



Monitoring report form for CDM programme of activities
(Version 05.0)

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 number of the PoA-DD applicable to this monitoring report	Version 07		
Version number of this monitoring report	Version 05		
Completion date of this monitoring report	21/10/2021		
Monitoring period number	02		
Duration of this monitoring period	01/01/2020 to 31/12/2020 (both days included)		
Monitoring report number for this monitoring period	02		
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 until 31 December 2020	Amount achieved from 1 January 2021
	0	38,179 tCO ₂ e ¹	0
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs	52,135 tCO ₂ e		

¹ The emission reductions are calculated from the start date of the crediting period of CPA-0002 i.e. 28/08/2020

covered in this monitoring report

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	07	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/QWJA0G7VOXCS4UPELMYN9HF/DI3TZ85/EB100_repan10_AMS-I.E.pdf?t=NXZ8cThmem5yfDCFuFLL_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)	07	CPA-00xx: KOKO Kenya - Ethanol Cookstoves Program Generic CPA#0001	Fixed (23/10/2019 to 22/10/2029 – both inclusive)	No
CPA-0002: KOKO Kenya - Ethanol Cookstoves Program Version 4.0 (10476-P1-0002-CP1)	07	CPA-00xx: KOKO Kenya - Ethanol Cookstoves Program Generic CPA#0001	Fixed (28/08/2020 to 27/08/2030 – 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”². 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

²

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

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

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SECTION C. Implementation of CPAs**C.1. Description of implemented CPAs**

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CPA-0002 has been included in this monitoring report. The CPA involves distribution of bio-ethanol fuel cookstoves and promote its use for cooking purposes in households in Kenya.

The implementation of phase 1 of CPA-0002 is currently undergoing around Greater Nairobi Region in Kenya. The distribution breakup of cookstoves to users till the end of monitoring period is provided below:

CPAs	Households
CPA-0002	27,919

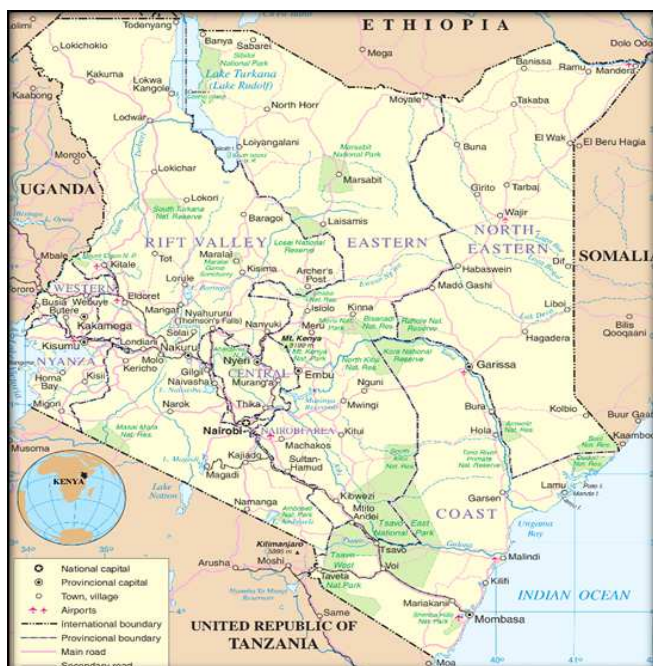
The total of 583 KOKOpoints (out of total 596 installed) were found operational in the Greater Nairobi region at the end of the monitoring period, thereby ensuring smooth supply of fuel to all the registered users.

Pine Tree Carbon LLC has provided for all implementation costs for the CPA-0002. The funds 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 the CPA are managed by the CME who is also the CPA implementer for both the CPAs.

C.2. Location of CPAs

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The geographical boundary for the CPA-0002 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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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

>>

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.

