



**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 01	
Completion date of this monitoring report	13/01/2020	
Monitoring period number	01	
Duration of this monitoring period	23/10/2019 to 31/12/2019	
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
	N/A	N/A
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	3,201 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.

KOKO's clean fuel solution, the "KOKO Cooker" kit consists of a two-burner bioethanol stove and a durable 'smart' canister equipped with an NFC chip that enables tracking of household-level fuel purchases. To create affordable and reliable access to bioethanol 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. These KOKOpoinTs enable customers to use their smart canisters to refill with convenience at local corner shops. Customers can buy their KOKO Cookers by completing one-time registration process and ordering it on the KOKOpoinT tablet screen, via the myKOKO mobile app. Customers can also take advantage of the savings scheme launched on the KOKO platform, which enables low-income customers who have difficulty with the upfront cost of the KOKO Cooker to make progressive payments towards their stove. KOKO's smart distribution platform allows purchase of bio-ethanol fuel through a digital billing system in bundles of as low as \$0.30, without charging any additional cost on the fuel, thereby eliminating the "poverty penalty" often charged to low-income consumers who buy fuel in small units.

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"

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 (10476-P1-0001-CP1)	05	CPA-00xx: KOKO Kenya - Ethanol Cookstoves Program Generic CPA#0001	Fixed (23/10/2019 to 22/10/2029)	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 included “KOKOCooker” 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
Overall Efficiency	60% (energy content of fuel transferred to contents of pot; as defined by ISO WBT methodology)
Fuel Capacity	2.3 Litres fuel capacity
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

¹

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

PART II Monitoring of CPAs

SECTION C. Implementation of CPAs

C.1. Description of implemented CPAs

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CPA 1 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 took place in April-May 2019. Till the end of this monitoring period, 9,883 cookstoves are distributed in households and SMEs under this CPA through the network of KOKO Agents with the following break up:

Type of Customers	Number of cookstoves distributed
Households	9252
SMEs (Food outlets)	631

The CPA is expected to be completed by the year 2020 with distribution of 42,000 cookstoves in Kenya.

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 PoA 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

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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The approved small-scale methodology AMS-I.E. Version 9.0 requires application of "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" Version 3.0 for monitoring of project emissions related to electricity consumption for a project activity.

As per this tool, the monitoring of all electricity consumption sources is required for calculation of project emissions (Data, parameter table 10, pg 20). Additionally, in section 6.2.2 "Alternative approaches for project and/or leakage emissions" (pg 12), alternative approaches for conservative estimation of project emissions are also provided where monitoring of electricity consumption sources are not required. However, the approaches are restricted to electricity consumption sources as identified under Scenario B i.e. Off-grid Captive Power Plants.

Unfortunately, the tool does not extend such alternative approaches for project/leakage emissions to distributive/decentralized electricity consumption sources (small appliances) where monitoring of such electricity consumption of such sources is practically impossible. The electricity consumption sources involved in the project activity are fuel dispensing units called KOKOpoints. The KOKOpoints have a small electronic display screen for enabling digital transactions which consume electricity just like a mobile smart phone. The power consumption rating of these KOKOpoints is 20 W (proof of specifications attached) which results in aggregate project emissions (conservatively calculated) of 191 tCO₂/year against the total emission reduction estimates of 156,063 tCO₂/year. This represents that electricity consumption-related project emissions are restricted to 0.12% of total estimated emission reductions. It shall be noted that total number of KOKOpoints installed in a region will depend on the number of cookstove distributed in actual or as planned and cannot exceed the total demand requirement due to economic unviability.

Considering the above context, CME has adopted the following approach for estimating electricity consumption:

Conservative estimation of project emissions assuming continuous operations of electricity consumption sources (KOKOpoints) at rated capacity during the monitoring period. Instead of direct monitoring, the overall electricity consumption of KOKOpoints will be estimated by multiplying the number of hours in the monitoring period, the rated electrical consumption of the KOKOpoints (kW) and the number of KOKOpoints installed (Monitored parameter as per CPA-DD). This is same as the alternative approach defined in section 6.2.2 of the tool and does not have any negative impact on conservativeness of ER calculations. Moreover, the monitoring Data/parameter table 10 also allows estimation of project emissions based on conservative emissions assuming continuous operations of the electricity consuming system during the monitoring period, in case of missed monitoring for not more than 30 days. The proposed approach will be extension of this conservative estimation over the complete monitoring period.

