



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

MONITORING REPORT

Title of the PoA	Improved Cookstoves Program for Malawi and cross-border regions of Mozambique	
UNFCCC reference number of the PoA	9558	
Version numbers of the PoA-DD applicable to this monitoring report	11	
Version number of this monitoring report	01	
Completion date of this monitoring report	20/05/2018	
Monitoring period number	Fourth Monitoring Period	
Duration of this monitoring period	16/04/2017 to 15/04/2018 (both days inclusive)	
Monitoring report number for this monitoring period	01	
Coordinating/managing entity	C-Quest Capital Malaysia Global Stoves Limited	
Host Parties	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	Republic of Malawi	Yes
Sectoral scopes	Sectoral scope 3: Energy demand	
Applied methodologies and standardized baselines	AMS-II.G: "Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass" (Version 05.0)	
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
	0 t CO ₂ e	174,233 t CO ₂ e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs	224,265 t CO ₂ e	

covered in this monitoring report

PART I Monitoring of programme of activities (PoA)

SECTION A. Description of PoA

A.1. General description of PoA

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This Small-Scale Programme of Activities (SSC-PoA) involves the promotion, distribution / installation of fuefficient improved cook stoves (ICS) in Malawi and will at a later stage to include cross-border regions in Mozambique. The ICS disseminated through this programme will replace the prevailing inefficient three-stone fires or traditional pot support with stoves that combust firewood more efficiently and improve thermal transfer to pots, thus saving fuel and lowering greenhouse gas emissions.

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
Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – XXX	11	Sectoral scope 3: Energy demand	AMS-II.G:“Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass” (Version 05.0)

A.1.2. CPAs included in the PoA

Title and UNFCCC reference number of the CPA	Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Crediting period type and duration	Covered in this monitoring report? (yes/no)
Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – 001; 9558-0001	Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – XXX	11	Renewable 13/03/2014 – 12/03/2021	Yes
Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – 002; 9558-0002	Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – XXX	11	Renewable 10/12/2014 – 09/12/2021	Yes
Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – 003; 9558-0003	Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – XXX	11	Renewable 20/10/2015 – 19/10/2022	Yes
Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – 004; 9558-0004	Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – XXX	11	Renewable 07/10/2016 – 06/10/2023	Yes
Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – 005; 9558-0005	Improved Cookstoves Program for Malawi and cross-border regions of Mozambique – CPA – MAL – XXX	11	Renewable 07/10/2016 – 06/10/2023	Yes

A.2. Coordinating/managing entity

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C-Quest Capital Malaysia Global Stoves Limited

SECTION B. Implementation of PoA**B.1. Description of implemented PoA**

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a) Definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies;

C-Quest Capital Malaysia Global Stoves Limited (CQC) as a CME to the PoA has managed the relevant activities prior and post registration of the PoA. The competency check on the new proposed CPA was conducted by CME to ensure that the CPA meets all requirements and eligibility criteria before inclusion in the PoA. The competency check was conducted by experienced staffs with CDM projects.

b) Records of arrangements for training and capacity development for personnelBaseline Survey:

The Baseline Firewood Consumption Study was carried out during May 2012. It was conducted via hiring of third party, HED Consulting Ltd. The baseline report has been presented to validating DoE during the PoA registration process. The general guidance to complete the survey was integrated into the questionnaire form. The complete questionnaire form is available in Annexure 6.2 of the baseline report.

ICS installation:

Till the end of the monitoring period, only one ICS model has been implemented under the PoA, which is TLC Rocket Stove. The training on installation of TLC Rocket Stove was provided by Total LandCare (TLC) Malawi. The training has been organised in several locations and sessions as below:

a) Rumphu (1 session): July 29-30, 2013

b) Lilongwe (3 sessions): (Sessions 1 & 2) Aug 1-2, 2013; (Session 3) Aug 5-6, 2013

c) Nkhosakota (4 sessions): (Sessions 1 & 2) August 12-13, 2013; (Sessions 3 and 4) August 15-16, 2013

d) Kasungu (2 sessions): (Sessions 1 and 2) August 20-21, 2013

The materials used in the training and photos captured during the training classes are available for sharing with DoE.

Monitoring:

The monitoring activities of the PoA comprises of the monitoring of the three parameters which are proportion of ICS still in operation ($n_{y,j}$), percentage of continued baseline stove use among ICS households in the database (SS_y) and thermal efficiency of operational ICS ($\eta_{new,y,i}$).

The first two parameters are to be monitored via visual inspection and interview/survey with the ICS end users. The third parameter is to measure the stove efficiency via Water Boiling Test (WBT).

c) Procedures for technical review of inclusion of CPAs

Prior to the inclusion of CPAs, a technical review was conducted by CME to ensure that

i) the CPA meets each eligibility criteria of the PoA;

ii) the stove model proposed for the CPA meets minimum thermal efficiency of 20% as required by the methodology. The thermal efficiency of the stove is justified with the Water Boiling Test (WBT) result;

iii) the proposed data collection procedures by the CPA is in line with the methodology and SSC-PoA eligibility criteria;

iv) Monitoring procedures proposed by the CPA conform with the monitoring plan in the PoA.

Once the CPA meets all the eligibility criteria of the PoA, the letter of approval for CPA inclusion is issued by CME and the CPA-DD is submitted to DoE for validation purposes and formal inclusion into the PoA.

d) 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 SSC-PoA).

Each ICS registered under the PoA is identified by a unique combination of customer name and geographical location and serial number. In addition to that the GPS coordinates of the household is recorded during the registration process. With the combination of the parameters mentioned above, thus each ICS recorded in the project database will be unique.

