



Monitoring report form (Version 03.2)

Monitoring report

Title of the project activity	POA 5336 Efficient Cook Stove Programme: Kenya CPA 1 - Efficient Cook Stove Programme: Kenya CPA No. 1 Eldoret East and Keiyo Districts co2balance UK Ltd CPA 2 - Efficient Cook Stove Programme: Kenya CPA No. 2 Mathira East District co2balance UK Ltd		
Reference number of the project activity	5336 5336-0001 (CPA 1) 5336-0002 (CPA 2)		
Version number of the monitoring report	2		
Completion date of the monitoring report	17/04/2014		
Registration date of the project activity	5336 - 21/03/2012 CPA 1 - 21/03/2012 CPA 2 – 31/01/2013		
Monitoring period number and duration of this monitoring period	MP2 CPA 1 (21/03/2013-20/03/2014), 12 Months MP2 CPA 2 (21/03/2013-20/03/2014), 12 Months POA MP2 ((21/03/2013-20/03/2014), 12 Months		
Project participant(s)	Co2balance UK		
Host Party(ies)	Republic of Kenya		
Sectoral scope(s) and applied methodology(ies)	Scope 3 Energy Demand; AMS ii G (v3)		
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	CPA 1 - 48,646 CPA 2 - 46,214		
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	CPA 1 – 19,741 CPA 2 – 8,206		
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	Not applicable Not applicable		
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	CPA 1	CPA 2	Total
	19,741	8,206	27,947



SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The Efficient Cook Stove Programme: Kenya is located in the Republic of Kenya and involves the distribution of domestic fuel-efficient cooking stoves by the co2balance UK to rural households in Eldoret East and Keiyo Districts (CPA 1) Mathira East District (CPA 2). The efficient stoves are based on a design developed by co2balance UK. The stoves were tested independently and were installed by the company free-of-charge for users in exchange for the rights to the emission reductions. It is the revenue from the sale of emissions reductions only that will fund the installation process.

Traditionally, families in Eldoret East, Keiyo and Mathira East Districts cook on an open fire, utilizing the 'three stone' method for heating pots. This method is quite inefficient and leads to the unsustainable usage of non-renewable biomass in the cooking process. The replacement fuel-efficient stove will lead to a reduction in the annual usage of biomass for users by 67%. The majority of families do not have access to the market for fuel-efficient cooking stoves for economic reasons.

Users entered into an agreement with co2balance UK transferring rights to the CERs generated in return for the free installation of the stove and its ongoing maintenance over the lifetime of the project.

The stove was manufactured in a Kenyan factory and then transported to the project area by truck, where they were installed one per household in exchange for the rights to the emissions reductions.

Monitoring data collected during the installation and operation of the stoves was captured in an electronic data management system, or monitoring database. From this data, the emissions reductions of the project were determined.

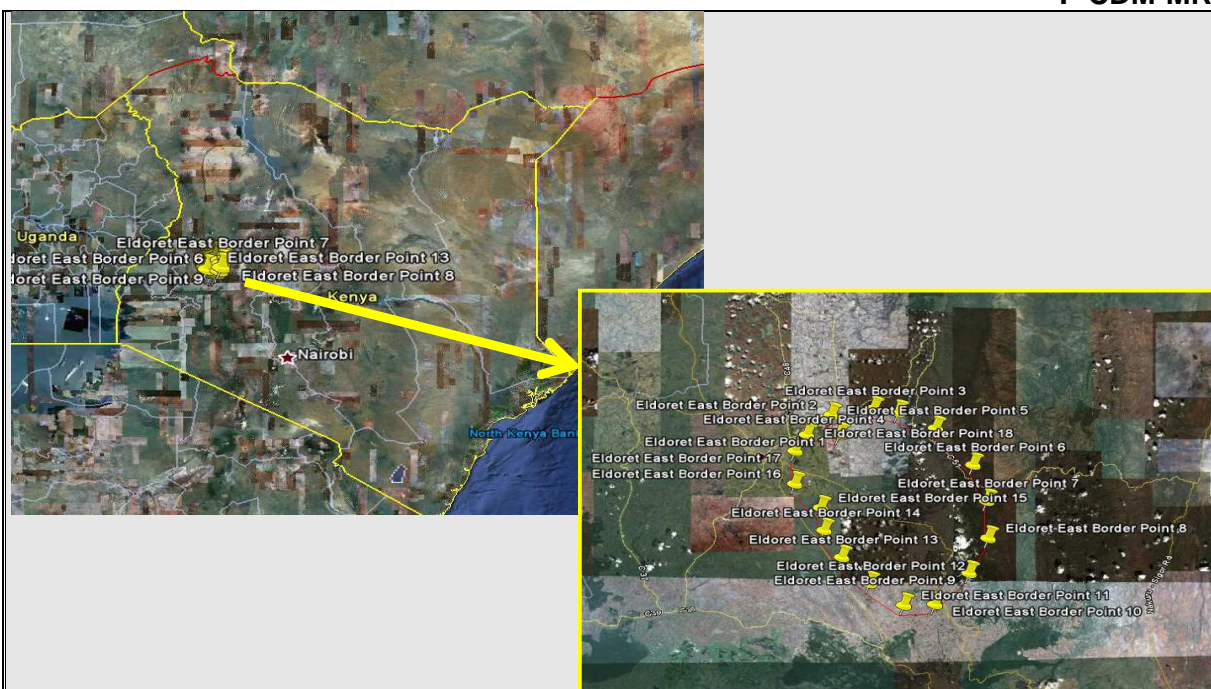
A.2. Location of project activity

All CPAs with this POA are located within the Host Party, the Republic of Kenya. Individual CPAs are located as follows:

CPA 1

Below is the geographic reference to allow unique identification of CPA1: Eldoret East and Keiyo Districts. The project activity is limited to a region within Eldoret East and Keiyo Districts in Rift Valley Province. GPS coordinates for the location boundary below. Each stove built as part of the project activity was assigned a unique GPS coordinate, which was uploaded to the project database managed by co2balance UK.

