# Monitoring report form for CDM programme of activities (Version 04.0)

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

| MONITORING REPORT | | | |
|---|---|---|---|
| **Title of the PoA** | Fuel Efficient Stoves in Africa | | |
| **UNFCCC reference number of the PoA** | PoA 6864 | | |
| **Version numbers of the PoA-DD applicable to this monitoring report** | Version 7.2 | | |
| **Version number of this monitoring report** | 1.0 | | |
| **Completion date of this monitoring report** | 22/07/2021 | | |
| **Monitoring period number** | 6 | | |
| **Duration of this monitoring period** | 01/07/2020 – 31/12/2020 (both dates inclusive) | | |
| **Monitoring report number for this monitoring period** | 2 | | |
| **Coordinating/managing entity** | 3 Rocks Ltd. | | |
| **Host Parties** | Host Party of the PoA | Is this the host Party of a CPA covered in this monitoring report? (yes/no) | |
| | Zambia | Yes | |
| **Applied methodologies and standardized baselines** | AMS II.G version 3 | | |
| **Sectoral scopes** | 3: Energy demand | | |
| **Amount of GHG emission reductions or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period** | Amount achieved before 1 January 2013 | Amount achieved from 1 January 2013 until 31 December 2020 | Amount achieved from 1 January 2021 |
| | 0 | 26,044 | 0 |
| **Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs covered in this monitoring report** | 26,443 | | |

# PART I Monitoring of programme of activities (PoA)

## SECTION A. Description of PoA

### A.1. General description of PoA

The small scale PoA involves the distribution of fuel-efficient stoves by 3 Rocks Ltd. (3RL) in individual households in Zambia, as described in each of the PoA's Component Project Activity Design Documents (CPA-DD) and according to the requirements of the appropriate small-scale methodology: AMS II.G Energy efficiency measures in thermal applications of non-renewable biomass, Version 3.

The efficient stoves are based on designs approved by 3RL and will be distributed by CPA Implementers. The stove design to be distributed in each CPA will be tested independently in accordance with a published Water Boil Test (WBT) methodology, such as the "Stove Manufacturers Emissions & Performance Test Protocol (EPTP)"[1] and certified by the manufacturer or an independent laboratory to determine the baseline thermal efficiency. 3RL is the Coordinating/Managing Entity (CME) for the PoA.

Traditionally, the majority of Zambian families cook on an open fire or charcoal grate to heat pots. This method is inefficient and leads to the unsustainable use of non-renewable biomass in the process. The replacement fuel-efficient stoves will lead to a reduction in the annual usage of biomass for users. The majority of Zambians do not have access to the market for fuel-efficient cooking stoves, mainly for economic reasons. Utilizing carbon finance, the proposed PoA aims to overcome this barrier to market entry for households, substituting baseline appliances for fuel-efficient stoves. The benefits of the stove and various user commitments will be clearly explained to prospective users during communication events at the CPA implementation stage.

Stoves will be distributed by CPA Implementers, or their local partners (collectively known hereafter as "CPA Implementer"), and distribution teams will be trained to distribute the stoves and capture the monitoring data from the distribution process; identifying each stove via unique end user information, including: owner name and/or government identification number, address or location, and GPS location reference. Each stove will be assigned a unique reference number in the monitoring database.

Data collected during the distribution process will be captured from the end-user on electronic devices, or via paper forms, and uploaded to the monitoring database. This database will be maintained locally in Zambia and backed-up securely offsite. This system will be available for review by the Designated Operational Entity (DOE) during verification of the PoA.

3RL has completed stakeholder consultations at the PoA level, including national awareness raising meetings, regional meetings and user trials of prototype stoves. It is, furthermore, the intention of 3RL to run an ongoing, post-registration programme of awareness-raising of the optimal usage of the stove, allowing a further mechanism for feedback on its performance from recipients.

The PoA is funded entirely by private investment and does not form a part of any government-funded or supported programme in Zambia.

[1] Stove Manufacturers Emissions & Performance Test Protocol (EPTP): A protocol for testing stove fuel efficiency and emissions and a standard for improved stoves; Defoort, L'Orange, Kreutzer (EECL), Lorenz (Envirofit), Kamping (Philips) 2009

### 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 |
|---|---|---|---|
| Fuel Efficient Stoves in Zambia (3RL CPA No.XX) | 6.2 | 3 | AMS II.G version 3 |
| Fuel Efficient Stoves in Zambia [CPA Implementer] CPA No.xx | 7.2 | 3 | AMS II.G version 3 |

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

| Title and UNFCCC reference number of the CPA | Version of the PoA-DD | Title and reference number of the corresponding generic CPA | Crediting period type and duration | Covered in this monitoring report? (yes/no) |
|---|---|---|---|---|
| CPA 6864-P1-0001-CP1: Fuel Efficient Stoves in Zambia (3RL CPA No. 01) Version 6.2 Dated: 07/01/2013 | 6.2 | Fuel Efficient Stoves in Zambia (3RL CPA No. XX) | 7 years, renewable (28/01/2013 – 27/01/2020) | No |
| CPA 6864-P1-0002-CP1: Fuel Efficient Stoves in Zambia (3RL CPA No. 02) Version 2.1 Dated: 23/10/2013 | 6.2 | Fuel Efficient Stoves in Zambia (3RL CPA No. XX) | 7 years, renewable (25/10/2013 – 23/10/2020) | No |
| CPA 6864-P1-0003-CP1: Fuel Efficient Stoves in Zambia (3RL CPA No. 03) Version 2.1 Dated: 23/10/2013 | 6.2 | Fuel Efficient Stoves in Zambia (3RL CPA No. XX) | 7 years, renewable (01/11/2013 – 31/10/2020) | No |
| 6864-P1-0004-CP1: Fuel Efficient Stoves in Zambia (Korea Carbon Offsets Ltd. CPA No.01) Version 01.3 Dated: 23/09/2019 | 7.2 | Fuel Efficient Stoves in Zambia [CPA Implementer] CPA No.xx | 10 years, fixed (10/10/2019 – 09/10/2029) | No |
| 6864-P1-0005-CP1: Fuel Efficient Stoves in Zambia – Korea Carbon Management Ltd. CPA No.1 Version 1.3 Dated: 12/05/2020 (Previous Version 1.2 Dated: 13/01/2020) | 7.2 | Fuel Efficient Stoves in Zambia [CPA Implementer] CPA No.xx | 10 years, fixed (26/01/2020 – 25/01/2030) | Yes |

