



Monitoring report form for CDM programme of activities
(Version 02.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT

Title of the PoA	CDM Sustainable Energy Programme	
UNFCCC reference number of the PoA	10124	
Version numbers of the PoA-DD applicable to this monitoring report	04	
Version number of this monitoring report	01	
Completion date of this monitoring report	29/11/2017	
Monitoring period number	01	
Duration of this monitoring period	01/05/2016 to 30/04/2017	
Monitoring report number for this monitoring period	01	
Coordinating/managing entity	SEM Fund	
Host Parties	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	Republic of Senegal, Republic of Zambia	Yes
Sectoral scopes	1: Energy Industries (renewable - / non-renewable sources)	
Applied methodologies and standardized baselines	AMS-I.E. ver. 5 - Switch from non-renewable biomass for thermal applications by the user	
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
	0 t CO ₂ e	546.88 t CO ₂ e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs	21,959 t CO ₂ e	

covered in this monitoring report

PART I Monitoring of programme of activities (PoA)

SECTION A. Description of PoA

A.1. General description of PoA

This Small-Scale Programme of Activities involves the promotion, distribution of fuel-efficient improved cook stoves (ICS) and renewable fuelwood in select areas of Senegal and Zambia to displace and reduce the consumption of non-renewable baseline fuelwood in order to decrease CO₂ emissions and contribute to sustainable development.

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
Generic CPA included in version 04 of the PoA-DD. Generic CPA identification or reference number. It will be henceforth be referred to as "Generic CPA version 04"	04	1: Energy Industries (renewable - / non-renewable sources)	AMS-I.E. ver. 5 - Switch from non-renewable biomass for thermal applications by the user

A.1.2. CPAs included in the PoA

Title and UNFCCC reference number of the CPA	Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Crediting period type and duration	Covered in this monitoring report? (yes/no)
CDM Sustainable Energy Project Dakar CPA_SEM01 (10124-0001)	Generic CPA version 04	Version 04	01/05/2016 to 30/04/2023 inclusive.	Yes
CDM Sustainable Energy Project Zambia 1 CPA_SEM02 (10124-0002)	Generic CPA version 04	Version 04	01/05/2016 to 30/04/2023 inclusive.	Yes

A.2. Coordinating/managing entity

The SEM Fund

SECTION B. Implementation of PoA

B.1. Description of implemented PoA

The PoA involves the promotion of improved cooking stoves (ICS) and renewable biomass in order to displace the consumption of non-renewable fuel for cooking and heating water in residential households and to reduce GHG emissions.

An ICS is a single or multi pot portable or in-situ cook stove with a high level of performance and safety, and with thermal efficiency above 21% as evaluated by an independent third party such as nationally or internationally recognized testing centres or those listed on the Global Alliance for

Clean Cookstoves website, as reported in published articles or based on manufacturers specifications.

A variety of ICS models and brands meeting the CME performance requirements can be implemented in the PoA in order to facilitate the switch to renewable biomass fuels in the Host countries. Compared to the prevailing traditional stoves used, the renewable biomass fired ICS included in the PoA are improved stoves that allow quicker heating up, longer cooking and heat retention with less wood fuel used as well as lower harmful emissions. ICS may use a variety of designs/technologies/materials to improve thermal efficiency and combust fuel more completely, such as gasification, rocket stoves, ceramic insulation, and/or refractory metal combustion chambers.

ICS included in this PoA have been tested by nationally accredited laboratories using relevant international standards¹ and have efficiency of no less than 21%, and meet CME eligibility requirements. A number of ICS including the Prime square stove, the Peko Pe stove, the Jambar, and the EcoZoom Jet and Fresh stove have been promoted in CPAs and new varieties may be introduced according to the local context.

B.2. Post-registration changes to PoA

B.2.1. Corrections

Corrections were approved through PRC-10124-001 on 26 May 2016.

B.2.2. Inclusion of monitoring plan

The monitoring plan was approved during the registration of the PoA-DD.

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

N/A

B.2.4. Changes to programme design

N/A

PART II Monitoring of CPAs

SECTION C. Implementation of CPAs

C.1. Description of implemented CPAs

The CPAs included in this monitoring report (10124-0001 and 10124-0002) involve the promotion of improved cooking stoves (ICS) and renewable biomass in order to displace the consumption of non-renewable fuel for cooking and heating water in residential households and to reduce GHG emissions.

