



**Monitoring report form for CDM project activity
(Version 06.0)**

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

MONITORING REPORT

| | | |
|---|--|-------------------------------------|
| Title of the project activity | Improved Cook Stove Project 2, Nkhata Bay District, Malawi | |
| UNFCCC reference number of the project activity | 9935 | |
| Version number of the PDD applicable to this monitoring report | 1.5 | |
| Version number of this monitoring report | 1 | |
| Completion date of this monitoring report | 11/10/2017 | |
| Monitoring period number | 3 | |
| Duration of this monitoring period | 12/08/2016 to 10/08/2017 | |
| Monitoring report number for this monitoring report | N/A | |
| Project participants | The Sigma Global Company Pty Ltd Vimiti Limited | |
| Host Party | Malawi | |
| Sectoral scopes | Sectoral Scope: 3, Energy Demand Project Type: II, Energy Efficiency Improvement Projects | |
| Applied methodologies and standardized baselines | AMS-II.G, Energy efficiency measures in thermal applications of non-renewable biomass, version 5.0 | |
| Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period | Amount achieved before 1 January 2013 | Amount achieved from 1 January 2013 |
| | | 68,533 t CO ₂ e |
| Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD | 37,830 tCO ₂ e | |

SECTION A. Description of project activity

A.1. General description of project activity

The project involves dissemination of the Changu Changu Moto high efficiency biomass cook stoves to approximately 22,000 households in Nkhata Bay District, Malawi. The project is being developed under the small scale CDM methodology AMS- II.G. Energy efficiency measures in thermal applications of non-renewable biomass, version 5.

The Changu Changu Moto is a low cost, high efficiency biomass fired cook stove developed through extensive trials with the local communities and is specifically designed for local Malawian conditions. The stove is constructed from locally available materials and does not require specialist construction skills or equipment. The stove design is a brick rocket stove, constructed using 26 mud bricks and a mud mortar mix. The Chichewan name Changu Changu Moto translates to “Fast Fast Fire”, and reflects one of the main benefits of the improved cook stove in reducing cooking time and saving wood fuel.

The Changu Changu Moto improved cook stove replaces the low efficiency 3-stone fire stove, which is the dominant firewood end-use system for cooking within Malawi. Emission reductions are achieved through improving household energy efficiency and thus reducing the consumption of non-renewable woody biomass.

The construction of the Changu Changu Moto improved cook stoves started in August 2013 and continues today. The stove is constructed and then further instruction is provided to the household owner. It is not until a period later that the stove is recorded as being in use with the construction verification date, to ensure the householder knows completely how to use and repair the stove.

Sustainable development

The project contributes to the sustainable development of the Nkhata Bay District and Malawi in a number of ways:

- Environmental
 - The project helps significantly reduce Malawi's greenhouse gas emissions;
 - The project helps reduce the use of non-renewable biomass from forests, thus assisting in conserving existing forest stocks, and the protection of natural forest eco-systems and wildlife habitats; and
 - The protection of standing forests also helps protect watersheds, reduce soil erosion and maintain rainfall in the project area.
- Social
 - The Changu Changu Moto stove provides a significantly safer method for cooking with biomass, helping to reduce burn injuries, especially for children;
 - The improved efficiency of the Changu Changu Moto stove significantly reduces wood fuel consumption, meaning that considerably less time is required to collect wood fuel. This reduces the work burden on rural families and allows for alternative opportunities for economic development.
- Health
 - Worldwide, it is estimated that around 4 million premature deaths occur annually due to indoor air pollution, with around 15,000 per year in Malawi¹. Women and children are the main victims. Adoption of more efficient stoves significantly reduces indoor air pollution respiratory and health problems associated with smoke emission

¹ **Country profile of Environmental Burden of Disease - Malawi.** [Online] 2004. [Cited: 13 June 2012.] http://www.who.int/quantifying_ehimpacts/national/countryprofile/malawi.pdf

from biomass stoves^{2 3}. The decrease in total biomass burned and an increase in the temperature of combustion in the Changu Changu Moto improved cook stove will result in lower carbon dioxide, carbon monoxide and particulate emissions.

- Economic
 - The project creates employment and contributes to the economic development of Nkhata Bay District through the stove construction, maintenance and monitoring activities.
 - In areas where wood fuel is purchased, use of the Changu Changu Moto stove will significantly reduce household expenditure on cooking fuel.

A.2. Location of project activity

Nkhata Bay District, Malawi

This project will install improved cook stoves in eligible households within the boundaries of six Traditional Authorities within Nkhata Bay District as shown in Table 1.

Table 1 Traditional Authorities in project boundary

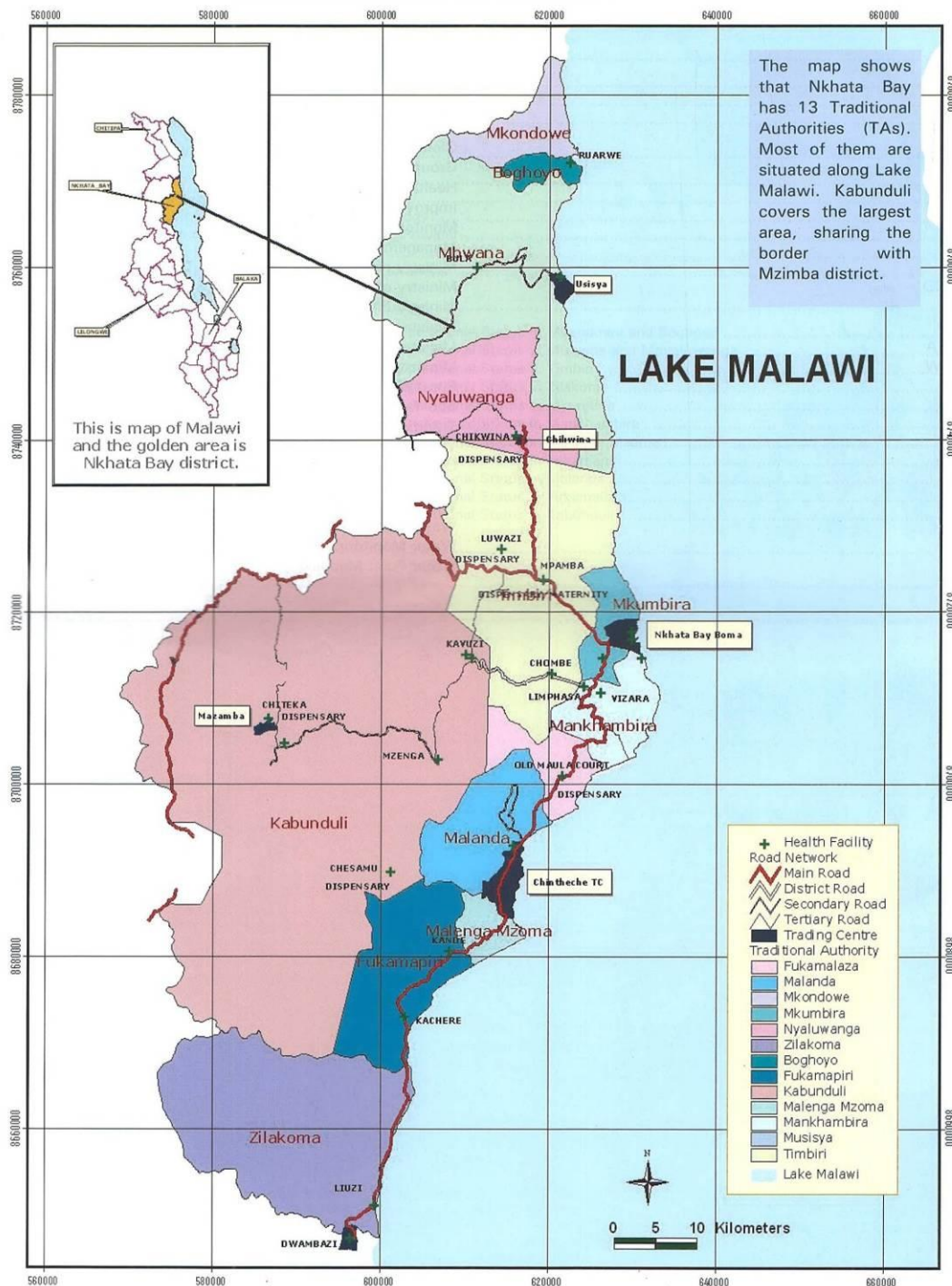
| Traditional Authority |
|-----------------------|
| Mkondwe |
| Boghoyo |
| Mbwana |
| M'nyaluwanga |
| Timbiri |
| Kabunduli |

The total number of eligible households in the project area is estimated at 22,000.

² *Quantifying the effects of exposure to indoor air pollution from biomass combustion on acute respiratory infections in developing countries.* **Ezzati, M and Kammen, D M. 2001.** 2001, Environ Health Perspect, Vol. 109, pp. 481-488.

³ **Khennas S., Anderson T., Doig A. and Rees D., 1999.** Rural Energy Services: A Handbook for Sustainable Energy Development. London, United Kingdom: Intermediate Technology Publications

The location of the six Traditional Authorities that make up the project area is shown below.