### A.2. Coordinating/managing entity

3 Rocks Ltd.

## SECTION B. Implementation of PoA

### B.1. Description of implemented PoA

**Information on how the management system described in the PoA-DD was implemented:**

1. *A clear definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies*

The CME, 3 Rocks Ltd., has overall operational and management responsibility for the implementation and monitoring of the proposed PoA and is therefore acting as the sole PoA CME. The roles and responsibilities of the CME are:

i. *3RL Board & Zambia Branch Board*: oversight of management system & sign-off on CPA inclusions and monitoring reports, review of competencies of team members

ii. *Technical review team*: technical review of process and documentation; proposal of CPA-DDs and monitoring reports to 3RL board.

iii. *CDM Compliance Manager*: writing PDDs & monitoring reports, ensuring compliance with CDM rules

The roles and responsibilities of KCM, or its local partners, are:

i. *Zambia Director:* oversees operation of distribution centres and head office; execution of set up activities; works with project manager on all planning; reports to CME.

ii. *Project Manager:* project planning and management; issue and risk management; execution of set up activities such as recruitment and training; reporting of monitoring data;

iii. *Logistics Manager:* planning; identification of target households; contractor management; overall day to day management of installation staff; weekly and monthly reporting.

iv. *Data administrators:* monitoring database management; accounting; data reconciliations; monthly reporting; local HR;

v. *Pre- & Post-distribution data collection:* conveying project messages; selling the project; signing up householders wanting a stove; sign up data capture; distribution data capture

vi. *Distribution team:* management of distribution process; ensuring quality stove distributions;

vii. *Monitoring team:* gathering compliance monitoring data; gathering marketing data; data input

Overall responsibility for the roles and responsibilities and associated below processes lies with the CME. The CME assesses the competencies of individuals responsible for each of the roles stated above.

### A. Manufacturing and logistics

Overall responsibility for manufacturing and logistics lies with the CME and CPA Implementers. The process is as follows:

- Depending on the stove model, complete stoves or components for the stoves are manufactured (some imported into Zambia, others produced locally) by a stove manufacturer
- Stoves are distributed to warehouses within each CPA
- CPA Implementers coordinate the distribution of stoves to recipient households

### B. CPA household identification

- A process for identifying households is managed by CPA Implementers. This involves working with local community leaders and other partners to help identify recipient households suitable for the distribution of a stove;
- In partnership with community leaders, NGOs and other local organizations, CPA Implementers initiate a communication process to ensure that households understand the benefits of the stoves, that cultural issues are addressed and that users are trained in the optimal use and performance of the stove;

- 3RL pre-installation teams visit recipient households in each CPA and ensure recipients understand and acknowledge the conditions for participation in the CPA; this will act as the "order" for each stove.
- Each stove is assigned a unique distribution number chronologically; this is used to determine the CPA into which the stove is included.

### C. Distribution

- CPA Implementers train stove distribution teams to distribute stoves within each CPA
- CPA Implementers coordinate the receipt of stoves and components in the distribution process
- CPA Implementers will be trained in the distribution of the stove to a standardized design and installation procedure
- CPA Implementers will be responsible for physically distributing the stoves to the stove recipient

### D. Data Capture

- The CPA implementer checks the quality of installation work
- If the work is satisfactory, distribution data is collected by the CPA Implementer, which includes:
    - Username: the household family name, plus Zambian government identification number of the stove recipient (if available)
    - Location: the address and/or physical location description (i.e. village) of the household, plus a GPS location reference (if available and accurate)
    - Date and time of installation
- Distribution data is collected by the CPA Implementer and uploaded to the monitoring database
- The database will include a unique reference number for each stove

### E. CPA Inclusion

CPA inclusions are the overall responsibility of the CME.

- Data from each CPA is provided by the CPA Implementer to the CME.
- The CDM Compliance Manager oversees the writing of each CPA-DD
- The CDM Compliance Manager submits to the 3RL technical team for technical review
- The technical team proposes the CPA inclusion to the 3RL Board for approval

### F. Monitoring

Monitoring activities will be conducted as follows:

- Surveys completed in the field by trained local monitoring teams
- Data captured by the monitoring teams is passed to 3RL data administration team
- Data is checked for completeness, consistency and accuracy
- Project manager summarizes data in a report to the 3RL CDM compliance manager
- CDM compliance manager writes monitoring reports for each monitoring period
- Technical review by in-house technical team
- CME board approval
- Submission of issuance request to CDM Executive Board

*2. Records of arrangements for training and capacity development for personnel*

3RL conducts an ongoing programme of training and capacity development for key personnel. This training is premised on documentation that includes:

- Management Information Systems & Data Capture Process
- Stove Distribution Guidelines

Records of training and capacity development will be kept by the CME on each member of staff's file.