¹ Water Boiling Tests

The ICS listed below have been promoted in the two CPAs in this monitoring period and new varieties may be introduced according to the local context. Specifically, the Jambar and Peko Pe design stoves have been distributed in CPA 10124-0001 and the Prime square stove, the Peko Pe design stove, and the EcoZoom stoves have been distributed in CPA 10124-0002. The CME confirmed that before including each ICS model that they conform to the eligibility criteria, i.e. that each are single or multi pot portable or in-situ cook stove with a high level of performance and safety, and with thermal efficiency above 21% as evaluated by an independent third party such as nationally or internationally recognized testing centres or those listed on the Global Alliance for Clean Cookstoves website, as reported in published articles or based on manufacturers specifications.



Figure 1: Prime square stove example

The Prime Square Stove is an energy efficient gasifier biomass stove with combustion chambers designed for chopped wood or pellets/briquettes, with a fire extinguishing system. Its maximum fuel capacity is approximately 1.5 kg of chopped wood and its lifetime is anticipated to be at least two years.

Prime Square Stove technical specifications

Dimensions	Approx. 28cm wide and 32cm tall
Fuel capacity	Up to 1.5kg



Figure 2: Peko Pe Stove example²

The Peko Pe stove is an energy efficient gasifier biomass stove with combustion chamber designed for a variety of small wood types. It utilizes natural draft gasification resulting in high combustion temperatures and complete combustion, and due to its simple form has been produced

² Peko pe stoves distributed utilized the same combustion technologies but had a variety of exterior designs.

locally. Its maximum fuel capacity is approximately 3 kg of chopped wood or pellets and its lifetime is expected to be at least one year.

Peko Pe technical specifications

Dimensions	24 - 50cm wide and 28 – 60 cm tall
Fuel capacity	Approximately 3 - 5kg



Figure 3: EcoZoom Jet example

Two EcoZoom stoves are distributed in programme, the EcoZoom Jet and EcoZoom Fresh. The stoves utilize ceramic insulation and refractory metal combustion chamber to ensure high temperatures for highly efficient and clean combustion of renewable charcoal, and adjustable air flow to control cooking temperatures. The stoves' fuel capacity is less than a third of a kilogram of fuel, and lifetime is expected to be 2 – 3 years.

EcoZoom Fresh and Jet technical specifications

Dimensions	28cm wide and 30cm tall (Jet), 26cm wide and 26cm tall (Fresh)
Fuel capacity	Approximately 200 - 300g



Figure 4: Jambar stove example

The Jambar stove is an ICS with metal cladding surrounding a ceramic liner. The ceramic liner provides the combustion chamber insulation and improves overall efficiency of the ICS. The Jambar is locally manufactured and intended for use with renewable charcoal. The capacity of the stove is approximately 1 – 1.5 kg of charcoal.

Jambar technical specifications

Dimensions	40cm wide and 44cm tall (medium), 44cm wide and 48cm tall (large)
Fuel capacity	Approximately 1 – 1.5 kg

Relevant dates for each SSC-CPA are listed below.

Sales and Registration of ICS

CPA	10124-0001	10124-0002
Date of first ICS sold/registered	30/09/2016	28/04/2014
Date of last ICS sold/registered	30/04/2017	30/04/2017
Total ICS sold/registered (up to 30/04/2017)	483	2824

Monitoring Survey

CPA	10124-0001	10124-0002
Data collection for Ny and Ti,y	Continuous	Continuous
Data collection for other parameters	17/03/2017 to 29/04/2017	06/03/2017 to 07/05/2017

Biomass was sourced from renewable stocks in both CPAs. In CPA 10124-0001 renewable biomass was primarily sourced from the Bande de Filao plantations of *Casuarina Equisitifolia* and processed into chips, as described in the CPA-DD. In CPA 10124-0002 renewable biomass was sourced from sawmill and forest plantation waste wood in the Copperbelt and from a community managed sustainable forest in Chongwe and Rufunsa districts, and biomass was processed into chips or eco-charcoal using improved kilns.

C.2. Location of CPAs

The project boundary is the physical location of ICS included in each CPA in the two Host Countries, Senegal and Zambia. The location of CPA 10124-0001 is in the urban and peri-urban areas of the City of Dakar, Senegal, and the location of CPA 10124-0002 is in urban and peri-urban areas of the City of Lusaka, the capital city of Zambia, and cities in the Copperbelt including Kitwe and Luanshya.

