



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

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

**MONITORING REPORT**

<b>Title of the PoA</b>	Biomass Energy Conservation Programme	
<b>UNFCCC reference number of the PoA</b>	10 182	
<b>Version numbers of the PoA-DD applicable to this monitoring report</b>	07	
<b>Version number of this monitoring report</b>	2.5	
<b>Completion date of this monitoring report</b>	03/04/2019	
<b>Monitoring period number</b>	Third (3rd) Monitoring Period	
<b>Duration of this monitoring period</b>	01/02/2018 – 31/05/2018	
<b>Monitoring report number for this monitoring period</b>	1	
<b>Coordinating/managing entity</b>	Hestian Innovation Ltd.	
<b>Host Parties</b>	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	Malawi Rwanda	Yes No
<b>Sectoral scopes</b>	Sectoral Scope 3 (Energy Demand)	
<b>Applied methodologies and standardized baselines</b>	AMS-II.G.: Energy efficiency measures in thermal applications of non-renewable biomass --- Version 6.0	
<b>Amount of GHG emission reductions or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period</b>	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0	100,512 tonnes of CO <sub>2</sub> equivalent
<b>Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs covered in this monitoring report</b>	104,604 tonnes of CO <sub>2</sub> equivalent	

## PART I Monitoring of programme of activities (PoA)

### SECTION A. Description of PoA

#### A.1. General description of PoA

The Biomass Energy Conservation (BEC) PoA is a voluntary initiative by Hestian Innovation Ltd. (Hestian) which aims to promote sustainable development and the reduction of greenhouse gas emissions from non-renewable biomass fuel through dissemination of improved household cook-stoves in Malawi and Rwanda. Each CPA will consist of a number of improved cook-stoves (ICS), such as the Chitetezo Mbaula or Canarumwe stoves, or others as specified in each CPA- DD.

The fuel type used by improved household cook-stoves is predominantly fire wood and to a small extent other biomass agricultural residue (e.g. pigeonpea stalks, maize hobs, etc.).

The improved household stoves reduce fuel consumption by improved combustion and improved heat transfer. The stoves raise the cooking pot to the hottest point above the flame. The improved household cook-stoves target predominantly low-income households using non-renewable biomass energy on traditional/unimproved/low-efficiency stoves.

Both Malawi and Rwanda are Least Developed Countries (LDCs) where biomass in the form of firewood, charcoal and crop waste meets 93% and 99.2%, respectively, of household and industrial energy needs.

The overall aim of the PoA is to positively impact air quality, soil condition, quality and quantity of employment and income generation, livelihood of the poor, access to affordable and clean energy services, human and institutional capacity, access to investment, and technology transfer and technological self- reliance.

#### 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
Biomass Energy Conservation Programme CPA, generic CPA 1	07	Sectoral Scope 3 (Energy Demand)	AMS-II.G.: Energy efficiency measures in thermal applications of non-renewable biomass --- Version 6.0 <a href="https://cdm.unfccc.int/methodologies/DB/DCO8WRRQVTGLH1GHQBCL035F5M13R8">https://cdm.unfccc.int/methodologies/DB/DCO8WRRQVTGLH1GHQBCL035F5M13R8</a>

#### A.1.2. CPAs included in the PoA

Title and UNFCCC reference number of the CPA	Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Crediting period type and duration	Covered in this monitoring report? (yes/no)
Malawi Biomass Energy Conservation Programme CPA 1 - CPA 10182-0001	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 13/08/2015 – 12/08/2022	Yes

Malawi Biomass Energy Conservation Programme CPA 2 - CPA 10182-0002	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 15/10/2016 – 14/10/2023	Yes
Malawi Biomass Energy Conservation Programme CPA 3 - CPA 10182-0003	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 15/10/2016 – 14/10/2023	Yes
Malawi Biomass Energy Conservation Programme CPA 4 - CPA 10182-0004	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 15/10/2016 – 14/10/2023	Yes
Malawi Biomass Energy Conservation Programme CPA 5 - CPA 10182-0005	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 03/05/2017 – 14/10/2023	Yes
Malawi Biomass Energy Conservation Programme CPA 6 - CPA 10182-0006	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 01/09/2017 – 30/11/2023	Yes
Malawi Biomass Energy Conservation Programme CPA 7 - CPA 10182-0025	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 11/08/2017 – 10/08/2024	Yes
Malawi Biomass Energy Conservation Programme CPA 8 - CPA 10182-0020	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 06/04/2018 – 05/04/2025	Yes
Malawi Biomass Energy Conservation Programme CPA 9 - CPA 10182-0021	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 29/03/2018 – 28/03/2025	Yes
Malawi Biomass Energy Conservation Programme CPA 10 - CPA 10182-0022	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 11/08/2017 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 11 - CPA 10182-0023	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 11/08/2017 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 12 - CPA 10182-0024	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 11/08/2017 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 13 - CPA 10182-0007	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 11/08/2017 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 14 - CPA 10182-0009	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 11/08/2017 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 15 - CPA 10182-0008	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 11/08/2017 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 16 - CPA 10182-0010	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 11/08/2017 – 10/08/2024	No
Malawi Biomass Energy Conservation	Biomass Energy Conservation	07	Renewable	No

Programme CPA 17 - CPA 10182-0011	Programme CPA, generic CPA 1		11/08/2017 – 10/08/2024	
Malawi Biomass Energy Conservation Programme CPA 18 - CPA 10182-0012	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 01/09/2018 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 19 - CPA 10182-0013	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 11/08/2017 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 20 - CPA 10182-0014	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 01/10/2018 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 21 - CPA 10182-0015	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 01/11/2018 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 22 - CPA 10182-0016	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 01/01/2019 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 23 - CPA 10182-0017	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 01/01/2019 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 24 - CPA 10182-0018	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 01/02/2019 – 10/08/2024	No
Malawi Biomass Energy Conservation Programme CPA 25 - CPA 10182-0019	Biomass Energy Conservation Programme CPA, generic CPA 1	07	Renewable 01/02/2019 – 10/08/2024	No

## A.2. Coordinating/managing entity

Hestian Innovation Limited (Hestian) is the coordinating/managing entity of the PoA, which communicates with the Board.

Contact person: Mr. Conor Fox, conor.fox@hestian.com

## SECTION B. Implementation of PoA

### B.1. Description of implemented PoA

The Biomass Energy Conservation (BEC) POA is a voluntary initiative by Hestian Innovation Ltd. (Hestian) which aims to promote sustainable development and the reduction of greenhouse gas emissions from non-renewable biomass fuel through dissemination of improved household cookstoves in Malawi and Rwanda. CPAs included in the monitoring report are being implemented in Malawi and foresees the dissemination of Chitetezo Mbaula stoves. This stove can be used as a portable stove or can be fixed, and has a laboratory test efficiency of 30.6%<sup>1</sup> (more than three times the default 10% efficiency of the baseline three stone and unimproved cookstoves) which results in reduced fuel consumption by improved combustion and improved heat transfer, raising the cooking pot to the hottest point above the flame. The Chitetezo Mbaula has an average lifespan of 47 months<sup>2</sup> and can be used for various pot sizes. The Ceramic Stove is produced at a local level using locally available materials, thereby creating employment in a 'green' industry.

There are three CPA implementers at the time of monitoring report preparation: Area 55 (CPA 1, CPA 2, CPA 4, CPA 5, CPA 6, CPA 8), Sunfire (CPA 3 and CPA 7), and Eden by Design (CPA 9, started implementation on 29/03/2018).

Total sales records database has been maintained so that end users can be traced (i.e. name, address and telephone number, if available) documenting the date and place of sale and the number of stoves bought. End user information is collected through direct sales to end-users by retailers or agents of the CPA implementers and is contained in an emission reduction contract. This information is collated into a spreadsheet/database from which CPA monitoring can be conducted. The database also contains stoves serial numbers and CPA id information. In the case of bulk sales of domestic<sup>3</sup> cook-stoves in Malawi, which represent less than 50% of the customers, information is kept on the place of sale and of the date of delivery with a conservative means of estimating when the stove is first used (each stove is assumed to be first used on the last day of the month next to the month, when the stove is delivered to the shop; this is the conservative assumption as after 25 days since date of delivery based on the bulk sales analysis of the average time between delivery to retail outlet and purchase by end-user is 25 days)<sup>1</sup>. In the case of direct sales, it is assumed that the stove is first used on the next date after the date of sale.