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

>>

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 for the PoA is designed in accordance with the requirements of the applied methodology – AMS-I.E. Version 9. In accordance with the requirements of the methodology and registered CPA-DD, the parameters, monitored within the scope of project operations during the monitoring period, are discussed in section E.2 below.

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. 1. Country specific default values suggested by the CDM EB / DNA;
Value(s) applied	0.92
Choice of data or measurement methods and procedures	The value was published as the default value on UNFCCC website. However, it expired on 18 th September 2017. To confirm the validity of the value for this CPA, recent publications from the DNA were considered. The latest Climate Change Action Plan 2018-2022, published by Kenyan DNA - Ministry of Environment and Forestry, reports f_{NRB} value as 0.92 for Kenya. Moreover, it was further confirmed by the DNA representative that the DNA considers the same value as applicable in context of woody biomass consumed in Kenya.
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	$BC_{BLPP,y}$
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: (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	<p>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.</p> <p>The calculation approach of the parameter is further discussed in findings section of the validation report of this CPA.</p>
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	<p>Fixed ex-ante at CPA level.</p> <p>The parameter value determined in this CPA will be used in subsequent CPAs in lieu of conducting fresh assessments at each CPA level.</p>

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	<p>Published Life Cycle Assessment Report "Lifecycle Greenhouse Gas Emissions and Energy Balances of Sugarcane Molasses-Based Bioethanol in Kenya"</p> <p>Detailed calculations presented in Excel-sheet "ER Calculation Sheet – CPA0001".</p>
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 calculated project emissions associated with electricity consumption at KOKOpoints in the PoA.
Purpose of data/parameter	Calculation of Project Emissions
Additional comments	No Comments

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 calculated 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: (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 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	The date of commissioning is provided in ER calculation sheet (Customer DB Worksheet).
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 $Stove_{Year}(i)$, fraction of year(s) the cookstove i was operational during the monitoring period which is applied for baseline emission calculation $Stove_{Year}(i) = \text{Maximum of } \{ (\text{End-Date of Monitoring Period} - D_i, \text{Date of Commissioning of Project Device}) \text{ AND } (\text{End-Date of Monitoring Period} - \text{Start-Date of Monitoring Period}) \} / 365$
Additional comments	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	9252
Monitoring equipment	Project Survey & Digital Logs
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 (domestic). 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 operating.
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 07.0 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	0.09
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 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 07.0. 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
Measured/calculated/default	Measured
Source of data	Project Survey
Value(s) of monitored parameter	Average monthly consumption of bioethanol in project households: 15.25 Average monthly consumption of bioethanol in project SMEs: 34.74
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 07.0. 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 Project Emissions due to bioethanol production
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	631
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 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 07.0 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 customr type.

Parameter 6

Data/Parameter	$N_{KP,y}$
Unit	Number
Description	Number of KOKOpoinTs operating during year y
Measured/calculated/default	Measured
Source of data	Digital Logs
Value(s) of monitored parameter	656
Monitoring equipment	KOKOpoinT Installation Logbook
Measuring/reading/recording frequency	Continuous
Calculation method (if applicable)	A real-time database is maintained to keep record of all operational KOKOpoinTs. All KOKOpoinTs 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 KOKOpoinT 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 KOKOpoinTs.
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 (TJ/tonne)	Value
	NCV _{Wood,Biomass}	Wood Fuel	0.0156	
	NCV _{Charcoal,Biomass}	Charcoal	0.0295	
Monitoring equipment	None			
Measuring/reading/recording frequency	None			
Calculation method (if applicable)	Default value for all fuels utilized in the PoA will be sourced from IPCC Guidelines for National Greenhouse Gas Inventories 2006.			
QA/QC procedures	CME will ensure that the NCV 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/year
Description	Total Quantity of thermal energy generated by the new renewable energy technology in the project in year y (TJ)
Measured/calculated/Default	Measured
Source of data	Project Survey
Value(s) of monitored parameter	293.83
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 I.7.1.4 above).
QA/QC procedures	-
Purpose of data/parameter	Used for calculation of baseline emissions
Additional comments	No Comments