Republic of Senegal



Republic of Zambia



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

A request was submitted to the UNFCCC CDM Secretariat to change the start date to 1 May 2016. The requested changes to the start date are less than two years and the PoA is implemented in least developed countries and therefore according to CDM-EB63-A06-PROC paragraph 128 do not require prior approval by the Board. The changed start date will be the start date of this monitoring period.

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 applied standards or tools

N/A

C.3.6. Changes to project design

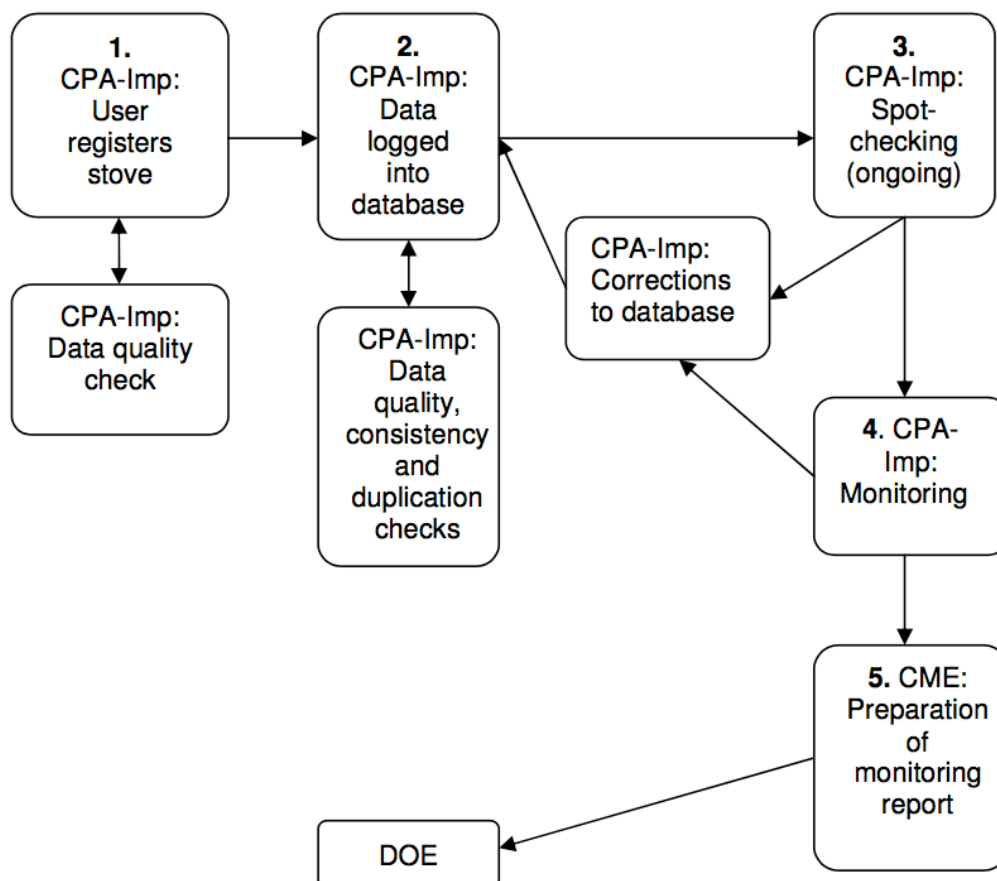
N/A

SECTION D. Description of monitoring system of CPAs

SSC-CPAs 10124-0001 and 10124-0002 apply the same monitoring system. The monitoring system applied involves a number of key elements that ensure that the CME and CPA-Implementer have high-quality, unbiased and reliable information regarding the performance of the project in terms of implementation and outcomes, and for the purposes of calculating Certified

Emission Reductions (CERs) following AMS I.E version 5.0 on the basis of the amount of non-renewable biomass saved in the CPA.

The below flow-chart illustrates the roles and responsibilities of the parties during the implementation of the monitoring plan for the SSC-CPA. In the below flowchart, the CPA implementer is abbreviated to “CPA-Imp”, and can be the CME or another party authorized by the CME.



Below is the description of the above steps on the flow-chart.