Geographical Reference of Borders Points		
Point	Latitude	Longitude
1	0°32'19.27"N	35°23'14.62"E
2	0°34'41.25"N	35°22'27.90"E
3	0°35'26.65"N	35°26'34.19"E
4	0°35'0.56"N	35°28'57.29"E
5	0°33'6.17"N	35°32'35.41"E
6	0°28'41.80"N	35°36'12.92"E
7	0°24'21.73"N	35°37'32.62"E
8	0°19'54.80"N	35°37'40.90"E
9	0°15'43.37"N	35°35'49.92"E
10	0°11'58.14"N	35°32'30.93"E
11	0°11'51.76"N	35°29'29.93"E
12	0°14'27.29"N	35°26'9.28"E
13	0°17'36.32"N	35°23'28.58"E
14	0°20'49.96"N	35°21'45.84"E
15	0°23'32.71"N	35°21'26.48"E
16	0°26'25.31"N	35°18'55.10"E
17	0°30'21.94"N	35°18'56.94"E
18	0°32'18.46"N	35°20'4.72"E



CPA 2

Below is the geographic reference to allow unique identification of the CPA 2 including GPS coordinates for the location boundary below. The project activity is limited to a region within Mathira East District in Central Province. Each stove built as part of the project activity will be assigned a unique GPS coordinate, which was uploaded to the project database managed by co2balance UK.

Geographical Reference of Borders Points		
Point	Latitude	Longitude
1	-0.371630°	37.156131°
2	-0.398360°	37.177201°
3	-0.399258°	37.198643°
4	-0.424319°	37.206003°
5	-0.443929°	37.201528°
6	-0.447762°	37.178449°
7	-0.484437°	37.178884°
8	-0.508798°	37.173560°
9	-0.534419°	37.153839°
10	-0.565039°	37.149580°
11	-0.546726°	37.105532°
12	-0.532851°	37.080709°
13	-0.457310°	37.097248°
14	-0.414087°	37.081765°

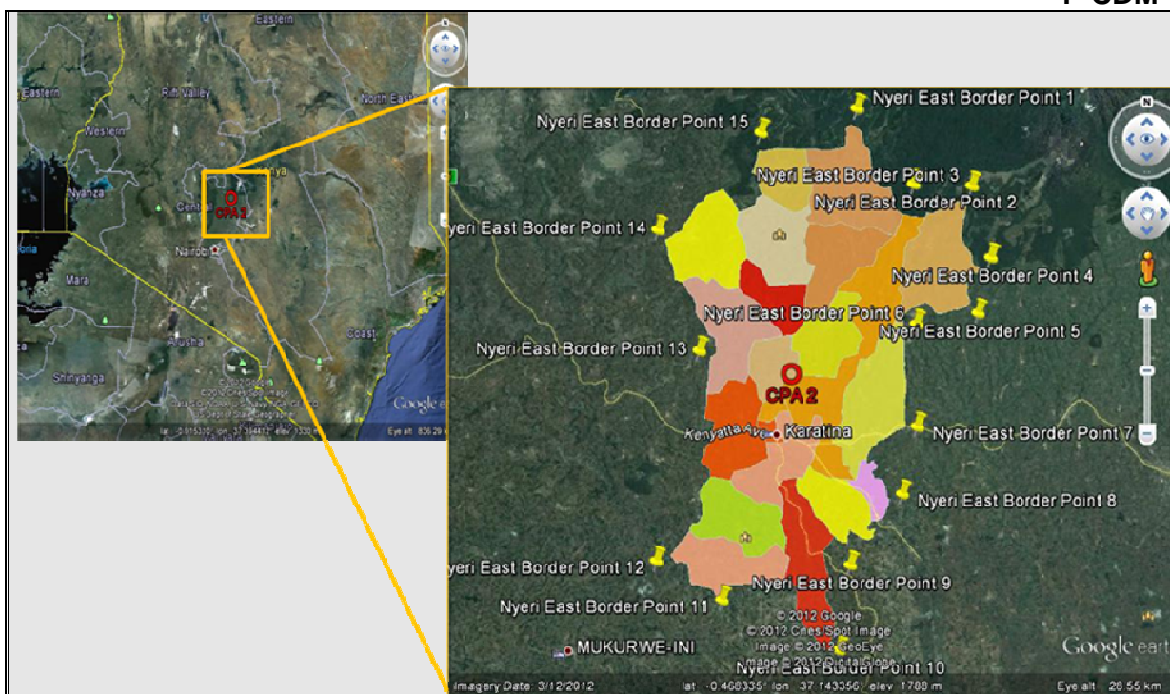


Figure 1. CPA location within Kenya

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Kenya (host)	Co2balance UK (private)	No
United Kingdom	Co2balance UK (private)	No
...	...	

A.4. Reference of applied methodology

AMS II G (version3) Energy efficiency measures in thermal applications of non-renewable biomass Other tools used:

Standard for sampling and surveys for CDM project activities and Programme of Activities (version 4.1)
Best Practice for Sampling (EB 67 Annex 6)

Guideline: Sampling and surveys for CDM project activities and programmes of activities (Version 03.0).

A.5. Crediting period of project activity

This POA operates a 7 year renewable crediting period

POA Crediting Period (1st 7 years)	
POA	21/03/2012-20/03/2019
CPA 1	21/03/2012-20/03/2019
CPA 2	31/01/2013-30/01/2020

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

This POA has distributed domestic, fuel-efficient cooking stoves based on a design by the POA implementer to rural households in exchange for the right to the emissions reductions saved by the stove. Stove owners also agreed to submit to the monitoring programme as described in the Efficient Cook Stove Programme: Kenya PoA-DD and the proposed CPA-DD.



CZK Stove

The stove components were manufactured in Kenya using a part factory, part contractor installation strategy to allow for a swift, efficient roll out. A standardized, pre-cast combustion chamber and liner was manufactured at a central location and distributed to a contractor who then assembled the stoves in situ. The contractor was trained to build each stove to a pre-determined standard, eliminating variation in performance.