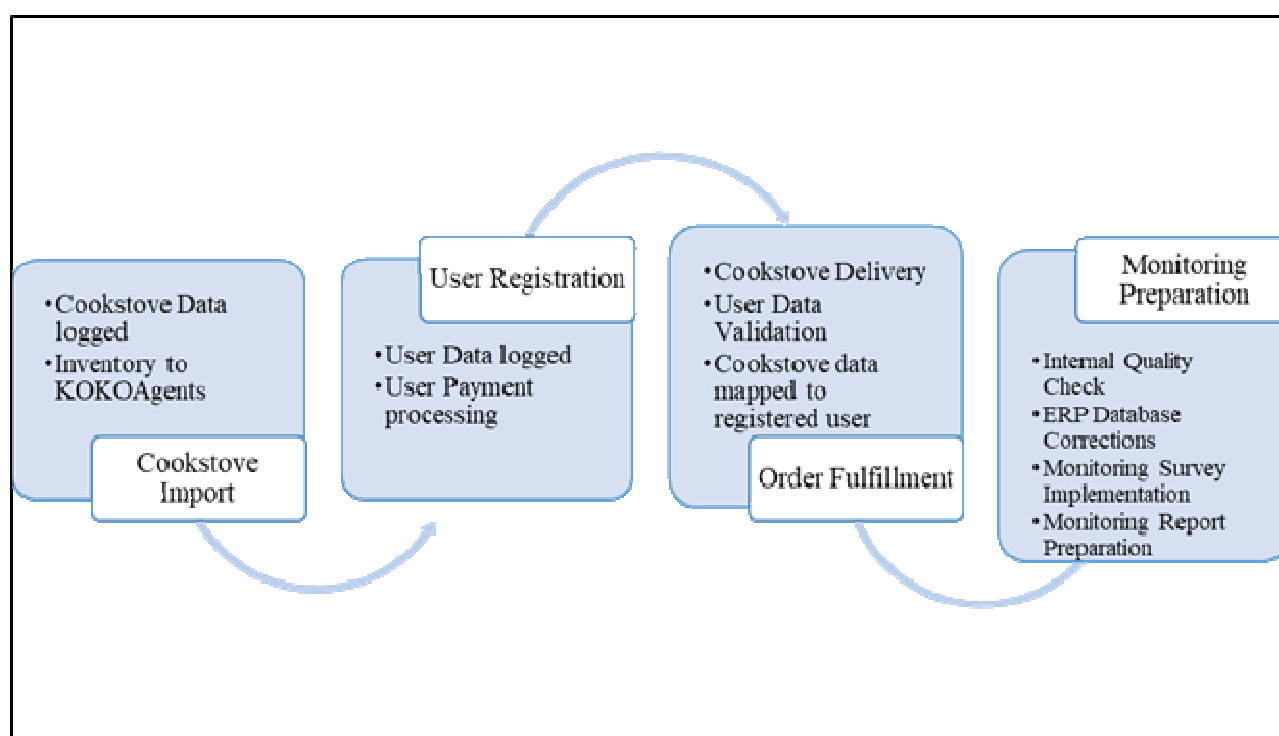


Fig 1: CDM Monitoring System implemented by KOKO Networks

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 purposed 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 minotring 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 3 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	0.9268
Choice of data or measurement methods and procedures	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.
Purpose of data/parameter	Used for calculation of baseline emissions
Additional comments	None

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	None

Parameter 3

Data/Parameter	$EF_{projected}$
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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	None

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	None

Parameter 5

Data/Parameter	$BC_{BLFF,y}$
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 "Kenya Household Cooking Sector Study", 2019 (Figure 36: Monthly consumption of polluting fuels by Households). The complete calculations for the parameter are provided in Excel-sheet "CPA2_ER Calculation Sheet_V-2".</p>
Value(s) applied	CPA-0002: 1.71
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.
Purpose of data/parameter	Used for Calculation of baseline emissions
Additional comments	None

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	Average household size in Kenya in 2019 http://www.arcgis.com/home/item.html?id=d8c1d70fbb2d49028e0713d425b26805
Value(s) applied	4.0
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	None

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” ³
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	None

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

³ Detailed calculations presented in Excel-sheet “ER Calculation Sheet – CPA0001”

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 KOKOpoints in the PoA.
Purpose of data/parameter	Calculation of Project Emissions
Additional comments	None

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	None

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;</p> <p>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
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Parameter 12

Data/Parameter	EF_{CO₂,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.

