



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

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

MONITORING REPORT

Title of the PoA	KOKO Kenya - Ethanol Cookstoves Program	
UNFCCC reference number of the PoA	PoA 10476	
Version numbers of the PoA-DD applicable to this monitoring report	Version 05	
Version number of this monitoring report	Version 06	
Completion date of this monitoring report	15/06/2020	
Monitoring period number	01	
Duration of this monitoring period	23/10/2019 to 31/12/2019 (both days included)	
Monitoring report number for this monitoring period	01	
Coordinating/managing entity	KOKO Networks Limited	
Host Parties	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	Kenya	Yes
Applied methodologies and standardized baselines	AMS-I.E. Version 09.0 - "Switch from non-renewable biomass for thermal applications by the user"	
Sectoral scopes	01	
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	2,319 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 covered in this monitoring report	29,929 t CO ₂ e	

PART I Monitoring of programme of activities (PoA)

SECTION A. Description of PoA

A.1. General description of PoA

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This small-scale Programme of Activities (PoA) is promoting widespread commercial use of bioethanol in Kenya as clean cooking fuel by effective use of efficient cooking technologies in low-income households as well as institutions including small-scale industries and commercial set ups like catering services, street food outlets and restaurants. The operations of the PoA has resulted in reduction of carbon-dioxide emissions to the atmosphere caused by consumption of non-renewable fuelwood and charcoal and prevention of associated deforestation, thereby contributing towards climate change mitigation.

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
CPA-00xx: KOKO Kenya - Ethanol Cookstoves Program Generic CPA#0001	05	01	AMS-I.E. Version 09.0 - "Switch from non-renewable biomass for thermal applications by the user" https://cdm.unfccc.int/filestorage/Q/W/J/QWJA0G7VOXCS4UPELMYN9HFDI3TZ85/EB100_repan10_AMS-I.E.pdf?t=NXZ8cThmem5yDCFuLL_QqAh68lgY4-m0cr

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)
CPA-0001: KOKO Kenya - Ethanol Cookstoves Program Version 4.0 (10476-P1-0001-CP1)	05	CPA-00xx: KOKO Kenya - Ethanol Cookstoves Program Generic CPA#0001	Fixed (23/10/2019 to 22/10/2029 – both inclusive)	Yes

A.2. Coordinating/managing entity

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KOKO Networks Limited

SECTION B. Implementation of PoA

B.1. Description of implemented PoA

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The PoA implementation includes procurement, distribution, installation and maintenance of clean fuel bioethanol modern cookstoves. KOKO provides a digital platform to consumers by leveraging an agent network to provide convenient and affordable access to cookstove kits and bio-ethanol fuel.

"KOKO Cooker" stove kit consists of a two-burner stove and a durable 'smart' canister equipped with an NFC chip that enables tracking of customer fuel purchases. To create affordable and reliable access to bio-ethanol as clean cooking fuel, KOKO has developed first-of-its-kind technology to lower distribution costs by launching a network of cloud-connected "KOKOpoinT" fuel ATMs across Kenya, which enable customers to refill their smart canisters in local retail corner stores. Customers

can buy their KOKO Cookers through ordering on the KOKOpoint tablet screen, via the myKOKO mobile app, or from a network of field sales promoters.

The procurement of the cookstoves for the PoA complies with the national regulation on ethanol cookstoves – “Ethanol Fuelled Cooking Appliances Specifications”¹. The PoA has currently included model “KOKO Cooker” in its distribution chain and may further introduce new cookstove models based on customers needs. The detailed specification of KOKO Cooker are as follows:

Description	2-burner Bio-ethanol stove
Model Name	KOKO Cooker
Fuel Denatured	Bio-ethanol Cooking Fuel
Firepower	2100 Watts on MAX flame setting
Overall Efficiency	60% (energy content of fuel transferred to contents of pot; as defined by ISO WBT methodology)
Fuel Capacity	2.4 Litres fuel capacity within stove
Expected Service Life	10 years with routine annual maintenance

B.2. Post-registration changes to PoA

B.2.1. Corrections

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Not Applicable

B.2.2. Inclusion of monitoring plan

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Not Applicable

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

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Not Applicable

B.2.4. Changes to programme design

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Not Applicable

B.2.5. Changes specific to afforestation or reforestation activities

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Not Applicable

PART II Monitoring of CPAs

SECTION C. Implementation of CPAs

C.1. Description of implemented CPAs

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¹

Kenya Standard: Ethanol fueled cooking appliances – Specification (KS 2759:2018 – ICS 97.040.20)

CPA-0001 has been included in this monitoring report which is the only CPA of this PoA. The CPA involves distribution of bio-ethanol fuel cookstoves and promote its use for cooking purposes in households and institutions falling in the SME category in Kenya.

CPA-0001 has been under implementation with development of fuel supply network in and around Greater Nairobi Region in Kenya. The launch of network and sale of cookstoves initiated in April-May 2019. Till the end of this monitoring period, 9,630 cookstoves (KOKO Cooker) are distributed in households and SMEs (food outlets locally referred as “Kibandas”) under this CPA through the network of KOKOagents with the following break up:

Type of Customers	Number of cookstoves distributed
Households	9421
SMEs (Kibandas)	209

The total of 624 KOKOpoints have already been installed and operational out of 700 planned in the Greater Nairobi region, thereby ensuring smooth supply of fuel to all the registered users. The adequate fuel supply to all KOKOpoints is ensured by CME's fuel partner Vivo Energy, a licensee company of Royal Dutch Shell PLC, which is procuring locally produced bio-ethanol from Sugar refineries. The complete fuel supply logistics is enabled through long term supply contracts with each stakeholder in the value chain. The expected time of completion for phase 1 of the CPA, comprising of approximately 42,000 cookstoves, is June 2021.

ECOEYE Co., Ltd. has provided for all implementation costs for the CPA. The funds from ECOEYE Co., Ltd. have been utilized to make the KOKO Cooker affordable to low-income households, as well as for the operation & maintenance costs of the ethanol cookstove supply chain. The funds for implementation of this CPA are managed by the CME who is also the CPA implementer for this CPA.

C.2. Location of CPAs

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The geographical boundary for the CPA-0001 is defined by the geographical boundary of the country “Republic of Kenya”.



Geo-Coordinates of Kenya

Southern-most point of Kenya	4°38'47.4"S 39°12'31.6"E
Western-most point of Kenya	0°06'58.9"N 33°57'35.3"E
Eastern-most point of Kenya	3°55'51.6"N 41°51'59.9"E

Northern-most point of Kenya	4°28'42.5"N 35°52'31.8"E
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C.3. Post-registration changes to CPAs**C.3.1. Temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies, standardized baselines or other methodological regulatory documents**

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Not Applicable

C.3.2. Corrections

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Not Applicable

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

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Not Applicable

C.3.4. Inclusion of monitoring plan

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Not Applicable

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

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Not Applicable

C.3.6. Changes to project design

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Not Applicable

C.3.7. Changes specific to afforestation or reforestation CPA

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Not Applicable

SECTION D. Description of monitoring system of CPAs

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The monitoring system, applied by the PoA, involves a number of key elements that ensure that the CME has 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 9.0 on the basis of the amount of non-renewable biomass saved in the CPA.

The monitoring system for the PoA is designed in accordance with the requirements of the applied methodology – AMS-I.E. Version 9. The fixed and the monitoring parameters of the CPA for this monitoring period are discussed in section E.1 and E.2 respectively.