*3. Procedures for technical review of inclusion of CPAs*

The technical review of CPA inclusions will be undertaken at CME board level by an in-house technical team. This review will be undertaken in accordance with the eligibility criteria outlined in this PDD and the most recent guidance issued by the CDM Executive Board.
Following its review, the technical team will affirm the CPA's compliance with the eligibility criteria and recommend its inclusion in the PoA to the CME board. The proposed inclusion will then be either approved or rejected by the CME board.

4. *A procedure to avoid double counting (e.g. to avoid the case of including a new CPA that has already been registered either as a CDM project activity or as a CPA of another PoA)*

Double-counting of emissions reductions will be avoided by the unique referencing of stoves included in each CPA. This will be done through:

- ***GPS references*:** if possible, each stove will have a unique GPS-referenced location. During the verification process the DOE will be able to check the existence of stoves related to this GPS location reference.
- ***Name, location and/or ID number*:** an additional check of double-counting may be made against the household name, location and/or Zambian government ID number of the stove recipient ascribed to each stove. This may be checked physically during the verification process.
- ***Unique reference numbers*:** each stove will also have a unique reference number in the monitoring database. Only one stove will be installed per household. The DOE will be able to check this during the verification process.

5. *Records and documentation control process for each CPA under the PoA*

The CME is responsible for managing the record and documentation system for each CPA under the PoA. In most cases data will be collected electronically and uploaded directly to the monitoring database. Where data is collected manually, it will be collated by the CME.
*Distribution data* will be collected from each CPA by the CPA Implementer and uploaded into the monitoring database. This will ensure that each stove is individually referenced and logged for monitoring and verification purposes.
*Monitoring data* will be collected by the monitoring team responsible and passed to the CME for collation. Periodic monitoring reports and emissions reduction calculations will be generated from this data.
All records will be securely maintained and backed-up by the CME.

6. *Measures for continuous improvements of the PoA management system*

Periodic reviews of the procedures noted here in this management system will be conducted at the behest of the CME. This will be conducted at the time of each annual or biennial monitoring activity.

7. *Any other relevant elements*

a) *The CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity:*

Each CPA under the proposed PoA will be exempt from a de-bundling check due to each independent subsystem/measure being less 1% of the small-scale methodology energy output threshold (as per guidance EB54 Annex 13).
This has been included as an eligibility criterion for the inclusion of each CPA in the PoA.

b) *The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA*

The CME has overall responsibility for managing and operating each of the CPAs.
In the case of CPA 6864-P1-0005-CP1, KCM is legally contracted to the CME and is fully aware, and has agreed, that their activity is being subscribed to the PoA.

**Indicate whether a sampling approach was applied for monitoring of a group of CPAs or each CPA covered in this monitoring report:**

The monitoring report covers 1 included CPAs, namely CPA 6864-P1-0005-CP1: Fuel Efficient Stoves in Zambia – Korea Carbon Management Ltd. CPA No.1.

Sampling was done across a group of CPAs that have the same end-user characteristics (households) and the same stove (Greenway Jumbo Stove) and includes CPAs CPA 6864-P1-0005-CP1 and CPA 6864-P2-0006-CP1.

**Provide the description of installed technologies, technical processes and equipment for the included CPAs:**

The monitored CPA 6864-P1-0005-CP1 that is covered in this monitoring report involves the distribution of fuel-efficient stoves by Korea Carbon Management Ltd. (KCM) in individual households in Zambia. KCM provides all implementation and ongoing project operation costs for the development of the CPA, including total ICS purchase, distribution, and maintenance costs.

CPA 6864-P1-0005-CP1 involves the distribution of energy efficient biomass fuel-based ICS, with a minimum 20% thermal efficiency. CPA 6864-P1-0005-CP1 distributes the Greenway Jumbo Stove manufactured by Greenway Grameen Infra Pvt Ltd. This cookstove delivers a thermal efficiency of 31.17% according to an independent lab report from the India Institute of Technology (IIT) dated 17/12/2015.


The technical details are as follows:

| Specifications | Unit | Value |
|---|---|---|
| Cookstove Model | | Greenway Jumbo Stove |
| Lifespan | Years | 5 Years |
| Thermal efficiency | % | 31.17% |
| Outside Diameter | cm | 27 |

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

### B.2.1. Corrections

PRC ref No.: PRC-6864-001
Date of approval: 21/07/2019
Details can be found at: https://cdm.unfccc.int/PRCContainer/DB/prcp328341810/view

### B.2.2. Inclusion of monitoring plan

Not applicable

### B.2.3. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

Not applicable

### B.2.4. Changes to programme design

PRC ref No.: PRC-6864-001
Date of approval: 21/07/2019
Details can be found at: https://cdm.unfccc.int/PRCContainer/DB/prcp328341810/view

### B.2.5. Changes specific to afforestation or reforestation activities

Not applicable

# PART II Monitoring of CPAs

## SECTION C. Implementation of CPAs

### C.1. Description of implemented CPAs

1. Provide a brief summary of the CPA covered in this monitoring report in terms of the purpose of the CPAs and the measures taken for GHG emission reductions or net anthropogenic GHG removals.
   CPA 6864-P1-0005-CP1: Fuel Efficient Stoves in Zambia - Korea Carbon Management Ltd.
   CPA No.1 involves the distribution of fuel-efficient stoves by Korea Carbon Management Ltd. (KCM) in individual households in Zambia. KCM provides all implementation and ongoing project operation costs for the development of the CPA, including total ICS purchase, distribution, and maintenance costs. The ICS technology ensures a minimum 20% thermal efficiency.

