Monitoring report form for CDM project activity
(Version 06.0)

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

MONITORING REPORT		
Title of the project activity	Efficient Fuel Wood Stoves for Nigeria	
UNFCCC reference number of the project activity	2711	
Version number of the PDD applicable to this monitoring report	03	
Version number of this monitoring report	01	
Completion date of this monitoring report	07/09/2018	
Monitoring period number	8	
Duration of this monitoring period	01/07/2017 – 30/06/2018	
Monitoring report number for this monitoring report	N/A	
Project participants	Atmosfair gGmbH Developmental Association for Renewable Energies Lernen-Helfen-Leben e.V.	
Host Party	Nigeria	
Sectoral scopes	3: Energy demand	
Applied methodologies and standardized baselines	AMS II.G., version 1 (EB37), “Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass”	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0	13,572 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	34,027 tCO_2e	

SECTION A. Description of project activity

A.1. General description of project activity

(a) Purpose of the project activity and the measures taken for GHG emission reductions or net anthropogenic GHG removals by sinks

The purpose of the project activity is the dissemination of up to 12,500 efficient fuel wood stoves (SAVE80) and heat retaining polypropylene boxes (hereafter referred to as the SAVE80 system) in different states located in the Guinea Savannah Zone of Nigeria, at subsidized prices.
Users are households who previously used inefficient, traditional fireplaces, consuming non-renewable biomass. The SAVE80 system saves up to 80% of fuel wood. By reducing the fuel wood consumption, the project activity hence reduces greenhouse gas emissions stemming from the use of non-renewable biomass.

A.2. Location of project activity

(a) Host Party:

Federal Republic of Nigeria

(b) Region/ State/ Province:

The project activity is located in the states belonging to the Guinea Savannah Zone of Nigeria:

The following states mainly belong to the Guinea Savannah Zone:

a. Benue
b. Enugu
c. Kaduna
d. Kogi
e. Kwara
f. Nasarawa
g. Niger
h. Oyo
i. Plateau
j. Taraba
k. Federal Capital Territory (FCT)

(c) City/ Town/ Community:

The SAVE80 systems were installed in households in the Guinea Savannah Zone.

(d) Physical/ Geographical location:

The coordinates of DARE‟s main office at Km 38, Kaduna-Zaria Expressway (after Jaji Military Cantonement), Sabon Yelwa, Kaduna - North, Kaduna State – Nigeria are used to represent the physical location of the project activity.

The coordinates are:

Latitude: 10.866425 degree
Longitude: 7.614297 degree

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Nigeria (host Party)	Developmental Association for Renewable Energies (private entity)	No
Germany	atmosfair gGmbH (Private entity) Lernen-Helfen-Leben e.V. (private entity)	No

A.4. Reference to applied methodologies and standardized baselines

AMS II.G., version 1 (EB37), "Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass"

A.5. Crediting period type and duration

Fixed crediting period (10 years)
Start of crediting period: 12/10/2009
End of crediting period: 11/10/2019

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

(a) Description of the installed technology, technical processes and equipment

The SAVE80 is a portable stove made of stainless steel, developed and prefabricated by a German manufacturer and assembled locally to create employment and income. The initial model has a specified thermal efficiency of 52% and nominal effective thermal power of about 1.5 kW. As per specification of the manufacturer, the SAVE80 needs only about 250 g of small brittle sticks of wood to bring 6 litres of water to the boil, 80% less than traditional fire places. The design ensures preheating of the air and a complete combustion with no visible smoke and only small amounts of ash. The SAVE80 system also consists of custom-fit pots, pans and a heat retaining box ('Wonderbox'), where food can be transferred after reaching the boiling temperature, and where it will continue to simmer until it is well cooked. The Wonderbox allows important energy savings in addition to the savings by the Save80. However, these energy savings will not be taken into account for calculating emission reductions which is increasing the overall conservativeness of the Emission Reduction calculations.

(b) Information on the implementation and actual operation of the project activity, including relevant dates (e.g. construction, commissioning, continued operation periods, etc.).

Date	Milestone
01/04/2008	Starting date of the project activity: First stove sales under CDM activity
12/10/2009	Registration with UNFCCC
12/10/2009 – 30/06/2010	First Monitoring Period
01/07/2010 – 30/06/2012	Second Monitoring Period
01/07/2012 – 30/06/2013	Third Monitoring Period
01/07/2013 – 30/06/2014	Fourth Monitoring Period
01/07/2014 – 30/06/2015	Fifth Monitoring Period
01/07/2015 – 30/06/2016	Sixth Monitoring Period
01/07/2016 – 30/06/2017	Seventh Monitoring Period
01/07/2017 – 30/06/2018	Eighth Monitoring Period

The following table lists the number of SAVE80 systems deployed under the project activity since the starting date of the project activity on 01/04/2008 and as recorded in the database at the end of the monitoring period. Please note: Not all SAVE80 systems sold under this SSC project are yet recorded in the database. Hence in case SAVE80 systems already sold but not yet recorded will be recorded in the database at a later time, deployment figures in the subsequent monitoring reports may slightly vary.

Year	ICS deployed
2008 (01/04 – 31/12)	346
2009	804
2010	1,390
2011	2,721
2012	106
2013	1
2014	2
Total	**5,370**

Note: Each SAVE80 system starts to generate emission reductions in the month following the delivery of the SAVE80 system.

B.2. Post-registration changes

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

There are no temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines during this monitoring period.

B.2.2. Corrections

There are corrections to project information or parameters fixed at the registration of the project activity.

(a) Corrections that have been approved by the Board as applicable from a period prior to this monitoring period

During the third Monitoring Period, a Post Registration Change for correcting:

a) The location of the project activity
b) Clarification related to length of monitoring period and duration of vintage
c) Editorial correction from $t_{j,i}$ to $t_{y,j}$

was submitted to the UNFCCC. The submission date was the 19/06/2013.