A.3. Parties and project participants

| Parties involved | Project participants | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|------------------|---|--|
| Party A Malawi | The Sigma Global Company Pty Ltd (private entity) | No |
| Party B | Vimiti Limited (private entity) | |

A.4. Reference to applied methodologies and standardized baselines

AMS - II.G. Energy efficiency measures in thermal applications of non-renewable biomass (version 5.0)

A.5. Crediting period type and duration

27/10/2014 – 26/10/2024 (Fixed)

SECTION B. Implementation of project activity**B.1. Description of implemented project activity**

The Changu Changu Moto is a low cost, high efficiency biomass fired cook stove designed by the project implementer, RIPPLE Africa, for local Malawian conditions. The stove is constructed from locally available materials and does not require specialist construction skills or equipment. The stove design is a two chamber brick rocket stove, constructed using 26 mud bricks and a mud mortar mix. The Changu Changu Moto improved cook stoves feature an insulated combustion chamber which retains heat while also raising the cooking pot to the hottest point above the flame. This improves combustion efficiency and heat transfer, thus reducing fuel consumption. The energy flows can be described as the household use of non-renewable woody biomass to produce heat energy for cooking and heating water, and also releasing carbon dioxide as a combustion product. The project technology improves the energy efficiency of the combustion process, using less non-renewable woody biomass, and therefore releasing less carbon dioxide, to produce the same amount of useable heat energy.

The Changu Changu Moto improved cook stove, recently constructed (left) and in use (right)



The stove replaces the 3 stone fire and other inefficient cooking methods that currently use non-renewable woody biomass within the project area.

The Changu Changu Moto improved cook stoves are manufactured by project implementation staff with the household owners, who take an active role to ensure they are able to undertake any repairs that may be required in the future. Training is provided to the householders on how to maintain and repair the stove. Project implementation staff are also available to assist

householders repair and maintain their stoves. With the correct use and maintenance procedures, the lifetime of each stove is in excess of 10 years. The use of virtually unlimited, locally available, natural materials to construct the stove allows repairs and re-builds of stoves to be conducted as required at little cost ad infinitum.

The stove is constructed and then further instruction is provided to the household owner. It is not until a period later that the stove is recorded as being in use with the construction verification date, to ensure the householder knows completely how to use and repair the stove.

The construction of the stoves has been staggered according to availability of staff and geography constraints. Continuous training and assistance is provided to the household owner to ensure they know how to use and repair their stoves. If a household owner is having any difficulty a staff member is available to provide assistance when needed.

There have been no issues or events occurring during this monitoring period that will impact the applicability of the applied methodology.

No requests have been made to the CDM Board to make changes to the registered CDM project activity.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

>>N/A

B.2.2. Corrections

>> N/A

B.2.3. Changes to the start date of the crediting period

>> N/A

B.2.4. Inclusion of monitoring plan

>> N/A

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

>> N/A

B.2.6. Changes to project design

>> N/A

SECTION C. Description of monitoring system

The monitoring system for the project activity consists of regular checks at the household level to assess the ongoing use and maintenance of the Changu Changu Moto improved cook stoves. It also consists of the annual KPTs conducted to determine the number of operating Changu Changu Moto improved cook stoves and the quantity of woody biomass used per Changu Changu Moto improved cook stove during the monitoring period.

The implementation team at RIPPLE Africa is responsible for gathering the necessary information from householders for monitoring purposes. An organisation chart and a summary of the roles and responsibilities of each position as they relate to the implementation and monitoring of this project are given below.

Eligibility for a household to participate in the project is determined through an Initial Survey conducted by the Community Volunteers (CVs). During the Initial Survey, a registration number is assigned to each eligible household.

The following householder information is recorded on the Initial Survey forms:

- Householder registration number
- Name of stove user or head of the household
- Name of Chief and village (and other location information where available)
- Current cooking method
- Current time spent collecting wood
- House ownership status
- Quantity of people in household
- Condition of kitchen
- Wood purchaser
- Availability of axe

This information is then checked by the Project Coordinators and Managers to ensure the completed forms represent the situation observed. Further investigation is completed by the Coordinator or Manager to investigate any missing or inconsistent values.

The completed forms are then transferred to project headquarters. Data entry officers then enter the information into the project database. All office personnel are trained in the use of the project database to reduce the chance for data entry errors. Staff are trained in the use of the data base as part of their basic training. As a further check, supervisory staff conduct an audit of the data at minimum once every month data entry is occurring by randomly selecting at least 50 household database entries and comparing the database record with the information from the original written monitoring form. Any inconsistencies will be rectified and will trigger an audit of all household records for that chief area.

Project eligibility is determined by the record of the current cooking method for the household. Households participating in the pilot project are identified by having a current cooking method as the Changu Changu Moto improved cook stove at the time of the initial survey. These households are recorded in the project database, but excluded from eligible households in all emission reduction calculations. Furthermore, any households using cooking methods other than the traditional three stone fire, such as charcoal or electric stoves, are also excluded from eligible households, but are recorded in the project database for tracking purposes.

Following the eligibility assessment and Initial Survey, the construction of the Changu Changu Moto improved cook stoves is recorded on separate construction monitoring forms with the following information:

- Household registration number
- Name of stove user or head of the household
- Name of Chief and village (and other location information where available)
- Stove construction date
- Stove user Signature
- CCM in use
- CCM condition
- Wood use
- Construction verification date
- Construction verification signature (by Coordinator)

Training in the use of the stove will be provided to the householder by the Community Volunteer. The Community Volunteer will then conduct checks that the householder is using the stove at different intervals following the stove construction. The outcome of these checks is recorded on the construction form. Further training is provided to the householder by the Community Volunteer as required.

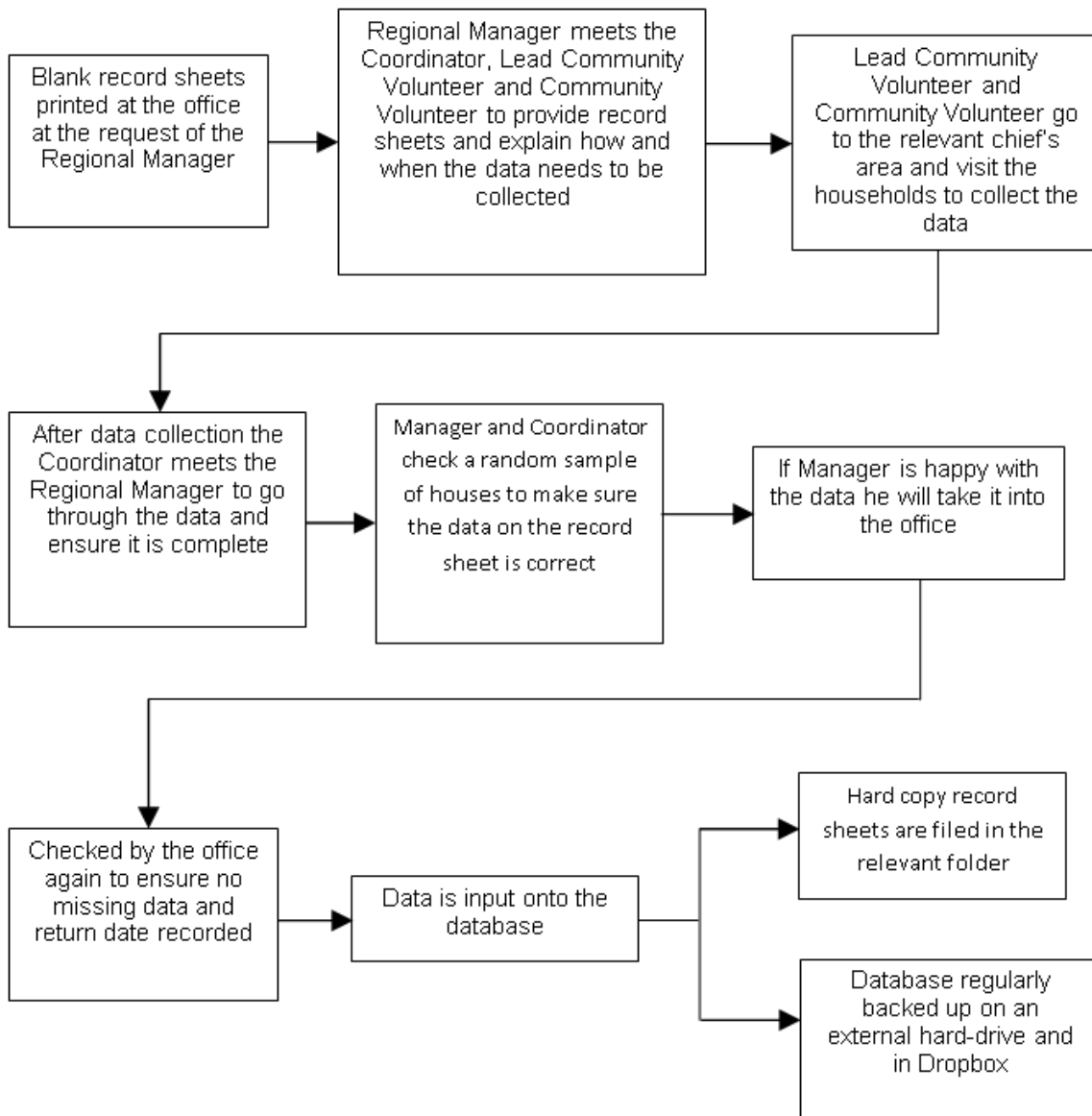
When the eight week checks have been completed for all householders in an area, the Community Volunteer forwards the completed construction monitoring forms to their Coordinator. The Coordinator then checks every household to ensure the stove is in use and in good condition, and completes the construction verification date construction verification signature.

Completed construction monitoring forms are then forwarded to the project headquarters, and all information will be entered into the project database following the QA/QC procedures detailed below.

As a conservative assumption, the emission reduction calculations for each stove are based on the date of successful construction verification by a Coordinator, rather than the actual stove build date.

Regular ongoing checks of stove usage and condition are conducted by Community Volunteers, Coordinators and Managers. Regular checks at household level are undertaken to assess the success of people using and maintaining their stoves.