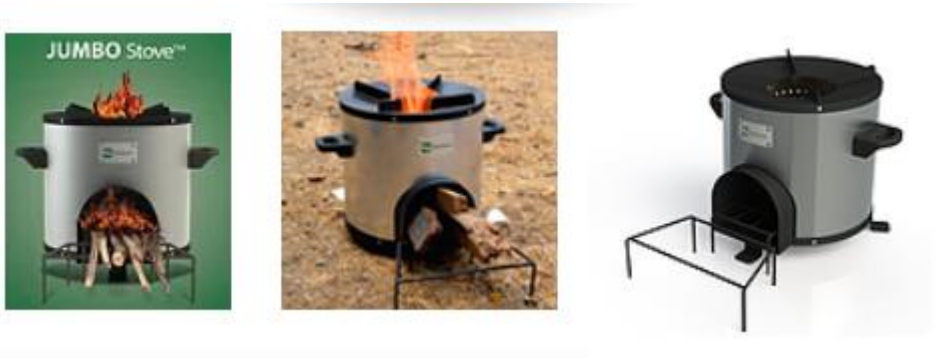
2. Provide information on the implementation status of the CPAs in accordance with the applicable provisions on the description of implemented CPAs in the project standard, including:

   (a) Description of the installed technologies, technical processes and equipment for the CPAs;
   CPA 6864-P1-0005-CP1: KCM has distributed/installed 20,000 Greenway Jumbo Stove manufactured by Greenway Grameen Infra Pvt Ltd. This cookstove delivers a thermal efficiency of 31.17% according to an independent lab report from the India Institute of Technology (IIT) dated 17/12/2015.

   (b) Information on the implementation and actual operation of the CPAs, including relevant dates (e.g. construction, commissioning, start of operation). If a CPA consists of more than one site, describe the status of implementation and start date of operation for each site. If a CPA is implemented in phases, indicate the progress of the CPA achieved in each phase.
   CPA 6864-P1-0005-CP1: Stoves were distributed in as follows:

| | |
|---|---|
| Date of first stove distributed | 30/03/2020 |
| Date of last stove distributed | 26/08/2020 |

3. For the description of the installed technologies, technical processes and equipment, include diagrams, where appropriate.
   In CPA 6864-P1-0005-CP1, the portable Greenway Jumbo Stoves were distributed to each household.




## C.2. Location of CPAs

The geographical boundary of the CPAs is the country of Zambia. The **Republic of Zambia lies within the latitude and longitude** of 15 00 S and 30 00 E[2]. The approximate GPS coordinates derived from Google Earth for the furthest extremities of the Zambian border are:

North (border with Tanzania and DRC): 08º12'11.83" S & 30º46'22.26" E
South (border with Zimbabwe):18º04'34.03" S & 26º41'47.24" E
East (border with Malawi):10º33'43.01" S & 33º42'08.00" E
West (border with Angola):14º33'34.57" S & 21º59'58.74" E


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

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

Not applicable

### C.3.2. Corrections

PRC ref No.: PRC-6864-003.
Date of approval: 20/07/2020
Details can be found at: https://cdm.unfccc.int/CPAPostRegChanges/DB/prcp63698127/view

[2] https://greenwichmeantime.com/time-zone/africa/zambia/map-zambia/

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

Not applicable

### C.3.4. Inclusion of monitoring plan

Not applicable

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

Not applicable

### C.3.6. Changes to project design

PRC ref No.: PRC-6864-003.
Date of approval: 20/07/2020
Details can be found at: https://cdm.unfccc.int/CPAPostRegChanges/DB/prcp63698127/view

### C.3.7. Changes specific to afforestation or reforestation CPA

Not applicable

## SECTION D. Description of monitoring system of CPAs

Under CPA 6864-P1-0005-CP1, stove distribution data was collected by trained data handlers under this CPA using a digital data collection system that is operated on a smartphone. Required data was gathered from end users to uniquely identify stoves in the monitoring database. Data included:

- Date of Distribution
- GPS location reference
- Stove Serial Number
- Name, location, phone number and/or ID number of End User
- Type of baseline stove replaced
- Baseline fuel used

This data was transmitted to an online monitoring database that stores the data.

This data was then exported in a spreadsheet format to calculate the emissions reductions.

## SECTION E. Data and parameters

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

| **Data/Parameter** | $B_{old}$ |
|---|---|
| Data unit | Tonnes per annum |
| Description | Quantity of biomass used in absence of the project activity |
| Source of data | Baseline survey |
| Value(s) applied | 4.1 |
| Choice of data or Measurement methods and procedures | The baseline survey assessed the average domestic biomass usage for cooking and water heating per household per annum amongst users of traditional 3-rock fires, according to interviews. This data was gathered according to: General Guidelines for Sampling and Surveys For Small-Scale CDM Project Activities (Version 01); CDM EB50 Annex 30. |
| Purpose of data | Baseline emissions calculations |
| Additional comment | See Annex 4 & Sampling Plan for Household Annual Average Woodfuel Usage Survey for details of the POA-DD version 7.2. |

| **Data/Parameter** | $f_{NRB,y}$ |
|---|---|
| Data unit | Fraction |
| Description | Non-renewable biomass usage in Zambia, as a proportion of total biomass usage |
| Source of data | EB 67 country-specific default value for Zambia |
| Value(s) applied | 0.81 |
| Choice of data or Measurement methods and procedures | An independent consultant calculated the overall biomass usage in Zambia and, according to independently published sources, ascertained the proportion of that biomass which is non-renewable to be 0.93. However, EB 67, Annex 22 indicates a country-specific default value for Zambia at 0.81. For conservativeness, the latter value is selected. |
| Purpose of data | Baseline emissions calculations |
| Additional comment | |

| **Data/Parameter** | $\eta_{old}$ |
|---|---|
| Data unit | Fraction |
| Description | Efficiency of the system being replaced |
| Source of data | Methodology default |
| Value(s) applied | 0.10 |
| Choice of data or Measurement methods and procedures | AMS II.G, version 3 |
| Purpose of data | Baseline emissions calculations |
| Additional comment | |