The quality control and quality assurance procedures is always in place to avoid the double counting cases. As each CPA has its own database, using the functions available in Microsoft Excel, any duplicate within the CPA or between the CPAs can be easily identified and removed from database. In addition, each CPA was cross-checked with other CPAs in this SSC-PoA and with CPAs in any other SSC-PoA or in a CDM project activity operating in the country using the UNFCCC, the Gold Standard, and other relevant voluntary carbon schemes to ensure that the CPA is not included in any other SSC-PoA, CDM project activity or voluntary carbon project activity.

In the new ICS registration process, the confirmation below was obtained from the end user and acknowledgement was made in the registration card.

"During the distribution/ installation, the user shall confirm that

- a) he/she is a household,*
- b) the ICS is replacing a traditional 3 stone fire or port support,*
- c) their participation on the SSC-PoA and that CDM finance is being used to fund the ICS,*
- d) he/she did not previously own an ICS and*
- e) to transfer the rights of any emission reduction generated by the ICS to the CME."*

e) Records and documentation control process for each CPA under the SSC-PoA

(i) There will be a record keeping system for each CPA under the SSC-PoA,

Till the end of this monitoring period, all the data recorded during ICS registration process was captured via electronic means where the handheld device (PDA) was used. Therefore no hard copy is available.

The following information is captured in the electronic copy of Registration Card which is in line with PoA requirements:

- Date of registration/installation
- Retailer/distributor information
- ICS serial number
- Stove model
- Name of ICS user
- Phone number of ICS user or household
- Address of ICS user or household (District, Traditional Authority, Village)¹
- GPS location of household
- Acknowledgement on transfer of carbon rights to CME and use of baseline stove

The information collected via PDA is then transferred to a server which serves as the electronic project database. The server is updated regularly and shared with the CME. The database is backed up by

¹There is no physical address for rural households in Malawi.

CME in Excel spreadsheet. Each CPA has its own database with number of registered ICSs below the maximum units fixed by the CPA which is 20,763 units.

Till the end of monitoring period, there is no report in the project database on the replacement of stove to the existing registered ICS user.

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

During the CPA inclusion process, it was confirmed that the CPAs 9558-0001, 9558-0002, 9558-0003, 9558-0004 and 9558-0005 are not the de-bundled component of any large scale activity.

- (iii) *The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the SSC-PoA;*

CME has executed the contract² with TotalLandCare (TLC) Malawi (sole CPA implementer for this PoA) which defines TLC's operational responsibility for implementing and monitoring the CPAs.

f) Measures for continuous improvements of the SSC-PoA management system

CME will continue to review and improve the overall SSC-PoA management system. CME is generally satisfied with the overall performance of the CPA implementer and database maintenance.

B.2. Post-registration changes to PoA

B.2.1. Corrections

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Corrections were approved through PRC-9558-001 dated 11/08/2015. The PoA-DD, currently available on project web page is PoA-DD Version 11 dated 27/04/2015.

B.2.2. Inclusion of monitoring plan

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Not Applicable.

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

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Permanent Changes were approved through PRC-9558-001 dated 11/08/2015. The PoA-DD, currently available on project web page is PoA-DD Version 11 dated 27/04/2015.

B.2.4. Changes to programme design

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Not Applicable.

PART II Monitoring of CPAs

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²A term sheet was executed with TLC on 15/07/2013, and subsequently the formal agreement was signed on 20/02/2014.

SECTION C. Implementation of CPAs

C.1. Description of implemented CPAs

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- (a) Purpose of the specific-case CPA(s) and the measures taken for GHG emission reductions or net GHG removals by sinks;

The CPAs (9558-0001, 9558-0002, 9558-0003, 9558-0004 and 9558-0005) involve the promotion and installation of TLC Rocket Stove in Malawi for use by residential households in rural areas. The ICS disseminated through this programme will replace the prevailing inefficient three-stone fires or traditional pot support with stoves which combust wood more efficiently and improve thermal transfer to pots, hence saving fuel and lowering greenhouse gas emissions.

- (b) Description of the technology employed and installed equipment and/or infrastructure, including information requested by the eligibility criteria;

TLC Rocket Stove is a type of single pot fixed cook stoves. The TLC Rocket Stove is a simple design with basic features. The design uses readily available building bricks that are made by the household using locally available clay. The average size of the brick used on the TLC Rocket Stove which is produced using a standard mold is 22.5cm x 11cm x 6.5cm. The bricks are mortared together using locally available material (clay soil, cow dung, and sand) for better insulation and heat loss reduction. The mud mortar is a mix of 5 liters clay, 5 liters sand, 5 liters manure with 5 liters of water.

Metal components have been added to optimize combustion and heat transfer. To aid the combustion process a Grate and a Stick Support have been added. The grate is made from heat corrosiresistant cast iron and sits at the bottom of the combustion chamber. It allows the firewood to rest on it while allowing airflow underneath the firewood to improve combustion. A metal stick support is placed in front of and slightly into the opening of the stove and acts as a firewood feeding platform and also ensures airflow while feeding the fuel into the combustion chamber. To aid the process of heat transfer a Pot Skirt is added, made from galvanized iron sheet metal.

Technical Specifications – TLC Rocket Stove	
Size (stove)	Depth: 35 cm Width: 35 cm Height: 28 cm
Size (combustion chamber)	Depth: 12 cm Width: 12 cm Height: 28 cm

Figure 1 below shows the TLC Rocket Stove:



- (c) Relevant dates for the specific-case CPA(s) (e.g. construction, commissioning, continued operation periods, etc.);

Installation and Registration of ICS

CPA ³	9558-0001	9558-0002	9558-0003	9558-0004	9558-0005
Date of first ICS installed	21/08/2013	24/09/2013	06/06/2015	01/01/2016	05/05/2016
Date of first ICS registered	20/10/2013	10/12/2014	20/10/2015	23/07/2016	05/05/2016
Date of last ICS registered in the database	09/12/2014	19/10/2015	22/07/2016	21/09/2016	24/11/2017
Total ICS working (till 15/04/2018)	19,097	19,469	20,763	16,417	8,597