The below flow-chart illustrates the data collection and quality control processes followed during the implementation of the CPA for emission reduction monitoring. All processes are directly controlled by the CME.

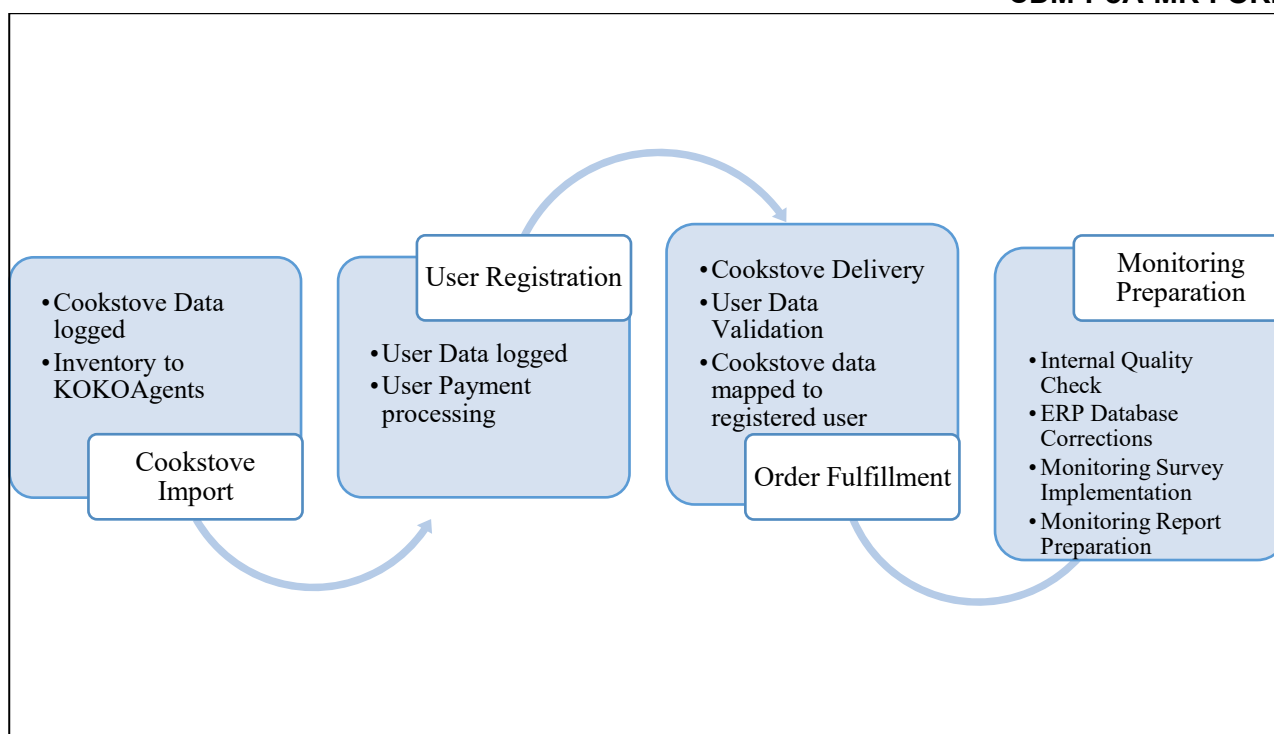


Fig 1: CDM Monitoring System implemented by KOKO Networks

Cookstove Import: The cookstoves (KOKO Cooker) are manufactured in India and imported in Kenya for distribution under the PoA. Then, the cookstove information, including manufacturing details, Serial numbers of all components and Near Field Communication (NFC) tracking IDs are imported in the Enterprise Resource Planning (ERP) database maintained by the CME. After validation of import consignment, the cookstove inventory is distributed to KOKOAgents for delivery to users.

User Registration: The user information is collected through online registration via KOKO mobile app. The collected user information is automatically transferred to ERP Database. Once the complete payment for cookstove kit is processed by the user, then order fulfillment instructions are released by the CME.

Order Fulfillment: The cookstove kit is delivered to the user from the nearby KOKOAgent. The customer care team of the CME conducts data validation of the user information and relays it to the CME operation team. On successful order fulfillment and data validation, the ERP System is updated to map the user credentials with the cookstove data.

Monitoring Preparation: The CME CDM Team conducts the quality checks of the processes implemented and the data collected for the purposes of CDM monitoring. In case of any discrepancy identified in the database, corrective actions are taken to remove discrepancy. Based on the ERP database, CME conducts the sampling based CDM monitoring survey to collect monitoring data related to operations of the cookstoves. The survey is conducted in accordance with relevant CDM guidelines related to sampling and surveys. The details of survey conducted for this monitoring period are included in section E.3 below. Based on the ERP database and survey results, CDM monitoring report and ER calculations are performed for initiating CDM verification.

SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

Parameter 1

Data/Parameter	$f_{NRB,y}$ or f_{NRB}
Unit	Fraction or %
Description	Fraction of woody biomass saved by the project activity during year y that can be established as non-renewable biomass
Source of data	The value of the parameter is determined using Option 1 of the registered PoA-DD, i.e. Country specific default values suggested by the CDM EB / DNA along with calculation of f_{NRB} value in accordance with Tool 30.
Value(s) applied	0.915
Choice of data or measurement methods and procedures	The value of 0.92 (included in CPA-DD) was endorsed by the Kenyan DNA. The value was also published as the default f_{NRB} value for Kenya on UNFCCC website till 18 th September 2017. In accordance with the option 3 of the registered PoA-DD, the appropriateness of value has been demonstrated by applying Tool 30: Calculation of the fraction of non-renewable biomass. The resultant value came out to be 0.915 which was more conservative and hence replaced the original value of 0.92 reported in CPA-DD.
Purpose of data/parameter	Used for calculation of baseline emissions
Additional comments	Fixed ex-ante at CPA level. Assessments, information and results established in initial CPA may be used in subsequent CPAs in lieu of conducting fresh assessments at each CPA level in absence of new data.

Parameter 2

Data/Parameter	$NCV_{biomass}$
Unit	TJ/tonne
Description	Net calorific value of biomass displaced by the project activity
Source of data	The net calorific value of wood & charcoal is as given in 2006 IPCC Guidelines Reference: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html
Value(s) applied	Wood: 0.0156 Charcoal: 0.0295
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Used for calculation of baseline emissions
Additional comments	The parameter values are fixed ex-ante at PoA level.

Parameter 3

Data/Parameter	$EF_{projected}$
Unit	Tonnes CO ₂ / TJ
Description	Emission factor for the substitution of non-renewable woody biomass by similar consumers
Source of data	AMS-I.E. Version 9, equation (1)
Value(s) applied	63.7
Choice of data or measurement methods and procedures	Default value as per applied methodology

Purpose of data/parameter	Used for calculation of baseline emissions
Additional comments	The parameter value is fixed ex-ante at PoA level.

Parameter 4

Data/Parameter	LAF_y
Unit	Fraction
Description	Leakage Adjustment Factor
Source of data	AMS-I.E. Version 9, equation (1)
Value(s) applied	0.95
Choice of data or measurement methods and procedures	Default value as per paragraph (24) of applied methodology
Purpose of data/parameter	Used for calculation of baseline emissions
Additional comments	The parameter value is fixed ex-ante at PoA level.