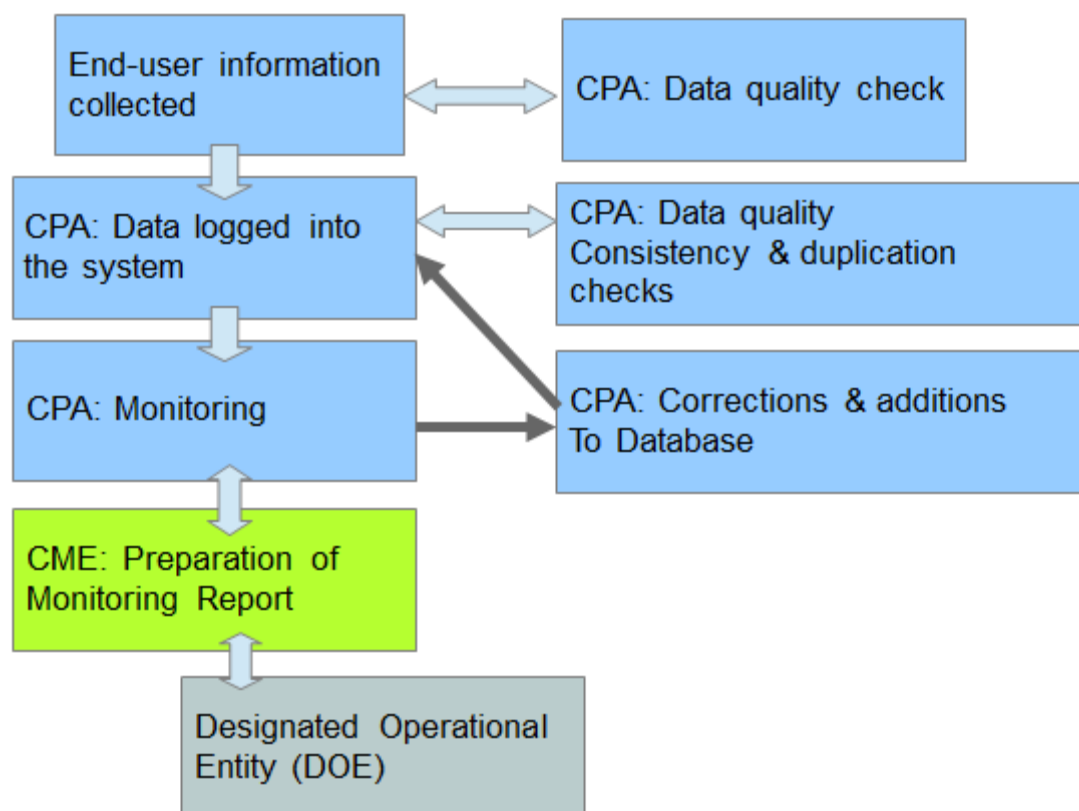
Organizational structure, roles and competencies of the personnel involved in the monitoring activities have been reviewed throughout the monitoring period. Up-to-date CDM requirements for the PoA management were analysed and no new requirements demanding changes to the existing PoA management system were identified. Procedures for relations with clients and stakeholders, data keeping and recording, training and quantification of the personnel were reviewed and found satisfactory. The flow chart below illustrates the roles and responsibilities of the parties during the implementation of the PoA.

---

• 1 Tests were carried out in August 2012 by the Regional Stove Testing Centre, Centre for Research in Energy and Energy Conservation (CREEC), at College of Engineering, Design, Art and Technology, Makerere University, Kampala, Uganda ([creec@tech.mak.ac.ug](mailto:creec@tech.mak.ac.ug)).

2 Estimates are based on verification report for GS613, a Gold Standard project that has been developed by the CME that promotes the Chitetezo Mbaula in Malawi. The Verification Report is for the period 02/10/2012 to 01/10/2013 (both days inclusive). (page 19 of 118).

3



The serial numbers allocated to each device under the PoA allow unique identification and tracking of the devices to avoid double accounting. Based on the serial numbers, a device can only count in one CPA.

Data will be kept for the whole crediting period of the CPA and an additional two years.

The database records are backed up and sent to the CME for checking prior to using them as the basis for monitoring activities. Hard copies of Emission Reduction contracts are filed (in paper or electronically) as additional backup and for verification purposes. All CPA implementers are strongly encouraged to scan ER contracts as an additional form of backup to secure data.

The CME plays a pivotal role in the development of CPAs and oversees the inclusion of CPAs under the PoA. Through a technical review, the CME assesses the competence of potential CPA implementers to ensure that they fulfil technical and eligibility aspects of potential CPAs and to plan technical and administrative processes to meet PoA requirements.

Monitoring tasks are managed by the CPA implementer in collaboration with the CME. Surveys are organised by agents of the CPA implementers, and enumerators are trained and re-trained prior to conducting surveys and tests. Survey and test results are filed in paper and/or in electronic form at the CPA implementer's office and are analysed using spreadsheets or database programmes to compile reports. The integrity of data is cross-checked with other variables to ensure consistency and avoid mistakes. Calibration of the monitoring equipment for project emission parameters is performed by enumerators as per the equipment's operating instructions, prior to conducting surveys and tests and is documented in usage & monitoring survey report and water boiling test reports.

The description of implemented sampling design is provided below:

- 1) objective of the sampling is to collect data to estimate monitoring parameters needed for emission reduction calculation meeting the requirements for minimum sample size, and required confidence (95%) / precision (10%) level;
- 2) target population – 128,451 ICS (at the time of monitoring report preparation the total number of improved cook-stoves disseminated within the PoA reached 180,095; monitoring is, however,

performed on an annual basis and target population at the time of sample size estimation (January, 2018) was 128,451 ICS;

3) sampling frame – ICSs distributed in 4 Districts randomly sampled taking into account the population size of each District, i.e. considering probability proportional to size on the primary unit (this gives more populous areas a higher chance of being selected); the 4 districts sampled were Dowa, Mzimba South, Lilongwe and Balaka with total of 78,019 distributed ICS;

4) sampling methods - stratified random sampling; the strata were defined by project participant based on the approach described in PoA DD; the primary sampling units were identified based on CPA Implementer and ICS vintage;

5) sample size - the minimal sample sizes are presented in the table below; from experience some households will not be available or away from home at the time of the visit so oversampling was performed;

Parameter	Sample size calculated	Whether minimum sample size (30) achieved	Sample size arrived	Assumed response rate	Recommended sample size	Actual Sample Size	Precision achieved
Proportion of stoves that are still in operation	80	Yes	80	80%	100	127	4.6%
Retention use of ICS	113	Yes	113	80%	145	127	3.6%
Thermal efficiency of the device 'i' at age 'a' determined using the water boiling test	10	No, Student t-distribution is applied	13	90%	16	16	3.7%

Information about the precision achieved demonstrates that the required confidence/precision level has been met.

6) formulas used in the sampling:

- overall proportion and overall variance for proportional parameters were calculated based on equations (5) and (6); overall mean and overall variance for mean parameters were calculated based on equations (22) and (23) of CDM Guideline “Sampling and surveys for CDM project activities and programmes of activities”, Version 03.0.
- the minimum sample size required is calculated based on equation (4) for proportional parameters and equation (21) for mean parameters of CDM Guideline “Sampling and surveys for CDM project activities and programmes of activities”, Version 03.0.

Data were collected among households randomly selected among target population meeting the requirements for minimum sample size, thus the selected samples are representative of the population.

CME prepares and submits monitoring reports and facilitate the verification of the same and act as the focal point with the CDM Executive Board.

The following monitoring tasks are being undertaken (periodically):

- usage and monitoring surveys to determine proportion of operational stoves;
- evaluation of annual quantity of woody biomass used by project devices determined in the first year of the introduction of the devices;
- in cases, where users retain the baseline technology as a backup or auxiliary technology in

parallel with the improved technology, the extent to which the baseline technology is used has been quantitatively assessed through monitoring surveys and an appropriate and conservative adjustment factor has been applied - proportion of discontinued use of baseline stoves;

- water boiling tests to determine thermal efficiency of project devices;
- fNRB is monitored over time and any new official fNRB can be applied if they are officially published or officially recognised by the DNA of the Host country.

The mean number of months when only 50% of customers are using their stoves has been used to calculate the “average lifespan” of a stove, after which CERs will no longer be claimed. The conservative value of the estimated life-span for the clay stoves (Chitetezo Mbaula Malawi and Canarumwe in Rwanda) based on previous project proponent experience equal to 1417 days will be used for calculation of emission reductions.<sup>4</sup>

All parties involved in implementing CPAs are aware and agree that the CPAs are subscribed to the PoA.

## **B.2. Post-registration changes to PoA**

### **B.2.1. Corrections**

There are no corrections to programme information or parameters fixed at the registration of the PoA.

### **B.2.2. Inclusion of monitoring plan**

Not Applicable. The section is left blank intentionally.

### **B.2.3. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools**

Not Applicable. The section is left blank intentionally.

### **B.2.4. Changes to programme design**

Not Applicable. The section is left blank intentionally.