First Monitoring Survey

CPA	9558-0001 and 9558-0002
Survey dates for parameters n_y and SS_y	01/06/2015 – 05/06/2015
Survey dates for parameter $\eta_{new,y,i}$	25/05/2015 – 03/06/2015

Second Monitoring Survey

CPA	9558-0001, 9558-0002 and 9558-0003
Survey dates for parameters n_y and SS_y	05/06/2016 – 07/06/2016
Survey dates for parameter $\eta_{new,y,i}$	01/06/2016 – 08/06/2016

Third Monitoring Survey

CPA	9558-0001, 9558-0002, 9558-0003 and 9558-0004
Survey dates for parameters n_y and SS_y	15/02/2017 – 07/03/2017
Survey dates for parameter $\eta_{new,y,i}$	09/02/2017 – 22/02/2017

Fourth Monitoring Survey

CPA	9558-0001, 9558-0002, 9558-0003, 9558-0003 and 9558-0005
Survey dates for parameters n_y and SS_y	15/02/2018 – 07/03/2018
Survey dates for parameter $\eta_{new,y,i}$	09/02/2018 – 22/02/2018

- (d) Total GHG emission reductions or net GHG removals by sinks achieved in this monitoring period for the specific-case CPA(s).

CPA	Emission reductions (t CO ₂ e)
9558-0001	43,778
9558-0002	44,260
9558-0003	46,667
9558-0004	25,773
9558-0005	13,755
Total	174,233

Each ICS registered under the PoA is identified by a unique identification number, along with combination of customer name and geographical location identified by geo co-ordinates to avoid the double counting.

³ The spot-checking (ongoing) was during carried out during the monitoring period. There are 5585 ICS from CPA 9558-0001 and 1162 ICS from CPA 9558-0002 that have been excluded from ER calculation. The removal of these stoves from ER calculation is in accordance with the guideline in Section F of monitoring report. These ICSs need maintenance or repair. The ICS will be rebuilt in next monitoring period and included in database as per ICS replacement procedures defined in PoA-DD.

C.2. Location of CPAs

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CPAs of 9558-0001, 9558-0002, 9558-0003 and 9558-0004 are implemented within the geographical boundary of Malawi. Malawi is divided into 28 administrative districts within three regions – Southern, Central and Northern. The ICS could be installed in any district within these three regions.

The GPS coordinates of TLC Rocket Stoves/ households are recorded on the database and this provides exact location where the ICS is installed.

C.3. Post-registration changes to CPAs**C.3.1. Temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies or standardized baselines**

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Not Applicable.

C.3.2. Corrections

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Corrections were approved through PRC-9558-001 dated 11/08/2015. The PoA-DD, currently available on project web page is PoA-DD Version 11 dated 27/04/2015.

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

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The request for change on start date of crediting period of CPA 9558-0003 was submitted to CDM Secretariat on 02/06/2016 and UNFCCC has changed the dates on 08/06/2016 on UNFCCC site. The changes on start date of crediting period for this CPA is less than a year and not required prior approval from the Board.

The revised start date of the CPA is described in the table below.

No.	CDM Ref No. of CPA	Initial start date of crediting period	Revised start date proposed
1	9558-0003	10/12/2014	20/10/2015

C.3.4. Inclusion of monitoring plan

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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 applied standards or tools

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Permanent changes were approved through PRC-9558-001 dated 11/08/2015. The PoA-DD, currently available on project web page is PoA-DD Version 11 dated 27/04/2015.

C.3.6. Changes to project design

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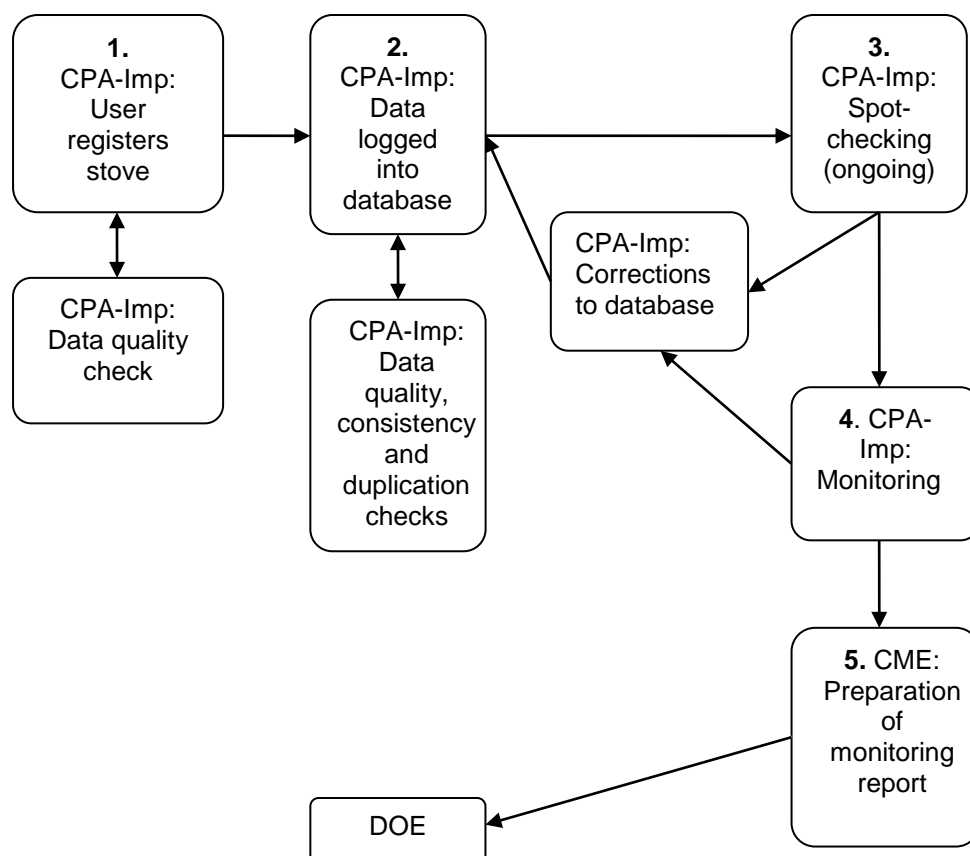
Not Applicable.