Parameter 5

Data/Parameter	$BC_{BL,PP,y}$
Unit	tonnes/person/year
Description	Average annual consumption of woody biomass per person before the start of the project activity
Source of data	<p>The average annual consumption is determined ex ante the following option (as provisioned in PoA-DD) and remains fixed during the crediting period:</p> <p>(a) Calculated based on historical data or published reports from reputed sources</p> <p>The household fuel consumption data for Kenya is extracted from publicly available report on Economic Survey 2018 by Kenya national Bureau of Statistics. The complete calculations for the parameter are provided in Excel-sheet "ER Calculation Sheet – CPA0001".</p>
Value(s) applied	0.93
Choice of data or measurement methods and procedures	A baseline national average value of woody biomass consumption per person is estimated using the above source of data. The historical survey data available from the source is the most recent data, representative of the population of Kenya and hence used for estimation of the ex-ante value.
Purpose of data/parameter	Used for Calculation of baseline emissions
Additional comments	<p>Fixed ex-ante at CPA level.</p> <p>Assessments, information and results established in initial CPA may be used in subsequent CPAs in lieu of conducting fresh assessments at each CPA level in absence of new data.</p>

Parameter 6

Data/Parameter	$N_{p,HH}$
Unit	Persons per household
Description	Average number of persons served per household prior to the project Implementation
Source of data	<p>Average household size in Kenya in 2016</p> <p>http://www.arcgis.com/home/item.html?id=d8c1d70fbb2d49028e0713d425b26805</p>
Value(s) applied	4.4
Choice of data or measurement methods and procedures	As per registered CPA-DD

Purpose of data/parameter	Used for calculation of baseline emissions
Additional comments	Fixed ex-ante at CPA level. The parameter value determined in this CPA will be used in subsequent CPAs in lieu of conducting fresh assessments at each CPA level.

Parameter 7

Data/Parameter	EF_{bioethanol_production}
Unit	g CO ₂ /Litre of Bioethanol
Description	Project Emission Factor for production of bioethanol
Source of data	Published Life Cycle Assessment Report “Lifecycle Greenhouse Gas Emissions and Energy Balances of Sugarcane Molasses-Based Bioethanol in Kenya” ²
Value(s) applied	8.73
Choice of data or measurement methods and procedures	The emissions associated with production of bioethanol which can be attributed to bioethanol are accounted in this emission factor.
Purpose of data/parameter	Calculation of project emissions due to bioethanol production
Additional comments	No comments

Parameter 8

Data/Parameter	η_{Eth}
Unit	%
Description	Efficiency of bioethanol KOKO Cooker
Source of data	Manufacturer’s Specification of Cookstove
Value(s) applied	60
Choice of data or measurement methods and procedures	Efficiency of KOKO Cooker as per the standard tests protocols for cookstove efficiency.
Purpose of data/parameter	Calculation of baseline emissions for SME
Additional comments	No comments

Parameter 9

Data/Parameter	EF_{EF,j,y}
Unit	t CO ₂ /MWh
Description	Emission factor for electricity generation for source j in year y
Source of data	Option A.2 (a) of tool 5: Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation Version 03.0
Value(s) applied	1.3
Choice of data or measurement methods and procedures	As per point (i) of Option A.2 of tool 5: Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation Version 03.0, the default value for Emission Factor can be applied to project and/or leakage electricity consumption sources but not to baseline electricity consumption sources. Therefore, the default value is used to calculate project emissions associated with electricity consumption at KOKO points in the PoA.
Purpose of data/parameter	Calculation of Project Emissions
Additional comments	No Comments

² Detailed calculations presented in Excel-sheet “ER Calculation Sheet – CPA0001”

Parameter 10

Data/Parameter	$TDL_{j,y}$
Unit	%
Description	Average technical transmission and distribution losses for providing electricity to source j in year y
Source of data	Tool 5: Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation Version 03.0
Value(s) applied	20
Choice of data or measurement methods and procedures	The default value is applied in accordance with the provisions under Data/Parameter Table 3 of Tool 5: Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation Version 03.0. The default value for Emission Factor can be applied to project and/or leakage electricity consumption sources but not to baseline electricity consumption sources. Therefore, the default value is used to calculate project emissions associated with electricity consumption at KOKOpoints in the PoA.
Purpose of data/parameter	Calculation of Project Emissions
Additional comments	This parameter is not included as monitoring parameter as default value is used which does not require periodic monitoring.

Parameter 11

Data/Parameter	$\eta_{old,i}$
Unit	%
Description	Efficiency of baseline appliance being replaced
Source of data	Default value as per the applicable methodology
Value(s) applied	20
Choice of data or measurement methods and procedures	<p>Efficiency of pre - project device is calculated by the following approach:</p> <p>(i) Default Approach: Efficiency of 0.1 will be used for 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 all other types of devices, a default value of 0.2 will be used. As per applied methodology, weighted-average values (taking the 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 in a SME</p> <p>It is observed in Kenya that most of the SMEs (Kibandas) are using improved cookstoves or improvised traditional cookstoves owing to higher efficiency than the traditional 3-stone cookstoves. Hence, 20% default value is used for all cookstoves replaced in SMEs.</p> <p>The value is calculated at the time of 1st CPA inclusion and will be applied across all CPAs.</p>
Purpose of data/parameter	Calculation of baseline emissions for SME
Additional comments	No comments

Parameter 12

Data/Parameter	$EF_{CO_2,f}$
Unit	g CO ₂ /t km
Description	Default CO ₂ emission factor for freight transportation activity f
Source of data	Tool 12 "Methodological tool: Project and leakage emissions from transportation of freight"

Value(s) applied	Light Vehicle: 245 Heavy Vehicle: 145
Choice of data or measurement methods and procedures	The type of vehicle used for transportation will be recorded and appropriate emission factor for the vehicle type will be applied.
Purpose of data/parameter	Calculation of transportation emissions
Additional comments	In case of unavailability of the vehicle category, conservative emission factor of Light Vehicle will be used.

E.2. Data and parameters monitored

Parameter 1

Data/Parameter	D_i, Date of commissioning of project device i
Unit	Date
Description	Actual date of commissioning of project device
Measured/calculated/default	Measured
Source of data	Sales Database
Value(s) of monitored parameter	Month-wise summary of cookstove distribution is provided in "DB Summary" worksheet of ER calculations. The complete sales database for all customers is provided to verification team.
Monitoring equipment	Digital Logs
Measuring/reading/recording frequency	Recorded at the time of selling of project devices
Calculation method (if applicable)	Each sale is recorded in sales database along with the name of recipient, usage type, location of household (Neighbourhood, district etc)
QA/QC procedures	The information is recorded electronically through a robust registration process and archived on cloud system. Periodic backup of the complete database is automatically taken by the system.
Purpose of data/parameter	Used for calculating $\text{Stove}_{\text{Year}(i)}$, fraction of year(s) the cookstove i was operational during the monitoring period which is applied for baseline emission calculation $\text{Stove}_{\text{Year}(i)} = \text{Maximum of } \{ (\text{End-Date of Monitoring Period} - D_i, \text{Date of Commissioning of Project Device}) \text{ AND } (\text{End-Date of Monitoring Period} - \text{Start-Date of Monitoring Period}) \} / 365$
Additional comments	To account for the potential non-operational days during the Christmas festive season, the total Stove years calculated for each user type are multiplied by the Stove Year correction Factor (0.7857) which is determined by deducting the 15 days of festive season from the total number of monitoring days and dividing it by the number of monitoring days (please refer to "DB Summary Sheet" in ER Calculation Workbook). This is conservative as this one-time correction factor will lead to lower emission reductions for the monitoring period. The database has recorded the commissioning date as the date of fulfillment.