Figure 1 Overview of data collection and storage



Version control is implemented for all electronic records, and off-site backups to a removable hard drive and secure Cloud server are made on a monthly or more regular basis. All records will be retained for the duration of the crediting period and for at least 2 years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Figure 2 Implementation team organisation chart

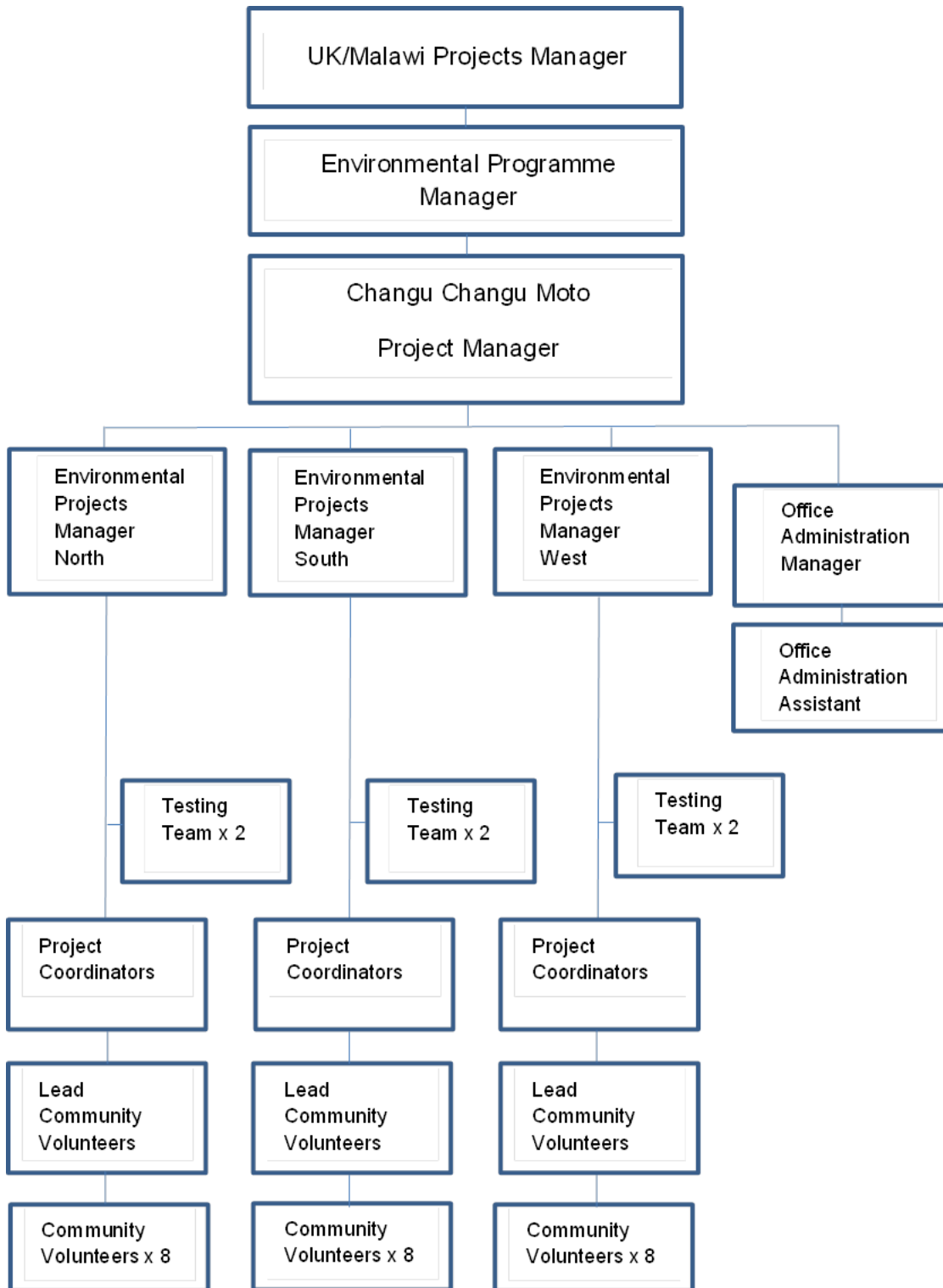
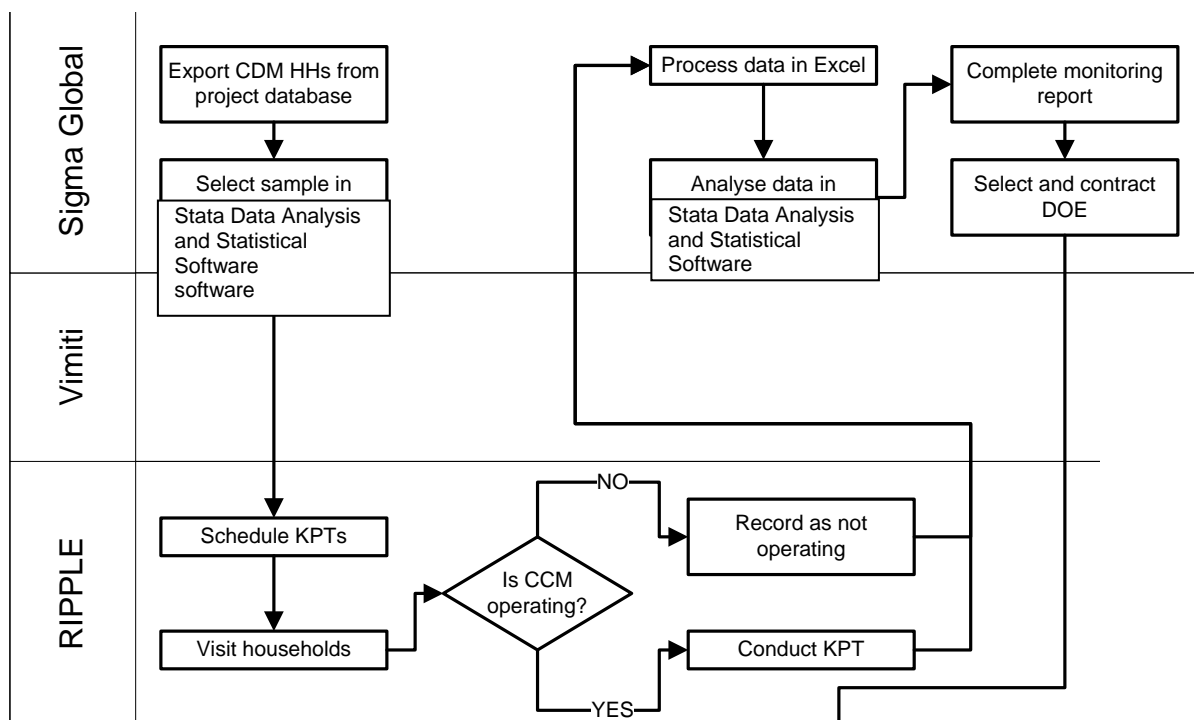


Figure 3 Overview of KPT Monitoring Procedure



Roles and Responsibilities of implementation team for monitoring of this project.

Malawi Projects Manager

- Responsible overall for the project in Malawi.
- Responsible for making sure that information is collected and recorded accurately.
- Responsible for the smooth running of the implementation and monitoring of the project.
- Responsible for coordinating all stove testing and monitoring, and general problem-solving.
- Responsible for liaising with the senior management of Project Participants.

Environmental Programme Manager

- Main link with all senior Malawian stakeholders in the project, namely Traditional Authorities, District Council, and other Government staff.
- Responsible for day-to-day management of the Managers and for staff recruitment.
- Responsible for training of Managers, Coordinators, and lead Community Volunteers.
- Responsible for producing progress reports at all stages of the programme.
- Responsible for monitoring the performance of Managers, Coordinators, and Community Volunteers.

Environmental Project Managers (North and South and West)

- Responsible for introducing the project to all Chiefs and communities within their project areas.
- Responsible for all activities in their respective areas, including management of Coordinators, Lead Community Volunteers, and Community Volunteers.
- Responsible for staff training.
- Responsible for monitoring performance of all staff, data collection, programme implementation, and ongoing monitoring in their respective areas.
- Responsible for collecting field data and providing it to the Office Administration Manager on time and completed correctly.

Office Administration Manager

- Responsible for collecting and collating all handwritten data from Community Volunteers and Coordinators, and for electronic data entry into the project database.
- Responsible for QA/QC of data entry
- Responsible for additional data entry staff.
- Responsible for printing and distributing training leaflets and data entry forms for all Community Volunteers, Coordinators, and Managers.
- Responsible for providing all senior managers with data entry progress.

Testing Officers

- Responsible for organising and performing Kitchen Performance Tests and providing all data to the Malawi Projects Manager.
- Responsible for training Coordinators and Community Volunteers on site and monitoring progress under instructions from the Projects Managers

Project Coordinators

- Responsible for running the project within their defined area, which typically would include about 30 Chiefs comprising approximately 2,000 – 3,000 households in total.
- Responsible for their Lead Community Volunteer who typically would look after 6 of the above Chiefs and manage and monitor the 15 Community Volunteers who will be implementing and monitoring the project.
- Responsible for the collection of all data entry forms on a monthly basis to be provided to the Environmental Project Managers and subsequently to the Office Administration Manager.
- Responsible for checking and monitoring the accuracy of all data provided by the Lead Community Volunteers and Community Volunteers by randomly inspecting the households and scrutinising the data collected therein.
- Responsible for training all Lead Community Volunteers and Community Volunteers in their area in the construction of Changu Changu Motos, and imparting to the Community Volunteers the skills necessary for them to provide ongoing maintenance and wood use training to each household.
- Responsible for monitoring the standard of work of all Lead Community Volunteers and Community Volunteers.