SECTION D. Description of monitoring system of CPAs

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CPAs of 9558-0001, 9558-0002, 9558-0003 and 9558-0004 apply the same monitoring system. The monitoring system applied involves a number of key elements to ensure that the CME and CPA-Implementer have high-quality, unbiased and reliable information regarding the performance of the project in terms of implementation and outcomes, and for the purposes of calculating Certified Emission Reductions (CERs) following AMS II.G version 5.0 on the basis of the amount of non-renewable biomass saved by the ICS in the CPA.

The below flow-chart illustrates the roles and responsibilities of the parties during the implementation of the monitoring plan for the SSC-CPA. In the below flowchart, the CPA implementer is abbreviated to “CPA-Imp”, and can be the CME or another party authorized by the CME.



Below is the description of the above steps on the flow-chart.

- 1. CPA-I: User registers stove:** CPA implementer will collect/receive the necessary information requested on the Registration Card from the user. Means of collecting this information may be through a physical Registration Card filled by CPA-Imp staff, retailers, end-users or partner organization's staff, or through the use of ICTs or SMS. CPA Implementers' staff shall double check the accuracy of information provided, and request for field staff additional clarifications if needed;
- 2. CPA-I: Data logged into database:** CPA implementer trained staff will input the data in the database either manually (if data collected from physical Registration Card) or this will be automatically input if data was collected using ICTs or SMS. CPA implementer staff shall double check the information included on the database and check for duplications. Any duplicate information shall be investigated and errors corrected or excluded from the database if it is a true duplicate entry.
- 3. CPA-I: Spot- checking (ongoing):** CPA implementer field staff will randomly select units included in the database and visit or contact the stove users to cross-check the information on the database with the factual evidence in the field. Any inconsistencies found (eg. change in the address of a user) will

be updated on the database , and in the case ICS are found to be no longer in use, they will be clearly marked as such and excluded from emission reductions calculations.

4. **CPA-I: Monitoring:** CPA implementer will follow the requirements as per POA-DD to collect the necessary information for a monitoring report.
5. **CME:Preparation of monitoring report:** the CPA implementers or the CME will prepare the final monitoring report to be provided to the verifier DOE for verification of emission reductions. A copy of the monitoring report will remain with the CME

The CME will coordinate and manage each CPA Implementer and assist them in implementing each element of the monitoring plan

SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

Data/parameter	Bold
Unit	Tonnes per annum
Description	Quantity of woody biomass used in absence of the project activity in three-stone fires or traditional pot supports per household
Source of data	Baseline survey
Value(s) applied	3.2558
Choice of data or measurement methods and procedures	The baseline survey assessed the average woody biomass usage per household per annum amongst users of 3-stone fires, / pot support according to interviews in Malawi. This data was gathered according to: Standard for Sampling And Surveys CDM Project Activities and Programme of Activities (Version 04); CDM EB74 Annex 6.
Purpose of data	Calculation of baseline emissions
Additional comments	For the purposes of calculating ex-ante emission reductions a baseline adjustment factor has been applied to Bold to account for fuel-wood used in a second baseline stove for the 19.7% of households in the baseline study who reported using a second stove at least once per week. This baseline adjustment factor is based on the mean number of stoves used per household averaged across the entire baseline sample, calculated to be 1.0471 stoves/household. The value of Bold applied in this PoA-DD for wood fuel baseline stoves (3.2558 tonnes/year) incorporates this baseline adjustment factor.

Data/parameter	η_{old}
Unit	Fraction
Description	Efficiency of 3-stone fire or traditional pot support cooking method (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 5 paragraph 12, option 2
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data/parameter	$f_{NRB,y}$								
Unit	Fraction								
Description	Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass								
Source of data	Independent Report (local study) by Whale								
Value(s) applied	<table border="1"> <thead> <tr> <th>Region</th><th>f_{NRB}</th></tr> </thead> <tbody> <tr> <td>Central</td><td>0.97</td></tr> <tr> <td>Northern</td><td>0.93</td></tr> <tr> <td>Southern</td><td>0.90</td></tr> </tbody> </table>	Region	f_{NRB}	Central	0.97	Northern	0.93	Southern	0.90
Region	f_{NRB}								
Central	0.97								
Northern	0.93								
Southern	0.90								
Choice of data or measurement methods and procedures	Sub national value (AMS II.G version 5, paragraph 30, option a)								
Purpose of data	Calculation of baseline emissions								
Additional comments									

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
Value(s) applied	0.015
Choice of data or measurement methods and procedures	AMS II.G, version 5, paragraph 11
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data/parameter	$EF_{projected_fossilfuel}$
Unit	tCO ₂ /TJ
Description	Emission factor: substitution of non-renewable woody biomass by similar consumers
Source of data	IPCC default
Value(s) applied	81.6
Choice of data or measurement methods and procedures	AMS II.G, version 5, paragraph 11
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data/parameter	L
Unit	Fraction
Description	Leakage Adjustment Factor
Source of data	Default
Value(s) applied	0.95
Choice of data or measurement methods and procedures	A net to gross adjustment factor (0.95 default) is applied in order to adjust Bold to account for leakages as per paragraph 20 of the AMS II.G, version 5 methodology.
Purpose of data	Calculation of baseline emissions

Additional comments	-
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E.2. Data and parameters monitored