The dates of the implementation of the POA at CPA level is described below:

CPA 1

CZK stoves were installed in CPA 1 from the 05/01/2011, with additional stoves being added each month until 02/04/2012, when construction was complete.

Months	Stoves Constructed	Cumulative Total Stoves
Jan-11	28	28
Feb-11	2255	2283

Mar-11	3952	6235
Apr-11	2194	8429
May-11	2771	11200
Jun-11	2456	13656
Jul-11	411	14067
Aug-11	986	15053
Sep-11	491	15544
Oct-11	40	15584
Nov-11	41	15625
Dec-11	1	15626
Jan-12	0	15626
Feb-12	0	15626
Mar-12	0	15626
Apr-12	2	15628

CPA 2

CZK stoves were installed in CPA 2 from 02/03/2011, with additional stoves being added each month until 04/11/12, when construction was complete.

Months	Stoves Constructed	Cumulative Total Stoves
Mar-11	130	130
Apr-11	1900	2,030
May-11	1837	3,867
Jun-11	175	4,042
Jul-11	0	4,042
Aug-11	3	4,045
Sep-11	0	4,045
Oct-11	0	4,045
Nov-11	1	4,046

B.2. Post registration changes**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

None

B.2.2. Corrections

None

B.2.3. Permanent changes from registered monitoring plan or applied methodology

The sampling plan and equations have been updated to be in line with the Standard: Sampling and surveys for CDM project activities and programme of activities (version 04.1), dated 28th November 2013 (after EB74 Annex 6), applying equations from the Best Practice for Sampling (EB 67 Annex 6) and Guideline: Sampling and surveys for CDM project activities and programmes of activities (Version 03.0). The reason for this change was because the equations originally given in the POA dd were from an unknown source and, in addition, the assumptions used in them were incorrect¹ which meant that the number of samples required in the sampling plan was incorrect.

As described above, the approach used to correct for continued baseline use is now included in the parameter boxes in each CPA DD and described fully in Annex 4 to avoid ambiguity about which method should be used.

B.2.4. Changes to project design of registered project activity

A number of editorials have also been included in tracked change mode to ensure that the documents are as accurate and up to date as possible, including removing barrier analysis to prove additionality (as ICS are deemed positively additional - *EB 68 Annex 27*).

B.2.5. Changes to start date of crediting period

None

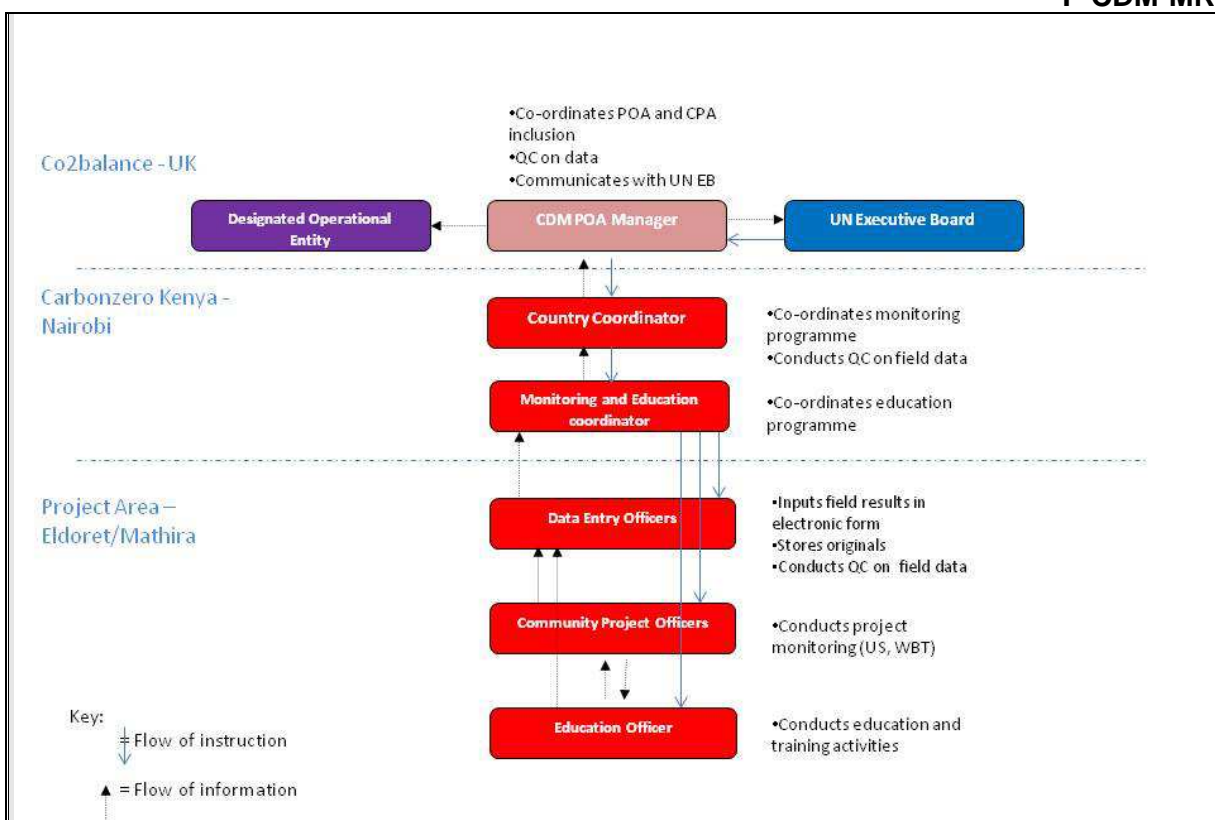
B.2.6. Types of changes specific to afforestation or reforestation project activity

None

SECTION C. Description of monitoring system

This co2balance stove project employed stove contractors for stove construction; the stove materials were manufactured in Kenya and delivered to a location central to the project area. The materials were then distributed from this central location to the individual households for stove construction. During the construction process, co2balance employees collected stove data, performed quality control checks of the constructed stove, collected carbon handover sheets, and educated stove recipients on proper usage. This process - along with the responsibilities of the staff within it - are summarised in the following diagram:

¹ “the expected variance is 40% for samples of household wood consumption and 20% for a WBT” – variance here is misquoted, it should be coefficient of variance. Also, the COV for WBT is 10%, not 20%.