| **Data/Parameter** | $NCV_{biomass}$ |
|---|---|
| Data unit | TJ/tonne |
| Description | Net calorific value of the non-renewable woody biomass that is substituted |
| Source of data | IPCC default |
| Value(s) applied | 0.015 |
| Choice of data or Measurement methods and procedures | AMS II.G, version 3 |

| | |
|---|---|
| Purpose of data | Baseline emissions calculation |
| Additional comment | |

| **Data/Parameter** | $EF_{projected\_fossilfuel}$ |
|---|---|
| Data unit | tCO2/TJ |
| Description | Emission factor: substitution of non-renewable biomass by similar consumers |
| Source of data | Methodology default |
| Value(s) applied | 81.6 |
| Choice of data or Measurement methods and procedures | AMS II.G, version 3 |
| Purpose of data | Baseline emissions calculation |
| Additional comment | |

| **Data/Parameter** | *Ly* |
|---|---|
| Data unit | Fraction |
| Description | Leakage |
| Source of data | Methodology default |
| Value(s) applied | 0.95 |
| Choice of data or Measurement methods and procedures | AMS II.G, version 3 |
| Purpose of data | Baseline emissions calculation |
| Additional comment | |

| **Data/Parameter** | $\eta_{new}$ |
|---|---|
| Data unit | Fraction |
| Description | Thermal efficiency of the stove |
| Source of data | WBT Protocol or Stove Manufacturers Emissions & Performance Test Protocol (EPTP) |
| Value(s) applied | 0.3117 |
| Choice of data or Measurement methods and procedures | From an independent lab report from the Indian Institute of Technology (IIT) dated 17/12/2015. |
| Purpose of data | Baseline emissions calculation |
| Additional comment | The first included CPAs (1-3) consisted of an initial stove model with a thermal efficiency of 0.295, as tested in a recognized lab using the EPTP. Following PRC, new stove models may be introduced in new CPAs, which must comply with the methodology and PoA eligibility criteria. An example is used here of the Greenway Jumbo Stove, but others may be outlined in the relevant CPA monitoring reports |

| **Data/Parameter** | *DRB* |
|---|---|
| Data unit | Tonnes |
| Description | Demonstrably renewable biomass |
| Source of data | *fNRB,y* baseline study |
| Value(s) applied | 1,278,025 |

| | |
|---|---|
| Choice of data or Measurement methods and procedures | The justification is clearly outlined in the full *fNRB,y* baseline study, presented in Appendix 3 |
| Purpose of data | Baseline emissions calculation |
| Additional comment | |

## E.2. Data and parameters monitored

| **Data/Parameter** | *NS* |
|---|---|
| Unit | Number |
| Description | Number of stoves still operation during the monitoring period |
| Measured/calculated/default | Measured |
| Source of data | Monitoring database |
| Value(s) of monitored parameter | 20,000 |
| Monitoring equipment | Monitoring database |
| Measuring/reading/recording frequency | Annual |
| Calculation method (if applicable) | The sample for the survey was selected based on a 95% level of confidence (single CPA) and 10% precision required for annal surveys in line with the sampling plan in the registered PoA-DD.<br>The ASG Household survey checked the continued operation of stoves, or 'drop-out rate', in the household of stove recipients and the survey questionnaire was used to ascertain the patterns of usage of each appliance. A proportion of stoves still in usage was calculated across the ASG and applied to the total number of stoves in the Monitoring Database. |
| QA/QC procedures | The unique reference number of each stove was logged in the monitoring database showing the total number of stoves. |
| Purpose of data/parameter | Baseline emissions calculation |
| Additional comments | |

| **Data/Parameter** | *OD* |
|---|---|
| Unit | Days |
| Description | Total stove operating days in monitoring period |
| Measured/calculated/default | Calculated |
| Source of data | Distribution and monitoring survey data in monitoring database |
| Value(s) of monitored parameter | 3,612,766 |
| Monitoring equipment | Monitoring database |
| Measuring/reading/recording frequency | Annual |
| Calculation method (if applicable) | The number is calculated by counting the number of days from the distribution date of each stove until the end of the monitoring period and aggregating the total days. This number is calculated net of any stove attrition rate identified in the ASG survey. |
| QA/QC procedures | The unique reference number of each stove is logged in the monitoring database. The date of distribution is utilized to determine the portion of the monitoring period that the stove has been in operation. Any interruption in the stoves' operation (e.g. where stoves are replaced or drop out) is registered as missed operating days in the monitoring database for emissions calculation purposes. |

| | |
|---|---|
| Purpose of data/parameter | Baseline emissions calculation |
| Additional comments | |

| | |
|---|---|
| **Data/Parameter** | $\eta_{new,i}$ |
| Unit | Fraction |
| Description | Thermal efficiency of the stove |
| Measured/calculated/default | Measured |
| Source of data | WBT |
| Value(s) of monitored parameter | 0.3404 |
| Monitoring equipment | New equipment (digital weighing scale, thermometer and moisture meter) was used to carry out the WBT hence did not require any calibration as they had not been used before.<br>**Thermometer**<br>Brand: Terminator<br>Model: TPT9282A<br>Measure range: -50C - +150C<br>Resolution: 0.1C<br>Accuracy: ±1 %<br><br>**Weighing Scale**<br>Brand: ATOM KangRui<br>Model: KR-B09<br>Measure range: 7kg<br>Resolution: 1g<br>Accuracy: ±1g<br><br>**Moisture meter**<br>Brand: TESTO<br>Model: 606-1 Portable<br>Measure range: 0.0 - 54.8% (depending on material)<br>Resolution: 0.1%<br>Accuracy: ±1 % |
| Measuring/reading/recording frequency | Annual |
| Calculation method (if applicable) | A simple random sample of the distributed stoves which are in operation was taken. A sample of 18 stoves was tested for thermal efficiency to ensure that they are still operating at the specified efficiency. 3 Tests were performed on each test. |
| QA/QC procedures | The stove efficiency sample group (SESG) was selected based on a 95% level of confidence. The margin of error is 10% for annual surveys, in accordance with the methodology and EB69 Annex 4 & 5 Guidance.<br>Tests were undertaken between 30/04/2021 – 05/06/2021 by experienced project staff following a WBT protocol 4.2.3 |
| Purpose of data/parameter | Baseline emissions calculation |
| Additional comments | See Sample Calculation in ER Calc sheet<br>All equipment was purchased new for this monitoring all purchase receipts provided for the equipment. As the equipment was new, no calibration was required. |