Lead Community Volunteers

- Responsible to their Coordinator and responsible for approximately 6 Community Volunteers working in 15 Chiefs' areas.
- Similar responsibilities to the Coordinators above.

Community Volunteers

- Responsible to their Lead Community Volunteer.
- Responsible for the implementation and monitoring of the project in all households within a Chiefs' area (typically 100 households).
- Responsible for making all households aware of the project.
- Responsible for ensuring all households make 30 bricks each and collect mud for the construction of the Changu Changu Moto.

- Responsible for constructing the Changu Changu Moto in each householders' kitchen in conjunction with the householder (the householder must take part in the construction in order to learn the skills required).
- Responsible for full training on maintenance of the Changu Changu Moto, and how to prepare and use the wood in the new stove.
- Responsible for regular monitoring and data collection at all stages of the project.

Quality Assurance/Quality Control

People

- The RIPPLE Africa Malawi Projects Manager is responsible for the coordination and implementation of the sampling plan. The KPTs were conducted by 8 teams of managers and coordinators. These staff members have been given comprehensive training in conducting KPTs by the Malawi Projects Manager, and the Technical Manager from Sigma Global.

Training

- Training documents have been created to be used as instruction for RIPPLE Africa staff carrying out the KPTs. The documents give day by day instructions on what needs to occur during the KPTs and how the results need to be recorded. Additional training documents have also been created for the period leading up to the KPTs to ensure that all documentation is organised correctly and all records made correctly.

Equipment

- Equipment used for data collection during the KPTs includes scales and electronic moisture meters. Certification records of all equipment used will be kept and be available to view as part of the project verification process. Training documents have been created on how to use the equipment and any equipment requirements.

Data Collection

- Data was collected during the KPTs, and recorded on printed data collection sheets. Calculations of daily household wood use was completed in the field each day following weighing of the remaining wood piles, and recorded on the template. This allowed immediate investigation of any values that appear to be outliers. Any reasons for abnormal results were recorded on the data collection sheet.
- Electronic data entry occurred as soon as possible after the completion of the tests. Any calculations were performed in the spreadsheets by in-built formulas. Any cells with formulas are locked to prevent unauthorised changes. A template has been created which is checked before each use. Data input is checked at the time it is input into the data base and random checks are held through the once a month audit as described in Section C.

Data Secured

- Written and electronic copies of the test results have been backed up in multiple locations and will be archived for the duration of the project crediting period.

Outliers

- Following data entry, outliers have been identified using a box plot of the data. Any potential reasons for outlier results recorded during data collection have been analysed and a decision made regarding removal of the potential outlier. Outliers will only be removed when there is a statistically valid reason, considering the sample weighting and following the principle of conservativeness. No outliers were removed in these results.
- No systematic differences between respondents and non-respondents are expected. As described the sample size has been calculated to allow for a conservative 15% non-response rate to allow for a number of households being unable to or un-willing to participate in the survey for some reason.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

(Copy this table for each data or parameter.)

| | |
|--|--|
| Data/Parameter | $NCV_{biomass}$ |
| Unit | TJ/tonne |
| Description | Net calorific value of the non-renewable woody biomass that is substituted |
| Source of data | IPCC default for wood fuel |
| Value(s) applied | 0.015 |
| Choice of data or measurement methods and procedures | Default value provided in AMS-II.G. |
| Purpose of data/parameter | Calculation of baseline and project emissions |
| Additional comments | |

| | |
|--|---|
| Data/Parameter | $EF_{projected_fossilfuel}$ |
| Unit | tCO ₂ /TJ |
| Description | Emission factor for the substitution of non-renewable woody biomass by similar consumers. |
| Source of data | Weighted average of the emission factors of substitution fuels likely to be used by similar consumers |
| Value(s) applied | 81.6 |
| Choice of data or measurement methods and procedures | Default value provided in AMS-II.G. |
| Purpose of data/parameter | Calculation of baseline and project emissions |
| Additional comments | |

| | |
|-----------------------|---|
| Data/Parameter | f_{NRB} |
| Unit | Fraction |
| Description | Fraction of non-renewable woody biomass saved by the project activity |
| Source of data | UNFCCC CDM website ⁴ |

⁴ <http://cdm.unfccc.int/DNA/fNRB/index.html>

| | |
|--|--|
| Value(s) applied | 0.81 |
| Choice of data or measurement methods and procedures | Default Malawi specific value available on the CDM website as approved by CDM EB and the Malawi DNA. This value is fixed for the crediting period, so $f_{NRB,y} = f_{NRB} = 0.81$ |
| Purpose of data/parameter | Calculation of baseline and project emissions |
| Additional comments | |

| | |
|--|--|
| Data/Parameter | B_{old} |
| Unit | tonnes/device/yr |
| Description | Quantity of woody biomass used per device in the absence of the project activity |
| Source of data | Survey/testing of local usage |
| Value(s) applied | 5.04 |
| Choice of data or measurement methods and procedures | The value of B_{old} has been determined through a survey and series of Kitchen Performance Tests conducted by the project implementer, RIPPLE Africa, within the project area. A sample of households from the project area was selected to participate and the data collected during July-August 2012. A detailed description of the sampling plan and results of the survey is contained in a report. |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | |

| | |
|--|--|
| Data/Parameter | L_{NTG} |
| Unit | Factor |
| Description | Net to gross adjustment factor to account for the use/diversion of non-renewable biomass saved under the project activity by non-project households/users that previously used renewable energy sources. |
| Source of data | Default value provided in AMS-II.G. |
| Value(s) applied | 0.95 |
| Choice of data or measurement methods and procedures | The default adjustment factor is chosen to avoid conducting surveys of non-project households/users, a number of which could potentially be located outside the defined project area. |
| Purpose of data/parameter | Calculation of leakage |
| Additional comments | |

D.2. Data and parameters monitored

(Copy this table for each data or parameter.)

| | |
|---------------------------------------|--|
| Data/Parameter | $N_{y,CCM}$ |
| Unit | none |
| Description | Number of operating Changu Changu Moto improved cook stoves in period y |
| Measured/calculated/default | Calculated |
| Source of data | Survey conducted in the project area at a sample of households |
| Value(s) of monitored parameter | 20,106 |
| Monitoring equipment | N/A |
| Measuring/reading/recording frequency | Recorded annually |
| Calculation method (if applicable) | Actual number of stoves in use taken from data base, then corrected for any stoves not in use using survey data from the sample group. |

| | | | |
|---------------------------|--|-----|---------|
| QA/QC procedures | As per description of monitoring system above | | |
| Purpose of data/parameter | Calculation of baseline and project emissions | | |
| Additional comments | The number of stoves operating in the monitoring period is corrected for any stoves not in use. 100% of households were using the stove. | | |
| | Total CCMs in use | 180 | 100% |
| | Total CCMs not in use | 0 | 0% |
| | Total Households | 180 | 100.00% |
| | So the number of operating Changu Changu Moto improved cook stoves in period y is $1 \times 20,106 = 20,106$. | | |

| | |
|---------------------------------|---|
| Data/Parameter | $B_{y,new,KPT}$ |
| Unit | tonnes/device/yr |
| Description | Quantity of woody biomass used per device during the project activity in period y |
| Measured/calculated/default | Calculated |
| Source of data | Kitchen Performance Test |
| Value(s) of monitored parameter | 1.35 |