---

4

Based on a survey of 144 households sampled and surveyed and stratified into the age-groups within 16 geographic areas, locally known as GVHs, statistical analysis gave a total days of technical life-time of Portable Clay Stoves (PCS) of 1,417 days. 4<sup>th</sup> Periodic Verification Report “Integrated Biomass Energy Conservation Project, Malawi (GS613), by TUV Nord, Page 29 of 115.

## **PART II      Monitoring of CPAs**

### **SECTION C.    Implementation of CPAs**

#### **C.1.    Description of implemented CPAs**

There are 9 specific-case CPAs included in monitoring report. Under each CPA improved cook-stoves (i.e. the technology) that are more efficient and use less wood for household cooking and heating than the traditional stoves are disseminated. Therefore, the brief description below is provided for the group of registered specific-case CPAs (CPA1, CPA 2, CPA 3, CPA 4, CPA 5, CPA 6, CPA 7, CPA 8 and CPA 9).

The purpose of the group of specific-case CPAs is to reduce greenhouse gases emissions due to improved efficiency of firewood consumption achieved in improved cook-stoves.

Project activities also aim promotion of improved kitchen and firewood management practices e.g. use of less firewood, use of dry firewood, using a pot lid while cooking and soaking legumes before cooking (i.e. practices) to households.

The measures taken for GHG emission reduction include the application of the improved cook-stoves and cooking practices, and replacement of less efficient technologies and practices. The application of improved cook-stoves results in biomass conservation and a reduction of greenhouse gas emissions into the atmosphere from the burning of solid biomass.

The cook-stove model disseminated within PoA is a Ceramic Stove called the Chitetezo Mbaula in Malawi and Canarumwe in Rwanda. This stove can be used as a portable stove or can be fixed, and has a laboratory test efficiency of 30.6% (more than three times the default 10% efficiency of the baseline three stone and unimproved cook-stoves) which results in reduced fuel consumption by improved combustion, improved heat transfer, raising the cooking pot to the hottest point above the flame, and improved heat retention.

The Ceramic Stove is produced at a local level using locally available materials, thereby creating employment in a 'green' industry.

Under CPA 1 improved household cook-stoves are disseminated in the Northern, Central and Southern Districts of Malawi. CPA 1 was included in Programme of Activities on 13/08/2015. Beginning of household stoves (ICS) distribution under the CPA is 13/08/2015 and the end of distribution is 31/05/2016. It is assumed that each household stove starts its operation on the next day after the date of sale. In case of bulk sales it is assumed that each household stove starts its operation on the last day of the month next to the month, when the stove is delivered to the shop. The number of household stoves (portable clay stoves) distributed within CPA as of the end of the monitoring period considered is 22,171. Monitoring period covered in this monitoring report is 01/02/2018 – 31/05/2018 (both dates included). The type of stove disseminated is Chitetezo Mbaula ceramic stove, which has a laboratory test efficiency of 30.6%. Total GHG emission reductions achieved in this monitoring period is 13,253 tonnes CO<sub>2</sub>e. Double counting is avoided by using unique serial numbers for each household stove distributed within CPAs included in the programme of activities.

Under CPA 2 improved household cook-stoves are disseminated in the Northern, Central and Southern Districts of Malawi. CPA 2 was included in Programme of Activities on 15/10/2016. Beginning of household stoves (ICS) distribution under the CPA is 03/06/2016. The stoves were distributed between 03/06/2016 and 18/11/2016 and between 22/09/2017 and 30/10/2017. It is assumed that each household stove starts its operation on the next day after the date of sale. In case of bulk sales it is assumed that each household stove starts its operation on the last day of the month next to the month, when the stove is delivered to the shop. The number of household stoves (portable clay stoves) distributed within CPA as of the end of the monitoring period considered is 22,301. Monitoring period covered in this monitoring report is 01/02/2018 – 31/05/2018 (both dates

included). The type of stove disseminated is Chitetezo Mbaula ceramic stove, which has a laboratory test efficiency of 30.6%. Total GHG emission reductions achieved in this monitoring period is 14,741 tonnes CO<sub>2</sub>e. Double counting is avoided by using unique serial numbers for each household stove distributed within CPAs included in the programme of activities.

Under CPA 3 improved household cook-stoves are disseminated in the Northern, Central and Southern Districts of Malawi. CPA 3 was included in Programme of Activities on 15/10/2016. Beginning of household stoves (ICS) distribution under the CPA is 01/07/2016 and the end of distribution is 22/11/2017. It is assumed that each household stove starts its operation on the next day after the date of sale. In case of bulk sales it is assumed that each household stove starts its operation on the last day of the month next to the month, when the stove is delivered to the shop. The number of household stoves (portable clay stoves) distributed within CPA as of the end of the monitoring period considered is 22,306. Monitoring period covered in this monitoring report is 01/02/2018 – 31/05/2018 (both dates included). The type of stove disseminated is Chitetezo Mbaula ceramic stove, which has a laboratory test efficiency of 30.6%. Total GHG emission reductions achieved in this monitoring period is 15,702 tonnes CO<sub>2</sub>e. Double counting is avoided by using unique serial numbers for each household stove distributed within CPAs included in the programme of activities.

Under CPA 4 improved household cook-stoves are disseminated in the Northern, Central and Southern Districts of Malawi. CPA 4 was included in Programme of Activities on 15/10/2016. Beginning of household stoves (ICS) distribution under the CPA is 19/11/2016 and the end of stove distribution is 02/05/2017. It is assumed that each household stove starts its operation on the next day after the date of sale. In case of bulk sales it is assumed that each household stove starts its operation on the last day of the month next to the month, when the stove is delivered to the shop. The number of household stoves (portable clay stoves) distributed within CPA as of the end of the monitoring period considered is 21,052. Monitoring period covered in this monitoring report is 01/02/2018 – 31/05/2018 (both dates included). The type of stove disseminated is Chitetezo Mbaula ceramic stove, which has a laboratory test efficiency of 30.6%. Total GHG emission reductions achieved in this monitoring period is 13,396 tonnes CO<sub>2</sub>e. Double counting is avoided by using unique serial numbers for each household stove distributed within CPAs included in the programme of activities.

Under CPA 5 improved household cook-stoves are disseminated in the Northern, Central and Southern Districts of Malawi. CPA 5 was included in Programme of Activities on 15/10/2016. Beginning of household stoves (ICS) distribution under the CPA is 03/05/2017 and the end of stove distribution is 21/09/2017. It is assumed that each household stove starts its operation on the next day after the date of sale. In case of bulk sales it is assumed that each household stove starts its operation on the last day of the month next to the month, when the stove is delivered to the shop. The number of household stoves (portable clay stoves) distributed within CPA as of the end of the monitoring period considered is 21,341. Monitoring period covered in this monitoring report is 01/02/2018 – 31/05/2018 (both dates included). The type of stove disseminated is Chitetezo Mbaula ceramic stove, which has a laboratory test efficiency of 30.6%. Total GHG emission reductions achieved in this monitoring period is 14,975 tonnes CO<sub>2</sub>e. Double counting is avoided by using unique serial numbers for each household stove distributed within CPAs included in the programme of activities.

Under CPA 6 improved household cook-stoves are disseminated in the Northern, Central and Southern Districts of Malawi. CPA 6 was included in Programme of Activities on 15/10/2016. Beginning of household stoves (ICS) distribution under the CPA is 31/10/2017. It is assumed that each household stove starts its operation on the next day after the date of sale. In case of bulk sales it is assumed that each household stove starts its operation on the last day of the month next to the month, when the stove is delivered to the shop. The distribution of stoves under CPA 6 has ended on 05/04/2018. The number of household stoves (portable clay stoves) distributed within CPA as of the end of the monitoring period considered is 21,403. Monitoring period covered in this monitoring report is 01/02/2018 – 31/05/2018 (both dates included). The type of stove disseminated is Chitetezo Mbaula ceramic stove, which has a laboratory test efficiency of 30.6%. Total GHG emission

reductions achieved in this monitoring period is 12,636 tonnes CO<sub>2</sub>e. Double counting is avoided by using unique serial numbers for each household stove distributed within CPAs included in the programme of activities.

Under CPA 7 improved household cook-stoves are disseminated in the Northern, Central and Southern Districts of Malawi. CPA 7 was included in Programme of Activities on 11/08/2017. Beginning of household stoves (ICS) distribution under the CPA is 23/11/2017. It is assumed that each household stove starts its operation on the next day after the date of sale. In case of bulk sales it is assumed that each household stove starts its operation on the last day of the month next to the month, when the stove is delivered to the shop. The distribution of stoves under CPA 7 has ended on 31/05/2018. The number of household stoves (portable clay stoves) distributed within CPA as of the end of the monitoring period considered is 21,020. Monitoring period covered in this monitoring report is 01/02/2018 – 31/05/2018 (both dates included). The type of stove disseminated is Chitetezo Mbaula ceramic stove, which has a laboratory test efficiency of 30.6%. Total GHG emission reductions achieved in this monitoring period is 10,218 tonnes CO<sub>2</sub>e. Double counting is avoided by using unique serial numbers for each household stove distributed within CPAs included in the programme of activities.