Stove Data

For each constructed stove, the following information was collected and then uploaded to a central database:

- 1. Unique Stove Serial Number** - Each stove was assigned a unique serial number. The number has three characters designating the stove type, followed by three characters designating the project location, completed by a five-digit number identifying the stove number within that project. A stamp was used to permanently imprint the serial number into the side of the stove before the cement dried.
- 2. Stove GPS Coordinates** - After the construction of a stove, a co2balance employee photographed the stove with a GPS enabled device, typically a Nokia N82. The GPS enabled device tagged GPS coordinates to the picture of the stove, thereby recording the exact location. The picture was then titled as the serial number of the stove and uploaded to an online database capable of reading the GPS information.
- 3. Address/ID Number/Mobile Number of Stove recipient** - Each household participating in the project received one stove, with a unique location and serial number. To ensure the avoidance of double-counting stoves, personal information of the stove recipient was recorded in addition to the GPS coordinates and serial number. Due to the fact that some rural households in project locations did not have an official address, and some stove recipients did not possess an ID number or mobile phone number a complete set of information was not collectible.
- 4. Carbon Handover Sheet** - Each stove recipient signed a Carbon Handover Sheet in exchange for the complimentary construction of an efficient stove. The signed Carbon Handover Sheet was scanned and stored in an electronic database along with the GPS coordinates, serial number, and stove recipient information.
- 5. Stove Construction Date** - The construction date of each stove was recorded by co2balance during the initial data collection. The construction date was uploaded to the electronic database containing the

previously described stove information. The hardcopy and virtual copy of the stove information will be stored for at least seven years after collection.

Monitoring Plan

In accordance with the methodology and monitoring plan, the following parameters were monitored using a Random Sample Group (RSG). This size of the sample group was selected to ensure the parameters measured satisfied 95/5 precision (95% confidence interval and 5% margin of error). The individual participants were selected at random from the stove information database. A random number generator was used to sort the unique serial numbers of the stoves in the project, with the first entries sorted in numerical order generating a RSG to meet 95/5.

1. Number of appliances operating (Ny) - Each household selected in the RSG was visited to ensure that the efficient cooking stove supplied as part of the project activity was still in operation. All stoves in the RSG were re-photographed with a GPS enabled device. The GPS images were uploaded to the electronic database so that the GPS information and unique serial number could be cross-checked with the information from the initial data collection to ensure that the photograph is of the same stove. The date on which the stove was constructed was used to determine the operating time of the stove during the crediting period. Crediting of each stove begins 1 month after construction to ensure a conservative estimate of stove operating time.

The following information was also obtained from each household:

- a. A confirmation that the stove is still in situ and being utilized in the correct fashion
- b. A confirmation if the old appliance (three-stone fire) is being used
- c. A check whether any maintenance of the stove is required following wear and tear

Project monitoring will ensure that for households where baseline stove usage continues, the fuel wood consumed is not included in the calculation of emissions reductions.

2. The efficiency of the operating stoves (N_{new,i}) - The efficiency of each stove in the RSG was tested via the same Water Boiling Test methodology used initially to demonstrate the efficiency of the project technology. The resulting efficiency was uploaded to the electronic stove information database and, along with the information in section 1 above, used to calculate the emission reductions.

3. Continued use of baseline stoves (B_{v, baseline tech}) - Perform measurements of wood used exclusively on the baseline technology, if existing. The wood measurements will be in the form of a KPT as directed by the PCIA. The data collected is the daily mass of wood used on the baseline technology for at least 3 consecutive days.

4. The renewability of wood fuel consumed in the project (f_{NRB}) – f_{NRB} is determined on an annual basis using a report, following the guidance issued in AMS III G (version 3).

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

CPA 1

Data / Parameter:	B _{average_use}
Unit:	Tonnes per annum

Description:	Fuel wood consumption per appliance in absence of the project activity
Source of data:	Baseline study
Value (s) applied:	3.98
Purpose of data:	Calculation of baseline emissions
Additional comment:	B _{average_use} is the average annual consumption of woody biomass on the single baseline appliance – equal and equivalent to B old/stove/year. As per para 7 of the meth, it is multiplied by the number of systems, less any continued baseline use, to determine B old/tonnes per annum.

Data / Parameter:	n _{old}
Unit:	Fraction
Description:	Efficiency of three-stone fire or conventional system
Source of data:	Methodology default
Value (s) applied:	0.10
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	NCVbiomass
Unit:	TJ/tonne
Description:	Net calorific value of the non-renewable woody biomass that is substituted
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value (s) applied:	0.015
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	EFprojected_fossilfuel
Unit:	tCO ₂ /TJ
Description:	Emission factor: substitution of non-renewable biomass by similar consumers
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value (s) applied:	81.6
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	L
Unit:	Fraction

Description:	Leakage Correction Factor
Source of data:	Leakage assessment
Value (s) applied:	0.95
Purpose of data:	Calculation of leakage
Additional comment:	Under a POA the methodology requires leakage monitoring to 90/30 precision unless a correction factor of 0.95 is chosen as per subpara (c) This project applies the correction factor of 0.95, in which case monitoring surveys are not required.

CPA 2

Data / Parameter:	B _{average_use}
Unit:	Tonnes per annum
Description:	Fuel wood consumption per appliance in absence of the project activity
Source of data:	Baseline study
Value (s) applied:	5.14
Purpose of data:	Calculation of baseline emissions
Additional comment:	B _{average_use} is the average annual consumption of woody biomass on the single baseline appliance – equal and equivalent to B old/stove/year. As per para 7 of the meth, it is multiplied by the number of systems, less any continued baseline use, to determine B old/tonnes per annum.