- CPA-I: User registers stove:** CPA implementer will collect/receive the necessary information requested on the Registration Card from the user. Means of collecting this information may be through a physical Registration Card filled by CPA-Imp staff, retailers, end-users or partner organization’s staff, or through the use of ICTs or SMS. CPA Implementers’ staff shall double check the accuracy of information provided, and request for field staff additional clarifications if needed;
- CPA-I: Data logged into database:** CPA implementer trained staff will input the data in the database either manually (if data collected from physical Registration Card) or this will be automatically input if data was collected using ICTs or SMS. CPA implementer staff shall double check the information included on the database and check for duplications. Any duplicate information shall be investigated and errors corrected or excluded from the database if it is a true duplicate entry.
- CPA-I: Spot- checking (ongoing):** CPA implementer field staff will randomly select units included in the database and visit or contact the stove users to cross-check the information on the database with the factual evidence in the field. Any inconsistencies found (eg. change in the address of a user) will be updated on the database , and in

the case ICS are found to be no longer in use, they will be clearly marked as such and excluded from emission reductions calculations.

- **CPA-I: Monitoring:** CPA implementer will follow the requirements as per POA-DD to collect the necessary information for a monitoring report.
- **CME: Preparation of monitoring report:** the CPA implementers or the CME will prepare the final monitoring report to be provided to the verifier DOE for verification of emission reductions. A copy of the monitoring report will remain with the CME.

The CME will coordinate and manage each CPA Implementer and assist them in implementing each element of the monitoring plan.

SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

Data / Parameter	$f_{NRB,y}$
Unit	Fraction
Description	Fraction of biomass used in the absence of the project activity in year y that can be established as non-renewable biomass using survey methods
Source of data	National default value for the two Host countries are used.
Value(s) applied	0.81 Zambia 0.85 Senegal
Choice of data or Measurement methods and procedures	National default values.
Purpose of data/parameter	To calculate emission reductions resulting from the displacement of non-renewable biomass.
Additional comment	n/a

Data / Parameter	M
Unit	Tonnes per year
Description	Quantity of woody biomass used in the absence of the project activity in the selected operational areas of each CPA.
Source of data	Independent reports on local usage
Value(s) applied	5.606 (Lusaka, Zambia) 6.066 (Copperbelt, Zambia) 5.103 (Dakar, Senegal)
Choice of data or Measurement methods and procedures	Surveys were carried out on fuelwood (charcoal) usage in the target markets of Lusaka, cities in the Copperbelt Province, and Dakar. The surveys meet the confidence precision required in AMS-I.E version 5.0 and follow the standard and guidelines for sampling and surveys as found in the standard for sampling and surveys EB74 Annex 6 and related guidelines in EB75 Annex 8. To convert from charcoal to woody biomass equivalent the default value of 6 is applied following the recommendation in the IPCC Guidelines.
Purpose of data/parameter	To calculate emission reductions resulting from the displacement of non-renewable biomass.
Additional comment	n/a

Data / Parameter	CAP_{ICS}
Unit	KW _{th}

Description	Installed/rated capacity of ICS model/s in kilowatt equivalent of thermal energy
Source of data	WBT reports from GERES, the Technical University of Denmark, Kenyan Industrial Research and Development Institute.
Value(s) applied	2.9 KW _{th} for Prime square ICS (wood burning chamber) and 0.9 KW _{th} for Peko Pe ICS, 5.0 KW _{th} for Jambar stove, and 3.0 KW _{th} for the EcoZoom Jet stove and 3.4 KW _{th} for the EcoZoom Fresh stove.
Choice of data or Measurement methods and procedures	Data from ICS manufacturer, or from other nationally or internationally recognized testing protocol. A weighted average is used where there is more than one model distributed in the SSC-CPA, the weights determined by the number of units distributed of each model.
Purpose of data	To calculate the total rated capacity of all ICS included in the CPA in order to ensure the small-scale threshold (i.e. 45 MW _{th} per CPA) is not exceeded
Additional comment	n/a