Under CPA 8 improved household cook-stoves are disseminated in the Northern, Central and Southern Districts of Malawi. CPA 8 was included in Programme of Activities on 11/08/2017. Beginning of household stoves (ICS) distribution under the CPA is 06/04/2018. It is assumed that each household stove starts its operation on the next day after the date of sale. In case of bulk sales it is assumed that each household stove starts its operation on the last day of the month next to the month, when the stove is delivered to the shop. The distribution of stoves under CPA 8 is being continued. The number of household stoves (portable clay stoves) distributed within CPA as of the end of the monitoring period considered is 8,948. Monitoring period covered in this monitoring report is 01/02/2018 – 31/05/2018 (both dates included). The type of stove disseminated is Chitetezo Mbaula ceramic stove, which has a laboratory test efficiency of 30.6%. Total GHG emission reductions achieved in this monitoring period is 2,610 tonnes CO<sub>2</sub>e. Double counting is avoided by using unique serial numbers for each household stove distributed within CPAs included in the programme of activities.

Under CPA 9 improved household cook-stoves are disseminated in the Northern, Central and Southern Districts of Malawi. CPA 9 was included in Programme of Activities on 11/08/2017. Beginning of household stoves (ICS) distribution under the CPA is 29/03/2018. It is assumed that each household stove starts its operation on the next day after the date of sale. In case of bulk sales it is assumed that each household stove starts its operation on the last day of the month next to the month, when the stove is delivered to the shop. The distribution of stoves under CPA 9 is being continued. The number of household stoves (portable clay stoves) distributed within CPA as of the end of the monitoring period considered is 19,074. Monitoring period covered in this monitoring report is 01/02/2018 – 31/05/2018 (both dates included). The type of stove disseminated is Chitetezo Mbaula ceramic stove, which has a laboratory test efficiency of 30.6%. Total GHG emission reductions achieved in this monitoring period is 2,981 tonnes CO<sub>2</sub>e. Double counting is avoided by using unique serial numbers for each household stove distributed within CPAs included in the programme of activities.

## **C.2. Location of CPAs**

All specific-case CPAs, i.e. CPA 1, CPA 2, CPA 3, CPA 4, CPA 5, CPA 6, CPA 7, CPA 8 and CPA 9, are CPAs promoting ICSs in Malawi (Host Party). The location of all specific-case CPAs cover all regions and districts of Malawi and programme of activities is implemented in different villages, towns and cities of Malawi. Malawi is a landlocked country which shares its north-west border with the Republic of Zambia, north-east border with the United Republic of Tanzania, and its borders at east, south and west with the Republic of Mozambique. Physical/geographical location of Malawi is the following: latitude: 13°30', longitude: 34° 00'.



Pic. 1. Map of Malawi

### C.3. Post-registration changes to CPAs

#### C.3.1. Temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies or standardized baselines

Not Applicable. The section is left blank intentionally.

#### C.3.2. Corrections

Not Applicable. The section is left blank intentionally.

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

The following changes of the start date of the crediting period were made:

Reference number	CPA title	The new start date of the crediting period
CPA 10182-0005	Malawi Biomass Energy Conservation Programme CPA 5	03/05/2017
CPA 10182-0006	Malawi Biomass Energy Conservation Programme CPA 6	01/09/2017
CPA 10182-0020	Malawi Biomass Energy Conservation Programme CPA 8	06/04/2018

CPA 10182-0021	Malawi Biomass Energy Conservation Programme CPA 9	29/03/2018
10182-0012	Malawi Biomass Energy Conservation Programme CPA 18	01/09/2018
10182-0014	Malawi Biomass Energy Conservation Programme CPA 20	01/10/2018
10182-0015	Malawi Biomass Energy Conservation Programme CPA 21	01/11/2018
10182-0016	Malawi Biomass Energy Conservation Programme CPA 22	01/01/2019
10182-0017	Malawi Biomass Energy Conservation Programme CPA 23	01/01/2019
10182-0018	Malawi Biomass Energy Conservation Programme CPA 24	01/02/2019
10182-0019	Malawi Biomass Energy Conservation Programme CPA 25	01/02/2019

#### C.3.4. Inclusion of monitoring plan

Monitoring plan for each specific-case CPA-DD(s) was submitted at the time of the registration of the PoA.

#### C.3.5. Permanent changes to the included monitoring plans, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

Not Applicable. The section is left blank intentionally.

#### C.3.6. Changes to project design

Not Applicable. The section is left blank intentionally.

## SECTION D. Description of monitoring system of CPAs

The CME is responsible for collecting the monitoring data in accordance with the requirements from the CDM EB on monitoring and verification to ensure that the emission reductions are monitored recorded and reported accurately. The CME is responsible for verification of the measurement, data collection and the calculation of the emissions reductions.

An electronic record keeping system is operated and maintained by the coordinating managing entity for each CPA under the PoA, which contains at least the following information:

- Type of appliance (ICS type) deployed
- Serial number (Stove-ID) of device
- Delivery date of appliance
- User details (name, address and telephone if available) will be collected for the majority of customers.

The record keeping system is updated as per the progress of the CPA. Data will be kept for the whole crediting period of the CPA and an additional two years.

A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or project within any other standard is in place. In each CPA-DD it is stated that the CPA has not been and will not be registered either as a single project activity or as a CPA under another PoA. The serial numbers allocated to each device under the PoA allow unique identification and tracking of the devices. Based on the serial numbers, a device can only count in one CPA.

Stoves sold before the CPA starting date will only claim credits from the day after the starting date of the CPA and will be limited to a lifespan from the day of initial adoption.

It is ensured that all parties involved in implementing a CPA are aware and agree that the CPAs are subscribed to the PoA.

The CME assists the CPA implementing and monitoring bodies (CPA implementers), such as Area 55 Consulting and Sunfire, to maintain and make available accurate records. The CME collates a composite electronic Total Sales Record and project implementers keep back-up paper records. The existing accounting and records system accurately tracks sales, inventories and supply and purchases. CPA implementers maintain a full electronic sales database of all household sales that take place, listed according to the sales mechanism, date, device, type etc. Sales databases are cross-checked with production records and other data to ensure consistency and accuracy.

There is no formal overarching warranty system in place for household cook-stoves, from any of the CPA implementers. Replacement within areas less than 10km away from promoter and production group may be done if stove breaks within first few weeks of use at the discretion of the stove promoter and production group<sup>5</sup>. Further than this it is too difficult to access for ceramic stove if stove broke during transport or recklessness or fault of user.

End user information is collected through direct sales to end-users by retailers or agents of the project and is contained in warranty and/or emission reduction contract. This information is collated into an electronic database from which project monitoring can be conducted. The database and Excel records are backed up and sent to the CME for checking prior to using them as the basis for monitoring activities. Hard copies of ER contracts (and where possible scanned copies as well) and warranty are filed as additional backup and for verification purposes.

---

5

The approach is an informal agreement between producers, promoters and customers. The complementary replacement stove promotes customer loyalty and helps to market the stoves locally.

Direct sales to end-users information is collected by CPAs' agents who are issued with contract forms in advance and submit the forms to the relevant project managers. The customers in the sales record for which phone numbers or addresses are available are used for survey sampling to support the periodic monitoring activities.

Monitoring tasks, such as monitoring surveys, assessment of leakage and other such tasks are managed by the CPA managers who are best capable of collecting this data because they know the technology and the end-users best, with the support of the CME.

Surveys and tests are organised by CPA implementer staff with guidance from the CME, and enumerators are trained prior to conducting surveys and tests. Survey and test results are filed in paper at project implementers' offices and are analysed using Excel to compile reports. The integrity of data is constantly cross-checked with other variables to ensure consistency and avoid mistakes.

## SECTION E. Data and parameters

### E.1. Data and parameters fixed ex ante

All data / parameters described in the tables below are applicable for all 9 CPAs of the programme of activities (i.e. CPA 1, CPA 2, CPA 3, CPA 4, CPA 5, CPA 6, CPA 7, CPA 8, CPA 9).