Data/parameter	$n_{y,j}$
Unit	Quantity
Description	Number of stoves still in operation during the monitoring period as determined by the monitoring survey. This includes total number of stoves installed in the entire CPA.
Measured/calculated/default	Measured
Source of data	Project database and monitoring survey
Value(s) of monitored parameter	9558-0001: 19,738 9558-0002: 19,304 9558-0003: 20,587 9558-0004: 16,277 9558-0005: 8,524
Monitoring equipment	Monitoring survey
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	<p>The percentage of stoves found to be still in operation based on the sampling plan in each monitoring period will be applied to the total number of stoves installed in the CPA (according to the ICS registration records in the monitoring database and the applicable sample frame). The proportion of sampled ICS found to be in operation during each monitoring period will be applied to the total number of stoves in the CPA when calculating emissions reductions.</p> <p>The percentage of stove found to be still in operation is 99.15%, thus the number of stoves still in operation is determined as below</p> <p>9558-0001: $19,907 \times 99.15\% = 19,738$ units 9558-0002: $19,469 \times 99.15\% = 19,304$ units 9558-0003: $20,763 \times 99.15\% = 20,587$ units 9558-0004: $16,417 \times 99.15\% = 16,277$ units 9558-0004: $8,597 \times 99.15\% = 8,524$ units</p>
QA/QC procedures	The reliability calculation was conducted to ensure that the result obtained from the survey meets the precision required.
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data/parameter	$t_{y,j}$
Unit	Fraction
Description	Fraction of monitoring period the stove is in operation (days in operation/total days in monitoring period)
Measured/calculated/default	Calculated
Source of data	Project database and length of monitoring period
Value(s) of monitored parameter	<p>Actual values are unique for each ICS.</p> <p>Average for 9558-0001: 0.98 Average for 9558-0002: 1.00 Average for 9558-0003: 1.00 Average for 9558-0004: 0.96 Average for 9558-0005: 0.76</p>

Monitoring equipment	-
Measuring/reading/recording frequency	Measured continuously, recorded annually
Calculation method (if applicable)	The fraction will be calculated by dividing the number of days from the registration date of the stove, or the start date of the monitoring period (whichever is later) until the end of the monitoring period by the total number of days in the monitoring period.
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data/parameter	$\eta_{new,y,i}$		
Unit	Fraction		
Description	Continuing efficiency of ICS		
Measured/calculated/default	Measured		
Source of data	Efficiency tests in each monitoring period		
Value(s) of monitored parameter	Vintage 1: 0.2697 Vintage 2: 0.2737 Vintage 3: 0.2762 Vinatge 4: 0.2745 Vinatge 4: 0.2750		
Monitoring equipment	The tests were coordinated by the CME and undertaken following WBT protocol 4.2.3 by a trained professional working for the CME or CPA Implementer or an experienced third party.Following equipments were used.		
	Instrument	Model	Other details
	Weighing Scale	Ohaus Portable Balances – Valor 1000 V11P6-AM	Range: upto 6 kg (±1g) Calibration facility: within the instrument with known weights Calibration frequency: once in three years ⁴ Date of purchase: 21/09/2015 Date of Calibration: 02/02/2017 Validity of calibration till: 02/02/2020
	Digital Thermometer	Fluke 51-2 Single Input Digital Thermometer	Thermocouple Type: Type K, ChromelAlumel, bead style Range: –40 °C to +260 °C (± 1.1°C) Calibration frequency: Annual ⁵ Date of purchase: 21/09/2015 Date of Calibration: 02/02/2017 Validity of calibration till: 02/02/2018
Measuring/reading/recording frequency	Annually		

⁴As per the user manual of the weighing scale, under section 2.4, it is mentioned that “When the scale is operated for the first time, a Span calibration is recommended to ensure accurate weighing results as per the procedures mentioned under section 4.3 of the user manual”, so the PP has carried out the initial calibration on 24/05/2016 as per the procedure described in the user manual. The user manual does not restrict the PP to carry out the initial calibration and does not suggest that the calibration has to be carried out by an accredited agency since the calibration of weighing scale is relatively easy. User's manual of the weighing scale used for the project does not specify the calibration frequency. Hence as per EB 61, Annex 21, para 17 (c): (“Measuring equipment should be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years”) the weighing scales were calibrated before commencement of WBT i.e. on 02/02/2017

⁵As per the user manual of the thermometer, under page 13, the manufacturer recommends that “To ensure that the thermometer performs to its accuracy specifications, Fluke recommends that you calibrate the thermometer annually, starting one year after purchase”. PP has calibrated the thermometer before start of the survey i.e. on 02/02/2017.

Calculation method (if applicable)	The efficiency was determined for three phases, cold start, hot start and simmering and then averaged for each stove.
QA/QC procedures	The reliability calculation was conducted to ensure that the result obtained from the survey meets the precision required. The weighing scale is manufactured and tested as per applicable IS standard. User's manual of the weighing scale used for the project does not specify the calibration frequency. Hence as per EB 61, Annex 21, para 17 (c): ("Measuring equipment should be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years") the weighing scale will be calibrated before completion of three years from the date of purchase. In user manual of the digital thermometer, it is clearly stated that "To ensure that the thermometer performs to its accuracy specifications, Fluke recommends that you calibrate the thermometer annually, starting one year after purchase". Same has been followed as QA/QC procedure of equipments. CME will calibrate the equipments as per the mentioned procedure or will purchase new equipments pre calibrated by the manufacturer prior to use in further WBT.
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data/parameter	SS_y
Unit	Percentage
Description	The percentage of ongoing baseline stove use within the population of in-use ICS during a monitoring period.
Measured/calculated/default	Measured
Source of data	Project database and monitoring survey
Value(s) of monitored parameter	26.69%
Monitoring equipment	Monitoring survey
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	<p>As per PoA-DD, SS_y in each monitoring period is calculated as follows: the number of sampled households with in-use ICS that also continue to use a baseline stove divided by the total number of in-use ICS in the sample.</p> <p>As per Standard for sampling and surveys for CDM project activities and programme of activities, a proportion can describe either of the two possible scenarios of the success rate or the failure rate and project proponents may use the larger of the two proportions in the sample size calculation, which is p or (1-p).</p> <p>For the PoA, the two possible scenarios are continued-use and discontinued-use rates of baseline stoves. As the result of pilot study indicated that the discontinued-use rates of baseline stove is in higher proportion, thus the survey was conducted to study the discontinued-use rate of baseline stoves.</p> <p>For calculation of discontinued-use rate of baseline stoves, the same rule was applied where only sampled households with in-use ICS will be considered for data analysis.</p> <p>The continued-use rate of baseline stove will be calculated from $1 - p$, where p is the result obtained from the survey. $= 1 - 0.7331$ $= 0.2669$</p>