Data / Parameter:	n _{old}
Unit:	Fraction
Description:	Efficiency of three-stone fire or conventional system
Source of data:	Methodology default
Value (s) applied:	0.10
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	NCVbiomass
Unit:	TJ/tonne
Description:	Net calorific value of the non-renewable woody biomass that is substituted
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value (s) applied:	0.015
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	EFprojected_fossilfuel
Unit:	tCO2/TJ
Description:	Emission factor: substitution of non-renewable biomass by similar consumers
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value (s) applied:	81.6
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	L
Unit:	Fraction
Description:	Leakage Correction Factor
Source of data:	Leakage assessment
Value (s) applied:	0.95
Purpose of data:	Calculation of leakage
Additional comment:	Under a POA the methodology requires leakage monitoring to 90/30 precision unless a correction factor of 0.95 is chosen as per subpara (c) This project applies the correction factor of 0.95, in which case monitoring surveys are not required.

D.2. Data and parameters monitored

CPA 1

Data / Parameter:	$N_{y,i}$
Unit:	-
Description:	Number of stoves in operation during the verification period
Measured/ Calculated / Default:	Calculated
Source of data:	Electronic database of stove IDs constructed in the project
Value(s) of monitored parameter:	14,586
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Recorded annually

Calculation method (if applicable):	Actual stove numbers counted in distribution record, then corrected for any drop off using a representative sample
QA/QC procedures:	Data from the field is GPS tagged to ensure that each stove can be located and distinguished. Digital database will not allow duplicate stove Ids or GPS data to be uploaded and hence double counted. Stoves assumed to begin crediting one month after installation.
Purpose of data:	Used for calculation of emissions reductions
Additional comment:	The number of stoves operating in the crediting period is corrected for any drop off - 93% of households were found to be using the project stove and so the corrected Total of crediting stoves is $(0.93 \times 15,628 = 14,586)$

Data / Parameter:	$n_{new,i}$
Unit:	%
Description:	Thermal efficiency of the project stove
Measured/ Calculated / Default:	Measured
Source of data:	Project Water Boiling Test
Value(s) of monitored parameter:	32.67
Monitoring equipment:	Thermometer, weighing scales, moisture content meters
Measuring/ Reading/ Recording frequency:	Recorded biennially (once every two years) (confidence interval meets 95/05)
Calculation method (if applicable):	Water Boiling Test on 21 Randomly selected Households
QA/QC procedures:	In case margin of error is more than 5%, lower bound value of the 95% confidence limit shall be used instead of repeating the sampling test / survey.
Purpose of data:	Used for calculation of emissions reductions
Additional comment:	The number of stoves operating in the crediting period is corrected for any drop off and/or continued baseline use.

Data / Parameter:	$f_{NRB,y}$
Unit:	Fraction
Description:	Fraction of the biomass that is used in the project area confirmed to be non renewable
Measured/ Calculated / Default:	Default
Source of data:	UNFCCC, Designated National Authority of Kenya
Value(s) of monitored parameter:	0.92
Monitoring equipment:	N/A

Measuring/ Reading/ Recording frequency:	Reviewed for each verification period
Calculation method (if applicable):	N/A
QA/QC procedures:	The data and study methodology used to define the CDM default value accepted by the Kenyan DNA was used to calculate a conservative figure for this monitoring period.
Purpose of data:	Used for calculation of emissions reductions
Additional comment:	

Data / Parameter:	B y, baseline tech
Unit:	Tonnes/HH/yr
Description:	Fuel wood consumption per appliance of baseline stoves continuing to be used in year y of the project activity
Measured/ Calculated / Default:	Calculated
Source of data:	Kitchen Performance Test
Value(s) of monitored parameter:	2.17
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Recorded annually
Calculation method (if applicable):	B_{old} (3.98 : $B_{average\ use}$ from KPT) is corrected for any wood that is measured to be continually used alongside project stoves. Wood used on baseline stoves is measured by KPT using a representative sample.
QA/QC procedures:	
Purpose of data:	Used for calculation of emissions reductions
Additional comment:	

CPA 2

Data / Parameter:	$N_{y,i}$
Unit:	-
Description:	Number of stoves in operation during the verification period
Measured/ Calculated / Default:	Calculated
Source of data:	Electronic database of stove IDs constructed in the project
Value(s) of monitored parameter:	3963

Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Recorded annually
Calculation method (if applicable):	Actual stove numbers counted in distribution record, then corrected for any drop off using a representative sample
QA/QC procedures:	Data from the field is GPS tagged to ensure that each stove can be located and distinguished. Digital database will not allow duplicate stove IDs or GPS data to be uploaded and hence double counted. Stoves assumed to begin crediting one month after installation.
Purpose of data:	Used for calculation of emissions reductions
Additional comment:	The number of stoves operating in the crediting period is corrected for any drop off – 98% of households were found to be using the project stove and so the corrected Total of crediting stoves is $(0.98 \times 4046 = 3963)$

Data / Parameter:	$n_{new,i}$
Unit:	Thermal efficiency of the project stove
Description:	%
Measured/ Calculated / Default:	Measured
Source of data:	Project Water Boiling Test
Value(s) of monitored parameter:	25.01%
Monitoring equipment:	Thermometer, weighing scales, moisture content meters
Measuring/ Reading/ Recording frequency:	Recorded biennially (once every two years) (confidence interval meets 95/05)
Calculation method (if applicable):	Water Boiling Test on 22 Randomly selected Households
QA/QC procedures:	In case margin of error is more than 5%, lower bound value of the 95% confidence limit shall be used instead of repeating the sampling test / survey.
Purpose of data:	Used for calculation of emissions reductions
Additional comment:	The number of stoves operating in the crediting period is corrected for any drop off and/or continued baseline use.