Data/parameter	$f_{NRB,y}$
Unit	%
Description	Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass
Source of data	Default values of fraction of non-renewable biomass approved by CDM EB and accepted by DNA as indicated at UNFCCC website <sup>6</sup>
Value(s) applied	0.81 for Malawi
Choice of data or measurement methods and procedures	Default country specific value
Purpose of data/parameter	Calculation of baseline emissions / emission reductions
Additional comments	-

Data/parameter	$NCV_{biomass}$
Unit	TJ/t
Description	Net calorific value of the non-renewable biomass that is substituted
Source of data	AMS-II.G Version 6.0
Value(s) applied	0.015
Choice of data or measurement methods and procedures	Default value
Purpose of data/parameter	Calculation of baseline emissions / emission reductions
Additional comments	-

Data/parameter	$EF_{projected\_fossilfuel}$
Unit	tCO <sub>2</sub> /TJ
Description	Emission factor for the substitution of non-renewable biomass by similar consumers
Source of data	AMS-II.G Version 6.0
Value(s) applied	81.6
Choice of data or measurement methods and procedures	Default value
Purpose of data/parameter	Calculation of baseline emissions / emission reductions
Additional comments	-

---

6

<https://cdm.unfccc.int/DNA/fNRB/index.html>

<b>Data/parameter</b>	$\eta_{old}$
Unit	%
Description	Efficiency of the system being replaced
Source of data	AMS-II.G Version 6.0
Value(s) applied	0.10
Choice of data or measurement methods and procedures	Default value
Purpose of data/parameter	Calculation of baseline emissions / emission reductions
Additional comments	The pre-project device is a three-stone fire using firewood (not charcoal) or a conventional device with no improved combustion air supply or flue gas ventilation.

<b>Data/parameter</b>	$L_y$
Unit	Fraction
Description	Leakage adjustment factor for period y
Source of data	AMS-II.G Version 6.0
Value(s) applied	0.95
Choice of data or measurement methods and procedures	Methodology allows for adjustment factor to be applied for leakage as an alternative to survey under paragraph 30 of Section 4.3
Purpose of data/parameter	Calculation of leakages / emission reductions
Additional comments	-

## E.2. Data and parameters monitored

<b>Data/parameter</b>	$B_{y=1,new,i,survey}$
Unit	t/HH/yr
Description	Annual quantity of woody biomass used by project devices in tonnes per device of type i
Measured/calculated/default	Measured / Calculated
Source of data	Sample surveys – Kitchen performance tests
Value(s) of monitored parameter	1.881
Monitoring equipment	<p><u>Weights:</u>            Digital high precision scale – MyWeigh KD- 8000, type - 8 kg capacity digital weighing scale, accuracy - accurate to 1 g;            Calibration date – 13/01/2017, expiry date – not applicable. Certificates of calibration # TM2017031301 and # TM2017031302 issued by Malawi Bureau of Standards.</p> <p>In the registered PoA DD as well as CPA DDs, there is no calibration frequency mentioned for the monitoring equipment's that will be used during the verification. However, the calibration of monitoring equipment's has been done from a reputed agency, even though the equipment are newly purchased and are under guaranty from the manufacturer. Since neither the calibration agency nor the equipment manufacturer mentioned any specific validity of the calibration, thus guidelines as per "General Guidelines to SSC CDM methodologies" EB 61, Annex 21, para 17 (c) has been followed which says: "Measuring</p>

	<p>equipment should be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years". Hence, the monitoring equipment will be calibrated before completion of three years from the date of last calibrations of the respective equipment.</p> <p><u>Moisture meters:</u>  Wood humidity measuring device - Voltcraft FM-300, type - moisture measuring range 6% to 99.9%, accuracy - <math>\pm 1\%</math> (in moisture range 6% ~ 40%).  Calibration date – 13/01/2017, expiry date – 12/01/2018. Certificates of calibration # GK201704005002 (moisture meter with serial number 12117541) and # GK201704005001 (moisture meter with serial number 12117617) issued by Malawi Bureau of Standards.</p> <p>Monitoring equipment has been also checked by monitoring facilitators as per the equipments' operating instructions, prior to conducting tests.</p>
Measuring/reading/recording frequency	Monitored in the first year of introduction of the devices (e.g. during the first year of the crediting period, $y=1$ ).
Calculation method (if applicable)	<p>Number of bundles of wood used in the project scenario is estimated via usage and monitoring survey of sampled households using an appropriate local metric (e.g. bundles of wood) for an easily understood period (e.g. per week). The average weight of a bundle of wood is calculated based on measurement of a sample of at least 30 different bundles adjusted for moisture content.</p> <p>Surveyed households does not include those that are identified as either (i) continue to use baseline technology through response to the survey or through observation by enumerator or (ii) no longer use the improved cook-stoves.</p>
QA/QC procedures	Use of calibrated measurement equipment.
Purpose of data/parameter	Calculation of emission reduction
Additional comments	Based on monitoring data from the first monitoring period. KPTs were conducted in between 24/01/2017 and 26/02/2017.

Data/parameter	$N_{y,i,a}$
Unit	Number of items
Description	Number of project devices of type $i$ and age $a$ that are operating in year $y$
Measured/calculated/default	Calculated
Source of data	Monitoring records (total sales records database), usage and monitoring survey

Value(s) of monitored parameter	<p>CPA 1 – 22,171  CPA 2 – 22,301  CPA 3 – 22,306  CPA 4 – 21,052  CPA 5 – 21,341  CPA 6 – 21,403  CPA 7 – 21,020  CPA 8 – 8,948  CPA 9 – 19,074</p> <p>Values adjusted for usage rate and duration of stove operation</p> <p>CPA 1 – 146 of age 2 and 4,885 of age 3  CPA 2 – 1,534 of age 1 and 4,260 of age 2  CPA 3 – 4,189 of age 1 and 1,855 of age 2  CPA 4 – 5,335 of age 2  CPA 5 – 3,877 of age 1 and 1,893 of age 2  CPA 6 – 4,793 of age 1  CPA 7 – 3,876 of age 1  CPA 8 – 990 of age 1  CPA 9 – 1,131 of age 1</p>
Monitoring equipment	None
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	<p>The installation date and recipient/location of each device is tracked individually, and emissions reductions is considered from the date of commissioning of each device.</p> <p>To reflect the number of stoves operating during a year (365 days) the number of stoves was calculated based on the number of technology days for each year (number of technology days divided by 365).</p> <p>The number of stoves were adjusted by percentage of stoves still in operation and percentage of households using more than 1 stoves as determined by usage and monitoring surveys.</p> <p>Discount factor to account for households with more than 1 stove installed has been used to discount usage rate for each age group monitored.</p> <p>Those devices that have been replaced prior to and independently from the monitoring survey by an equivalent in-service device are counted as operating.</p>
QA/QC procedures	Sampling will be conducted by applying the 95/10 confidence precision for the sample size calculation.
Purpose of data/parameter	Calculation of baseline and project emissions / emission reductions
Additional comments	Replaced devices are considered operational.

Data/parameter	$\mu_{y,i} / 365$
Unit	Proportion
Description	Number of days of utilization of the project device during the year 'y'
Measured/calculated/default	Calculated
Source of data	Usage and monitoring survey
Value(s) of monitored parameter	$\mu_{y,i}$ CPA 1 – 331 CPA 2 – 331 CPA 3 – 331 CPA 4 – 331 CPA 5 – 331 CPA 6 – 331 CPA 7 – 331 CPA 8 – 331 CPA 9 – 331 $\mu_{y,i} / 365$ CPA 1 – 0.907 CPA 2 – 0.907 CPA 3 – 0.907 CPA 4 – 0.907 CPA 5 – 0.907 CPA 6 – 0.907 CPA 7 – 0.907 CPA 8 – 0.907 CPA 9 – 0.907
Monitoring equipment	N/A
Measuring/reading/recording frequency	At least once every two years (biennial)
Calculation method (if applicable)	<p>As pre-project devices are unlikely to be totally decommissioned, surveys are designed to capture cooking habits and stove usage of households in the region, including quantification of use of baseline devices, by formulating questions and/or collecting evidences to determine the frequency of usage of both the project devices and baseline devices.</p> <p>According to paragraph 22 of the methodology, surveys may be conducted if the use of data loggers to record the continued operation of baseline devices is not practical, for example when the baseline device is the three stone fire. As using data loggers is not practical due to high number of ICS distributed within PoA and the baseline device is the three stone fire, the use of surveys is justified.</p> <p>The surveys were designed to capture cooking habits and stove usage of households, including quantification of use of baseline devices, by formulating questions and/or collecting evidences to determine the frequency of usage of both the project devices and baseline devices. Usage and monitoring survey included questions on cooking time using different stoves types for different types of meal (breakfast, lunch, dinner). The average daily cooking time in households using baseline stoves and the average daily cooking time using baseline stove were used to estimate baseline stoves usage in households using baseline stoves in % of cooking time. Baseline stoves usage was multiplied by percentage of households using baseline stoves to estimate the discount factor to account for baseline stove use – 9.19%.</p>

QA/QC procedures	Sampling has been conducted by applying the 95/10 confidence precision for the sample size calculation.
Purpose of data/parameter	Calculation of baseline and project emissions / emission reductions
Additional comments	N <sub>y,i,a</sub> is to be discounted for discontinued use of baseline technology confirmed through stratified random sampling, as explained in section B.7.2, Part II of the PoA-DD. The rounded-up value will be used. Replaced stoves will be considered operational.