Parameter 9

Data/Parameter	EC _{PJ,i,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	21.73
Monitoring equipment	Energy Meters
Measuring/reading/recording frequency	Continuous Monitoring
Calculation method (if applicable)	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 of KOKOpoints. Hence, a deviation is sought for the monitoring of electricity consumed by KOKOpoints during this monitoring period.
QA/QC procedures	The electricity meter will be subject to regular maintenance and testing as per the requirements set by the grid operators or national requirements. The calibration of meters, including the frequency of calibration, should be done in accordance with national standards or requirements set by the meter supplier or requirements set by the grid operators. The accuracy class of the meters should be in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements. Since all the KOKOpoints are installed in facilities which are receiving electricity from local grid, hence the control, maintenance and testing of electricity meters will be performed by regional/national electricity distribution company as per the applicable regulations.
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	Log Book
Value(s) of monitored parameter	Total Return Trip Distance = 4547.2 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 using initial and final readings of vehicle odometer. Since the vehicle is filled fully for each trip, the full capacity of the vehicle is considered as the total fuel supplied in each trip. This is conservative in nature for calculation of project emissions.
Purpose of data/parameter	Calculation of transportation emissions
Additional comments	No Comments

Parameter 11

Data/Parameter	FR_{f,m}
Unit	Litres

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	3500 Litres per trip
Monitoring equipment	Digital Logger
Measuring/reading/recording frequency	Continuous Monitoring
Calculation method (if applicable)	The full capacity of the vehicle is considered as the total fuel transported for supply in each trip. This is conservative in nature for calculation of project emissions.
QA/QC procedures	The type of vehicle and its total capacity in terms of volume is monitored for each trip.
Purpose of data/parameter	Calculation of transport emissions
Additional comments	No Comments

E.3. Implementation of sampling plan

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The sampling was designed to cover the monitoring of the complete PoA. CPA#1, which is the only CPA included in this PoA, becomes the sampling frame for this monitoring period.

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 Sampling Plan. The Sampling is based on 95/10 confidence/precision. Separate sampling was done for Households and SMEs. The following parameters were covered as part of the survey:

Households	SMEs (Kibandas)
1. Number of household cookstoves operating, N_{HH}	2. Number of SME cookstoves operating, $N_{i,i}$
3. Average Woody biomass consumption, $BC_{PJ,HH,Y}$	4. Average Bioethanol Consumption in SMEs
5. Average Bioethanol consumption in households	6. Average customers per SME

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 types of target population for the survey are households and SMEs (Kibandas) operating in Kenya. A digital database of all cookstoves sold to households and SMEs is maintained by the CME.

Sampling Frame

A single sampling frame was taken for each customer type i.e. Households and SMEs (Kibandas). There was no requirement for further categorization as all other factors were fairly homogenous.

Sampling Method

The sampling was conducted using simple random sampling technique over the aforesaid sampling frames created. The cookstove population in each category was arranged by date of distribution, assigning them a sampling serial number. Random numbers were generated using the

online random number generator ranging from 1 to total number of cookstove and the samples, corresponding to the random numbers, were picked for sampling. This approach ensured that each cookstove listed in the database had an equal chance of being selected. A slightly higher number of samples were picked than that needed to be monitored to cover for non-responses and other technical issues.

Sampling Size

The required sample sizes were derived using equation (1), (2), (3), (4) and (9) of Appendix 3 of the Guideline: Sampling and surveys for CDM project activities and programmes of activities, Version 04.0.

Collected data

Data was collected using surveys done by the CME. The data collected from the surveys were compiled into the Excel spreadsheet. In order to achieve the 95/10 reliability level for cross-CPA sampling few additional stoves were sampled from the database than that required to cover for non-responses, if any.