E.2. Data and parameters monitored

Data / Parameter	RB_y				
Unit	Tonnes/ICS/year				
Description	Mass of renewable woody biomass used in project ICS				
Measured/calculated/default	Measured				
Source of data	Monitoring survey				
Value(s) of monitored parameter	CPA	Baseline	CPA Implementer	Model	Value
	10124-0001	Dakar	SEM Fund	Jambar	0.00
	10124-0001	Dakar	SEM Fund	FG Peko Pe	0.935
	10124-0002	Lusaka	VITALITE	Peko Pe	0.360
	10124-0002	Lusaka	VITALITE	Prime	0.434
	10124-0002	Lusaka	VITALITE	VZ Peko Pe	0.330
	10124-0002	Lusaka	VITALITE	EcoZoom Fresh	0.0
	10124-0002	Lusaka	VITALITE	EcoZoom Jet	0.0
	10124-0002	Lusaka	Rainlands	Peko Pe	0.426
	10124-0002	Copperbelt	Rainlands	Peko Pe	0.475
Monitoring equipment	Scales				
Measuring/reading/recording frequency	Annually				
Calculation method (if applicable)	N/A				
QA/QC procedures	<p>$RB_y \leq M_{pt,y}$</p> <p>Monitoring complied with AMS-I.E and the standard for sampling as found in standard for sampling and surveys as found in EB74 Annex 6 and related guidelines in EB75 Annex 8.</p> <p>The 95/10 confidence/precision targets were not met, despite additional sampling, so the (more conservative) lower bound of the confidence interval was used for all of the values listed above.</p>				
Purpose of data	Calculation of baseline emissions.				
Additional comment	n/a				

Data / Parameter	M_{ps, y}
Unit	tonnes/ICS/year
Description	Mass of non-project woody biomass consumed in project ICS

Measured/calculated/default	Measured				
Source of data	Monitoring survey				
Value(s) of monitored parameter	CPA	Baseline	CPA Implementer	Model	Value
	10124-0001	Dakar	SEM Fund	Jambar	3.063
	10124-0001	Dakar	SEM Fund	FG Peko Pe	0.047
	10124-0002	Lusaka	VITALITE	Peko Pe	0.214
	10124-0002	Lusaka	VITALITE	Prime	0.217
	10124-0002	Lusaka	VITALITE	VZ Peko Pe	0.121
	10124-0002	Lusaka	VITALITE	EcoZoom Fresh	1.947
	10124-0002	Lusaka	VITALITE	EcoZoom Jet	2.768
	10124-0002	Lusaka	Rainlands	Peko Pe	0.00
	10124-0002	Copperbelt	Rainlands	Peko Pe	1.725
Monitoring equipment	Scales.				
Measuring/reading/recording frequency	Annually				
Calculation method (if applicable)	N/A				
QA/QC procedures	$M_{ps,y} \leq M_{pt,y}$ Monitoring complied with AMS-I.E and the standard for sampling and surveys as found in EB74 Annex 6 and related guidelines in EB75 Annex 8. The 95/10 confidence/precision targets were not met for the wood stoves listed above, despite additional sampling, so the (more conservative) upper bound of the confidence interval was used for those values listed above.				
Purpose of data	Calculation of emission reductions.				
Additional comment					

Data/Parameter	$M_{pt,y}$				
Unit	Tonnes/ICS/year				
Description	Total mass of woody biomass consumed in project ICS				
Measured/calculated/default	Calculated				
Source of data	Monitored sample observations				
Value(s) of monitored parameter	CPA	Baseline	CPA Implementer	Model	Value
	10124-0001	Dakar	SEM Fund	Jambar	3.063
	10124-0001	Dakar	SEM Fund	FG Peko Pe	0.982
	10124-0002	Lusaka	VITALITE	Peko Pe	0.574
	10124-0002	Lusaka	VITALITE	Prime	0.651
	10124-0002	Lusaka	VITALITE	VZ Peko Pe	0.451
	10124-0002	Lusaka	VITALITE	EcoZoom Fresh	1.974
	10124-0002	Lusaka	VITALITE	EcoZoom Jet	2.768
	10124-0002	Lusaka	Rainlands	Peko Pe	0.426
	10124-0002	Copperbelt	Rainlands	Peko Pe	2.20
Monitoring equipment	Scales				
Measuring/reading/recording frequency	Annually				
Calculation method (if applicable)	$M_{pt,y}$ was calculated from $M_{ps,y}$ and RB_y using the following formula: $M_{pt,y} = M_{ps,y} + RB_y$				
QA/QC procedures	Monitoring of the underlying parameters complied with AMS-I.E (version 5) and the standard for sampling and surveys as found in EB74 Annex 6 and related guidelines in EB75 Annex 8.				