Parameter 2

Data/Parameter	N_{HH}
Unit	Number
Description	Number of project devices in households of type i and batch j operating during year y
Measured/calculated/default	Measured
Source of data	Sales database and monitoring survey

Value(s) of monitored parameter	9421
Monitoring equipment	-
Measuring/reading/recording frequency	At least once every two years (biennial)
Calculation method (if applicable)	CME maintains online database of all stoves sold along with its usage. The information will be cross-checked during project monitoring surveys for the sample cookstoves. The proportion of operating cookstoves is determined statistically through the monitoring surveys. The number of operating cookstoves in households are determined by multiplying the total sales of cookstoves under each type with the proportion of operating cookstoves of each type estimated through the monitoring survey. 100% of the sample cookstoves from households were found operational.
QA/QC procedures	A 95 /10 confidence / margin of error shall be achieved for the sampling parameter irrespective of annual / biennial monitoring frequency as per para 22 of Standard: Sampling and surveys for CDM project activities and programmes of activities, Version 08.0 In the case the desired precision is not met, lower bound values shall be used against repeating the survey to determine the operational fraction of stoves.
Purpose of data/parameter	Used for calculation of baseline emissions for households
Additional comments	Left Blank

Parameter 3

Data/Parameter	BC_{PJ,PP,y}
Unit	Tonnes/person/year
Description	Average annual consumption of woody biomass in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent in the households
Measured/calculated/default	Measured
Source of data	Project Monitoring Survey for households
Value(s) of monitored parameter	0.0865
Monitoring equipment	Household Project Survey
Measuring/reading/recording frequency	At least once every two years (biennial)
Calculation method (if applicable)	A 95 /10 confidence / margin of error shall be achieved for the sampling parameter irrespective of annual / biennial monitoring frequency as per para 22 of Standard: Sampling and surveys for CDM project activities and programmes of activities, Version 08.0. In the case the desired precision is not met, lower bound values shall be used against repeating the survey to determine the operational fraction of stoves. The mean value from the survey results was found to be having high confidence and reliable precision, hence was accepted.
QA/QC procedures	The Guidelines for Sampling and Surveys will be referred to adopt the best practices for conducting the surveys.
Purpose of data/parameter	Used for calculation of baseline emissions
Additional comments	NA

Parameter 4

Data/Parameter	Q_{HH,Eth} and Q_{SME,Eth}
Unit	Litres/day

Description	Average daily consumption of bioethanol in a project cookstove (KOKO cooker) distributed to Households and SMEs (Kibandas)
Measured/calculated/default	Measured
Source of data	Project Survey
Value(s) of monitored parameter	Average daily consumption of bioethanol in project households: 0.54 Average daily consumption of bioethanol in project SMEs (Kibandas): 1.27
Monitoring equipment	Project Survey
Measuring/reading/recording frequency	At least once every two years (biennial)
Calculation method (if applicable)	A 95 /10 confidence / margin of error is achieved for the sampling Parameter during the monitoring period: as per Sampling and surveys for CDM project activities and programmes of activities, Version 08.0. In the case the desired precision is not met, lower bound values are used against repeating the survey to determine the operational fraction of stoves. The mean value from the survey results was found to be having high confidence and reliable precision, hence was accepted. The mean values for both customer type was used to calculate total supply quantity of bioethanol which was in turn used to calculate project emissions due to production of bioethanol.
QA/QC procedures	The Guidelines for Sampling and Surveys is referred to adopt the best practices for conducting the surveys.
Purpose of data/parameter	Calculation of Baseline Emissions for SMEs
Additional comments	No Comments

Parameter 5

Data/Parameter	N_{i,j}
Unit	Number
Description	Number of project devices of type i and batch j operating in institutions during year y
Measured/calculated/default	Measured
Source of data	Sales database and project monitoring survey of institutions
Value(s) of monitored parameter	209
Monitoring equipment	Project Survey
Measuring/reading/recording frequency	At least once every two years (biennial)
Calculation method (if applicable)	CME maintains online database of all stoves sold along with its usage (household/SME). The information will be cross-checked during project monitoring surveys for the sample cookstoves. The proportion of operating cookstoves will be determined statistically through the monitoring surveys in institutions/SME. The number of operating cookstoves of each type will be determined by multiplying the total sales of cookstoves under each type with the proportion of operating cookstoves of each type estimated through the monitoring survey. 100% of the sample cookstoves under SME (Kibandas) were found operational.
QA/QC procedures	A 95 /10 confidence / margin of error shall be achieved for the sampling parameter irrespective of annual / biennial monitoring frequency as per para 22 of Standard: Sampling and surveys for CDM project activities and programmes of activities, Version 08.0 In the case the desired precision is not met, lower bound values shall be used against repeating the survey to determine the operational fraction of stoves.

Purpose of data/parameter	Used for calculation of baseline emissions
Additional comments	All the cookstoves were distributed to Kibandas (Food Outlet) under SME customer type.

Parameter 6

Data/Parameter	N_{KP,y}
Unit	Number
Description	Number of KOKOp points operating during year y
Measured/calculated/default	Measured
Source of data	Database of installed KOKOp points under operations
Value(s) of monitored parameter	624
Monitoring equipment	KOKOp point Installation Logbook
Measuring/reading/recording frequency	Continuous
Calculation method (if applicable)	A real-time database is maintained to keep record of all operational KOKOp points. All KOKOp points are connected to internet and hence will be monitored for operational status online.
QA/QC procedures	As the database will be generated from online monitoring, it will be highly reliable and does not require further review. The technical support team will ensure that each of the non-operational KOKOp point is attended in a timely manner. Any discrepancy in the actual status and database will be highlighted by the technical team at the earliest.
Purpose of data/parameter	Calculation of project emissions due to electricity consumption at KOKOp points.
Additional comments	No Comments

Parameter 7

Data/Parameter	NCV_{i,biomass}		
Unit	TJ/tonne		
Description	Net calorific value of the fuel type "i" used in project scenario including non-renewable woody biomass, charcoal or renewable bio-ethanol.		
Measured/calculated/Default	Default		
Source of data	IPCC Guidelines for National Greenhouse Gas Inventories 2006 https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf		
Value(s) of monitored parameter	Notation	Fuel Type "i"	Default NCV Value (TJ/tonne)
	NCV _{Wood,Biomass}	Wood Fuel	0.0156
	NCV _{Charcoal,Biomass}	Charcoal	0.0295
	NCV of Bioethanol, NCV _{Bioethanol} : 0.0241 TJ/tonne		
Monitoring equipment	Bomb Calorimeter		
Measuring/reading/recording frequency	Annually once		
Calculation method (if applicable)	Default NCV value for biomass fuels (Charcoal and Fuelwood) utilized in the PoA will be sourced from IPCC Guidelines for National Greenhouse Gas Inventories 2006. GCV of Bioethanol is monitored in the bomb calorimeter at an external laboratory. NCV of the fuel is calculated using standard equations for deduction of heat of vaporization of moisture content from the GCV.		