Data / Parameter:	$f_{NRB,y}$
Unit:	Fraction
Description:	Fraction of the biomass that is used in the project area confirmed to be non renewable
Measured/ Calculated / Default:	Default
Source of data:	UNFCCC, Designated National Authority of Kenya

Value(s) of monitored parameter:	0.92
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Reviewed for each verification period
Calculation method (if applicable):	N/A
QA/QC procedures:	CDM default now replaces independent study.
Purpose of data:	Used for calculation of emissions reductions
Additional comment:	Data available from : http://cdm.unfccc.int/DNA/fNRB/index.html

Data / Parameter:	B y, baseline tech
Unit:	tonnes per HH/yr
Description:	Fuel wood consumption per appliance of baseline stoves continuing to be used in year y of the project activity
Measured/ Calculated / Default:	Calculated
Source of data:	Usage Surveys
Value(s) of monitored parameter:	1.92
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annual
Calculation method (if applicable):	B_{old} (5.14 : $B_{average\ use}$ from KPT) is corrected for any wood that is measured to be continually used alongside project stoves. Wood used on baseline stoves is measured by KPT using a representative sample.
QA/QC procedures:	
Purpose of data:	Used for calculation of emissions reductions
Additional comment:	

D.3. Implementation of sampling plan

New project stove efficiency and relevant correction factors (continued baseline and usage drop off) for N_y (number of stove operating in verification period) have been determined by sampling. Simple random sampling was used and this only applied within and not across CPAs. Samples were selected from the list of stoves built within the project area by selecting stove IDs at random.

The following approximate equations given in the Best Practice for Sampling (EB 67 Annex 6) and Guideline: Sampling and surveys for CDM project activities and programmes of activities (Version 03.0). were used to calculate sample sizes:

$$n \geq \frac{z^2 \times N \times V}{(N-1) \times \text{precision}^2 + z^2 \times V}$$

Where for proportions (stove usage/drop off)

$$V = \frac{p(1-p)}{p^2}$$

And for mean data (Water Boiling Test)

Where:

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

The values used in these equations are presented in the following tables summarising the sampling plans for both CPAs

The sampling plan for CPA 1 is summarised below:

	CPA 1		
	Parameter of interest		
Description	Nnew	Ny	By Baseline Tech
Measurement Method	WBT	Usage Survey	KPT
Type of Sampling	Simple Random	Simple Random	Simple Random
Frequency/Confidence/Precision	Biennial (95/05)	Annual (90/10)	Annual (90/10)
Confidence	95	90	90
Precision	5	10	10
N	15628	15628	15628
V	0.01	0.33	0.14
z	1.96	1.645	1.645
n	13	80.42	36.67
Actual Sample Size (inc buffer)	21	90	59

QA/QC: If a stove owner is not present, then a randomly selected household nearby is selected to fulfill the sampling requirement

Parameter N_{new} results

Nnew (WBT)	
Number of Stoves Sampled	21
Mean	0.3267
Standard Deviation	0.028905978
5% Mean	0.017345
Confidence Level	0.012363064
Sample meets 95/5	Yes

As the number of samples is less than the 30 minimum required by the Standard: Sampling and surveys for CDM project activities and programme of activities (version 04.1), then Student's t distribution shall be used to quantify the reliability of the data (as per para 31, Guideline: Sampling and surveys for CDM project activities and programmes of activities Version 03.0). The following equations were used:

$$\text{Sample Mean} \pm t_{(n-1)} \times \sqrt{1 - \frac{n}{N}} \times \frac{SD}{\sqrt{n}} =$$

$$\frac{\frac{1}{2} \text{width of confidence interval}}{\text{mean}} \times 100\%$$

Population	15636
Sample Size	21
Sample Mean	0.3267
Sample Standard Deviation	0.028906
Degrees Freedom	15635.00
T (n-1) for 95% confidence	1.96
Right side of Equation	0.0026961
Upper Conf Value	0.3294
Lower Conf Value	0.3240

We are 95% confident that the true mean lies between 0.3294 and 0.3240 therefore this sample meets the

95% requirement as the measured mean is 0.3267

Parameter N_y results

N_y (Usage Survey)	
Number of Stoves Sampled	90
Using CZK stove	84 (93.33%)
Using baseline	6 (6.97%)
<p>N_y is therefore adjusted by 6.97% for continued use of baseline stoves</p>	

Parameter $B_{y \text{ baseline tech}}$ results

$B_{y \text{ baseline tech}}$	
Number of Stoves Sampled	60
Mean	5.9114 47
Standard Deviation	1.2677 74
10% Mean	0.5911 45
Confidence Level	0.2864 38
Sample meets 90/10	Yes

The sampling plan for CPA 2 is summarised below:

	CPA 2		
	Parameter of interest		
Description	N_{new}	N_y	By Baseline Tech
Measurement Method	WBT	Usage Survey	KPT
Type of Sampling	Simple Random	Simple Random	Simple Random
Frequency/Confidence/Precision	Biennial (95/05)	Annual (90/10)	Annual (90/10)
Confidence	95	90	90
Precision	5	10	10
N	4046	4046	4046
V	0.01	0.33	0.07
z	1.96	1.645	1.645
n	13	88	18.61

Actual Sample Size (inc buffer)	22	122	37
QA/QC: If a stove owner is not present, then a randomly selected household nearby is selected to fulfill the sampling requirement			

Nnew (WBT)	
Number of Stoves Sampled	22
Mean	0.2501
Standard Deviation	0.020986
5% Mean	0.017345
Confidence Level	0.008769
Sample meets 95/5	Yes

As the number of samples is less than the 30 minimum required by the Standard: Sampling and surveys for CDM project activities and programme of activities (version 04.1), then Student's t distribution shall be used to quantify the reliability of the data (as per para 31, Guideline: Sampling and surveys for CDM project activities and programmes of activities Version 03.0). The following equations were used:

$$\text{Sample Mean} \pm t_{(n-1)} \times \sqrt{1 - \frac{n}{N}} \times \frac{SD}{\sqrt{n}} =$$

$$\frac{\frac{1}{2} \text{width of confidence interval}}{\text{mean}} \times 100\%$$

Population	4046
Sample Size	22
Sample Mean	0.2501
Sample Standard Deviation	0.0209856
Degrees Freedom	4045.00
T (n-1) for 95% confidence	1.96
Right side of Equation	0.0018645

Upper Conf Value	0.2520
Lower Conf Value	0.2482 539

We are 95% confident that the true mean lies between 0.2520 and 0.2482 therefore this sample meets the 95% requirement as the measured mean is 0.2501