| <p>Monitoring equipment</p> | <p>Equipment used for data collection during the KPTs includes scales and electronic moisture meters. Certification records of all equipment used will be kept and be available to view as part of the project verification process.</p> <p>Moisture Metres:</p> <ul style="list-style-type: none"> • Each moisture metres' calibration is checked internally on each day of the Kitchen Performance Tests. • Each moisture metres' calibration is checked once a month using an external device called the MCS-1, Moisture Content Standard, as provided by the moisture metre manufacturers. • Each moisture metre and the MCS-1 device have an up to date calibration certificate produced by the manufacturers that we keep on record. • The MCS-1 has a letter of certification dated 21 February 2017. The manufacturer does not have a prescribed expiration date for the MCS-1 standard since under normal use it does not typically go out of calibration. This also applies to the moisture meters. • As per manufacturer's specifications will re-certify or purchase a new MCS-1 and moisture meters every 5 years. <p>Weighing Scales:</p> <ul style="list-style-type: none"> • Each set of weighing scales has an up to date calibration certificate at the time of testing, provided by the manufacturers. <p>These certificates last for one year, at which stage a new certificate will be purchased from the manufacturers or new weighing scales will be purchased with its calibration certificate to ensure that the weighing scales always have a valid calibration certificate during the Kitchen Performance Tests.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| <p>Measuring/reading/recording frequency</p> | <p>Recorded annually</p> <p>Weighing Scales - Calibration Information</p> <table border="1" data-bbox="528 1077 1425 1346"> <thead> <tr> <th></th> <th>Make</th> <th>Model</th> <th>Serial No</th> <th>Certificate no</th> <th>Test Date</th> <th>Test next due</th> </tr> </thead> <tbody> <tr><td>1</td><td>Soufei</td><td>SF-911</td><td>10304162</td><td>15308</td><td>4-Apr-17</td><td>3-Apr-18</td></tr> <tr><td>2</td><td>Soufei</td><td>SF-911</td><td>10304163</td><td>15309</td><td>4-Apr-17</td><td>3-Apr-18</td></tr> <tr><td>3</td><td>Soufei</td><td>SF-911</td><td>10304164</td><td>15310</td><td>4-Apr-17</td><td>3-Apr-18</td></tr> <tr><td>4</td><td>Soufei</td><td>SF-911</td><td>10304165</td><td>15311</td><td>4-Apr-17</td><td>3-Apr-18</td></tr> <tr><td>5</td><td>Soufei</td><td>SF-911</td><td>10304166</td><td>15312</td><td>4-Apr-17</td><td>3-Apr-18</td></tr> <tr><td>6</td><td>Soufei</td><td>SF-911</td><td>10304167</td><td>15313</td><td>4-Apr-17</td><td>3-Apr-18</td></tr> <tr><td>7</td><td>Soufei</td><td>SF-911</td><td>10304168</td><td>15314</td><td>4-Apr-17</td><td>3-Apr-18</td></tr> <tr><td>8</td><td>Soufei</td><td>SF-911</td><td>10304169</td><td>15315</td><td>4-Apr-17</td><td>3-Apr-18</td></tr> </tbody> </table> <p>Moisture Meters - Calibration Information</p> <table border="1" data-bbox="528 1451 1425 1771"> <thead> <tr> <th></th> <th>Make</th> <th>Model</th> <th>Serial No</th> <th>Certificate no</th> <th>Certification Date</th> </tr> </thead> <tbody> <tr><td>1</td><td>Delmhorst</td><td>J-2000</td><td>40709</td><td>20170223-4</td><td>22-Feb-17</td></tr> <tr><td>2</td><td>Delmhorst</td><td>J-2000</td><td>40710</td><td>20170223-5</td><td>22-Feb-17</td></tr> <tr><td>3</td><td>Delmhorst</td><td>J-2000</td><td>40711</td><td>20170223-7</td><td>22-Feb-17</td></tr> <tr><td>4</td><td>Delmhorst</td><td>J-2000</td><td>40712</td><td>20170223-3</td><td>22-Feb-17</td></tr> <tr><td>5</td><td>Delmhorst</td><td>J-2000</td><td>40713</td><td>20170223-1</td><td>22-Feb-17</td></tr> <tr><td>6</td><td>Delmhorst</td><td>J-2000</td><td>40714</td><td>20170223-8</td><td>22-Feb-17</td></tr> <tr><td>7</td><td>Delmhorst</td><td>J-2000</td><td>35000</td><td>20170223-2</td><td>22-Feb-17</td></tr> <tr><td>8</td><td>Delmhorst</td><td>J-2000</td><td>35904</td><td>20170223-6</td><td>22-Feb-17</td></tr> </tbody> </table> | | Make | Model | Serial No | Certificate no | Test Date | Test next due | 1 | Soufei | SF-911 | 10304162 | 15308 | 4-Apr-17 | 3-Apr-18 | 2 | Soufei | SF-911 | 10304163 | 15309 | 4-Apr-17 | 3-Apr-18 | 3 | Soufei | SF-911 | 10304164 | 15310 | 4-Apr-17 | 3-Apr-18 | 4 | Soufei | SF-911 | 10304165 | 15311 | 4-Apr-17 | 3-Apr-18 | 5 | Soufei | SF-911 | 10304166 | 15312 | 4-Apr-17 | 3-Apr-18 | 6 | Soufei | SF-911 | 10304167 | 15313 | 4-Apr-17 | 3-Apr-18 | 7 | Soufei | SF-911 | 10304168 | 15314 | 4-Apr-17 | 3-Apr-18 | 8 | Soufei | SF-911 | 10304169 | 15315 | 4-Apr-17 | 3-Apr-18 | | Make | Model | Serial No | Certificate no | Certification Date | 1 | Delmhorst | J-2000 | 40709 | 20170223-4 | 22-Feb-17 | 2 | Delmhorst | J-2000 | 40710 | 20170223-5 | 22-Feb-17 | 3 | Delmhorst | J-2000 | 40711 | 20170223-7 | 22-Feb-17 | 4 | Delmhorst | J-2000 | 40712 | 20170223-3 | 22-Feb-17 | 5 | Delmhorst | J-2000 | 40713 | 20170223-1 | 22-Feb-17 | 6 | Delmhorst | J-2000 | 40714 | 20170223-8 | 22-Feb-17 | 7 | Delmhorst | J-2000 | 35000 | 20170223-2 | 22-Feb-17 | 8 | Delmhorst | J-2000 | 35904 | 20170223-6 | 22-Feb-17 |
| | Make | Model | Serial No | Certificate no | Test Date | Test next due | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Soufei | SF-911 | 10304162 | 15308 | 4-Apr-17 | 3-Apr-18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Soufei | SF-911 | 10304163 | 15309 | 4-Apr-17 | 3-Apr-18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Soufei | SF-911 | 10304164 | 15310 | 4-Apr-17 | 3-Apr-18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Soufei | SF-911 | 10304165 | 15311 | 4-Apr-17 | 3-Apr-18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | Soufei | SF-911 | 10304166 | 15312 | 4-Apr-17 | 3-Apr-18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Soufei | SF-911 | 10304167 | 15313 | 4-Apr-17 | 3-Apr-18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | Soufei | SF-911 | 10304168 | 15314 | 4-Apr-17 | 3-Apr-18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Soufei | SF-911 | 10304169 | 15315 | 4-Apr-17 | 3-Apr-18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Make | Model | Serial No | Certificate no | Certification Date | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Delmhorst | J-2000 | 40709 | 20170223-4 | 22-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Delmhorst | J-2000 | 40710 | 20170223-5 | 22-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Delmhorst | J-2000 | 40711 | 20170223-7 | 22-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Delmhorst | J-2000 | 40712 | 20170223-3 | 22-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | Delmhorst | J-2000 | 40713 | 20170223-1 | 22-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Delmhorst | J-2000 | 40714 | 20170223-8 | 22-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | Delmhorst | J-2000 | 35000 | 20170223-2 | 22-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Delmhorst | J-2000 | 35904 | 20170223-6 | 22-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Calculation method (if applicable)</p> | <p>3.69 kg dry wood used per device per day was the average recorded during the KPTs. To calculate the annual tonnes/device/yr: $3.69 \times 365 / 1000 = 1.35$ tonnes/device/yr.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>QA/QC procedures</p> | <p>As per description of monitoring system above</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Purpose of data/parameter</p> | <p>Calculation of project emissions</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Additional comments</p> | <p></p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | |
|---------------------------------------|---|
| Data/Parameter | f_{NRB} |
| Unit | Fraction |
| Description | Fraction of non-renewable woody biomass saved by the project activity |
| Measured/calculated/default | Default |
| Source of data | UNFCCC CDM website ⁵ |
| Value(s) of monitored parameter | 0.81 |
| Monitoring equipment | N/A |
| Measuring/reading/recording frequency | Reviewed during each monitoring period |
| Calculation method (if applicable) | N/A |
| QA/QC procedures | |
| Purpose of data/parameter | Calculation of baseline and project emissions |
| Additional comments | |

| | |
|---------------------------------------|--|
| Data/Parameter | B_{old} |
| Unit | Tonnes/device/yr |
| Description | Fuel-wood consumption of baseline stoves |
| Measured/calculated/default | Calculated |
| Source of data | Kitchen Performance Test |
| Value(s) of monitored parameter | 5.04 |
| Monitoring equipment | |
| Measuring/reading/recording frequency | Recorded annually |
| Calculation method (if applicable) | |
| QA/QC procedures | As per description of monitoring system above |
| Purpose of data/parameter | Calculation of baseline and project emissions |
| Additional comments | The number of stoves operating in the monitoring period is corrected for any stoves not in use. 0% of households were not using the Changu Changu Moto improved cook stoves in period y so no households were removed from the total number of households. |

D.3. Implementation of sampling plan

The sampling plan has been designed in accordance with Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities version 3.0 and Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities version 3.0.

It follows the recommended outline for a sampling plan in Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities version 3.0.

Practices for sample design and administering of the surveys and field measurements are based on *Household Sample Surveys in Developing and Transition Countries*⁶ as recommended in

⁵ <http://cdm.unfccc.int/DNA/fNRB/index.html>

Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities version 3.0.

The objective of the sampling plan is to determine an estimate of $B_{y,new,KPT}$, the quantity of woody biomass used per device during the project activity in period y . $B_{y,new,KPT}$ was measured as per the Kitchen Performance Test (KPT) protocol, with a 90% confidence interval and a 10% margin of error. The KPTs have been carried out in accordance with procedures specified by the Partnership for Clean Indoor Air (PCIA)⁷

The objective of the sampling plan is also to determine an estimate of $N_{y,CCM}$, the number of operating Changu Moto improved cook stoves in period y . This was determined by a survey of sampled households, with a 90% confidence interval and a 10% margin of error.

The same households selected for the determination of the annual quantity of woody biomass used in the project activity was used for the determination of the number of operating Changu Moto improved cook stoves.

The target population includes all households participating in the project. The target population is all individual households within each chief area in the Traditional Authorities within the project area. Each household has a chief. The total number of eligible households in the project area for this monitoring period is 20,106.

The sampling method used was multi-stage sampling using a self weighting sampling procedure as per section II.E of Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities version 3.0. Nkhata Bay District covers an area of 4,071 km². Transport infrastructure is limited, access to liquid fuels in Malawi is limited, and times and costs to travel within the district can be high. Multi-stage sampling was selected to significantly improve the efficiency and reduce the costs of the sampling compared to a simple random sample.

The primary sampling unit (PSU) includes all eligible households in the project area and is defined as each village under a chief (chief area) in the Traditional Authorities within the project area. The ultimate sampling units are defined as individual households within each chief area and include all households in the target population. The sample size is the total number of households selected to participate in the KPTs. The sample consists of 15 households from each of the 12 PSUs, giving a total sample size of 180 households.

Each PSU was checked to ensure it is sufficiently large enough to select the required number of households if required (i.e. as 15 households are to be selected from each PSU, as described below, each PSU must contain at least 15 households).

The 12 PSUs in the first stage was selected using a probability proportional to size (PPS) without replacement procedure, the size being the number of households in each unit. The number of households participating in the project in each chief area was determined from implementation data in the project database.