QA/QC procedures	CME ensures that the NCV of bioethanol determination is performed as per the national/international standards and procedures.
Purpose of data/parameter	Calculation of Project Emissions
Additional comments	No Comments

Parameter 8

Data/Parameter	HG_{SME}
Unit	TJ
Description	Total Quantity of thermal energy generated by the new renewable energy technology in the project in the monitoring period (TJ)
Measured/calculated/Default	Calculated
Source of data	Project Survey
Value(s) of monitored parameter	0.16
Monitoring equipment	None
Measuring/reading/recording frequency	Annual
Calculation method (if applicable)	The annual thermal energy generation by an SME is based on bioethanol quantity consumed by the SME which is determined using ex-post annual sampling-based survey (Please refer parameter Q _{SME,Eth} in table I.7.1.4 in CPA-DD).
QA/QC procedures	-
Purpose of data/parameter	Used for calculation of baseline emissions
Additional comments	No Comments

Parameter 9

Data/Parameter	EC_{PJ,j,y}
Unit	MWh
Description	Quantity of electricity consumed by the project electricity consumption source j in year y
Measured/calculated/Default	Measured
Source of data	"Direct measurement" or "Calculated based on measurements from more than one electricity meters" at each KOKOpoint
Value(s) of monitored parameter	25.16
Monitoring equipment	Energy Meters
Measuring/reading/recording frequency	Continuous Monitoring
Calculation method (if applicable)	<p>All KOKOpoints are supplied electricity from regional electricity grid. The electricity consumption is monitored through energy meters which are under regular control and maintenance of the grid authority. However, CME could not collect the bills and testing certificates for meters due to decentralized installation and no dedicated meters for KOKOpoints.</p> <p>In case of missing data due to meter failure or other reasons for a certain period of time, the following options to estimate electricity consumption are applied inline with the monitoring plan of CPA-DD (provision from CPA-DD).</p> <p>A conservative value based on rated capacity and full Operational hours (8760 hours); In case of the applied monitoring plan the actual days under monitoring period are considered and hours are calculated on pro-rata basis. Please refer ER calculation spreadsheet.</p>

QA/QC procedures	No QA/QC procedures were applied as the monitoring of the electricity recording could not be performed during the monitoring period.
Purpose of data/parameter	Calculation of Project Emissions due to electricity consumption
Additional comments	The project participants may choose not to monitor this parameter for a period of time if the emission factors associated to the electricity consumed are zero or close to zero. Due to unavailability of meter reading, a conservative value based on rated capacity and full Operational hours (8760 hours) has been considered.

Parameter 10

Data/Parameter	$D_{f,m}$
Unit	Kilometre
Description	Return trip distance between the origin and destination of freight transportation activity f in monitoring period m
Measured/calculated/default	Measured
Source of data	Records of vehicle operator or records by project participants
Value(s) of monitored parameter	Total Return Trip Distance = 5158.2 Kms
Monitoring equipment	Mileage Reading
Measuring/reading/recording frequency	Continuous monitoring
Calculation method (if applicable)	Determined for each freight transportation activity f using the vehicle odometer
QA/QC procedures	Daily trips made by the vehicles were monitored for the distance travelled by resetting trip meter to 0 and recording the final trip meter readings at the end of each trip.
Purpose of data/parameter	Calculation of transportation emissions
Additional comments	No Comments

Parameter 11

Data/Parameter	$FR_{f,m}$
Unit	Tonnes
Description	Total mass of freight transported in freight transportation activity f in monitoring period m
Measured/calculated/Default	Measured
Source of data	Log Book
Value(s) of monitored parameter	106.6
Monitoring equipment	Records by project participants or records by truck operators after trip completion
Measuring/reading/recording frequency	Continuous Monitoring
Calculation method (if applicable)	The bioethanol supplied to the KOKOpoints during each trip of the Microtanker is recorded electronically.
QA/QC procedures	The type of vehicle and its total capacity in terms of volume is monitored and appropriate emission factor is applied.
Purpose of data/parameter	Calculation of transport emissions
Additional comments	No Comments

E.3. Implementation of sampling plan

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a. List of CPA to which Sampling Plan was Applied

At present there is only one CPA implemented and covered under this monitoring report. The number of units installed under the CPA is as follows:

CPA#	Cookstove Model Distributed	Total Number of Stoves Distributed	CPA Monitoring Period under this PoA Monitoring Period
CPA-0001	KOKO Cooker	9630	23/10/2019 to 31/12/2019

The number of units installed under the CPA are distributed in 2 different user types which are as follows:

CPA#	Customer Type	Total Number of CookStoves (KOKO Cooker)	CPA monitoring period covered under this PoA monitoring period
CPA-0001	Households	9421	23/10/2019–31/12/2019 (both inclusive)
	SMEs (Kibandas)	209	

Due to the large number of cookstoves (KOKO cooker) installed under the CPA it was not economically feasible to monitor each individual Cookstove unit, therefore, a representative sampling was undertaken as part of a CPA Sampling Plan. The sampling includes the one and only implemented CPA under the PoA for this monitoring period. The Sampling Standard version 08.0 (paragraph 22) mandates application of 95/10 confidence/precision for CPAs solely composed of micro-scale CDM units hence the same was applied as a conservative measure despite the methodology taking precedence.

The objective of the sampling was to obtain an unbiased and reliable estimate of the proportion or mean value of the following parameters over the course of the monitoring period, and with 95/10 confidence/precision. The survey was designed and implemented in accordance with the monitoring plan of the registered PoA-DD (section I.7.1) and CPA-DD (section B.5.1). The following parameters were included in the survey:

1. Number of project devices in households of type i and batch j operating during year y, N_{HH}
2. Number of project devices of type i and batch j operating in institutions during year y, $N_{i,i}$
3. Average annual consumption of woody biomass per person in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent, $BC_{PJ,I,Y}$
4. Average daily consumption of bioethanol in a project cookstove (KOKO cooker) distributed to Households, $Q_{HH,Eth}$
5. Average daily consumption of bioethanol in a project cookstove (KOKO cooker) distributed to SMEs, $Q_{SME,Eth}$
6. Average number of persons equivalent served by the institution with full-day meals, $n_{p,i}$

Apart from the above survey parameters, the CPA-DD (CPA-0001) inadvertently mentions one more survey parameter – Average annual consumption of woody biomass per institution in the pre-project devices during the project activity, $BC_{PJ,I,Y}$. This parameter is neither referenced in any other section of CPA-DD nor in any other registered document (PoA-DD, CPA-0001 ER calculation sheet).

Justification of Calculation Approach

	Calculation Approach for Households	Calculation Approach for SMEs
Correlation	$B_y = B_{HH,y} = N_{HH} \times N_{p,HH} \times (BC_{BL,PP,y} - BC_{PJ,PP,y})$	$B_y = \sum_i^n HG_{p,y} \div (NCV_{biomass} \times \eta_{old,i})$
Determination of parameters	N_{HH} – Monitored through survey	$HG_{p,y}$ – Monitored through survey
	$N_{p,HH}$ – Fixed ex ante in CPA-DD	$NCV_{biomass}$ – Fixed ex ante in CPA – DD
	$BC_{BL,PP,y}$ – Fixed ex ante in CPA-DD	$\eta_{old,i}$ – Fixed ex ante in CPA – DD
	$BC_{PJ,PP,y}$ – Monitored through survey	

Conclusion	The monitoring and survey implemented covers all the required parameters for calculation of Emission Reductions for households.	The monitoring and survey implemented covers all the required parameters for calculation of Emission Reductions for SMEs.
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Note: As per the above table, household baseline calculation requires the baseline adjustment factor $BC_{PJ,PP,y}$ to account for operations of baseline appliance during the project scenario. However, no such adjustment factor is required by the formula applied for SME baseline emission calculation. Hence, $BC_{PJ,I,Y}$ is not included as the survey parameter.

