efficiency test sampling approach is undertaken similarly to other options of yearly efficiency determination, yet only applied among the population of the first batch of stoves implemented during the first 12 months. Same first batch population is then sampled again at each monitoring verification throughout the years of operation, and this rate of loss in efficiency is applied correspondingly to all subsequent batches of same age.

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 (and reseller as applicable) name
- Contact details of customer (and reseller as applicable)
- User type (e.g. household)

### Sampling Method

Due to the homogeneity requirement for grouping CPAs under one sampling plan, the sampling method is simple random sampling<sup>11</sup> 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 elects the sampling of each CPA individually.

Parameter values are estimated by sampling in accordance with the requirements in AMS-II.G. separately and independently for each of the CPAs included in the PoA.

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

$$n_p \geq \frac{t_{\alpha/2}^2 N_y \times p(1-p)}{(N_y - 1) \cdot 0.1^2 \times p^2 + \frac{t_{\alpha/2}^2}{2} p(1-p)} \quad \text{Equation (1)}$$

With:

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<sup>11</sup> 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.

$t_{\alpha/2}$	<i>Student's t Critical 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</i>
$N_y$	<i>Size of the population of stoves considered for the monitoring session</i>
$p$	<i>Expected proportion</i>

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

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

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

For  $n_{\text{new},i,j}$  the sample size is calculated using the formula mentioned in the “Guideline: Sampling and surveys for CDM project activities and PoAs” version 04.0 (simple random sampling, Appendix 1, para.51) applicable to the determination of a mean value parameter:

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

Where:

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

$N_{\text{age},y}$	Number of stoves distributed belonging to the age class y
$t_{\alpha/2}$	Student t critical values

For  $n_{\text{new},i,j}$ , one sample per age class is calculated in case efficiency losses are measured from a representative sample of each batch (sub-option d).

In general, if the sample size calculation returns a value of less than 30 samples, a minimum sample size of 30 is chosen when the parameter of interest is a proportion. If the parameter of interest is a numeric mean value (i.e. not a proportion or percentage) the student's t-distribution is used if the resulting sample size is less than 30.

Since the sample size calculation returns a value of less than 30 ( $n_{\eta} = 1$  without oversampling,  $n_{\eta} = 2$  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.

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.<sup>12</sup>

Please refer to the ER calculations for a detailed calculation.

<sup>12</sup> One may also refer to tables such as [https://en.wikipedia.org/wiki/Standard\\_normal\\_table](https://en.wikipedia.org/wiki/Standard_normal_table) .

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
$p_{\text{op stoves},y}$	1.645	35,185	0.95	18
$\mu_{y,i,j}$	1.645	35,185	0.95	18

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

Parameter	$Z_{\alpha/2} / t_{\alpha/2}$	$N_y$	SD	mean	Sample size
$\eta_{\text{new},i,j}$	1.645 / 6.314	35,185	0.02	0.321	4

## (b) Data to be 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**

Parameter	Description	Confidence / Precision level	Source of data (and method)	Grouped CPAs/PoAs	Frequency	Seasonality	Option selected to determine $B_{y,\text{savings},i,j}$ in AMS-II.G.
$N_{y,i,j} / (p_{\text{op\_stoves},y})_{13}$	Proportion of distributed ICS still operating in year y	95/10 (biennial) 90/10 (annual) --> 90/10 (annual) applied.	Monitoring (Visual inspection, field interviews)	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	n/a
$\mu_{y,i,j}$	Adjustment to account for any continued use of pre-project devices in year y	95/10 (biennial) 90/10 (annual) --> 90/10 (annual) applied.	Monitoring results (Interview of end-user, field interviews)	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	n/a
$\eta_{\text{new},i,j}$	Efficiency of the device being deployed as part of the project activity in year y	90/10 --> 90/10 (annual) applied.	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 (6) Sub-options c) selected requiring measurement of efficiency losses;

<sup>13</sup>  $N_{y,i}$  is not directly monitored. The parameter  $p_{\text{op\_stoves},y}$  is monitored in order to determine  $N_{y,i}$ .

**c) Analysis of collected data**

In total, a sample of 18 user households has been randomly drawn from the population of 35,185 stoves sold. The CPA implementer carried out the surveys on 16/10/2019 and 19/10/2019.

**Table 7: Sampled parameter values compared to ex ante values**

Parameter	Ex ante	Sample
$p_{op\_stoves,y}$	0.95	0.9444
$\mu_y$	0.95	0.9779
$\eta_{new,i,j}$	0.321	0.2975

The analysis of the sampled mean parameter values reveals that only the ex-ante parameter for the pre-project device use was 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 (start of first batch sale: 02/11/2018), i.e. relatively high values could still be expected as the product was still in relatively good shape.