Purpose of data/parameter	Calculation of emission reductions.
Additional comments	

Data/Parameter	$M_{p,y}$				
Unit	Tonnes/stove/year				
Description	Mean woody biomass consumption in baselines stoves amongst ICS users				
Measured/calculated/default	Measured				
Source of data	Monitoring survey				
Value(s) of monitored parameter	CPA	Baseline	CPA Implementer	Model	Value
	10124-0001	Dakar	SEM Fund	Jambar	0.157
	10124-0001	Dakar	SEM Fund	FG Peko Pe	0.747
	10124-0002	Lusaka	VITALITE	Peko Pe	5.683
	10124-0002	Lusaka	VITALITE	Prime	7.181
	10124-0002	Lusaka	VITALITE	VZ Peko Pe	6.650
	10124-0002	Lusaka	VITALITE	EcoZoom Fresh	1.974
	10124-0002	Lusaka	VITALITE	EcoZoom Jet	4.250
	10124-0002	Lusaka	Rainlands	Peko Pe	8.050
10124-0002	Copperbelt	Rainlands	Peko Pe	5.773	
Monitoring equipment	Scales				
Measuring/reading/recording frequency	Annually				
Calculation method (if applicable)	N/A				
QA/QC procedures	Monitoring complied with AMS-I.E and the standard for sampling and surveys as found in EB74 Annex 6 and related guidelines in EB75 Annex 8.				
Purpose of data/parameter	Calculation of emission reductions.				
Additional comments					

Data/Parameter	N _y					
Unit	ICS units sold/distributed					
Description	Total cumulative number of ICS distributed or replaced by an in service appliance					
Measured/calculated/default	Measured					
Source of data	CPA database or contracts					
Value(s) of monitored parameter	CPA	Baseline	CPA Implementer	Model	Value	
	10124-0001	Dakar	SEM Fund	Jambar	113	
	10124-0001	Dakar	SEM Fund	FG Peko Pe	370	
	10124-0002	Lusaka	VITALITE	Peko Pe	469	
	10124-0002	Lusaka	VITALITE	Prime	688	
	10124-0002	Lusaka	VITALITE	VZ Peko Pe	1372	
	10124-0002	Lusaka	VITALITE	EcoZoom Fresh	80	
	10124-0002	Lusaka	VITALITE	EcoZoom Jet	40	
	10124-0002	Lusaka	Rainlands	Peko Pe	82	
	10124-0002	Copperbelt	Rainlands	Peko Pe	93	
Monitoring equipment	N/A					
Measuring/reading/recording frequency	Continuous					
Calculation method (if applicable)	N/A					

QA/QC procedures	Entry of information into the database will be checked to ensure accuracy and to ensure no double entry. CPA Implementer databases will be periodically checked by the CME to count the total number of distributed ICS under the CPA and PoA.
Purpose of data/parameter	Calculation of emission reductions.
Additional comments	

Data/Parameter	n _y					
Unit	Fraction					
Description	Proportion of ICS still operating or replaced by an in service appliance					
Measured/calculated/default	Measured					
Source of data	Monitoring survey					
Value(s) of monitored parameter	CPA	Baseline	CPA Implementer	Model	Value	
	10124-0001	Dakar	SEM Fund	Jambar	87%	
	10124-0001	Dakar	SEM Fund	FG Peko Pe	98%	
	10124-0002	Lusaka	VITALITE	Peko Pe	94%	
	10124-0002	Lusaka	VITALITE	Prime	100%	
	10124-0002	Lusaka	VITALITE	VZ Peko Pe	100%	
	10124-0002	Lusaka	VITALITE	EcoZoom Fresh	100%	
	10124-0002	Lusaka	VITALITE	EcoZoom Jet	100%	
	10124-0002	Lusaka	Rainlands	Peko Pe	100%	
10124-0002	Copperbelt	Rainlands	Peko Pe	100%		
Monitoring equipment	Survey questionnaire					
Measuring/reading/recording frequency	Annually					
Calculation method (if applicable)	N/A					
QA/QC procedures	0 ≤ n _y ≤ 1 Monitoring complied with AMS-I.E and the standard for sampling and surveys as found in EB74 Annex 6 and related guidelines in EB75 Annex 8.					
Purpose of data/parameter	Calculation of emission reductions.					
Additional comments	n/a					

Data/Parameter	$T_{i,y}$
Unit	Fraction
Description	Fraction of monitoring period that ICS i was installed and in operation (represented in years)
Measured/calculated/default	Calculated
Source of data	CPA database and length of monitoring period
Value(s) of monitored parameter	Actual values are unique for each ICS. Average for 10124-0001: 0.29 Average for 10124-0002: 0.74
Monitoring equipment	N/A
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	The fraction is calculated by dividing the number of days the ICS was in operation in the monitoring period by 365.
QA/QC procedures	Database records are checked for accuracy
Purpose of data/parameter	Calculation of emission reductions.