12 PSUs were selected with PPS sampling, and 15 households were selected from each PSU using a simple random sample without replacement, both stages were conducted using a statistical software package. In this sample design, each sample is self-weighting. Adjustments to weights may be required following data collection due to issues such as non-response. This procedure is described in the section "Quality Assurance/Quality Control".

⁶ Department of Economic and Social Affairs, Statistics Division, United Nations . *Household Sample Surveys in Developing and Transition Countries*. New York : United Nations , 2005.

⁷ <http://www.pciaonline.org/node/1049>

The sample selection was done in two stages:

1. 12 chief areas were selected at random;
2. 15 households from each of the 12 chief areas were selected at random.

This gave us samples of 180 households.

A dedicated software package called the Stata IC14⁸ Data Analysis and Statistical Software was used. We exported the Excel spreadsheet with all chief areas into Stata. We then selected the sample using the Sampling Plan Wizard. We designed the sampling plan as shown in the table below. No stratification was used. The list was then sorted by *Household_ChiefArea* then *Household_GeoRef* to enable KPT planning.

Table 2 Summary of sampling plan

| Summary | | Stage 1 | Stage 2 |
|------------------------------------|-------------------------------|--|---|
| Design Variables | Cluster sampling | <i>Household_ChiefArea</i> | <i>Household_ID</i> |
| Sample Information | Selection Method | PPS sampling without replacement | Simple random sampling without replacement |
| | Measure of Size | Obtained from data | |
| | Number of Units Sampled | 12 | 15 |
| | Variables Created or Modified | Stagewise Inclusion (Selection) Probability | <i>InclusionProbability_1_</i> |
| Stagewise Cumulative Sample Weight | | <i>SampleWeightCumulative_1_</i> | <i>SampleWeightCumulative_2_</i> |
| Analysis Information | Estimator Assumption | Unequal probability sampling without replacement (using joint inclusion probabilities) | Equal probability sampling without replacement |
| | Inclusion Probability | Obtained from variable <i>InclusionProbability_1_</i> | Obtained from variable <i>InclusionProbability_2_</i> |
| Weight Variable: | | <i>SampleWeight_Final_</i> | |

The sampling frame consists of the 7 Traditional Authorities that make up the project boundary. The sampling frame was limited to the households that have had Changu Changu Moto improved cook stoves installed and were using the stoves at the time the sampling was conducted. Comprehensive record keeping in the project database eliminates the risk that the sample frame does not cover the entire target population.

KPT Data

The data was collected as per the KPT protocol⁹ from eligible households. An initial check was conducted to determine if the household is currently using the project stove, as per the sampling plan. If the household was not using the project stove, the KPT was not conducted. If the household was using the project stove, the average daily household use of woody biomass was calculated by measuring the wood moisture content and the mass of wood used each day by the household for a period of 3 days. Households were instructed to only use woody biomass for the duration of the test, and no biomass residues such as maize cobs or cassava stems.

The average daily household use of woody biomass during the testing period has been scaled up to calculate the average annual household use of woody biomass.

⁸ <http://www.stata.com/>

⁹ <http://www.pciaonline.org/node/1049>

The sampling plan and testing was conducted by the project implementer, RIPPLE Africa with support from the Project Participants. The tests were conducted between 11/06/2017 and 10/08/2017. The work plan for the KPTs conducted at the households selected at each PSU has been developed according to the KPT Protocol and is shown in the table below. The organisation chart and roles and responsibilities for the implementation team is shown in the description of the monitoring above.

Table 3 KPT conducted at each PSU

| Sunday | Monday | Tuesday | Wednesday | Thursday |
|-------------------------------------|------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Train householder in test procedure | Check on test progress | Check on test progress | Check on test progress | Weigh wood |
| Collect household information | Moisture readings | Weigh wood | Weigh wood | Collect information on meals cooked |
| Weigh wood for test | | Moisture readings | Moisture readings | |
| | | Collect information on meals cooked | Collect information on meals cooked | |

Data processing and analysis

The data collected from the complex survey design was combined in Excel and then analysed using statistical software appropriate to complex survey design data analysis to calculate the values for the proportion of stoves operating and the population estimate of the average annual quantity of woody biomass used per household in the project activity along with confidence intervals. Stata was used to analyse the results.

The daily wood use figures from each household have been converted to a 0% moisture dry wood basis as according to the applied KPT procedures specified by the PCIA. The IPCC default net calorific value (NCV) for wood fuel used in the CDM methodology is quoted on a “wet basis”, but it is unclear at what moisture content this is exactly. The emission reduction calculations therefore use a NCV on a wet basis and wood weights converted to 0% moisture dry wood weight to ensure conservativeness and to ensure compliance with methodology and KPT procedures simultaneously.

Each household has a sample weight, that is how many households of the full population that household represents. The sampling procedure is designed to be self-weighting, i.e. all 180 households selected represent that same number of households in the full population. The weights of all households in a chief area change if any of the 15 households in that chief did not complete the KPT. Weights were recalculated prior to data analysis to ensure non-biased estimates of the parameters.

Please see the confidential report attached to this document for more information: KPT Report Project 2 October 2017

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

Under AMS-II.G. version 5.0, emission reductions are calculated using equation (1) in paragraph 11:

$$ER_y = B_{y,savings} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossilfuel} \times N_{y,i}$$

Where:

ER_y Emission reductions during the year y in tCO₂e

| | |
|------------------------------|--|
| $B_{y,savings}$ | Quantity of woody biomass that is saved in tonnes per device |
| $f_{NRB,y}$ | 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 |
| $EF_{projected_fossilfuel}$ | Emission factor for the substitution of non-renewable woody biomass by similar consumers. |
| $N_{y,i}$ | Number of project devices of type i operating in year y |

For this project activity, the calculation is refined further to allow for monitoring periods that are not equal to one year¹⁰, fix the value for the fraction of non-renewable biomass and limit the number of operating stoves to one stove type:

$$ER_y = B_{y,savings} \times f_{NRB} \times NCV_{biomass} \times EF_{projected_fossilfuel} \times N_{y,CCM} \times y$$

Where:

| | |
|------------------------------|--|
| ER_y | Emission reductions during the period y in tCO ₂ e |
| $B_{y,savings}$ | Quantity of woody biomass that is saved in period y in tonnes per device |
| f_{NRB} | Fraction of woody biomass saved by the project activity established as non-renewable biomass |
| $NCV_{biomass}$ | Net calorific value of the non-renewable woody biomass that is substituted |
| $EF_{projected_fossilfuel}$ | Emission factor for the substitution of non-renewable woody biomass by similar consumers. |
| $N_{y,CCM}$ | Number of Changu Changu Moto improved cook stoves operating in period y |
| y | Length of period y , in years |

$B_{y,savings}$ is estimated using option 1 under paragraph 12:

$$B_{y,savings} = B_{old} - B_{y,new,KPT}$$

Where:

| | |
|-------------|--|
| B_{old} | Quantity of woody biomass used in the absence of the project activity in tonnes per device |
| $B_{y,new}$ | Quantity of woody biomass used during the project activity in period y in tonnes per device, measured as per the Kitchen Performance Test (KPT) protocol. The KPT should be carried out in accordance with national standards (if available) or international standards or guidelines (e.g. the KPT procedures specified by the Partnership for Clean Indoor Air (PCIA) < http://www.pciaonline.org/node/1049 >) |

Option 1 has been chosen by the project participants to determine the annual quantity of woody biomass used during the project activity for a number of reasons:

- To be consistent with the baseline quantity of woody biomass used in the absence of the project activity (also determined using the KPT);
- The KPT is a field test used to evaluate stove performance in real-world settings and is designed to assess actual impacts on household fuel consumption¹¹. KPTs typically give the best indication of real world changes, and therefore the most accurate estimate of wood fuel use.

¹⁰ For example, due to the phased implementation of the improved cook stoves.

¹¹ Stove Testing. *Partnership for Clean Indoor Air*. [Online] [Cited: 6 June 2012.] <http://pciaonline.org/testing>.

- Undertaking the KPTs is compatible with the structure of the project implementation and monitoring team.

The quantity of woody biomass used in the absence of the project activity in tonnes, B_{old} , has been determined by using option (a) of paragraph 13 in AMS-II.G.

Calculated as the estimated average annual consumption of woody biomass per device (tonnes/year). This may be derived from historical data or a survey of local usage.

The calculation of B_{old} will incorporate an adjustment for leakage. Under paragraph 20 (a), the use of a net to gross adjustment factor of 0.95 to account for the use/diversion of non-renewable biomass saved under the project activity by non-project households/users that previously used renewable energy sources has been chosen by the project participants. The default adjustment factor is chosen to avoid conducting surveys of non-project households/users, a number of which could potentially be located outside the defined project area.

The calculation of B_{old} considering leakage therefore becomes:

$$B_{old,leakage} = B_{old} \times L_{NTG}$$

Where:

B_{old} Quantity of woody biomass used per device in the absence of the project activity

L_{NTG} Net to gross adjustment factor to account for the use/diversion of non-renewable biomass saved under the project activity by non-project households/users that previously used renewable energy sources

Taking into account the adjusted calculation of B_{old} the quantity of woody biomass that is saved in period y in tonnes per device is then calculated as:

$$B_{y,savings} = B_{old,leakage} - B_{y,new,KPT}$$

Substituting values from Data and Parameters monitored we get:

$$B_{old,leakage} = 5.04 \times 0.95 = 4.788 \text{ tonnes woody biomass/device/year.}$$

The estimate for $B_{y,new,KPT}$ is 1.35 tonnes/device/year.