The cookstoves (KOKO cooker) were distributed in 2 types of customer segments, namely households and SMEs (Kibandas) both having separate basis for emission reduction calculations. Since there was no variation in terms of cookstove models (only 1 model type – KOKO Cooker) or any other parameter, a simple random sampling method was deemed appropriate for conducting surveys. Therefore, 2 separate surveys based on simple random sampling were designed for each type of customers which consist of following monitoring parameters:

Household Survey

S.No.	Monitoring Parameter	Description of Monitoring Parameter
1	N_{HH}	Number of project devices in households of type i and batch j operating during year y
2	$BC_{PJ,PP,Y}$	Average annual consumption of woody biomass per person in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent
3	$Q_{HH,Eth}$	Average daily consumption of bioethanol in a project cookstove (KOKO cooker) distributed to Households

SME Survey (Kibanda)

S.No.	Monitoring Parameter	Description of Monitoring Parameter
1	$N_{I,i}$	Number of project devices of type i and batch j operating in institutions during year y
2	$Q_{SME,Eth}$	Average daily consumption of bioethanol in a project cookstove (KOKO cooker) distributed to SMEs
3	$n_{p,l}$	The Average number of persons equivalent served by the SME with full-day meals

The surveys for both households and SMEs were implemented in Greater Nairobi Region, Kenya from 4th January 2020 and were completed by 12th January 2020. The survey confirmed 100% usage of cookstove in households and SMEs (Kibandas) and measured the monitoring parameters as described in the monitoring plan of the registered CPA-DD.

Description of implemented single sampling design

Sampling Design

A representative sampling of the total cookstoves sold in Kenya has been undertaken as part of a PoA-wide (the PoA currently include only CPA-0001) Sampling Plan. The Sampling is based on 95/10 confidence/precision. Separate sampling was done for Households and SMEs (Kibandas).

Objectives and Reliability Requirements

The objective was to obtain an unbiased and reliable estimate of the proportion or mean value of the following parameters over the course of the monitoring period, and with 95/10 confidence/precision for annual sampling across CPAs.

Target Population

The two separate target populations for the surveys are households and SMEs (Kibandas) users of KOKO cooker operating in Kenya. A digital database of all cookstoves sold to households and SMEs (Kibandas) is maintained by the CME.

Sampling Frame

The sampling frames for the 2 surveys, namely household and SME survey, consist of aggregated data of end-users of the cookstoves as recorded in the registered database operating in households and SMEs respectively. There was no requirement for further categorization as all other factors were fairly homogenous.

Total Sale of Cookstoves to Household Users	9421
Total Sale of Cookstoves to SME (Kibanda) Users	209

Sampling Method

The sampling for both the surveys was conducted using simple random sampling technique over the aforesaid sampling frames created. The cookstove population in each category (Household and Kibanda database) was arranged by date of distribution, assigning them a sampling serial number. Random numbers were generated using the RANDBETWEEN function in excel for each cookstove (KOKO Cooker) distributed in both household database and SME (Kibandas) database. The samples having highest random numbers within each database (Household and SME) were selected for conducting the two surveys. This approach ensured that each cookstove listed in the 2 databases had an equal chance of being selected. A slightly higher number of samples (318 for households and 87 for SMEs) were picked than that needed to be monitored to cover for non-responses and other technical issues. Out of these samples, 303 from households and 78 from SMEs participated in the 2 surveys.

Summary: Sampling Size Calculations

Parameter	Unit	Parameter Type	Population	Expected Mean/Proportion	Expected SD	(SD/p) ²	Minimum Sample Size (n)	Actual Sample Size
1.Number of project devices in households of type i and batch j operating during year y, N_{HH}	%	Proportion	9421	93%	26%	0.08	29	303
2.Number of project devices of type i and batch j operating in institutions during year y, $N_{i,i}$	%	Proportion	209	93%	26%	0.08	26	78
3. Average annual consumption of woody biomass per person in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent, $BC_{PJ,PP,Y}$	tonnes/person/annum	Mean	9421	0.02	0.018	0.81	302	303
4.Average daily consumption of bioethanol in a project cookstove (KOKO cooker) distributed to Household, $Q_{HH,Eth}$	Litres/day	Mean	9421	0.4	0.16	0.16	62	303
5.Average daily consumption of bioethanol in a project cookstove (KOKO cooker) distributed to SMEs, $Q_{SME,Eth}$	Litres/day	Mean	209	2.0	1.00	0.25	67	78
6.The Average number of persons equivalent served by the institutions with full-day meals, $n_{p,l}$	Number/Day	Mean	209	50	25	0.25	67	78

Random Sampling Details

Category	Population (A)	Sampling Frame (B)	Shortlisted Samples (C)	Non-Response (D)	Final Participants (C-D)
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Households	9421	9421	318	15	303
SME (Kibandas)	209	209	87	09	78

Sampling Size

The required sample sizes were derived using equation(1) on page 68 and equation (4) on page 70 of the Guideline: Sampling and surveys for CDM project activities and programmes of activities, Version 04.0 for proportion based and mean based parameters respectively as follows:

$$n = \frac{z^2 \cdot N \cdot V}{(N - 1) \cdot c^2 + z^2 \cdot V}$$

$$V = \left(\frac{SD}{Mean}\right)^2 \text{ for mean parameters}$$

$$V = p \cdot (1 - p) / p^2 \text{ for proportion parameters}$$

Where:

n = sample size

N = population size

z = Confidence value constant (1.96 for 95%)

c = Desired precision (10%)

SD = expected standard deviation for mean parameter

$Mean$ = expected mean for mean parameter

p = expected proportion for proportion based parameter

Simplified equation (1) and equation (4) of the Guideline: Sampling and surveys for CDM project activities and programmes of activities, Version 04.0 are as follows:

Equation (1) for Proportion Parameters

$$n > \frac{(1.96)^2 \times N \times p(1-p)}{(N-1) \times 0.1^2 \times p^2 + 1.96^2 \times p(1-p)} \quad \text{(Equation 1 of CDM Guideline Document)}$$

Equation (4) for Mean Parameters

$$n > \frac{(1.96)^2 \times N \times V}{(N-1) \times 0.1^2 + 1.96^2 \times V} \quad \text{(Equation 4 of CDM Guideline Document)}$$

$$V = (SD/Mean)^2$$

Refer ER calculator worksheet 'Sampling' for more details on calculation of sample size for each parameter. The expected parameter values (mean, standard deviation and proportion) have been determined based on project developer's knowledge and experience as per para 12(b) and 12(c) of the "Standard:Sampling and surveys for CDM project activities and programmes of activities", Version 08.0.