E.3. Implementation of sampling plan

A single sampling plan was conducted during the monitoring period covering both CPA 10124-0001 and CPA 10124-0002. The monitoring survey was conducted from March – May 2017 in Zambia and Senegal. The survey confirmed usage of the ICS and measured the following monitored parameters from each surveyed ICS user household:

- a) Continued consumption of woody biomass (charcoal) in baseline stove, $M_{p,y}$*
- b) Consumption of non-project woody biomass in ICS, $M_{ps,y}$*
- c) Consumption of renewable woody biomass in ICS, RB_y*

Total woody biomass consumption in ICS ($M_{pt,y}$) was calculated using parameters (b) and (c) above. Other monitored parameters are drawn from the CPA databases.

The sampling design for the survey is summarized below:

- Objectives and reliability requirements: The objective is to determine the values of monitored parameters with a 95% confidence and 10% precision.
- Target population: The target population is ICS user households participating in the PoA.
- Sampling method: A stratified random sampling is applied wherein strata are defined by Host country, baseline, CPA implementer and ICS model.
- Sample size: The sample size is first calculated from estimates of the likely mean value and standard deviation of the parameters.
- Sampling frame: The ICS were selected randomly from the CPA database of ICS users who purchased their stoves on or before the end of the monitoring period.

Samples were selected randomly from the ICS user database by defining the sampling interval needed to meet the sample size and using excel random number generator “RAND” to determine a random starting point.

Data collected during the survey include name, location, gender and contact information of respondents, GPS coordinates of survey location, mass measurements of each monitored parameter and other details. The data was collected using the OpenDataKit mobile phone survey package, and analyzed using statistical software. The collected data was computed and analyzed using Stata statistical software to obtain values for each parameter. At the end of the first phase, the sample size was recalculated with the new values to determine whether the 95/10 confidence precision target was met. Additional respondents were surveyed with the objective of reaching the 95/10 confidence/precision for each parameter. Where the confidence/precision could not be met, the lower bound (or upper bound according to the more conservative approach) value has been used in ER calculations.

SECTION F. Calculation of emission reductions or net anthropogenic removals

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

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The methodology applied AMS-I.E Version 05 “Switch from non-renewable biomass for thermal applications by the user” does not calculate baseline and project emissions separately. Emission reductions are calculated directly using the following equations (as per the registered PoA-DD):

- a) Formulas for emission reductions

$$ER_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossilfuel} \quad (1)$$

Where:

ER_y	Emission reductions during the year y in tCO ₂ e
B_y	Quantity of woody biomass that is substituted or displaced in tonnes
$f_{NRB,y}$	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non renewable biomass using survey methods, government data, or approved default country specific fractions of non-renewable biomass (f_{NRB}) values available on the UNFCCC-CDM website.
$NCV_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)
$EF_{projected_fossilfuel}$	Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO ₂ /TJ ³

Determination of B_y under option 6(a) of AMS-I.E

$$B_y = (M - M_{p,y} - M_{ps,y}) * N_{operational,y} * L \quad (2)$$

Where

M	Mean woody biomass consumption in the absence of the project (baseline) determined from a survey or historical data (tonnes/stove/year)
$M_{p,y}$	Mean woody biomass consumption in baselines stoves in year y amongst ICS users (tonnes/stove/year)
$M_{ps,y}$	Mean non project woody biomass consumed in the project ICS in year y (tonnes/stove/year)
$N_{operational,y}$	Number of ICS operational or replaced by an equivalent in-service ICS in year y
L	Leakage, a value of 0.95 will be used as per AMS-I.E clause 18 (c)

Determination of $N_{operational,y}$

$$N_{operational,y} = n_y * \sum_{i=1}^{N_y} T_{i,y}$$

Where

N_y	Total cumulative number of ICS distributed or replaced by an in service ICS up to and including year y
n_y	Proportion of ICS operational or replaced by an in service ICS in year y
$T_{i,y}$	Fraction of time in year y that ICS i was installed/owned by user

b) Calculation of emission reductions⁴

Step 1: Calculating $N_{operational,y}$

³ 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 tCO₂/TJ) and a 25% weight is assigned to both liquid and gaseous fuels (71.5 tCO₂/TJ for kerosene and 63.0 tCO₂/TJ for Liquefied Petroleum Gas (LPG)).