The amount of woody biomass saved under the project is then calculated as:

$$B_{y,savings} = B_{old,leakage} - B_{y,new,KPT} = 4.788 - 1.35 = 3.438 \text{ tonnes/device/year}$$

The emission reductions are calculated as:

$$ER_y = B_{y,savings} \times f_{NRB} \times NCV_{biomass} \times EF_{projected_fossilfuel} \times N_{y,CCM} \times y$$

Where:

ER_y Emission reductions during the period y in tCO₂e

$B_{y,savings}$ Quantity of woody biomass that is saved in period y in tonnes per device

f_{NRB} Fraction of woody biomass saved by the project activity established as non-renewable biomass

$NCV_{biomass}$ Net calorific value of the non-renewable woody biomass that is substituted

$EF_{projected_fossilfuel}$ Emission factor for the substitution of non-renewable woody biomass by similar consumers.

$N_{y,CCM}$ Number of Changu Changu Moto improved cook stoves operating in period y

y Length of period y , in years

Substituting values from above the estimate of emission reductions for year 1 becomes:

$$ER_y = 3.438 \times 0.81 \times 0.015 \times 81.6 \times 20,106 \times 1 = 68,533 \text{ tCO}_2\text{e}$$

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

Project emissions are calculated as:

$$\text{Project emissions} = B_{y,new,KPT} \times f_{NRB} \times NCV_{biomass} \times EF_{projected_fossilfuel} \times N_{y,CCM} \times y$$

Where:

$B_{y,new,KPT}$ Quantity of woody biomass used during the project activity in period y in tonnes per device, measured as per the Kitchen Performance Test (KPT) protocol.

f_{NRB} Fraction of woody biomass saved by the project activity established as non-renewable biomass

$NCV_{biomass}$ Net calorific value of the non-renewable woody biomass that is substituted

$EF_{projected_fossilfuel}$ Emission factor for the substitution of non-renewable woody biomass by similar consumers.

$N_{y,CCM}$ Number of Changu Changu Moto improved cook stoves operating in period y

y Length of period y , in years

Substituting values from above the estimate of project emissions for year 1 becomes:

$$\text{Project emissions} = 1.35 \times 0.81 \times 0.015 \times 81.6 \times 20,106 \times 1 = 26,911 \text{ tCO}_2\text{e.}$$

E.3. Calculation of leakage emissions

Default value provided in AMS-II.G. The default adjustment factor was chosen to avoid conducting surveys of non-project households/users, a number of which could potentially be located outside the defined project area.

Leakage emissions are calculated as:

$$\text{Leakage} = B_{old} \cdot B_{old,leakage} \times f_{NRB} \times NCV_{biomass} \times EF_{projected_fossilfuel} \times N_{y,CCM} \times y$$

Where:

B_{old} Quantity of woody biomass used per device in the absence of the project activity

$$B_{old,leakage} = B_{old} \times L_{NTG}$$

Where:

B_{old} Quantity of woody biomass used per device in the at project activity

L_{NTG} Net to gross adjustment factor to account for the use/div renewable biomass saved under the project activity b households/users that previously used renewable energy s

f_{NRB}

$NCV_{biomass}$ Fraction of woody biomass saved by the project activity established as non-renewable biomass

$EF_{projected_fossilfuel}$ Net calorific value of the non-renewable woody biomass that is substituted.

Emission factor for the substitution of non-renewable woody biomass by similar consumers.

$N_{y,CCM}$ Number of Changu Changu Moto improved cook stoves operating in period y
 y Length of period y , in years

Substituting values from above the estimate of leakage for year 1 becomes:

$$\text{Leakage} = 5.04 - 4.788 \times 0.81 \times 0.015 \times 81.6 \times 20,106 \times 1 = 5023 \text{ t CO}_2\text{e.}$$

E.4. Calculation of emission reductions or net anthropogenic removals

| | Baseline GHG emissions or baseline net GHG removals (t CO ₂ e) | Project GHG emissions or actual net GHG removals (t CO ₂ e) | Leakage GHG emissions (t CO ₂ e) | GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e) | | |
|--------------|---|--|---|---|----------------------------|----------------------------|
| | | | | Before 01/01/2013 | From 01/01/2013 | Total amount |
| Total | 100,467 t CO ₂ e | 26,911 t CO ₂ e | 5023 t CO ₂ e | | 68,533 t CO ₂ e | 68,533 t CO ₂ e |

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

| Amount achieved during this monitoring period (t CO ₂ e) | Amount estimated ex ante (t CO ₂ e) |
|---|--|
| 68,533 t CO ₂ e | 37,830 t CO ₂ e |

E.6. Remarks on increase in achieved emission reductions

The Kitchen Performance Test results gave the $B_{y,new,KPT}$ value. ERs are higher as shown by the KPT results. Reasons for this include:

- The quantity of woody biomass saved in tonnes per device $B_{y,savings}$ was higher than the ex ante estimates in the PDD as the quantity of woody biomass used in the project activity was lower than forecast.
- In the PDD the ex ante estimates for $B_{y,savings}$ was 2.168 tonnes/device/year. The $B_{y,savings}$ value from the KPT results for this monitoring period is 3.438 tonnes/device/year. Stove users are saving more wood each year they use the stove.
- The proportion of stoves operating was higher than forecast in the PDD. In the PDD the ex ante estimates for proportion of stoves operating was 80%. In this monitoring period 100% of households were using the stoves.
- Intensive training and monitoring of the households over many years has shown to be very effective in the KPT results and total ERs.
- The amount estimated ex ante t CO₂e is based on 80% stove usage and 2.168 tonnes/device/year wood saved.

Attachment. Instructions for completing this form

1. General instructions

1. When reporting on monitoring results and completing this form, in addition to applying the “CDM project standard for project activities” (hereinafter referred to as the project standard), the selected methodologies and, where applicable, the selected standardized baselines, consult the “Rules and Reference” section of the UNFCCC CDM website. This section contains all regulatory documents for the CDM, such as standards (including methodologies, and standardized baselines), procedures, tools, guidelines, clarifications, forms and the “Glossary: CDM terms”.
2. Make any data, values and formulae included in spreadsheets accessible and verifiable.
3. Complete this form in English. Prepare all attached documents in English, or if their originals were prepared in another language, provide a full translation of the relevant sections of these documents in English.
4. Complete this form using the same format without modifying its font, headings or logo, and without any other alteration to the form.
5. Do not modify or delete tables and their columns in this form. Add rows to the tables as needed. Add additional appendices as needed.
6. If a section of the form is not applicable, explicitly state that the section is left blank intentionally.
7. Use an internationally recognized format for presentation of values. For example, use digit grouping in thousands and mark a decimal point with a dot (.), not with a comma (,).
8. Complete this form deleting this attachment.

2. Specific instructions

1. Indicate the following information on the cover page:
 - (a) Title of the project activity;
 - (b) UNFCCC reference number of the project activity;
 - (c) Version number of the PDD applicable to this monitoring report;
 - (d) Version number of this monitoring report;
 - (e) Completion date of this monitoring report: Indicate the date in DD/MM/YYYY;
 - (f) Monitoring period number: The monitoring period number is an ordinal number referring to the chronological order of monitoring periods (e.g. “first monitoring period”);
 - (g) Duration of this monitoring period: Indicate the duration with the first and last dates in DD/MM/YYYY – DD/MM/YYYY;
 - (h) Monitoring report number for this monitoring period: Applicable when preparing multiple separate monitoring reports for the monitoring period for different batches of small-scale project activities in the registered bundle of small-scale project activities. To distinguish between such multiple separate monitoring reports, assign an ordinal number from 1 upwards (e.g. 1, 2, 3...*n*) to each monitoring report in the consecutive order;
 - (i) Project participants;
 - (j) Host Party;
 - (k) Sectoral scopes: List all sectoral scopes applicable to the project activity;
 - (l) Applied methodologies and standardized baselines: List all the methodologies and combination of methodologies, and where applicable, the standardized baselines, applied to the project activity;
 - (m) Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period: Provide the total amount in tonnes of CO₂ equivalent;
 - (n) Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD: Provide the total amount in tonnes of CO₂ equivalent based on the ex ante estimation in the PDD, with adjustment for the comparable period, as appropriate.

SECTION A. Description of project activity

A.1. General description of project activity

1. Provide a brief summary of the project activity in terms of the purpose of the project activity and the measures taken for GHG emission reductions or net anthropogenic GHG removals.

A.2. Location of project activity

1. Provide details of the physical/geographical location of the project activity, including physical address (host Party, region/state/province, city/town/community, street name and number) and a map, and if necessary, other information allowing for unique identification of the project activity (e.g. geographic coordinates).
2. Do not exceed one page for the description of location.

A.3. Parties and project participants

1. List in the table the Parties and the project participants involved in the project activity.

A.4. Reference to applied methodologies and standardized baselines

1. Indicate the exact reference (number, title, version) of:
 - (a) The applied methodologies or combination of methodologies (e.g. ACM0001: “Large-scale consolidated methodology: Flaring or use of landfill gas” (version 15.0));
 - (b) Any tools and other methodologies to which the applied methodologies refer (e.g. “Methodological tool: Tool for the demonstration and assessment of additionality” (version 07.0.0));
 - (c) The applied standardized baselines, where applicable (e.g. ASB0001 “Standardized baseline: Grid emission factor for the Southern African power pool” (version 01.0)).
2. Refer to the UNFCCC CDM website for the exact reference of the applied methodologies, tools and standardized baselines.