Parameter N_y results

N_y (Usage Survey)	
Number of Stoves Sampled	98
Using CZK stove	96 (97.06)
Using baseline	2 (2.94)
Ny is therefore adjusted by 2.94% for continued use of baseline stoves	

Parameter $B_{y \text{ baseline tech}}$ results

By Baseline Tech	
Number of Stoves Sampled	37
Mean	5.2479 28
Standard Deviation	0.6285 14
10% Mean	0.5247 93
Confidence Level	0.1699 58
Sample meets 90/10	Yes

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

The equations in the methodology do not calculate baseline and project emissions separately and instead calculate direct emissions reductions as shown below:

Emissions reductions are calculated using equation 1 of the methodology

$$ER_y = B_{y, \text{savings}} \times f_{NRB, y} \times NCV_{\text{biomass}} \times EF_{\text{projected_fossilfuel}} \quad (\text{equation 1})$$

Where:

$$ER_y = \text{Emission reductions during year } y \text{ in t CO}_2\text{e}$$

$B_{y,savings}$	=	Quantity of woody biomass that is saved in tonnes
$f_{NRB,y}$	=	Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass
$NCV_{biomass}$	=	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)
$EF_{projected_fossilfuel}$	=	Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 t CO ₂ /TJ

Where option 2 (equation 3) was used to determine B, y savings

$$B_{y,savings} = B_{old} \times \left(1 - \frac{\eta_{old}}{\eta_{new,y}}\right) \text{ (Option 2 - Equation 3)}$$

CPA 1 Calculations

B old was determined using a baseline KPT, which returned a value of 3.98 T/hh/yr. B old, as per the methodology para 20 (b), has been corrected to allow for the continued use of baseline stoves in this project.

B y baseline tech was determined by a KPT on non project stoves that were used alongside CZK stoves, the KPT revealed a wood use of 2.15 T/hh/yr. 3.98-2.15 was multiplied by the number of crediting stoves to give Bold (gross below)

B y baseline tech		2.157677987
-------------------	--	-------------

The number of crediting stoves was revealed by usage survey as 0.93 of the sample were using their project stove so Ny was corrected by multiplying by this figure to give 14586 crediting (corrected) stoves.

Number of Stoves	tonnes/stove/ yr	15628
Usage Percentage		0.93
Number of crediting Stoves	tonnes/stove/ yr	14586.13333

The number of crediting stoves was multiplied by Bold corrected for B y baseline tech (3.98 -2.15 = 1.82) to give Bold (gross) (26580)

The figure for B old 26580 was then corrected for leakage by multiplying by the net to gross factor of 0.95, giving 25251 as the final (net) figure for B old. Then, as per equation 3, Bold was multiplied by 1-(0.1/0.3267) giving B y savings of 17521.

Bold (gross)	tonnes/yr	26580.63185
Leakage Factor		0.95
By (net)	tonnes/yr	25251.60026
Nold		0.1
Nnew		0.326666667
By savings	tonnes/yr	17521.51855

B y savings (17521) was then inserted in equation 1 and multiplied by fNRB, NCV and the EF_{fossil fuel} to calculate the emissions reductions for one year (19730)

B Savings (inc leakage and usage)	tonnes/yr	17521.51855
fNRB		0.92
NCV	TJ/tonne	0.015
EF	tCO ₂ /TJ	81.6
ER _y	per/yr	19730.63161

The ER_y per stove was calculated by dividing the ER_y by the number of stoves (15628)

ER _y	per/yr	19730.63161
Number of Stoves		15628
ERs per stove	tco _{2e} /stove/yr	1.262518019

The ERs per stove/yr was then divided by the number of months in a year (12) to give a figure for ER_y per stove/month (0.11). The number of stoves built per month was then multiplied by the ERs/stove/month and the totals for each month summed to give the total ERs to March 20th 2014.

Months	Stoves Constructed	Cumulative Total Stoves	Ers/stove/month	Emissions Reductions
Mar-13	15637	15,637	0.11	584
Apr-13	15637	15,637	0.11	1645
May-13	15637	15,637	0.11	1645
Jun-13	15637	15,637	0.11	1645
Jul-13	15637	15,637	0.11	1645
Aug-13	15637	15,637	0.11	1645
Sep-13	15637	15,637	0.11	1645
Oct-13	15637	15,637	0.11	1645
Nov-13	15637	15,637	0.11	1645
Dec-13	15637	15,637	0.11	1645
Jan-14	15637	15,637	0.11	1645
Feb-14	15637	15,637	0.11	1645
Mar-14	15637	15,637	0.11	1061
Total ERS to March 20th 2014				19,741

CPA 2 Calculations

B old was determining using a baseline KPT, which returned a value of 5.14 T/hh/yr. B old, as per the methodology para 20 (b), has been corrected to allow for the continued use of baseline stoves in this project.

B y baseline tech was determined by a KPT on non project stoves that were used alongside CZK stoves,

the KPT revealed a wood use of 1.91 T/hh/yr. 5.14-1.91 was multiplied by the number of crediting stoves to give Bold (gross below)

B y baseline tech		1.915493694
-------------------	--	-------------

The usage survey revealed a usage fraction of 0.98 of the sample were using their project stove so Ny was corrected by multiplying by this figure to give 3963 crediting stoves.

Usage Percentage		0.98
Number of crediting Stoves	tonnes/stove/yr	3963.428571
Bold (less drop off and baseline use)	tonnes/yr	12780.10042

The number of crediting stoves was multiplied by Bold corrected for B y baseline tech ($5.14 - 1.92 = 3.22$) to give Bold (gross) (12780)

The figure for Bold (gross) 12780 was then corrected for leakage by multiplying by the net to gross factor of 0.95, giving 12141 as the final (net) figure for B old. Then, as per equation 3, Bold was multiplied by $1 - (0.1/0.2501)$ giving B y savings of 7286

Bold (gross)	tonnes/yr	12780.10042
Leakage Factor		0.95
By (net)	tonnes/yr	12141.0954
Nold		0.1
Nnew		25.01%
By savings	tonnes/yr	7286.956008

B y savings (7286) was then inserted in equation 1 and multiplied by fNRB, NCV and the EF_{fossil fuel} to calculate the emissions reductions for one year (8205)

B Savings (inc leakage and usage)	tonnes/yr	7286.956008
fNRB		0.92
NCV	TJ/tonne	0.015
EF	tCO ₂ /TJ	81.6
ERy	per/yr	8205.695421

The ERy per stove was calculated by dividing the ER y by the number of stoves (4046)

ERy	per/yr	8205.695421
Number of Stoves		4046
ERs per stove	tco2e/stove/yr	2.028100697

The ERs per stove/yr was then divided by the number of months in a year (12) to give a figure for ER y per stove/month (0.17). The number of stoves built per month was then multiplied by the ERs/stove/month and the totals for each month summed to give the total ERs to March 20th 2013.