<b>Data/parameter</b>	<b><math>\Delta\eta_{y,i,a}</math></b>
Unit	%
Description	Factor to consider the efficiency loss of the project device type i due to its aging at the year y
Measured/calculated/default	Measured / Calculated
Source of data	Survey – simple random sample using Water Boiling Test protocol
Value(s) of monitored parameter	CPA 1 – 86.31 for age group 1, 83.76 for age group 2, 86.34 for age group 3; CPA 2 – 86.31 for age group 1, 83.76 for age group 2, 86.34 for age group 3; CPA 3 – 86.31 for age group 1, 83.76 for age group 2, 86.34 for age group 3; CPA 4 – 86.31 for age group 1, 83.76 for age group 2, 86.34 for age group 3; CPA 5 – 86.31 for age group 1, 83.76 for age group 2, 86.34 for age group 3; CPA 6 – 86.31 for age group 1, 83.76 for age group 2, 86.34 for age group 3; CPA 7 – 86.31 for age group 1, 83.76 for age group 2, 86.34 for age group 3; CPA 8 – 86.31 for age group 1, 83.76 for age group 2, 86.34 for age group 3; CPA 9 – 86.31 for age group 1, 83.76 for age group 2, 86.34 for age group 3;
Monitoring equipment	<p>Scales, thermometer, timer, wood moisture meter</p> <p><u>Scales:</u> Digital high precision scale – My Weigh KD-8000, type - 8 kg capacity digital weighing scale, accuracy - accurate to 1 g; Calibration date – 23/01/2018, expiry date – not applicable. Certificates of calibration # TM2018012303 (serial #4) and # TM2018012304 (serial #1) issued by Malawi Bureau of Standards.</p> <p><u>Thermometers:</u> Digital hand thermometer - Voltcraft K 101 thermometer, type - measuring range - 200°C to +1370°C (reversible °C/°F); accuracy - - 200°C to +200°C accuracy of 0.3% of the display, +1 °C; Calibration date – 23/01/2018, expiry date – 22/01/2019. Certificates of calibration #TM2018012302 (thermometer with serial number 080506150) and #TM2018012301 (thermometer with serial number 060300261) issued by Malawi Bureau of Standards.</p> <p><u>Moisture meter:</u></p>

	<p>Wood humidity measuring device - Voltcraft FM-300, type - moisture measuring range 6% to 99.9%, accuracy - <math>\pm 1\%</math> (in moisture range 6% ~ 40% of volume). Serial numbers: 12117541 and 12117617. Calibration date – 29/01/2018, expiry date – 28/01/2019.</p> <p>Digital phones were used as timers.</p> <p>Monitoring equipment is calibrated by monitoring facilitators as per the equipments' operating instructions, prior to conducting tests. Equipment also has factory calibration and does not usually require recalibration during warranty period.</p> <p>In the registered PoA DD as well as CPA DDs, there is no calibration frequency mentioned for the monitoring equipment's that will be used during the verification. However, the calibration of monitoring equipment's has been done from a reputed agency, even though the equipment are newly purchased and are under guaranty from the manufacturer. Since neither the calibration agency nor the equipment manufacturer mentioned any specific validity of the calibration, thus guidelines as per "General Guidelines to SSC CDM methodologies" EB 61, Annex 21, para 17 (c) has been followed which says: "Measuring equipment should be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years". Hence, the monitoring equipment will be calibrated before completion of three years from the date of last calibrations of the respective equipment.</p>
Measuring/reading/recording frequency	Water Boiling Tests to be conducted in the first batch of stoves thereafter monitoring will determine the thermal efficiency of the devices installed at the first year of the crediting period, and the efficiency loss of this population will be used to correct the initial efficiency of the population of devices installed later on.
Calculation method (if applicable)	As per the WBT protocol (The Water Boiling Test, Version 4.2.3, Cook-stove Emissions and Efficiency in a Controlled Laboratory Setting. Released 19 March 2014).
QA/QC procedures	Conducted by a capable person with thorough understanding of internationally recognised WBT protocols, updated by the Partnership for Clean Indoor Air and the Global Alliance for Clean Cook-stoves. Use of calibrated measurement equipment.
Purpose of data/parameter	Calculation of baseline and project emissions / emission reductions
Additional comments	

<b>Data/parameter</b>	$\eta_{new,i,a}$
Unit	%
Description	Thermal efficiency of device of type i being deployed as part of the project activity with the age a
Measured/calculated/default	Measured / Calculated
Source of data	Survey – multi-stage stratified random sampling using Water Boiling Test protocol
Value(s) of monitored parameter	CPA 1 – 26.41% for age 1, 25.63% for age 2, 26.42% for age 3 CPA 2 – 26.41% for age 1, 25.63% for age 2, 26.42% for age 3 CPA 3 – 26.41% for age 1, 25.63% for age 2, 26.42% for age 3 CPA 4 – 26.41% for age 1, 25.63% for age 2, 26.42% for age 3 CPA 5 – 26.41% for age 1, 25.63% for age 2, 26.42% for age 3

	<p>CPA 6 – 26.41% for age 1, 25.63% for age 2, 26.42% for age 3</p> <p>CPA 7 – 26.41% for age 1, 25.63% for age 2, 26.42% for age 3</p> <p>CPA 8 – 26.41% for age 1, 25.63% for age 2, 26.42% for age 3</p> <p>CPA 9 – 26.41% for age 1, 25.63% for age 2, 26.42% for age 3</p>
Monitoring equipment	<p><b>Scales:</b>  <u>Digital high precision scale</u> –  My Weigh KD- 8000, type - 8 kg capacity digital weighing scale, accuracy - accurate to 1 g;  Calibration date – 23/01/2018, expiry date – not applicable. Certificates of calibration # TM2018012303 (serial #4) and # TM2018012304 (serial #1) issued by Malawi Bureau of Standards.</p> <p><b>Thermometers:</b>  <u>Digital hand thermometer</u> - Voltcraft K 101 thermometer, type - measuring range - 200°C to +1370°C (reversible °C/°F); accuracy - - 200°C to +200°C accuracy of 0.3% of the display, +1 °C;  Digital hand thermometer - Voltcraft K 101 thermometer, type - measuring range - 200°C to +1370°C (reversible °C/°F); accuracy - - 200°C to +200°C accuracy of 0.3% of the display, +1 °C;  Calibration date – 23/01/2018, expiry date – 22/01/2019. Certificates of calibration #TM2018012302 (thermometer with serial number 080506150) and #TM2018012301 (thermometer with serial number 060300261) issued by Malawi Bureau of Standards.</p> <p><b>Moisture meter:</b>  <u>Wood humidity measuring device</u> - Voltcraft FM-300, type - moisture measuring range 6% to 99.9%, accuracy - ±1% (in moisture range 6% ~40% of volume). Serial numbers: 12117541 and 12117617.  Calibration date – 29/01/2018, expiry date – 28/01/2019.</p> <p>Digital phones were used as timers.</p> <p>Monitoring equipment is calibrated by monitoring facilitators as per the equipments' operating instructions, prior to conducting tests. Equipment also has factory calibration and does not usually require recalibration during warranty period.</p> <p>In the registered PoA DD as well as CPA DDs, there is no calibration frequency mentioned for the monitoring equipment's that will be used during the verification. However, the calibration of monitoring equipment's has been done from a reputed agency, even though the equipment are newly purchased and are under guaranty from the manufacturer. Since neither the calibration agency nor the equipment manufacturer mentioned any specific validity of the calibration, thus guidelines as per "General Guidelines to SSC CDM methodologies" EB 61, Annex 21, para 17 (c) has been followed which says: "Measuring equipment should be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years". Hence, the monitoring equipment will be calibrated before completion of three years from the date of last calibrations of the respective equipment.</p>
Measuring/reading/recording frequency	Annually.
Calculation method (if applicable)	As per the WBT protocol 4.2.3.

QA/QC procedures	Conducted by a capable person with thorough understanding of internationally recognised WBT protocols, updated by the Partnership for Clean Indoor Air and the Global Alliance for Clean Cook-stoves. Use of calibrated measurement equipment. The relative precision achieved is 3.7% at confidence level of 95%. Thus, the required precision level of 5% has been met.
Purpose of data/parameter	Calculation of baseline and project emissions / emission reductions
Additional comments	The efficiency value for each age group is calculated as an average efficiency value of the stoves tested. First, the average value of each stove efficiency is calculated based on WBT results values (9 results for each stoves). Second, the average efficiency among the stoves of each age group is calculated.