QA/QC procedures	Data for this parameter was collected using the same survey for the parameter $n_{y,i}$ (in-use appliances) conducted by trained surveyors. Internal cross-checks by the CME or project implementer will be undertaken as QC. The reliability calculation was conducted to ensure that the result obtained from the survey meets the precision required.
Purpose of data	Calculation of baseline emissions
Additional comments	-

E.3. Implementation of sampling plan

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A single sampling plan was carried out across all specific-case CPAs covered in this monitoring report.

(a) List of CPAs to which the single sampling was applied;

CPAs of 9558-0001, 9558-0002, 9558-0003 9558-0004, and 9558-0005 were covered under the single sampling plan.

(b) Description of implemented single sampling design;

(i) Sampling Design:

Due to the large number of ICS envisioned to be distributed as part of the CPAs to be included in the SSC-PoA, it is not economically feasible to monitor each individual ICS unit distributed. Therefore, representative sampling will be undertaken as part of a SSC-PoA-wide Sampling Plan (by grouping and sampling across CPAs) that is designed in line with the requirements of the Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities version 04.1.

(ii) Objectives and Reliability Requirements:

The objective was to obtain an unbiased and reliable estimate of the proportion or mean value of the following parameters over the course of the crediting period, and with 95/10 confidence/precision for biennial sampling across CPAs.

Monitored Parameters:

Parameter	Description of Parameter
$n_{y,j}$	Proportion of ICS still in operation
SS_y	Percentage of continued baseline stove use among ICS households in the database
$\eta_{new,y,i}$	Thermal Efficiency of operational ICS

(iii) Target Population:

The target population for the three parameters stated above are all ICS recorded in the project database.

(iv) Sampling Frame:

The POA is open to different CPA Implementers and different models of ICS, which introduces variability to the target population. To ensure the homogeneity of the CPAs included for a single sampling plan, two sampling frames were defined for the three parameters above with parameters of $n_{y,j}$ and SS_y share the sampling frame.

(v) Sampling method:

Simple Random Sampling was applied and samples was randomly selected from the primary sampling units. To ensure a random selection of ICS, random number generators was applied.

To determine the parameters, sampling will involve the following approaches (outcome in brackets):

- $n_{y,j}$: Visual inspection of the premises to see if ICS is operational and in use. Interview with end user if required to verify that ICS is still in use (Yes/No)
- SS_y : Interview with end user and visual inspection to determine if a baseline (replaced) stove is still being used in addition to ICS (Yes/No)
- $\eta_{new,y,i}$: ICS will be tested using WBTs (ICS thermal efficiency)

(vi) Sample size

For the estimation of the proportion or mean value of the parameters investigated, the minimum sample size for each sample frame has to achieve the 95/10 confidence/precision for biennial sampling. Of the three parameters to be monitored, two are proportions/percentages (SS_y and $n_{y,j}$) and one is a mean value $\eta_{new,y,i}$.

In order to calculate the required sample size estimates, values for the proportions, mean values, and standard deviations are required. A pilot study was conducted to obtain the estimates for these values. Accordingly the sample size was calculated using the formula provided by Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities (Version 03.0). The sample size calculation is available in Excel spreadsheet for sharing with DoE. The sample size was adjusted upwards to account for non-responses where the rate was determined by CME based on previous experience.

(c) Collected data (electronic spreadsheets may be attached and referenced);

The method of collecting data is field surveys and the summary is provided in table below.

Parameter	Methods to be applied
$n_{y,j}$	Visits to the premises, visual inspection and interview with ICS end-user
SS_y	Visits to the premises, visual inspection and interview with ICS end-user.
$\eta_{new,y,i}$	Water Boiling Test (WBT) Protocol Version 4.2.3

The data collected from the surveys was compiled into the Excel spreadsheet and will be shared with DoE. Hard copies of the surveys form will be kept and the database has a back up.

(d) Analysis of the collected data;

Data obtained from the samples was used to estimate proportions and mean values for the parameters described above. The values were then be factored into the emissions reduction calculations.

(e) Demonstration of whether the required confidence/precision has been met;

As part of the quality control on the data collected, the reliability calculation was performed and summary provided in table below.

Parameter	Responded samples	Value of parameter obtained	Precision achieved
$n_{y,j}$	236	99.15%	1.18%
Discontinued-use rate of baseline stove ⁶	236	73.31%	7.68%
$\eta_{new,1}$ (Vintage 1)	16	26.97%	9.43%
$\eta_{new,2}$ (Vintage 2)	16	27.37%	9.90%
$\eta_{new,3}$ (Vintage 3)	12	27.62%	8.67%
$\eta_{new,4}$ (Vintage 4)	16	27.45%	10.27%
$\eta_{new,5}$ (Vintage 5)	17	27.50%	9.63%

Sample estimates of all three parameters are within the required reliability precision.