**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/precision level**

Parameter	f_op	1- $\mu_y$
Batch average	94.44%	2.21%
Sample size	18	18
Total population size	35,185	35,185
Required precision	90%	90%
z-value at 90% confidence	1,64	1,64
Confidence interval (+/-)	9%	6%
Lower bound of the interval	86%	-3%
Higher bound of the interval	103%	8%
Maximum error (precision)	10%	10%
Sample monitoring precision	9%	6%
<b>Conclusion</b>	<b>Precision OK</b>	<b>Precision OK</b>

**(e) Implementation Plan**

The CME and management of the monitoring team coordinate the overall implementation of the monitoring and sampling plan. The monitoring team consists of one monitoring manager and one data manager (cf. section I.7.3 of PoA-DD for their general responsibilities). The implementation plan consists of the following principal steps:

**Step 1:** Selection of all monitoring options at time of CPA inclusion

**Step 2:** Stove distribution and sales agreements

Person in charge: CPA implementer and CME

Cf. section B of PoA-DD.

The CME cross-checks data of at least 1% of monthly signed sales agreements/ registered in the electronic database. According to the *Standard for "Sampling and surveys for CDM project activities*

and programme of activities” this is representative<sup>14</sup>. This step is implemented continuously throughout the crediting period.

**Step 3: Compilation of data into electronic database**

Person in charge: CPA data manager

Cf. section B of PoA-DD.

Two different persons are in charge of recording sales agreements electronically so they can control the quality of each other's work. This step is implemented continuously throughout the implementation plan.

**Step 4: Choice of number of CPAs/PoAs under single sampling plan and number of monitored batches**

Person in charge: CPA implementer in accordance with CME

**Step 5: Sample size calculation including oversampling**

Person in charge: CPA data manager

**Step 6: Sample drawing**

Person in charge: CPA data manager

A sample of distributed ICSs is selected randomly out of the sampling frame per batch for monitoring

$p_{op\_stoves,y}$  (involved in the calculation of  $N_{y,i,j}$ ),  $\mu_y$  and  $\eta_{new,j}$ , respectively.

**Step 7: Data collection**

Person in charge: CPA data manager

The data manager organizes the monitoring campaigns, which includes lists of sampled users with contact details but without the stoves' serial numbers. This way the serial number recorded during the campaign can be matched with records in the electronic database to assess the accuracy of the measurement. The data of sampled users' is collected through surveys, which are filled at the operation site of the stove (a priori, customer's address). Questions to the end-user operationalize the monitored parameters. If required, the survey includes an additional question on the baseline stove to rule out the end-use of certain baseline stoves and verify the baseline of the specific CPA.

To measure the ICS efficiency  $\eta_{new,j}$  the stove is brought to a laboratory and tested as per monitoring specification and QA/QC requirements above.

**Step 8: Consolidation of monitoring results**

Person in charge: CPA data manager

In case of determination of the rate of efficiency drop as per option (c) of AMS-II.G, the degradation of efficiency measured in a representative sample of the first batch of project devices will apply to all subsequent batches. The efficiency of the project devices in the first batch is monitored annually through representative samples and this rate of loss in efficiency will be applied correspondingly to all batches.

**Step 9: Record keeping**

Person in charge: CPA data manager

All monitored data is recorded in hard copy and in the electronic database. All documents, lists and questionnaires produced during monitoring are saved electronically with physical copies securely stored under the direct responsibility of the data manager and the supervision of the monitoring manager. All data is kept and archived electronically for two years after the end of the crediting period or the last issuance of certified emission reductions, whichever occurs later.

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<sup>14</sup> For instance, according to the Standard for “Sampling and surveys for CDM project activities and programme of activities”, for a binary parameter and a sample of 15,000 ICSs with an assume proportion of 95%/5% a sample of 15 ICSs is calculated (section B.7.2). The minimum percentage is therefore  $15/15,000=0.1\%$ . 1% is therefore conservative.

## 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:

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

Where:

- $i$  = Indices for the situation where more than one type of project device is introduced to replace the pre-project devices<sup>15</sup>
- $j$  = Indices for the situation where there is more than one batch of project device
- $ER_y$  = Emission reductions during year  $y$  in t CO<sub>2</sub>e
- $ER_{y,i,j}$  = Emission reductions by project device of type  $i$  and batch  $j$  during year  $y$  in t CO<sub>2</sub>e
- $LE_y$  = 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 ( $f_{NRB}$ ) values available on the CDM website<sup>16</sup>.
- $NCV_{biomass}$  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<sub>2</sub>/TJ
- $N_{y,i,j}$  Number of project devices of type  $i$  and batch  $j$  operating during year  $y$
- $\mu_y$  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

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

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:

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

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)

<sup>15</sup> 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).