⁴ Some rounding errors are present in these tables, actual calculations undertaken without rounding in excel.

$$N_{operational,y} = n_y * \sum_{i=1}^{N_y} T_{i,y}$$

	CPA	10124-0001		10124-0002						
	Strata	1	2	3	4	5	6	7	8	9
Parameter	Step	-	-	-	-	-	-	-	-	-
$\sum_{i=1}^{N_y} T_{i,y}$	A	22.51	117.27	440.85	687.50	758.94	26.36	12.57	81.86	91.49
n_y	B	87%	98%	94%	100%	100%	100%	100%	100%	100%
$N_{operational,y}$	C = A*B	19.59	114.92	413.96	687.50	758.94	26.36	12.57	81.86	91.49

Step 2: Calculating B_y

$$B_y = (M - M_{p,y} - M_{ps,y}) * N_{operational,y} * L$$

	CPA	10124-0001		10124-0002						
	Strata	1	2	3	4	5	6	7	8	9
Parameter	Step	-	-	-	-	-	-	-	-	-
M	A	5.103	5.103	5.606	5.606	5.606	5.606	5.606	5.606	6.066
$M_{p,y}$	B	0.157	0.747	5.683	7.181	6.650	1.974	4.250	8.050	5.773
$M_{ps,y}$	C	3.063	0.047	0.214	0.217	0.121	1.947	2.768	0.000	1.725
$(M - M_{p,y} - M_{ps,y})$	D=A-B-C	1.883	4.309	-0.291	-1.791	-1.164	1.685	1.412	-2.444	-1.432
$N_{operational,y}$	E	19.59	114.92	413.96	687.50	758.94	26.36	12.57	81.86	91.49
L	F	.95	.95	.95	.95	.95	.95	.95	.95	.95
B_y	G=D*E*F	35.03	470.40	114.28	1169.96	839.49	42.21	16.86	190.03	124.43

Step 3: Calculating ER_y

$$ER_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossilfuel}$$

	CPA	10124-0001		10124-0002						
	Strata	1	2	3	4	5	6	7	8	9
Parameter	Step	-	-	-	-	-	-	-	-	-
B_y	A	35.03	470.40	-114.28	-1169.96	-839.49	42.21	-16.86	190.03	-124.43
$f_{NRB,y}$	B	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
$NCV_{biomass}$	C	0.0156	0.0156	0.0156	0.0156	0.0156	0.0156	0.0156	0.0156	0.0156
$EF_{projected_fossilfuel}$	D	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
ER_y	E=A*B*C*D	37.90	508.98	-117.83	-1206.35	-865.6	43.52	-17.38	195.94	-128.3
ER per CPA*	Max(0, $\sum ER$) by CPA	546.88		0						

*Bounded below at 0

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

N/A

F.3. Calculation of leakage emissions

N/A

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

CPA UNFCCC reference number	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)		
				Before 01/01/2013	From 01/01/2013	Total amount
10124-0001	575.67	0	28.78	0	546.88	546.88
10124-0002	0	0	0	0	0	0
Total	575.67	0	28.78	0	546.88	546.88

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 ₂ e)	Amount estimated ex ante (t CO ₂ e)
10124-0001	546.88	5,078
10124-0002	0	16,881
Total	546.88	21,959

F.6. Remarks on increase in achieved emission reductions

The emission reductions achieved in the monitoring period are lower than the value estimated in ex-ante calculations. The lower figures achieved are a consequence of the lower ICS in operation during the monitoring period and the shorter period ICS were in operation in the monitoring period due to the fact that many were not installed at the start of the monitoring period. Additionally, due to the semi-commercial basis of ICS sales, there is likely to be a self-selection process that results in differences in socio-economic or other characteristics between ICS customers and the total population of households in the target areas (such as having larger families and hence larger fuel consumption) from which the baseline was sampled.