⁶The value of SS_y (Continued-use rate of baseline stove) is obtained by $1 - 0.7308 = 0.2692$

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

The samples were randomly selected using Simple Random Sampling across the 5 CPAs. Under Simple Random Sampling, the entire target population has an equal chance of being selected, thus the samples selected were deemed to be representative of population.

SECTION F. Calculation of emission reductions or net anthropogenic removals

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

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a) Formulae for emission reductions

As per the SSC-POA-DD, emission reductions for the SSC-CPA will be calculated according to the following formula:

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

Where:

ER_y Emission reductions during the year y in tCO₂e

B_{y,savings} Total biomass that is saved in tonnes during the monitoring year(y) per device

f_{NRB,y} Fraction of biomass saved by the project activity in year y that has been established as non renewable biomass (Sub national values for Central, Northern, and Southern Regions are 0.97, 0.93 and 0.90 respectively)

NCV_{biomass} Net calorific value of the non-renewable biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)

EF_{projected_fossilfuel} Emission factor for the substitution of non-renewable biomass by similar consumers. (IPCC default of 81.6 tCO₂/TJ)

N_{y,i} Number of project devices of type i operating in year y

L A net to gross adjustment factor (0.95 default).is applied above (equation (1) of AMS II.G, version 5) in order to adjust B_{old} to account for leakages as per paragraph 13 (a) of the methodology.

Calculating B_{y, savings}

According to the AMS II.G (version 5) methodology, B_{y,savings} may be calculated in a number of ways (as per Options 1, 2 and 3 in Paragraph 12) and this PoA will allow the use of Option 2 in CPAs under this POA.

Option 2.

$$B_{y,savings} = B_{old} \times \left(1 - \frac{\eta_{old}}{\eta_{new,i}} \right)$$

Where:

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

η_{old, three-stone fire} Efficiency of the baseline system/s being replaced. The 0.10 default value is used as the replaced systems are three-stone fires or conventional systems lacking improved combustion air supply mechanism and flue gas ventilation system i.e., traditional stoves

η_{new,y,i} Efficiency of the system being deployed as part of the project activity (fraction)

For the purposes of calculating ex-ante emission reductions a baseline adjustment factor has been applied to B_{old} to account for wood fuel used for the 19.7% of households in the baseline study who reported using a

second stove at least once per week. This baseline adjustment factor is based on the mean number of stoves used per household averaged across the entire baseline sample, calculated to be 1.0471. The value of B_{old} applied in this PoA-DD for wood fuel baseline stoves (8.92 kg/day) incorporates this adjustment factor.

The percentage of households continuing to use a baseline stove in addition to an ICS has been monitored in order to address paragraph 26 (b) of the AMS II.G (version 5) methodology. The monitored (ex-post) percentage of ICS users continuing to use a baseline stove in addition to the ICS (parameter SS_y) was compared to the ex-ante percentage found in the baseline (19.7%) and B_{old} is adjusted proportionally based on the proportional change in the percentage. The parameter used to calculate ex-post $B_{y,savings}$ is $B_{old,adjusted}$ in order to account ex-post for fuel-wood used in baseline stoves in addition to ICS.

If percentage of households continuously using baseline stove is higher than 19.7%, $B_{old,adjusted}$ would become lower than B_{old} ; if the percentage of households continuously using their baseline stove is lower than 19.7%, then $B_{old,adjusted}$ would become higher than B_{old} stated in the PoA DD, in that case B_{old} will be taken into account for calculation of $B_{y,savings}$. If the percentage of households continuously using baseline stoves are found to be the same with the those found during baseline survey i.e. 19.7%, the formula becomes exactly 1. Hence there won't be any change of B_{old} value.

This procedure is outlined here:

In order to account for multiple stoves of different ages (i), which may have different efficiencies ($\eta_{new,y,i}$), this formula can be adapted as follows:

$$B_{y,savings} = B_{old,adjusted} \left(1 - \frac{\eta_{old}}{\eta_{new,y,i}} \right)$$

Where:

- $N_{y,i}$ Total number of stoves (i) in operation for a full monitoring period equivalent within each SSC-CPA
- η_{old} Efficiency of the baseline system/s being replaced. The 0.10 default value is used as the replaced systems are three-stone fires or conventional systems lacking improved combustion air supply mechanism and flue gas ventilation system i.e., traditional stoves.
- $\eta_{new,y,i}$ Efficiency of ICS of age i (fraction)

and

$$B_{old,adjusted} = B_{old} \times \left[\frac{1.0471}{1 + (SS_y / 0.197) \times (1.0471 - 1)} \right]$$

Where:

- B_{old} Baseline Quantity of woody biomass used in the absence of the project activity in tonnes
- SS_y is the percentage of households that continue to use baseline stoves simultaneously with ICS at least once per week (see section B.7.1. of the SSC-PoA-DD);

Note in the formula above that wood-fuel baseline data is used when calculating $B_{old,adjusted}$. The value 0.197 is the percentage of households in the baseline study who use a second stove simultaneously at least once per week and 1.0471 is the multiple stove adjustment factor, calculated as follows:

$$\text{Multi stove adjustment factor} = \frac{B_{old \text{ adjusted for seasons and multiple stove use}}}{B_{old \text{ adjusted for seasons}}} = \frac{9.34}{8.92} = 1.0471$$

b) Calculation of emission reductions

Calculation of $B_{old,adjusted}$

$$B_{old,adjusted} = B_{old} \times \left[\frac{1.0471}{1 + (SS_y / 0.197) \times (1.0471 - 1)} \right]$$

$$B_{old,adjusted} = 3.2558 \times 1.0471 / [1 + (0.2669/0.197) \times (1.0471 - 1)] \\ = 3.2047 \text{ tonnes/stove/year}$$

Calculation of $B_{y,savings}$

$$B_{y,savings} = B_{old,adjusted} \left(1 - \frac{\eta_{old}}{\eta_{new,y,i}} \right)$$