| Data/Parameter | *Bnew* |
|---|---|
| Unit | Tonnes per annum |
| Description | Quantity of biomass saved per stove per annum |
| Measured/calculated/default | Measured |
| Source of data | Survey |
| Value(s) of monitored parameter | 3.96 |
| Monitoring equipment | Survey Form |
| Measuring/reading/recording frequency | Annual |
| Calculation method (if applicable) | The sample for the survey was selected based on a 95% level of confidence and 10% precision required for annal surveys in line with the sampling plan in the registered PoA-DD.<br>The ASG Household survey checked the presence of domestic 3-rock fires in the household of stove recipients and the survey questionnaire was used to ascertain the patterns of usage of each appliance. A proportion of usage of 3 rock fires was calculated across the ASG and a deduction made to $B_{old}$, to determine $B_{new}$. The average of $B_{new}$ was then determined across the ASG. |
| QA/QC procedures | CME provides guidance and training to enumerators for conducting surveys. The value obtained was tested to determine if the desired precision was met. The survey result met the expected 95/10 precision. |
| Purpose of data/parameter | Baseline emissions calculation |
| Additional comments | |

## E.3. Implementation of sampling plan

The sampling plan was implemented as follows:
List of CPAs to which the sampling plan was applied
6864-P1-0005-CP1: Fuel Efficient Stoves in Zambia - Korea Carbon Management Ltd. CPA No.1
6864-P2-0006-CP1: Fuel Efficient Stoves in Zambia (Korea Carbon Management Ltd. CPA No.02)

(a) Description of implemented sampling design

A single sampling plan was implemented and is justified as 2 CPA are monitored and there is homogeneity related to parameters of interest, as described below:
Stove usage rate (ASG) parameters of interest:

(i) The CPAs have the same stove technology user profile (i.e. domestic households)

(ii) The CPAs employ the same stove technology

(iii) The baseline surveys shows that household usage of biomass and cooking technology in Zambia is homogenous across regions

Stove efficiency (SESG) parameter of interest:

(iv) The CPAs employ the same stove technology

(v) Each final constructed stove is robust, manufactured to identical standards and with no moving parts, and therefore efficiency is designed to remain constant over time

(c) Collected data

Parameters monitored and data collected:

(vi) Number of Stoves (NS, $Ny,i,j$, $\boldsymbol{\mu}_y$) – determined from the monitoring database as the number of stoves still operation during the monitoring period, as compared to the baseline distributed number of stoves.

(vii) Quantity of biomass saved per annum ($B_{new}$) – determining the average (proportion) deduction per stove from the baseline parameter $B_{old}$. This monitors the proportion of any residual use of the baseline appliance via a survey form.

(viii) Efficiency of stove (*ηnew,i*) – to determine the ongoing average efficiency of each stove distributed via a WBT. All equipment was purchased new for the monitoring exercise and all purchase receipts provided for this purpose. As equipment was new, no calibration was required.

(d) Analysis of the collected data:

Data was collected in the field by trained surveyors and efficiency testers. This was submitted to the CME for analysis and set out in the ER calculation spreadsheet. Oversampling was employed in order to ensure that the data is representative.

(e) Demonstration that the required confidence/precision level has been met:

Sample sizes for the ASG and SESG groups were calculated using a 95/10 level of precision, applicable under the sampling standard and the methodology for annual sampling surveys of single small-scale CDM Project Activities, as follows (calculations from the sample calculation spreadsheet):

| Sampling Constants | Values |
|---|---|
| Monitoring period start | 01/07/2020 |
| Monitoring period end | 31/12/2020 |
| Monitoring period (years) | 0.50 |
| Level of sampling | multiple CPAs |
| Confidence | 95% |
| Margin of Error (for annual survey) | 10% |
| Z value | 1.960 |
| Stove population | 62,188 |

| Stove population | | |
|---|---|---|
| Stove Population CPA 6864-P1-0005-CP1 | 20,000 | 32.16% |
| Stove Population CPA 6864-P2-0006-CP1 | 42,188 | 67.84% |
| Total Stove Population | 62,188 | 100.00% |

| Mean Value Parameter: Stove Efficiency Sample Group (SESG) | Stove Efficiency ($\eta_{new}$) - SESG | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling approach | Simple random sample across CPAs | | | | | | | | | | |
| Sampling Frame | Stove population | Expected Mean Efficiency(%) | Expected SD | Calculated Sample Size | tDistribution adjusted sample size | | | | | | |
| Greenway Jumbo Stove | 62,188 | 31.17 | 2.71 | 3 | 14 | 4 | 8 | 5 | 6 | 5 | 6 |

| Proportion Value Parameter (ASG) | | | |
|---|---|---|---|
| Sampling frame(s) | Stove Population across CPA | | |
| Sampling approach | Simple random sample across CPAs | | |
| Sampling Frame | Stove population | expected operational proportion (SoF) | Calculated Sample Size (n) |
| Greenway Jumbo Stove | 62,188 | 0.97 | 12 |