Parameter 13

Data/Parameter	D_{Ethanol}
Unit	Tonnes/kL
Description	Density of Bioethanol
Source of data	https://www.chemicalbook.com/CASEN_64-17-5.htm#ChemicalProperties
Value(s) applied	0.789
Choice of data or measurement methods and procedures	Standard chemical property of Ethanol
Purpose of data/parameter	Calculation of Project Emissions due to bioethanol production
Additional comments	-

Parameter 14

Data/Parameter	CF
Unit	Unitless
Description	Wood-to-Charcoal Conversion Factor
Source of data	pg 1.44, https://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref3.pdf
Value(s) applied	6.0
Choice of data or measurement methods and procedures	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. Hence, 6 kg of wood input per kg of charcoal is used as default.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

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 $\text{Stove}_{\text{Year}(i)} = \text{Minimum of } \{ (\text{End-Date of Monitoring Period} - D_i, \text{Date of Commissioning of Project Device}) \text{ AND } (\text{End-Date of Monitoring Period} - \text{Start-Date of Monitoring Period}) \} / 365$
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	27,919
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 user. 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 23 of Standard: Sampling and surveys for CDM project activities and programmes of activities, Version 09.0 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	0.064
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 23 of Standard: Sampling and surveys for CDM project activities and programmes of activities, Version 09.0. 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
Measured/calculated/Default	Measured
Source of data	Project Survey
Value(s) of monitored parameter	Average daily consumption of bioethanol in project households: 0.59
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 09.0. 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	N/A
Additional comments	No Comments

Parameter 5

Data/Parameter	N_{KP,y}
Unit	Number
Description	Number of KOKOpoints operating during year y
Measured/calculated/Default	Measured
Source of data	Database of installed KOKOpoints under operations
Value(s) of monitored parameter	596
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	The technical team receives continuous feed on the operational status of the KOKOpoints through online system which ensures that each of the non-operational KOKOpoint is attended in a timely manner.
Purpose of data/parameter	Calculation of project emissions due to electricity consumption at KOKOpoints.
Additional comments	No Comments

Parameter 6

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} : 0.0257 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 7

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	42.91
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 does not have record of electricity consumption as the KOKOpoints do not have dedicated stand-alone meter. 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). 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.
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	Due to unavailability of meter reading, a conservative value based on rated capacity and full Operational 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 = 56,245 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 either resetting the trip meter to 0 or taking the initial and final readings of the mileage meter.
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	1821.4
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 KOKO points 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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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 plan was designed to draw the samples across PoA (including both CPA-0001 and CPA-0002). The Sampling and Survey Standard version 09.0 (paragraph 23) 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 provisions of the registered PoA-DD. The survey parameters were chosen based on the sampling methodology provided in CPA-DD which requires following parameters to be monitored:

- Number of project devices distributed in households operating during year y, N_{HH}
- Average annual per-capita consumption of woody biomass in households 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, $BC_{PJ,PP,Y}$ ⁴
- Average annual bioethanol consumption per household during the operations of the project activity, $Q_{HH,Eth}$

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, a simple random sampling were designed for the survey which consist of following monitoring parameters:

⁴ The survey parameter $BC_{PJ,HH,Y}$ mentioned in the PoA-DD differs from $BC_{PJ,PP,Y}$ only by a constant factor of household size, $N_{p,HH}$ and hence replaced by $BC_{PJ,PP,Y}$ in order to align it with the monitoring requirement of Table I.7.1.3 of PoA-DD

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 per-capita consumption of woody biomass in the pre-project devices during the project activity
3	$Q_{HH,Eth}$	Average daily consumption of bioethanol in project households

The monitoring survey was implemented during September-October 2020 in Greater Nairobi Region, Kenya. The survey confirmed 100% usage of cookstove in households 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 CPA-0001 and CPA-0002) Sampling Plan. The Sampling is based on 95/10 confidence/precision.

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 target population for the survey is the households users of KOKO cooker operating in Kenya. A digital database of all cookstoves sold to households is maintained by the CME.

Sampling Frame

The sampling frame for the survey consists of aggregated data of end-users of the cookstoves (including both CPA-0001 and CPA-0002) as recorded in the registered database till 14th September 2020. There was no requirement for further categorization as all other factors were fairly homogenous.

Sampling Method

The sampling for the survey was conducted using simple random sampling technique over the aforesaid sampling frame created. The cookstove population was assigned a sampling serial number. A random sequence of sampling numbers were generated using online Random Integer Set Generator (<https://www.random.org/integer-sets/>). This approach ensured that each cookstove listed in the database had an equal chance of being selected.

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

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

Equation (4) for Mean Parameters

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

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

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 13(b) and 13(c) of the "Standard: Sampling and surveys for CDM project activities and programmes of activities", Version 09.0.