Quantity of woody biomass saved in tonnes per ICS in vintage 1

$$B_{1,savings} = 3.2047 \times [1 - (0.1/0.2697)] \\ = 2.0164 \text{ tonnes/stove/year}$$

Quantity of woody biomass saved in tonnes per ICS in vintage 2

$$B_{2,savings} = 3.2047 \times [1 - (0.1/0.2737)] \\ = 2.0338 \text{ tonnes/stove/year}$$

Quantity of woody biomass saved in tonnes per ICS in vintage 3

$$B_{3,savings} = 3.2047 \times [1 - (0.1/0.2762)] \\ = 2.0444 \text{ tonnes/stove/year}$$

Quantity of woody biomass saved in tonnes per ICS in vintage 4

$$B_{4,savings} = 3.2047 \times [1 - (0.1/0.2745)] \\ = 2.0372 \text{ tonnes/stove/year}$$

Quantity of woody biomass saved in tonnes per ICS in vintage 5

$$B_{5,savings} = 3.2047 \times [1 - (0.1/0.2750)] \\ = 2.0393 \text{ tonnes/stove/year}$$

Emission reductions for each ICS

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

The emission reductions shall be considered from the dates of installation and registration of each ICS. CME has opted to present the individual set of emission reductions calculation for each ICS in which the emission reductions obtained under each vintage will be presented separately. The full calculation of each ICS is available in Excel spreadsheet for sharing with DoE.

In this section, only the example of calculation for one of the ICS will be provided. The example given is for ICS with serial number TLC001884 which was registered under CPA 1 (9558-0001).

The details of registration record for ICS TLC001884 is as below.

CPA	ICS vintage at start date of MP	ICS vintage at end date of MP	Registration date	Installation date	Serial number	Stove model	User name	Region
1	4	5	21/10/2014	21/08/2013	TLC001884	TLC_Rocket	Kayenda Nyada	Central

Start date of monitoring period for CPA 9558-0001 = 16/04/2017

End date of monitoring period for CPA 9558-0001 = 15/04/2018

As monitoring period starts from 01/06/2016 thus Vintages 1, 2 and 3 are not covered under this monitoring period. (See stove vintage in table above)

The period of Vintages 3 and 4 for ICS TLC001884 is as below (based on Installation Date):

Vintage 4: 21/08/2016 – 20/08/2017

Vintage 5: 21/08/2017 – 20/08/2018

Since, ICS is only eligible to claim CER from the registration date (21/10/2014) i.e. which is before the monitoring period start date, thus emission reductions will be claimed for the period stated below.

Vintage 4: 16/04/2017 – 20/08/2017 (126 days or 0.35 year)

Vintage 5: 21/08/2017 – 15/04/2018 (238 days or 0.65 year)

Emission reductions achieved under Vintage 4

The CPA has opted for sub national value of f_{NRB} where the value for Central Region is 0.97.

As ICS has operated less than a year of each vintage period, thus fraction of year to be applied in the calculation.

$$ERs = 2.0372 \times 0.97 \times 0.015 \times 81.6 \times 0.95 \times 0.35 \\ = \mathbf{0.79 \text{ tCO}_2}$$

Emission reductions achieved under Vintage 5

$$ERs = 2.0393 \times 0.97 \times 0.015 \times 81.6 \times 0.95 \times 0.65 \\ = \mathbf{1.51 \text{ tCO}_2}$$

Total emission reductions achieved by each CPA

To account for the losses of emission reductions (ERs) due to non-operational of ICS, the total of emission reductions achieved by each CPA will take into account the proportion of ICS in operation which 99.15%.

The summary of total net ERs calculation is as below.

CPA	Initial total ERs	Calculation of net ERs	Net ERs (rounded down)
9558-0001	44,153.56	44,153.56 x 99.15%	43,778
9558-0002	44,640.00	44,640.00 x 99.15%	44,260
9558-0003	47,067.30	47,067.30 x 99.15%	46,667
9558-0004	25,995.59	25,995.59 x 99.15%	25,773
9558-0005	13,873.15	13,873.15 x 99.15%	13,755
		Total	174,233

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

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Not Applicable .

F.3. Calculation of leakage emissions

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Not Applicable.

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

CPA UNFCCC reference number	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)		
				Before 01/01/2013	From 01/01/2013	Total amount
9558-0001	43,778	0	0	0	43,778	43,778
9558-0002	44,260	0	0	0	44,260	44,260
9558-0003	46,667	0	0	0	46,667	46,667
9558-0004	25,773	0	0	0	25,773	25,773
9558-0005	13,755	0	0	0	13,755	13,755
Total	174,233	0	0	0	174,233	174,233

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

CPA UNFCCC reference number	Amount achieved during this monitoring period (t CO ₂ e)	Amount estimated ex ante (t CO ₂ e)
9558-0001	43,778	44,853
9558-0002	44,260	44,853
9558-0003	46,667	44,853
9558-0004	25,773	44,853
9558-0005	13,755	44,853
Total	174,233	224,265

F.6. Remarks on increase in achieved emission reductions

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Actual emission reduction for CPA 9558-0003 is more than the estimated emission reduction in registered CPA-DD. The increase of CER is about 4.04%. The reason for increase in the actual emission reduction is the higher value of the continuing efficiencies ($\eta_{new,y,i}$) for different vintages. The ex-ante efficiency of the TLC Rocket stove was assumed based on minimum guaranteed value of ICS from the manufacturer while the ex-post efficiency is the average efficiency calculated by the water boiling tests during monitoring surveys.

The emission reductions achieved in CPA 9558-0001, 9558-0002, 9558-0004 and CPA 9558-0005 are less than the value estimated in ex-ante calculation. The reduction on value achieved is because of the reduced number of ICS in operation. In the ex-ante calculation, it was assumed that 20,763 ICS will be in operational for the whole monitoring period.

Document information

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