### E.3. Implementation of sampling plan

According to the registered PoA DD, due to the large number of improved cook stoves (ICS) envisaged to be distributed as part of the CPAs to be included in the PoA, it is not economically feasible to monitor each individual ICS unit distributed.

Therefore, representative sampling has been undertaken as part of a PoA-wide Sampling Plan that is designed in line with the requirements of AMS II.G v6.0 and the CDM Guideline “Sampling and surveys for CDM project activities and programmes of activities”, Version 03.0. The parameters are estimated across all CPAs.

#### Procedure to draw a representative sample

Taking into account the importance of end-user information and the provisions of the registered PoA DD on end-users data cited below, the procedure to be used within PoA 10182 in order to draw a representative sample of the end-users based on a database containing end-user information on the majority of end-users has been included.

The entire population of POA10182 for monitoring period February 1st to May 31st 2018 was 180,095 stoves distributed among households throughout the country.

Registered PoA DD (page 10) states that for PoA 10182 the target population for the parameter “Proportion of stoves that are still in operation” are the users contained in the CPA databases.

It is not currently possible in Malawi (by any measure) to keep track - on a moment-to-moment basis - of the precise location of that quantum of people/portable stoves – users regularly die, move to other villages, migrate for work or become displaced due to severe weather events and natural disasters (such as the floods currently devastating Malawi<sup>7</sup>).

The traceability level for all of the approx. 180k project stoves in the sales database per usage survey conducted in February 2018 is 88%. Out from 145 households, the enumerators were able to identify and survey 127 households based on the information provided in total sales records (88%). The 145 randomly sampled households are rural and peri-urban households (i.e. households in population dense settings), that predominantly cook with firewood and are a subset that accurately reflect the characteristics of all households involved in the PoA.

The description of the monitoring plan of the registered PoA DD clearly states that user details (name, address and telephone if available) will be collected for the **majority of customers** (please, refer to page 35). As per the PoA DD “Although it is difficult to track 100% of households that will eventually use the stove(s) promoted by the PoA, the CME will encourage project implementers to

7 <https://news.un.org/en/story/2019/03/1034451>

**track as many as possible and definitely more than half**" (see footnote 44 at page 35). In reality, CME has collected such details for the vast majority of endusers.

There are different levels of details provided for the purchasers of stoves in the total sales records database. The analysis of the database revealed that for 78% of households in the total sales database (139,889 entries in the database) there is a contact information such as phone number or village or GVH (Group Village Headman) administrative unit, which allows the possibility to track the stove user for usage and monitoring survey. Even assuming the 88% response rate achieved during the usage and monitoring surveys, this allows to track 69% of households (i.e. 88% of 78%), which is significantly higher than "more than half" as defined in the registered PoA DD. Therefore, missing end user information for some households do not undermine the representativeness of the monitoring activities as prescribed by the registered PoA DD.

The CPA implementers tend to have a promoter for each village or set of villages who knows the customers and could help track users without complete end user details. In cases where there is no promoter the village chief tends to be the anchor in the village for the CPA.

In some cases customers buy multiple stoves (e.g. 3 to 10 stoves) for resale or distribution amongst relatives and/or neighbours which facilitates greater access but makes traceability difficult. In such cases various stoves may be allotted to the same individual in the total sales records database. Some purchasers keep 2 or even 3 stoves for own needs due to large family or household sizes (discounting for such a scenario is explained in *Results of the Survey* below). Thus, recording of several stoves per one household in the total sales database reflects the distribution and usage practices in the region of PoA implementation.

Even the stoves from users who received their stoves via onward gift or sale from the purchasers of multiple stoves have serial numbers and therefore have the equal probability to be randomly sampled (i.e. that person's serial number is as likely to be selected as any other serial number) and could be tracked via the initial purchaser.

Stratified random sampling approach was applied in line with the provisions of CDM Guideline "Sampling and surveys for CDM project activities and programmes of activities", Version 03.0. To optimize logistics and costs of the monitoring procedures first the 4 districts were randomly sampled, namely: Lilongwe, Dowa, Mzimba South, Balaka to optimize logistics and cost of monitoring procedures. Such approach ensures cost effectiveness and does not impact the quality of monitoring data as ICS and cooking practices does not differ among districts. On the second stage individual households were randomly sampled for data collection taking into account defined primary sampling units based on CPA Implementer and stove vintage.

Therefore, the random sampling demonstrates that possibility to identify most of the purchasers based on the information provided in the total sales records, even if not full contact information (telephone number, exact address) is recorded.

The procedure described above ensures that samples are randomly selected and are representative of the population.

### Parameters monitored using sampling plans

Monitored Parameter:	Description of Parameter:
$n_{y,j}$	Proportion of ICS still in operation
$\mu_{y,i}/365$	The relative share of usage of the project ICS if a baseline (replaced) stove is still being used in addition to ICS (hereafter called "retention use of ICS")
$\eta_{new,y,i}$	Thermal Efficiency of operational ICS

Annual quantity of woody biomass used by project devices in tonnes per device of type  $i$ , determined in the first year of the introduction of the devices ( $B_{y=1,new,i,survey}$ ) is estimated at the beginning of the crediting period and thus was not included in the sampling plan.

Of the three parameters to be monitored, two are proportions/percentages ( $n_{y,j}$ ) and ( $\mu_{y,i}/365$ ) and one is a mean value ( $\eta_{new,y,i}$ ).

### Primary sampling units

The sampling method for all three monitored parameters is stratified random sampling. This method is justified as the population will be divided into Primary Sampling Units (PSUs) by same country and fuel consumption cluster, ICS type, ICS vintage and CPA implementer. These PSUs are expected to be relatively homogenous but by dividing them into strata any variation will be captured.

There is only one country to be sampled, only one fuel consumption cluster (i.e. only firewood-fueled stoves), there is only one ICS type, there are 3 ICS vintages, and there are 2 CPA implementers (but one only started implementing in July 2016). The third CPA implementer started CPA implementation on 29/03/2018 and will be taken into account during the sampling within the next round of monitoring activities.

So, there are 5 primary sampling units:

- CPA Implementer Area 55 implementing 1 year old stoves,
- CPA Implementer Sunfire implementing 1 year old stoves,
- CPA Implementer Area 55 implementing 2 years old stoves,
- CPA Implementer Sunfire implementing 2 years old stoves,
- CPA Implementer Area 55 implementing 3 years old stoves.

The age group of the project devices has been determined based on the number of days stove operated since the first use and till the end of the monitoring period divided by 365.

The sample size for each primary sampling unit was calculated using proportional allocation, where the proportions of units from the different PSU in the sample is the same as the proportions in the population.

### Results of the surveys

In line with the approach proposed in PoA DD the survey for proportion of operational stoves and the proportion of discontinued use of baseline stoves will be conducted together. According to the standard for sampling and surveys, if there is more than one parameter to be estimated in a survey, the required sample size has to be the largest number obtained in the calculations.

Thus, the parameters is sampled in two separate surveys (1) single survey (Usage and Monitoring Survey) to estimate parameters for (i) operating stoves and (ii) proportion of displaced traditional cook stoves that continue to be used and (2) a separate survey to measure the mean operational efficiency (WBT survey) with a stratified random sample of ICS.

List of CPAs to which sampling method applied	Date of data collection	Implemented Sampling design	Analysis & Source of collected data
<b>Usage &amp; Monitoring Surveys</b>			
CPA 1 CPA 2 CPA 3 CPA 4	February, 2018	Sample size - 145 households	Values used in emission reduction calculations were calculated based on survey results using statistical analysis.