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 from 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 – 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.
- b) Average annual consumption of woody biomass per household during the monitoring period.
 $BC_{PJ,PP,y}$ – 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:

$$BC_{PJ,PP,y} = (1 - \text{Usage_Fraction(KOKO-Cooker)}) \times BC_{BL,PP,y} \quad (\text{Equation 05})$$

Where

$BC_{PJ,PP,y}$ – Annual average per-capita woody biomass consumption in project scenario

$BC_{BL,PP,y}$ – Annual average per-capita baseline woody biomass consumption

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 1.71 tonnes/person/annum as per the registered CPA-DD for CPA-0002. 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.

c) Average monthly Consumption of Bioethanol in households – 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 70.00 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 70). In case, if the price would 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 Survey Analysis 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}	%	52898	262.00	100%	0.00%	0.0%	0.00%
2. 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	52898	262.00	0.38	0.12	0.007	1.85%
3.Average daily consumption of bioethanol in a project cookstove (KOKO cooker) distributed to Household, $Q_{HH,Eth}$	Litres/day	52898	262.00	0.59	0.27	0.017	2.77%

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)
$EF_{projected\ fossil/fuel}$	=	Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 63.7 t CO ₂ /TJ ⁵
$Stove_{year}$	=	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.

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

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

Domestic Cookstoves

Parameters according to AMS I.E. Version 9	Value	Unit	Reference
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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).

Number of Cookstoves for HHs	27,919	-	Monitored Ex-post
Average Number of Operational days per Stove	0.247	Years	Monitored Ex-post
Avg Annual consumption of woody biomass per person, $BC_{BL,PP,Y}$	1.71	tonnes/person/year	Ex-Ante Parameter
Woody biomass consumed during project, $BC_{PJ,PP,Y}$	0.12	tonnes/person/year	Monitored Ex-post
Net per capita Woody Biomass displaced by PoA	1.59	tonnes/person/year	Calculated
$f_{NRB,y}$	0.927	Fraction	Ex-Ante Parameter (recalculated as per tool 30)
$NCV_{Biomass}$	0.0156	TJ/tonne	Ex-Ante Parameter
$EF_{projected\ fossil\ fuel}$	63.70	tCO ₂ /TJ	Ex-Ante Parameter
Leakage Adjustment Factor (LAF)	0.95	fraction	Ex-Ante Parameter
Stove Year(n,HH)	0.247	fraction	Monitored Ex-post
Per Capita Emission Reductions during the Monitoring Period	0.343	tCO ₂ /person	Calculated
Baseline Emissions per unit Cookstove	1.37	tCO₂/cookstove/yr	Calculated
Baseline Emissions from domestic use(Households)	38,295	tCO₂e	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	20.89
	Project Emissions due to Electricity Consumption	tCO ₂ e	55.79
	Project Emissions due to Transport	tCO ₂ e	39.11
	Total Project Emissions	tCO₂e	115.79

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 until 31/12/2020	From 01/01/2021	Total amount
10476-P1-0002-CP1	38,295.07	115.79	0	0	38,179	0	38,179
Total							38,179

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-P1-0002-CP1	38,179	52,135 ⁶
Total	38,179	52,135

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 151,026 tons CO₂e. The amount of GHG emission reductions, estimated ex ante, for this monitoring period was calculated by determining the fraction of year covered by the operational period of CPA-0002 (126/365) and multiply it with the annual ex ante estimation of ERs, which results in 52,135 tCO₂e. Please note that the CPA-0002 was not operational during the period 01/01/2020 – 27/08/2020.

F.6. Remarks on increase in achieved emission reductions

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The emission reductions achieved in the monitoring period are 38,179 tCO₂e which is less than the values estimated as per ex-ante calculation (52,135 tCO₂e).

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-0002 which has the maximum design thermal output of 2 x 2.1 kWth per burner much less than the limit of 1500 kWelec or 4500 kWth.

⁶ Ex-ante ER estimations are determined on the basis of the operational period of CPA-0002 i.e. 28/08/2020 – 31/12/2020

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
05.0	8 October 2021	Revision to: <ul style="list-style-type: none"> Ensure consistency with version 03.0 of the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN).
04.0	6 April 2021	Revision to: <ul style="list-style-type: none"> Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR).
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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