A.5. Crediting period type and duration

1. Provide the type (fixed or renewable), and the duration (with the start and end dates in DD/MM/YYYY – DD/MM/YYYY) of the crediting period corresponding to this monitoring period.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

1. Provide information on the implementation status of the project activity in accordance with the applicable provisions on the description of implemented registered CDM project activities in the project standard, including:
 - (a) Description of the installed technology, technical processes and equipment;
 - (b) Information on the implementation and actual operation of the project activity, including relevant dates (e.g. construction, commissioning, start of operation).
2. For the description of the installed technologies, technical processes and equipment, include diagrams, where appropriate.
3. If applicable, present information on any post-registration changes to the project activity in section B.2 below.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

1. Indicate whether there are temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines during this monitoring period.
2. If there are such deviations, for each deviation, provide a description of the nature, extent and duration of the non-conforming monitoring period, and:
 - (a) Propose alternative monitoring arrangements for the non-conforming monitoring period in accordance with the applicable provisions in the project standard; or
 - (b) Apply the most conservative values approach in accordance with the applicable provisions in the project standard.
3. Provide the version number and the completion date of the DOE verification report.

B.2.2. Corrections

1. Indicate whether there are corrections to project information or parameters fixed at the registration or renewal of crediting period of the project activity.
2. If there are such corrections, list all the corrections since the registration of the project activity, separating them into the following categories:
 - (a) Corrections that have been approved by the Board as applicable from the period prior to this monitoring period;
 - (b) Corrections that have been approved by the Board as applicable from this monitoring period;
 - (c) Corrections that are being submitted with this monitoring report as part of the request for issuance (post-registration change – issuance track) as applicable from this monitoring period.
3. For the corrections referred to in 1(a) and 1(b) above, provide the approval dates and reference numbers of the post-registration changes.
4. For the corrections referred to in 1(c) above, provide the version number and the completion date of the revised PDD and of the DOE validation report.

B.2.3. Changes to the start date of the crediting period

1. Indicate whether there are changes to the start date of the crediting period fixed at the registration of the project activity.
2. If there are such changes, list all the changes since the registration of the project activity, separating them into the following categories:
 - (a) Changes that have been approved by the Board or notified to the secretariat and that do not affect the start of this monitoring period (i.e. any of the changed start dates are prior to the start of this monitoring period);
 - (b) Change that has been approved by the Board or notified to the secretariat and that affects the start of this monitoring period (i.e. the changed start date is the start of this monitoring period);
 - (c) Change that affects the start of this monitoring period and is being submitted with this monitoring report as part of the request for issuance (post-registration change – issuance track) and that affects the start of this monitoring period.
3. For the changes referred to in 1(a) and 1(b) above, provide the approval dates and reference numbers of the post-registration changes, or provide the notification date.
4. For the changes referred to in 1(c) above, provide the version number and the completion date of the revised PDD and of the DOE validation report.

B.2.4. Inclusion of monitoring plan

1. Indicate whether there is a post-registration change to include a monitoring plan into the PDD, for which the delayed submission of the monitoring plan was chosen by the project participants at the time of the registration of the project activity.
2. If there is such change, indicate which one of the following categories that the change falls under:
 - (a) Inclusion has been approved by the Board as applicable from the period prior to this monitoring period;
 - (b) Inclusion has been approved by the Board as applicable from this monitoring period (i.e. this is the first monitoring period for the project activity); or
 - (c) Inclusion is being submitted together with this monitoring report (post-registration change – issuance track) as applicable from this monitoring period.
3. For the case referred to in 1(a) or 1(b) above, provide the approval date and reference number of the post-registration change.
4. For the case referred to in 1(c) above, provide the version number and the completion date of the revised PDD and of the DOE validation report.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

1. Indicate whether there are permanent changes to the registered monitoring plan, or permanent deviation of monitoring from applied methodologies, applied standardized baseline, or other applied standards or tools.
2. If there are such changes, list all the changes since the registration of the project activity, separating them into the following categories:
 - (a) Changes that have been approved by the Board as applicable from the period prior to this monitoring period;
 - (b) Changes that have been approved by the Board as applicable from this monitoring period;
 - (c) Changes that are being submitted with this monitoring report as part of the request for issuance (post-registration change - issuance track) as applicable from this monitoring period.
3. For the changes referred to in 1(a) and 1(b) above, provide the approval dates and reference numbers of the post-registration changes.
4. For the changes referred to in 1(c) above, provide the version number and the completion date of the revised PDD and of the DOE validation report.

B.2.6. Changes to project design

1. Indicate whether there are any changes to the project design of the project activity.
2. If there are such changes, list all the changes since the registration of the project activity, separating them into the following categories:
 - (a) Changes that have been approved by the Board as applicable from the period prior to this monitoring period;
 - (b) Changes that have been approved by the Board as applicable from this monitoring period;
 - (c) Changes that are being submitted with this monitoring report as part of the request for issuance (post-registration changes - issuance track) as applicable from this monitoring period.
3. For the changes referred to in 1(a) and 1(b) above, provide the approval dates and reference numbers of the post-registration changes.
4. For the changes referred to in 1(c) above, provide the version number and the completion date of the revised PDD and of the DOE validation report.

SECTION C. Description of monitoring system

1. Provide a description of the monitoring system in accordance with the applicable provisions on the description of monitoring system in the project standard and the monitoring plan in the registered PDD. Include line diagrams showing all relevant monitoring points.

SECTION D. Data and parameters

1. Provide information on all data and parameters in accordance with the applicable provisions on data and parameters in the project standard, using the tables provided in sections D.1 and 0.
2. For "Purpose of data/parameter" in the tables in D.1 and 0, choose one of the following options:
 - (a) Calculation of baseline emissions or baseline net GHG removals;
 - (b) Calculation of project emissions or actual net GHG removals;
 - (c) Calculation of leakage.
3. Where the applied standardized baselines standardize baseline emissions, apply the standardized values of the parameters in sections D.1 and/or 0 in accordance with the applicable provisions related to data and parameters in the project standard.

D.1. Data and parameters fixed ex ante

1. Include data that are fixed at the registration or at the renewal of crediting period of the project activity, and were used during this monitoring period, by replicating the information from the registered PDD.
2. For "Value(s) applied", use one table to report multiple values referring to the same data and parameter, if applicable.

D.2. Data and parameters monitored

1. Include data and parameters that were monitored during this monitoring period.
2. For "Monitoring equipment" in the table, provide information on type, accuracy class, serial number, calibration frequency, date of last calibration and validity.
3. For "Value(s) of monitored parameter", use one table to report multiple values referring to the same data and parameter, if applicable.
4. Describe details in spreadsheets if appropriate, attach them to the monitoring report, and provide the reference to the spreadsheets in this section.

D.3. Implementation of sampling plan

1. If a sampling plan was implemented to determine parameter values, provide a description of how the sampling for those parameters was implemented in accordance with the sampling plan in the registered monitoring plan, including the following information:
 - (a) Description of implemented sampling design;
 - (b) Collected data (attach and provide reference to spreadsheets, if necessary);
 - (c) Analysis of the collected data;
 - (d) Demonstration that the required confidence/precision has been met;
 - (e) Demonstration that the samples were randomly selected and are representative of the population.
2. Attach to the monitoring report any spreadsheets to present full calculations or detailed information.

SECTION E. Calculation of emission reductions or net anthropogenic removals

1. For the parameter global warming potentials (GWPs), from 1 January 2013, apply the values adopted by decision 4/CMP.7 to calculate GHG emission reductions or net anthropogenic GHG removals achieved in the second commitment period of the Kyoto Protocol in accordance with the applicable provisions in the project standard.

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

1. Provide sample calculations for all formulae used to calculate baseline GHG emissions or baseline net GHG removals, applying actual values. Attach spreadsheets to the monitoring report to present full calculations for this monitoring period.

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

1. Provide sample calculations for all formulae used to calculate project GHG emissions or actual net GHG removals, applying actual values. Attach spreadsheets to the monitoring report to present full calculations for this monitoring period.

E.3. Calculation of leakage emissions

1. Provide sample calculations for all formulae used to calculate leakage GHG emissions, applying actual values. Attach spreadsheets to the monitoring report to present full calculations for this monitoring period.

E.4. Calculation emission reductions or net anthropogenic removals

1. Summarize the results of sections E.1, E.2 and E.3 above, and provide GHG emission reductions or net anthropogenic GHG removals for this monitoring period, using the table.
2. If the monitoring period starts before 1 January 2013 and ends anytime thereafter, provide GHG emission reductions or net anthropogenic GHG removals achieved for the following two periods separately by allocating the raw data into the two periods in accordance with the applicable provisions in the project standard, and multiplying them with the applicable GWPs:
 - (a) Before 1 January 2013 (first commitment period);
 - (b) From 1 January 2013.

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

1. Provide a comparison of the GHG emission reductions or net anthropogenic GHG removals achieved by the project activity during this monitoring period with the amount based on the ex ante estimation in the registered PDD.

E.6. Remarks on increase in achieved emission reductions

1. State whether the actual GHG emission reductions achieved is greater than the amount based on the ex ante estimation in the registered PDD. If so, explain the cause of any increase in the actual GHG emission reductions achieved by the project activity during this monitoring period, including all information that is different from that stated in the registered PDD.
2. This section is not applicable for afforestation and reforestation (A/R) project activities.

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Document information

| <i>Version</i> | <i>Date</i> | <i>Description</i> |
|----------------|-------------|---|
| 06.0 | 7 June 2017 | Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements. |

| <i>Version</i> | <i>Date</i> | <i>Description</i> |
|---|-----------------|--|
| 05.1 | 4 May 2015 | Editorial revision to correct version numbering. |
| 05.0 | 1 April 2015 | Revisions to: <ul style="list-style-type: none"> • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement. |
| 04.0 | 25 June 2014 | Revisions to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement. |
| 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 GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, 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). |
| 01.0 | 28 May 2010 | EB 54, Annex 34. Initial adoption. |
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