Collected data

Data was collected using surveys done by the CME. The questionnaire for the survey was designed in Google Forms and the data was collected in the linked google spreadsheet. This survey form was designed in a way that would allow the surveyor first to check the validity of the records from the CPA Distribution Records, and secondly to collect the necessary information form field visit for the ER calculations.

In order to achieve the 95/10 reliability level for the CPA sampling few additional stoves were sampled from the database than that required (as mentioned in the table above) to cover for possible non-responses, if any. The data collected from the surveys was later compiled into the Excel spreadsheet. The description of data collection method for each parameter is provided below:

- a) Proportion of Operating Cookstoves in Households and SMEs (Kibanda) – The operational status was checked by confirming the regular usage of KOKO Cooker during the monitoring period for each of the users included in the survey. In case of non-operational status of any KOKO Cooker, the date on which the usage stopped was also recorded by the survey team. While performing ER calculations, CME observed that this monitoring period has a very short duration (70 days) and falling in the festive season in Kenya. During this festive season, most of the offices start getting closed by 20th December³ every year for Christmas holidays. However, people start migrating to their hometown (which is normally located in rural Kenya) from 16th December every year. As a result, there is a reasonable likelihood that many users were not able to operate their project cookstoves during this holiday period. Hence, CME decided to adopt a conservative approach for Stove Years calculation which is discussed in parameter 1 “Di, Date of commissioning of project device I” in above section E.2.
- b) Average annual consumption of woody biomass per person in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent, $BC_{PJ,PP,y}$ – The household emission reductions are required to be appropriately adjusted for partial or full operations of the baseline appliances. For this, the annual average per-capita woody biomass consumption in project scenario, $BC_{PJ,PP,y}$, is determined and deducted from the average annual per-capita baseline woody biomass consumption, $BC_{BL,PP,y}$. $BC_{PJ,PP,y}$ is calculated by applying the following formula:

$$BC_{PJ,PP,y} = (1 - \text{Usage_Fraction(KOKO-Cooker)}) \times BC_{BL,PP,y} \quad (\text{Equation 5})$$

Where

$BC_{PJ,PP,y}$ – Average annual consumption of woody biomass per person in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent

$BC_{BL,PP,y}$ – Average annual consumption of woody biomass per person before the start of the project activity

Usage_Fraction(KOKO-Cooker) – Fraction of daily meals cooked on project stove out of total daily meals

The average annual per-capita baseline woody biomass consumption ($BC_{BL,PP,y}$) for households is 0.93 tonnes/person/annum as per the registered CPA-DD. The survey collects data on the number of meals cooked on KOKO Cooker (project cookstove) and the total number of meals cooked by the users in a day for determining the Usage_Fraction(KOKO-Cooker). The survey questionnaire had incorporated the relevant questions for collecting the above data. Please refer Tab “HH Survey” of ER calculation workbook.

- c) Average monthly Consumption of Bioethanol in households and SMEs (Kibanda) – Through various prior interactions with users, the market research team at KOKO realized that the users may find it difficult to estimate the quantity of bioethanol consumed in a month as they don’t keep track of the quantity. However, the users do keep track of the expense incurred on most of the domestic products including cooking fuel. Hence, survey questionnaire incorporated the question on monthly bioethanol consumption by the user which was relatively easier for users to answer. Since the retail price of bioethanol was kept constant at KES 95.00 for the complete monitoring period, the quantity of bioethanol consumption was calculated by dividing the monthly bioethanol expenditure by the retail price of Bioethanol (KES 95). In case, if the price would

³ <http://www.msafirimag.com/featured-article/holiday-season/>

change during the future monitoring periods, a weighted average price would be used for calculation.

Survey Results

The complete survey results are provided in the ER calculation sheet submitted to the verification agency. The reliability test was also conducted for all survey parameters which are used for emission reduction calculations. It was found that the survey results for all parameters were within the precision limit of 10% with 95% confidence level.

Summary: Sampling Reliability Test

Parameter	Unit	Population	Actual Sample Size	Mean/ Proportion	SD	Standard Error of Mean	Relative Precision
1.Number of project devices in households of type i and batch j operating during year y, N_{HH}	%	9421	303	100%	0.00%	0.0%	0.00%
2.Number of project devices of type i and batch j operating in institutions during year y, $N_{I,i}$	%	209	78	100%	0.00%	0.0%	0.00%
3. Average annual consumption of woody biomass per person in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent, $BC_{PJ,PP,Y}$	tonnes/ person/ annum	9421	303	0.09	0.05	0.003	3.51%
4.Average daily consumption of bioethanol in a project cookstove (KOKO cooker) distributed to Household, $Q_{HH,Eth}$	Litres/d ay	9421	303	0.54	0.29	0.016	2.97%
5.Average daily consumption of bioethanol in a project cookstove (KOKO cooker) distributed to SMEs, $Q_{SME,Eth}$	Litres/d ay	209	78	1.27	0.73	0.065	5.02%
6.The Average number of persons equivalent served by the SME with full-day meals, $n_{p,l}$	Number /Day	209	78	56.23	30.35	2.720	4.74%

SECTION F. Calculation of emission reductions or net anthropogenic removals

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

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Baseline emissions will be calculated using equation (1) provided in paragraph 20 of the applied methodology. The equation (1) is modified to incorporate methodological and operational parameters which is as given below:

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected} \times Stove_{year} \times LAC \quad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions during the year y in t CO 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 (fNRB)
$NCV_{biomass}$	=	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne)

$EF_{projected_{fossilfuel}}$	=	Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 63.7 t CO ₂ /TJ ⁴
$Stove_{year}$		Fraction of Year(s) the cookstove i was operational during the monitoring period
LAC	=	Leakage Adjustment Factor (Default Value - 0.95)

B_y , quantity of woody biomass that is displaced, will be monitored ex post in accordance with paragraph 21 of the applied methodology. For cookstoves operational in households, Option (b) is applied to calculate parameter B_y as the product of the number of persons served per household multiplied by the number of households and the estimate of average annual consumption of woody biomass per person that is displaced by the project activity.

$$B_y = B_{HH,y} = N_{HH} \times N_{p,HH} \times (BC_{BL,PP,y} - BC_{PJ,PP,y}) \quad \text{Equation (2)}$$

Where:

N_{HH}	=	Number of households in the project activity, number
$N_{p,HH}$	=	Average number of persons served per household, number
$BC_{BL,PP,y}$	=	Average annual consumption of woody biomass per person before the start of the project activity, tonnes/person/year
$BC_{PJ,PP,y}$	=	If it is found that pre-project devices were not completely displaced but continue to be used to some extent, average annual consumption of woody biomass per person in the pre-project devices during the project activity, tonnes/person/year

For cookstoves operational in SMEs, Option (d) is applied to calculate parameter B_y on the basis of bioethanol consumed in the SME.

$$B_y = \sum_i^n HG_{p,y} \div (NCV_{biomass} \times \eta_{old,i}) \quad \text{Equation (3)}$$

Where:

$HG_{p,y}$ or HG_{SME}	=	Quantity of thermal energy generated by the new renewable energy technology in the project in year y (TJ)
$\eta_{old,i}$	=	Efficiency of pre - project device per type of device i

NOTE: In this PoA, $HG_{p,y}$ is referred as HG_{SME} since the approach is applicable for SME sector.