<sup>16</sup> Default values endorsed by designated national authorities and approved by the Board are available at <http://cdm.unfccc.int/DNA/fNRB/index.html>

$N_{d,HH}$  = Number of project devices per household (number)

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

### Jiko Matawi stove stove:

Substituting for values for Jiko Matawi stoves in use for 100% of the time over the monitoring period, the calculation results in the below.

	Value	Unit	Source/reference
N	35,185	n/a	Section E.2
$N_{y,i,j}$	33,230	n/a	Section E.2 $N_{y,i,j} = N * pop\_stoves_y$
$\mu_y$	0.9779	fraction	Section E.2
$f_{NRB,y}$	0.8183	fraction	Section E.1
$NCV_{biomass}$	0.0156	TJ/tonne	Section E.2
$EF_{projected\_fossil\ fuel}$	81.6	tCO <sub>2</sub> /TJ	IPCC Guidelines 2006
$B_{y,savings,i,j}$	3.17	tonnes/year	ER calculations $B_{y,savings,i,j} = B_{old,i,j} * (1 - \eta_{old,i,j} / \eta_{new,i,j}) * 0.95$
$B_{old,i,j}$	5.03	tonnes/year	Section E.1
$B_{old,HH}$	5.03	tonnes/HH/year	Section E.1
$N_{d,HH}$	1.0	Personnes/HH	Section E.2
$\eta_{old,i,j}$	10	%	Section E.1
$\eta_{new,i,j}$	29.75	%	Section E.2
Baseline Emissions	1,378	tCO <sub>2</sub> /year	Section F.1, 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 <sub>y</sub> )	0	tCO <sub>2</sub> /year	Section F.2, ER calculations
Leakage emissions (LE <sub>y</sub> )	0	tCO <sub>2</sub> /year	Section E.1, section F.3 Adjustment factor (0.95) already applied at $B_{y,savings,i,j}$ level
Emission reductions	1,378	tCO <sub>2</sub> /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<sup>17</sup>, effective emissions reductions are as follows:

	ER <sub>y</sub> (tCO <sub>2</sub> e)
10/09/2019-15/09/2019	1,378
<b>TOTAL</b>	<b>1,378</b>

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

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

<sup>17</sup> 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 <sub>2</sub> e)	Project GHG emissions or actual net GHG removals (t CO <sub>2</sub> e)	Leakage GHG emissions (t CO <sub>2</sub> e)	GHG emission reductions or net anthropogenic GHG removals (t CO <sub>2</sub> e)		
				Before 01/01/2013	From 01/01/2013	Total amount
0474-P1-0001-CP1	1,378	0	0	-	1,378	1,378
<b>Total</b>	<b>1,378</b>	<b>0</b>	<b>0</b>	<b>-</b>	<b>1,378</b>	<b>1,378</b>

**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 <sub>2</sub> e)	Amount estimated ex ante for this monitoring period in the CPA-DD (t CO <sub>2</sub> e)
0474-P1-0001-CP1	1,378	8,123
<b>Total</b>	<b>1,378</b>	<b>8,123</b>

**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 for 2019 (165,159 tCO<sub>2</sub>e) is divided by the ex ante number of credited days in 2019 (122) divided by the number of days in this monitoring period (6).

**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-DD.

Emission reduction per stove during the monitoring period is 2.38 tCO<sub>2</sub> per year, which compares to 2.61 tCO<sub>2</sub> per year in the ex-ante calculations.<sup>18</sup>

The difference between the estimated and actual, realized emission reductions is mainly due to a higher pre-project device use than expected in the ex-ante calculations.

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

Not applicable. As per section C of the PoA-DD CPAs under this PoA are not limited in size by CPA thresholds.

<sup>18</sup> The ex-ante calculations take account of the ex ante number of credited days in 2019 (122 days) .



## Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	31 May 2019	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with version 02.0 of the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN);</li> <li>• Add a section on remarks on the observance of the scale limit of small-scale CPAs during the crediting periods;</li> <li>• Add "changes specific to afforestation or reforestation activities/CPA" as a possible post-registration changes;</li> <li>• Clarify the reporting of net anthropogenic GHG removals for A/R PoAs between two commitment periods;</li> <li>• Make structural and editorial improvements.</li> </ul>
02.0	7 June 2017	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with version 01.0 of the “CDM project standard for programmes of activities (CDM-EB93-A07-STAN);</li> <li>• Make editorial improvements.</li> </ul>
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