| Required sample sizes | | Total Samples CPA 6864-P1-0005-CP1 | Total Samples CPA 6864-P2-0006-CP1 | Total samples |
|---|---|---|---|---|
| Requierd sample size for SESG | 14 | 6 | 12 | 18 |
| Required sample size for ASG | 30 | 12 | 25 | 37 |

the Expected standard deviation for the efficiency of the cookstoves is based on the results of the independent lab report from the Indian Institute of Technology (IIT) dated 17/12/2015.
The expected usage rate for stoves is based on the CPA-DD Section B.5.2.
Below excerpt demonstrates that all confidence/precision levels have been met:

| Sampling Framework | Values |
|---|---|
| Level of sampling | multiple CPAs |
| Confidence | 95% |
| Margin of Error (for annual survey) | 10% |
| Z value | 1.960 |
| Stove population | 62,188 |

**Monitoring Period**

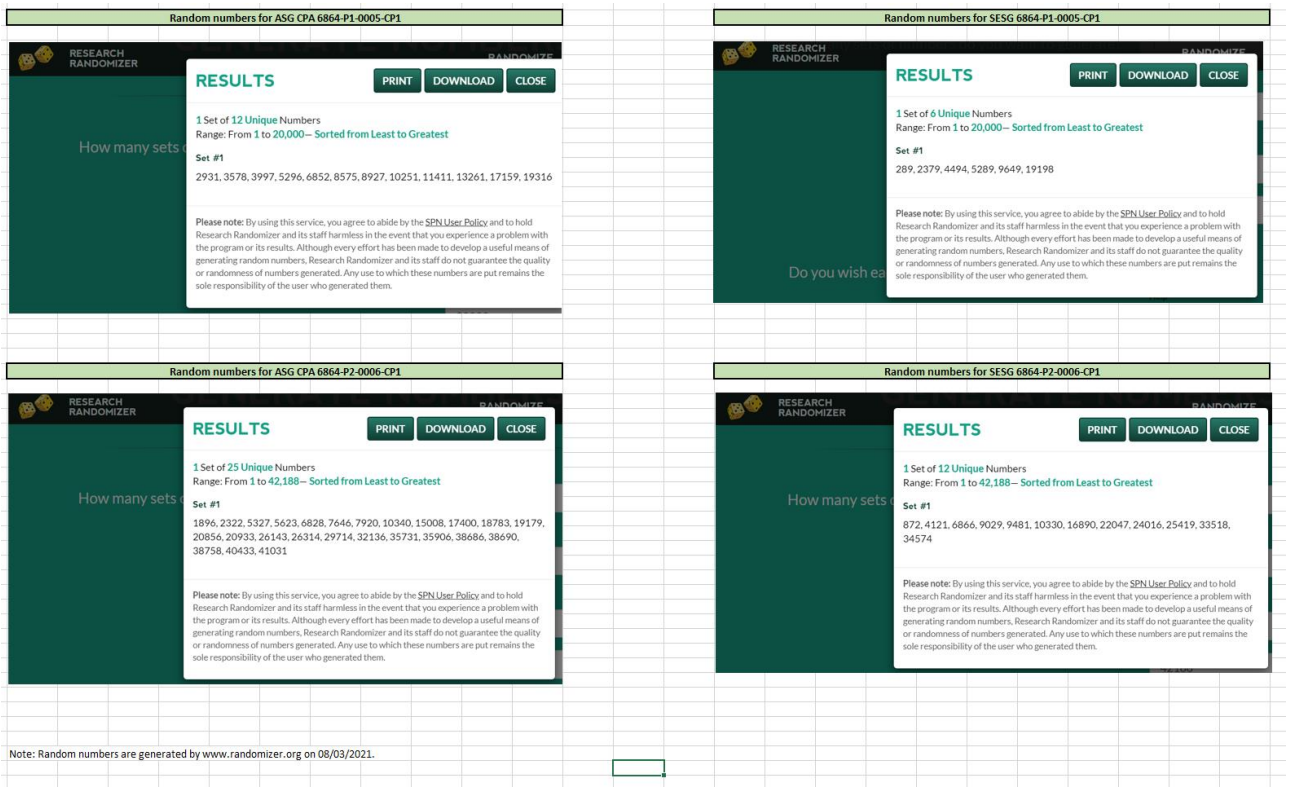
| Sampling Constants | Values |
|---|---|
| Monitoring period start | 01/07/2020 |
| Monitoring period end | 31/12/2020 |
| Monitoring period (years) | 0.50 |

| **Stove usage (NS)** | **1.0000** | **Fraction** |
|---|---|---|
| Population Size | 62,188 | number |
| Sample Size | 34 | number |
| Proportion | 1.0000 | Fraction |
| Standard error of proportion | 0.00% | |
| Precision | 0.00% | % |
| Statistical Acceptance of Result | ok, acceptable | -- |

| **Bnew** | **3.9557** | **tonnes/y** |
|---|---|---|
| Population Size | 62,188 | number |
| Sample Size (excluding outliers) | 34 | number |
| Proportion | 96.48% | Fraction |
| Standard error of proportion | 3.16% | % |
| Precision | 6.42% | % |
| Result | ok, acceptable | -- |

| **$\eta_{new}$** | **34.04%** | **Percentage** |
|---|---|---|
| Population Size | 62,188 | number |
| Sample Size | 18 | number |
| Mean | 34.04% | % |
| Standard Deviation | 1.70% | % |
| Standard error of mean | 0.00 | % |
| Precision | 2.31% | % |
| Result | ok, acceptable | -- |

(f) Demonstration that the samples were randomly selected and are representative of the population.