Since the emission reduction calculation in SMEs is dependent on conversion of thermal energy in woody biomass equivalents, a wood-to-charcoal conversion factor is applied for all users who have charcoal as the baseline fuel since the process of charcoal production involves high woody biomass consumption. This calculation method is consistent with the provisions of the applied methodology. IPCC reports that values for estimating the amount of carbon released through charcoal production and consumption, the wood-to-charcoal factor, are stated to be between 4 and 8. If no local information is available, 6 kg of wood input per kg of charcoal may be used as default (pg 1.44, <https://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref3.pdf>).

Domestic Cookstoves

Parameters according to AMS I.E. Version 9	Value	Unit	Remarks
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This value represents the emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis. The value is calculated, based on the global average ratio of cooking fuels (the normalized ratio of kerosene and liquefied petroleum gas (LPG) excluding coal), i.e. 9 per cent for kerosene (71.5 t CO₂/TJ) and 91 per cent for LPG (63.0 t CO₂/TJ).

CDM-PoA-MR-FORM

Avg Fraction of year(s) the cookstove is operational in Household during the monitoring period, Stove_{year}(HH)	0.075	Years/cookstove	Monitored Ex-post
Average annual consumption of woody biomass per person before the start of the project activity, BC_{BL,PP,Y}	0.93	tonnes/person/year	Registered CPA-DD-0001
Average annual consumption of woody biomass in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent, BC_{PJ,PP,Y}	0.09	tonnes/person/Year	Monitored Ex-post
Net per capita Woody Biomass displaced by PoA	0.84	tonnes/person/year	Calculated
f_{NRB,y}	0.915	Fraction, %	Re-calculated as per Tool 30 in accordance with PoA requirement
NCV_{Biomass}	0.0156	TJ/Tonne	Registered CPA-DD-0001
EF_{projected fossil fuel}	63.70	Tonnes CO ₂ e/TJ	Registered CPA-DD-0001
Leakage Adjustment Factor (LAF)	0.95	fraction	Registered CPA-DD-0001
Avg Fraction of year(s) the cookstove is operational in Household during the monitoring period, Stove_{year}(HH)	0.075	Years/cookstove	Monitored Ex-post
Per Capita Emission Reductions during the Monitoring Period	0.055	tCO ₂ /person	Calculated
Baseline Emissions per unit Cookstove	0.24	tCO ₂ /cookstove	Calculated
Baseline Emissions from domestic use (Households)	2,267.93	tCO₂/yr	Calculated

Institutional Cookstoves

Parameters according to AMS I.E. Version 9	Value	Unit	Reference
Number of project devices of type i and batch j operating in institutions (SME) during year y, N_i	209	Cookstoves	Monitored Ex-post
Avg Fraction of year(s) the cookstove is operational in SME (Kibanda) during the monitoring period, Stove_{year}(I)	0.090	Years/cookstove	Monitored Ex-post
Avg ethanol consumption per SME, μ(ethanol,D)	1.27	Lt/SME/day	Monitored Ex-post
Annual SME Ethanol Consumption, μ(ethanol,D,Y)	0.458	KL/SME/year	Calculated
Annual Commercial Ethanol Consumption	0.36	tonnes/SME/year	Calculated

Annual Quantity of thermal energy generated by new renewable technology in project in year y (HG _{SME/stove})	0.0087	TJ/SME/year	Calculated
Annual Quantity of woody biomass that is substituted or displaced in tonnes, By	5.3173	tonnes/SME/year	Calculated
f _{NRB,y}	0.915	fraction (%)	Calculated as per Tool 30 in accordance with PoA requirement
NCV _{Biomass}	0.016	TJ/tonne	IPCC Default Value, AMS-I.E.
EF _{projected fossil fuel}	63.7	tCO ₂ /TJ	Default Value, AMS-I.E.
Leakage Adjustment Factor (LAF)	0.95	fraction	Default Value, AMS-I.E.
Annual Baseline Emissions per SME, BE	4.59	t CO₂ e/SME/year	Calculated
SME Baseline Emissions during the Monitoring Period	86.83	t CO₂ e	Calculated

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

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Project emissions due to continued use of non-renewable biomass during the operation of the project activity is already factored into the baseline emission calculation. Since the project activity does not involve production of bioethanol, the other project emissions identified in the applied methodology are not applicable.

Project Emission Calculation Approach			
A.	Project Emissions due to Bioethanol Production	-	-
	Para 22, AMS-I.E	$PE_{bioeth-prod} =$	$Q_{Eth} \times EF(bioethanol\ production)$
B.	Project Emissions due to Electricity Consumption		
		$PE_{EC,y} =$	$N_{KP} \times EC_{PJ,j,y} \times EF_{EF,j,y} \times (1+TDL_{j,y})$
C.	Project Emissions due to Transport		
		$PE_{TR,m} =$	$\sum D_{f,m} \times FR_{f,m} \times EF_{CO2,f} \times 10^{-6}$
Project Emission Calculation			
	Project Emissions due to Bioethanol Production	tCO ₂ e	1.28
	Project Emissions due to Electricity Consumption	tCO ₂ e	32.71
	Project Emissions due to Transport	tCO ₂ e	1.21
	Total Project Emissions	tCO₂e	35.20

F.3. Calculation of leakage emissions

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The leakage due to the use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources has been considered in the emission reduction calculation. In accordance with paragraph 24 of the applied methodology, a default net to gross adjustment factor of 0.95 to account for this leakage is applied.

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
10476-P1-0001-CP1	2,354.76	35.20	0	0	2,319.00	2,319.00
Total						2,319.00

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 for this monitoring period in the CPA-DD (t CO ₂ e)
10476-P1-0001-CP1	2,319.00	29,929.00
Total	2,319.00	29,929.00

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

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The annual ex-ante estimation of GHG emission reductions reported in registered CPA-DD Version 4.0 is 156,063 tons CO₂e. The amount of GHG emission reductions, estimated ex ante, for this monitoring period was calculated by determining the fraction of year covered under this monitoring period (70/365) and multiply it with the annual ex ante estimation of ERs, which results in 29,929 tCO₂e. The achieved emission reductions were further compared to the estimated ex ante GHG emissions proportional to actual sales of cookstoves, which comes out to be 6,862 tons CO₂ (based on the fraction of actual cookstove (KOKO Cooker) sales out of expected total sales on full operation of the CPA) for the monitoring period.

F.6. Remarks on increase in achieved emission reductions

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The emission reductions achieved in the monitoring period are less than the values estimated in ex-ante calculation, mainly due to gradual adoption of technology. The achieved emission reductions are 2,319 tons CO₂ against the estimate ex-ante GHG emission reductions of 29,929 tons CO₂ (based on CPA-DD design parameters) and 6,862 tons CO₂ (based on actual sales figures) for the monitoring period.

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

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The project activity is exempted from small scale threshold due to micro-scale CDM units. The KOKO Cooker is the only cookstove model which is distributed under CPA-0001 which has the maximum design thermal output of 2 x 2.1 kW_{th} per burner much less than the limit of 1500 kW_{elec} or 4500 kW_{th}.

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN); • Add a section on remarks on the observance of the scale limit of small-scale CPAs during the crediting periods; • Add "changes specific to afforestation or reforestation activities/CPA" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R PoAs between two commitment periods; • Make structural and editorial improvements.
02.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 01.0 of the “CDM project standard for programmes of activities (CDM-EB93-A07-STAN); • Make editorial improvements.
01.0	1 April 2015	Initial publication.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report, programme of activities		