Months	Stoves Constructed	Cumulative Total Stoves	Ers/stove/month	Emissions Reductions
Mar-13	4046	4,046	0.17	243
Apr-13	4046	4,046	0.17	684
May-13	4046	4,046	0.17	684
Jun-13	4046	4,046	0.17	684
Jul-13	4046	4,046	0.17	684
Aug-13	4046	4,046	0.17	684
Sep-13	4046	4,046	0.17	684
Oct-13	4046	4,046	0.17	684
Nov-13	4046	4,046	0.17	684
Dec-13	4046	4,046	0.17	684
Jan-14	4046	4,046	0.17	684
Feb-14	4046	4,046	0.17	684
Mar-14	4046	4,046	0.17	441
Total ERS to March 20th 2014				8,205

E.2. Calculation of project emissions or actual net GHG removals by sinks

Project emissions are not calculated because the methodology calculates emission reductions directly.

E.3. Calculation of leakage

Leakage does not need to be calculated separately because it has already been removed as a 0.95 net to gross factor from the parameter B_{old} , used in direct emissions reductions calculations (equation 1).

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

CPA 1

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	19741	-	-	19741

CPA 2

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	8205	-	-	8205

POA 5336 (CPA 1&2 combined)

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	27947	-	-	27947

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

CPA 1

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO ₂ e)	48646.66	19741

CPA 2

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO ₂ e)	46214	8206

POA 5336 (CPA 1&2 combined)

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
------	---	--

Emission reductions or GHG removals by sinks (t CO₂e)	94,860	27947
---	--------	-------

E.6. Remarks on difference from estimated value in registered PDD

CPA 1

ERs are lower for the following reasons:

The number of stoves actually built was 15628, not 16048 as estimated in the PDD

Continued baseline stove use was not envisaged in the registered PDD, Bold has been corrected for this continued usage, which has reduced the ERs

100% project usage was expected in the registered PDD, whereas the actual usage was recorded to be 93%

The project stove efficiency was expected to be the same as that recorded in the initial laboratory test (34.67%), whereas the actual figure recorded was 32.67%

fNRB y value of 0.96 originally estimated has been replaced by the CDM default figure for Kenya of 0.92, which has reduced ERs.

CPA 2

ERs are lower for the following reasons:

The number of stoves actually built was 4046, not 11907 as estimated in the PDD

Continued baseline stove use was not envisaged in the registered PDD, Bold has been corrected for this continued usage

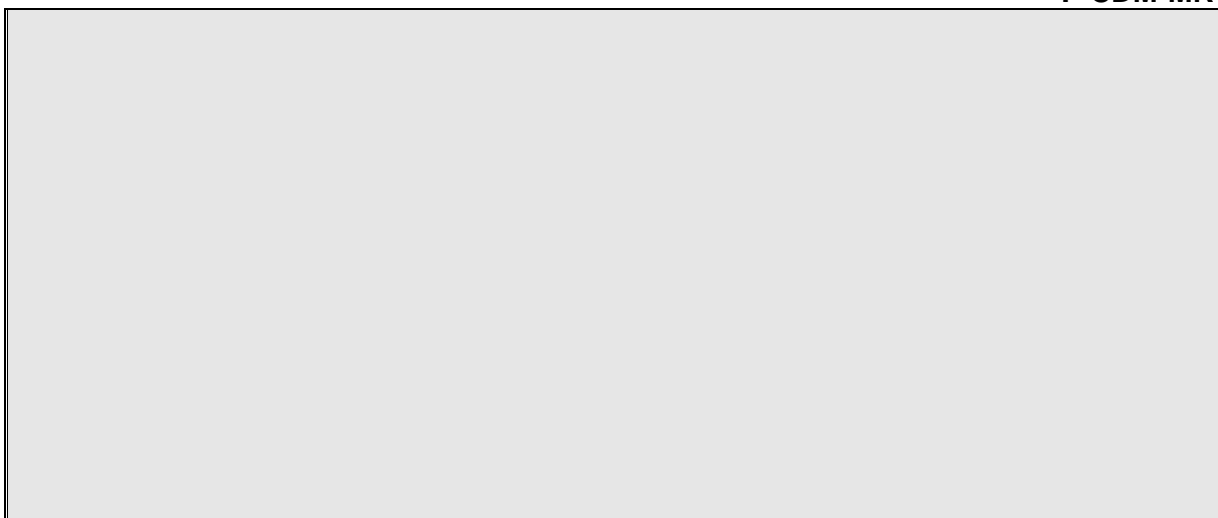
100% project usage was expected in the registered PDD, whereas the actual usage was recorded to be 98%

The project stove efficiency was expected to be the same as that recorded in the initial laboratory test (34.67%), whereas the actual figure recorded was 25.01% as a result of tampering of the stoves within the sample selections. We do not expect this tampering to be present in all of our stoves throughout the project; nonetheless we have applied this figure as a demonstrably conservative assumption.

fNRB y value of 0.96 originally estimated has been replaced by the CDM default figure for Kenya of 0.92

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO₂e)	CPA 1 – 0 CPA 2 – 0 POA 5336 – 0	CPA 1 – 19741 CPA 2 – 8206 POA 5336 – 27947



- - - - -

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: issuance Keywords: monitoring report, performance monitoring		