Out of all samples, 3 samples (Record IDs 5327, 35731 and 38758 from CPA 6864-P2-0006-CP1) were excluded from the ASG survey as the answers provided represent outliers. In the case of samples 5327 and 38758 for “meals cooked per week” the response seems to indicate that the respondent answered as “days per week” rather than “meals per week” and was therefore substantially lower compared to other respondents. Redord ID 35731 supplied an answer with meals cooked substantially higher compared to other responses received for the ASG survey.

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

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

Emissions reductions are calculated as follows:

$ER_y = (B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel})$

Where:

1. $B_{y,\ savings}$ - Quantity of woody biomass that is saved per stove per annum in tonnes. The formula for calculating this is: $B_{new} * (1-\eta_{old}/\eta_{new,i})$
2. $f_{NRB,y}$ - Fraction of biomass used in absence of the project that is non-renewable. Country-specific default value selected (0.81).
3. $NCV_{biomass}$ - Methodology default (0.015 TJ/tonne)
4. $EF_{projected\_fossilfuel}$ - Methodology default (81.6 tCO2/TJ)
5. $B_{new}$ - Monitored average quantity of woody biomass saved per stove per annum
6. $\eta_{old}$ - Methodology default (0.10)
7. $\eta_{new,i}$ - Monitored thermal efficiency of the new appliance

$ER_y$ per stove is then converted to emissions reductions per stove per diem and this figure will be multiplied by the total aggregated number of stove operating days per monitoring period (*OD*) to give the total emissions reductions per monitoring period.

| MP Parameter | Unit | 6864-P1-0005-CP1 | Source |
|---|---|---|---|
| N | stoves | 20,000 | CPA Installation database |
| NS | stoves | 20,000 | Calculated |
| $STOVE_{days}$ | number | 184 | Calculated |
| OD | stove-days | 3,612,766 | Calculated |
| ηnew (Efficiency new) | fraction | 34.04% | Calculated |
| Stoves operation (proportion) | Fraction | 100.00% | Calculated |
| Bnew | t/yr/stove | 3.96 | Calculated |
| By,savings | t biomass/stove/y | 2.79 | Calculated |

| ER Calculations | Unit | 6864-P1-0005-CP1 | Source |
|---|---|---|---|
| $ER_{year}$ | tCO2/stove/year | 2.77 | Calculated |
| ER**day** | tCO2/stove/day | 0.0076 | Calculated |
| ER**mp** | tCO2 | 26,044 | Calculated |

$B_{new}$ has been reduced from 4.1t/year to 3.96 due to continued use of some baseline stoves.
ηnew (Efficiency new) has increased from 31.17% to 34.042% due to the WBT Protocol Version 4.2.3 being used for measuring the efficiency during this monitoring exercise, whereas the initial efficiency was based on the Bureau of Indian Standards (BIS) protocol.

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

Not applicable

### F.3. Calculation of leakage emissions

Leakage emissions are calculated using 5%, the methodology default and applied in the ex-post emissions calculations:

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

| CPA UNFCCC reference number | Baseline GHG emissions or baseline net GHG removals (t $CO_2e$) | Project GHG emissions or actual net GHG removals (t $CO_2e$) | Leakage GHG emissions (t $CO_2e$) | GHG emission reductions or net anthropogenic GHG removals (t $CO_2e$) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Before 01/01/2013 | From 01/01/2013 until 31/12/2020 | From 01/01/ 2021 | Total amount |
| 6864-P1-0005-CP1 | 26,044 | 0 | 0 | 0 | 26,044 | 0 | 26,044 |
| **Total** | 26,044 | 0 | 0 | 0 | 26,044 | 0 | 26,044 |

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

| CPA UNFCCC reference number | Amount achieved during this monitoring period (t $CO_2e$) | Amount estimated ex ante for this monitoring period in the CPA-DD (t $CO_2e$) |
|---|---|---|
| 6864-P1-0005-CP1 | 26,044 | 26,443 |
| **Total** | 26,044 | 26,443 |

### F.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the CPA-DD"

Ex-ante emissions are calculated based on the total amount of 20,000 stoves distributed with the assumption that all stoves are operational and that no baseline stoves continue to be operated. Although the project is now fully implemented at the end of this monitoring period, the resulting ERs achieved were lower as not all stoves projected by the CPA-DD were fully operational throughout the entire monitoring period. Furthermore, the fact that baseline stoves were still partially operated lead to a reduction in parameter Bnew. The higher observed efficiency of the stoves compensated these reductions only to a limited degree.

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

No increase in emissions reductions are observed.

## F.7. Remarks on scale of small-scale CPAs

Each stove distributed in the CPA will be a microscale unit according to Tool 19, para 9 because:

a) The project is located in a Least Developed Country – Zambia;

b) Each stove distributed in the CPA achieves savings of less than 1.8$GWh_{th}$/year. The thermal savings per stove per year is 0.012$GWh_{th}$/year and is distributed to households.

## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 04.0 | 6 April 2021 | Revision to:<br>• Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR). |
| 03.0 | 31 May 2019 | Revision to:<br>• Ensure consistency with version 02.0 of the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN);<br>• Add a section on remarks on the observance of the scale limit of small-scale CPAs during the crediting periods;<br>• Add "changes specific to afforestation or reforestation activities/CPA" as a possible post-registration changes;<br>• Clarify the reporting of net anthropogenic GHG removals for A/R PoAs between two commitment periods;<br>• Make structural and editorial improvements. |
| 02.0 | 7 June 2017 | Revision to:<br>• Ensure consistency with version 01.0 of the “CDM project standard for programmes of activities (CDM-EB93-A07-STAN);<br>• Make editorial improvements. |
| 01.0 | 1 April 2015 | Initial publication. |

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: monitoring report, programme of activities