CPA 5 CPA 6 CPA 7 CPA 8 CPA 9	Previous usage and monitoring surveys were carried between January 11 and February 14, 2017	<p>Surveys were carried between February 2 and February 6, 2018</p> <p>Actually surveyed 127.</p> <p>Sampling method - multi-stage stratified random sampling</p> <p>Required precision/confidence - the minimum sample size is determined to achieve the 95% confidence level and a 10% margin of error.</p>	<p>Results of analysis:</p> <p>Percentage of operating stoves based on usage age: age 0-1 – 85.03%; age 1-2 – 77.09%; age 2-3 – 68.83%</p> <p>Precision level achieved is 4.6%.</p> <p>To ensure conservative calculation of generated emission reductions the usage rate estimated via Usage and Monitoring survey was discounted by 3.64% to account for households using &gt;1 project stoves.</p> <p>According to the paragraph 33 of the applied methodology, monitoring shall consist of checking all devices or a representative sample thereof, at least once every two years (biennially) to determine if they are still operating. Therefore, estimation of percentage of operating stoves based on usage and monitoring survey has been applied.</p> <p>According to paragraph 22 of the methodology, surveys may be conducted if the use of data loggers to record the continued operation of baseline devices is not practical, for example when the baseline device is the three stone fire. As using data loggers is not practical due to high number of ICS distributed within PoA and the baseline device is the three stone fire, the use of surveys is justified.</p> <p>Stove stacking (using different types of stoves in a single household) was assessed based on the surveys of cooking time for different stoves types.<sup>8</sup></p> <p>Number of days of utilization of the project device during the year 'y', <math>\mu_{y,i} - 331, \mu_{y,i}/365 - 0.907</math>.</p> <p>Source of collected data: Usage &amp; Monitoring Survey Report – 2018</p> <p>Total population at the time of conducting annual monitoring activities was 128,451 stoves.</p>
<b>WBTs</b>			
CPA 1 CPA 2 CPA 3	February, 2018	<p>Sample size - 16 stoves.</p> <p>Actually tested – 16.</p>	<p>Values used in emission reduction calculations were calculated based on survey results using statistical analysis.</p>

8 Based on EnDev's proxy-indicator approach for assessing the quality of a Cooking Energy System [https://endev.info/images/f/f7/Factsheet\\_EnDev\\_CES\\_EN.pdf](https://endev.info/images/f/f7/Factsheet_EnDev_CES_EN.pdf).

CPA 4 CPA 5 CPA 6 CPA 7 CPA 8 CPA 9	Previous WBTs were conducted in February, 2017.	<p>Tests were carried between February 4 and February 12, 2018</p> <p>Sampling method - multi-stage stratified random sampling</p> <p>WBTs were conducted in February, 2018.</p> <p>The minimum sample size is determined to achieve the 95% confidence level and a 10% margin of error.</p>	<p>Results of analysis:  <math>\text{Eff}_{P,PCS,0-1} = 26.41\%</math>; <math>\text{Eff}_{P,PCS,1-2} = 25.63\%</math>;  <math>\text{Eff}_{P,PCS,2-3} = 26.42\%</math>;</p> <p>The precision level achieved is 3.7%.</p> <p>Source of collected data:  Water Boiling Test Report - 2018</p>
--	---	--	--

Kitchen Performance Test was conducted during the first verification to estimate the annual quantity of woody biomass used by project devices in tonnes per device.

As per point 40 in the applied methodology and PoA DD for cost effectiveness and to facilitate logistics the CME preferred to monitor efficiency of devices in a common survey with other monitoring parameters (i.e. the usage survey).

Data has been collected by data collectors of the CPA implementers that are trained and have successfully pre-tested the questionnaire and thermal efficiency tests (e.g. water boiling test).

## **SECTION F. Calculation of emission reductions or net anthropogenic removals**

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

The methodology applied does not foresee the calculation of baseline emissions and estimate directly emission reductions.

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

The methodology applied does not foresee the calculation of project emissions and estimate directly emission reductions.

### **F.3. Calculation of leakage emissions**

The methodology applied does not foresee the calculation of leakages and estimate directly emission reductions.

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

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

$$ER_{y,i} = \sum_{a=1}^{a=y} B_{y,savings,i,a} \times N_{y,i,a} \times \left( \frac{\mu}{365} \right) \times F_{NRB,y} \times NCV_{biomass} \times EF_{projectedfossilfuel} - LE_y$$

where

$ER_y$	– emission reductions, t CO <sub>2e</sub> ,
'a'	– the indices for the age (in years) of the cook stoves that are operating in the year y of the crediting period.
$B_{y, savings, i, a}$	– annual quantity of woody biomass that is saved in tonnes per cook stove device of type i and age a in year y
$N_{y a}$	– number of project devices of type i and age a that are operating in year y
$\mu_{y, i}$	– number of days of utilization of the project device during the year y
$f_{NRB, y}$	– 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 biomass that is substituted
$EF_{projected\_fossilfuel}$	– emission factor for the substitution of non-renewable biomass by similar consumers
$LE_y$	– Leakage adjustment factor for period y

$B_{y, savings, i, a}$  is calculated using Equation 6 of the methodology AMS-II.G Version 6.0:

$$B_{y, savings, i, a} = B_{y=1, new, i, survey} \times ( (\eta_{new, i, a=1} \times \Delta\eta_{y, i, a} / \eta_{old}) - 1 )$$

and

$$\Delta\eta_{y, i, a} = ( \eta_{new, i, a} / \eta_{new, i, a=1} )$$

Where

$B_{y=1, new, i, survey}$	– annual quantity of woody biomass used by project devices in tonnes per device of type i
$\eta_{new, i, a}$	– the thermal efficiency of the device 'i' at age 'a' determined using the water boiling test
$\eta_{new, i, a=1}$	– the thermal efficiency of the device at its first year of operation
$\Delta\eta_{y, i, a}$	– factor to consider the efficiency loss of the project device type i due to its aging at the year y
$\eta_{old}$	– efficiency of the device being replaced

The results of emission reduction calculation for each CPA and for each year of the monitoring period is provided below:

CPA	CPA UNFCCC reference number	2018	Total
1	CPA 10182-0001	13,253	13,253
2	CPA 10182-0002	14,741	14,741
3	CPA 10182-0003	15,702	15,702
4	CPA 10182-0004	13,396	13,396
5	CPA 10182-0005	14,975	14,975

6	CPA 10182-0006	12,636	12,636
7	CPA 10182-0025	10,218	10,218
8	CPA 10182-0020	2,610	2,610
9	CPA 10182-0021	2,981	2,981
	<b>Total</b>	<b>100,512</b>	<b>100,512</b>

CPA UNFCCC reference number	Baseline GHG emissions or baseline net GHG removals (t CO2e)	Project GHG emissions or actual net GHG removals (t CO2e)	Leakage GHG emissions (t CO2e)	GHG emission reductions or net anthropogenic GHG removals (t CO2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
CPA 10182-0001	N/A	N/A	N/A	0	13,253	13,253
CPA 10182-0002	N/A	N/A	N/A	0	14,741	14,741
CPA 10182-0003	N/A	N/A	N/A	0	15,702	15,702
CPA 10182-0004	N/A	N/A	N/A	0	13,396	13,396
CPA 10182-0005	N/A	N/A	N/A	0	14,975	14,975
CPA 10182-0006	N/A	N/A	N/A	0	12,636	12,636
CPA 10182-0025	N/A	N/A	N/A	0	10,218	10,218
CPA 10182-0020	N/A	N/A	N/A	0	2,610	2,610
CPA 10182-0021	N/A	N/A	N/A	0	2,981	2,981
<b>Total</b>	N/A	N/A	N/A	0	100,512	100,512

#### F.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the included CPA-Dds

Estimated amount of annual average GHG emission reductions according to the latest version of CPA-DD has been compared to actual values of emission reductions achieved by specific-case CPA during this monitoring period.

CPA UNFCCC reference number	Amount achieved during this Monitoring period (t CO2e)	Amount estimated ex ante (t CO2e)
CPA 10182-0001	13,253	13,075
CPA 10182-0002	14,741	13,075
CPA 10182-0003	15,702	13,075
CPA 10182-0004	13,396	13,075
CPA 10182-0005	14,975	13,075
CPA 10182-0006	12,636	13,075
CPA 10182-0025	10,218	13,075
CPA 10182-0020	2,610	6,102
CPA 10182-0021	2,981	6,974

<b>Total</b>	<b>100,512</b>	<b>104,604</b>
--------------	----------------	----------------

#### **F.6. Remarks on increase in achieved emission reductions**

Actual values achieved by the specific-case CPA(s) during the monitoring period for CPA 6, CPA 7, CPA 8, CPA 9 were lower than values estimated in ex ante calculation as under some CPAs the distribution of the stoves started or continued after the beginning of the monitoring period and the number of the stoves has not yet reached the targeted limit. Actual values achieved by the specific-case CPA(s) during the monitoring periods for CPA 1, CPA 2, CPA 3, CPA 4 and CPA 5 were 3% to 17% higher than values estimated in ex ante calculation due to slightly higher monitored stove efficiency comparing to the 25% value assumed for ex ante calculation. Actual efficiency based on the WBTs conducted within monitoring activities was in the range of 25.63% - 26.42%. (comparing to the laboratory test efficiency of 30.6%). There is no increase in total achieved emission reductions.

Only as many devices as necessary to meet the small scale limit have be included in each CPA.

- - - - -

**Document information**

<i>Version</i>	<i>Date</i>	<i>Description</i>
02.0	7 June 2017	Revision to: <ul style="list-style-type: none"><li>• Ensure consistency with version 01.0 of the “CDM project standard for programmes of activities (CDM-EB93-A07-STAN);</li><li>• Make editorial improvements.</li></ul>
01.0	1 April 2015	Initial publication.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report, programme of activities		