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:

Equation (1)

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected} \times Stove_{year} \times LAC$$

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 ²
$Stove_{year}$	=	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.

2

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).

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

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.

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

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.

Domestic Cookstoves

Parameters according to AMS I.E. Version 9		Unit	Remarks
Average Number of Operational days per Stove	0.10	Years	Average value to be calculated from All Customer Database on 31st Dec
Avg Annual consumption of woody biomass per person, $BC_{BL,PP,y}$	0.93	tonnes/person/year	Ex-Ante Parameter
Woody biomass consumed during project, $BC_{PJ,PP,y}$	0.09	tonnes/person/year	Monitored Ex-post
Net per capita Woody Biomass displaced by PoA	0.84	tonnes/person/year	Calculated
$f_{NRB,y}$	0.92		Ex-Ante Parameter
$NCV_{Biomass}$	0.0156		Ex-Ante Parameter
$EF_{projected}$ fossil fuel	63.70		Ex-Ante Parameter
Leakage Adjustment Factor (LAF)	0.95		Ex-Ante Parameter
Stove Year(n,HH)	0.10	fraction	Monitored Ex-post
Per Capita Emission Reductions during the Monitoring Period	0.073	tCO2/person	Calculated
Emission Reductions per unit Cookstove	0.32	tCO2/cook stove/yr	Calculated
Emission Reductions achieved from domestic use (Households)	2977.48	tCO2/yr	Calculated

Institutional Cookstoves

Parameters according to AMS I.E. Version 9		Unit	Reference
Number of Cookstoves for Kibandas	631		Monitored Ex-post
Average Stove Years for Kibandas	0.08	Years	Monitored Ex-post
Annual SME Ethanol Consumption,	0.42	KL/SME/year	Calculated

$\mu(\text{ethanol}, D, Y)$			
Annual Commercial Ethanol Consumption	0.34	tonnes/SME/year	Monitored Ex-post
Thermal Energy generated by Ethanol, Hgy,E	0.009	TJ./year	Calculated
HH Woody Biomass saved, By	5.7445	tonnes/year	Calculated
$f_{\text{NRB},y}$	0.92	fraction (%)	fixed ex-ante at CPA-DD
$\text{NCV}_{\text{Biomass}}$	0.016	TJ/tonne	fixed ex-ante at CPA-DD
$\text{EF}_{\text{projected fossil fuel}}$	63.7	tCO ₂ /TJ	fixed ex-ante at CPA-DD
Leakage Adjustment Factor (LAF)	0.95	fraction	fixed ex-ante at CPA-DD
Baseline Emissions per SME, BE	4.99	t CO₂ e/SME/year	Calculated
SME Baseline Emissions	262.96	t CO₂ e/year	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	$PE_{\text{bioeth-prod}} =$	$Q_{\text{Eth}} \times \text{EF}(\text{bioethanol production})$
B.	Project Emissions due to Electricity Consumption		
		$PE_{\text{EC},y} =$	$N_{\text{KP}} \times \text{EC}_{\text{PJ},y} \times \text{EF}_{\text{EF},y} \times (1 + \text{TDL}_{j,y})$
C.	Project Emissions due to Transport		
		$PE_{\text{TR},m} =$	$\sum D_{f,m} \times \text{FR}_{f,m} \times \text{EF}_{\text{CO}_2,f} \times 10^{-6}$
Project Emission Calculation			
	Project Emissions due to Bioethanol Production	tCO ₂ e	1.67
	Project Emissions due to Electricity Consumption	tCO ₂ e	33.89
	Project Emissions due to Transport	tCO ₂ e	3.08
	Total Project Emissions	tCO₂e	38.64

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
CPA#1	3,240.43	38.64	0	0	3201.00	3201.00
Total						3,201.00

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)
CPA#1	3,201.00	29,929.00
Total	3,201.00	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.

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.

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#01 which has the maximum design thermal output of 2.1 kW per burner.

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.
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