The correction and the revised PDD were approved 08/11/2013. The PRC reference number is: PRC-2711-001 (https://cdm.unfccc.int/PRCContainer/DB/prcp445244817/view)

(b) Corrections that have been approved by the Board as applicable from this monitoring period

No corrections have been submitted and approved by the Board as applicable from this monitoring period.

(c) Corrections that are being submitted with this monitoring report

No corrections are being submitted with this monitoring report.

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

There are no changes to the start date of the crediting period fixed at the registration of the project activity.

B.2.4. Inclusion of monitoring plan

There is no post-registration change to include a monitoring plan into the PDD.

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

There are no permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools.

B.2.6. Changes to project design

There are no changes to the project design of the project activity.

SECTION C. Description of monitoring system

In accordance with the registered PDD, monitoring consists of:

Parameter	Data Source(s)
Number of SAVE80 systems in use ($N_{y,i}$)	1. Purchase Contracts 2. Project Database Records 3. Spot Checks to User Households
Operation time of the SAVE80 ($t_{y,j}$)	Project Database Records
Efficiency of the SAVE80 ($\eta_{new,i}$)	Water Boiling Test

According to request for clarification on monitoring and verification in conflict zones (INQ-Q4074-EB) we applied for contingency measures for monitoring and verification.
Based on the political situation in Nigeria UNFCCC approved following exception, which is valid until the 27/11/2018:

a) The CME and DOE may apply a combination of survey and data collection methods as per section 9 of the “Guidelines for sampling and surveys for CDM project activities and programme of activities” (version 4.0, CDM-EB86-A04), for example using telephone interviews and household visits for the data collection;
b) Joint site visits by the monitoring and verification personnel to collect data and evidence may be undertaken.

Number of SAVE 80 systems in use and operation time of the SAVE80

- Users who wished to obtain a SAVE80 system under the CDM project 2711 signed a purchase contract, which contained their contact details, serial number (Cooker-ID) of the SAVE80 stove delivered, and the contract / delivery date.
- User contact information, Cooker-ID, contract and delivery date was regularly transferred to an electronic database (“Project database”).

- The project database was used for calculation of number of systems delivered and recorded in the database as per end of the monitoring period 8 on 30/06/2018, and for random selection of households for the spot checks for monitoring period 8, 01/07/2017 – 30/06/2018.
- Spot Checks to User Households were conducted in at least 100 households through households visits and telephone interviews.
- Drop-Out rate (i.e. households found not to use the SAVE80 during the spot checks) was calculated and standard error added as per requirement of the PDD.
- The number of SAVE80 systems as recorded in the project database was multiplied with the drop-out rate + standard error determined for the monitoring period and adjusted for the operational time[1] to derive the parameter $N_{y,i}$ (Number of SAVE80 systems in use during the specified period).

Note: not all users who obtained a SAVE80 stove under this project activity are contained in the database used, due to administrative reasons. The users not yet recorded in the database do not count for calculation of emission reductions in this monitoring period; however, they may be added to the database later and hence count in the subsequent monitoring periods.

Efficiency of the SAVE 80 - Water Boiling Test

- Efficiency Tests (Water Boiling Tests) were conducted during the presence of an experienced researcher as required by the PDD. Three SAVE80 cookers of the 1st vintage were tested. The SAVE80 cookers were obtained from frequent users that are using the SAVE80 at least 2-3 times a day.
- Data was recorded manually and thereafter entered into an electronic data sheet and cross-checked with manufacturer specifications and literature values.
- The mean values of the efficiency tests were calculated by atmosfair and multiplied with the conservativeness factor as in the registered PDD.

Organizational structure, roles and responsibilities of personnel

The following persons were assigned to conduct monitoring tasks of this project implemented by DARE, LHL and atmosfair.

Organisation	Name	Role	Responsibility/Tasks
DARE	Yahaya Ahmed	Monitoring Officer	- Supervision of purchase contracts and project database recording*
LHL	Bernd Blaschke	Monitoring Officer	- Project Database Records Assessment*
atmosfair	Toyin Oshaniwa	Assigned CDM Monitoring Officer	- Supervision of Efficiency Testing and Spot Checks
atmosfair	Katrin Mikolajewski	Monitoring Officer	- Efficiency Tests Data Assessment - Spot Checks Data Assessment - CER calculation and Preparation of Monitoring Report
atmosfair	Katrin	Project Manager	- Data Quality Control

[1] The operation time of a SAVE80 system is a simple calculation of months a SAVE 80 system generated emission reductions within the monitoring period divided by months of the year, to take into account that the Monitoring Period may be less than a year, or the systems start to generate emission reductions within a Monitoring period. According to the PDD, each SAVE80 system starts to generate emission reductions in the month following delivery of the SAVE80 system, to account for delays between purchase and first use. The operation time is hence the number of months during the Monitoring period where the system generated emission reductions, divided by the number of months of a year.

	Mikolajewski		- Review of Monitoring Report

*in this monitoring period, no new database recording took place.

Emergency procedures for the monitoring system

There is a separation of roles for every step of the data generation, aggregation & recording, calculation and reporting between those who are responsible and those who are controlling the respective step.
The assigned CDM Monitoring Officer was responsible for supervision of efficiency testing and spot checks. The atmosfair Monitoring Officer was responsible for overall data control, i.e. checked again correctness and consistency of all data collected and processed in this Monitoring Period. This included, inter alia, a cross-check if the values entered into forms for the spot checks and the efficiency test are correct and plausible.

Procedures for tracking of changes of ownerships and/or relocations of SAVE80 systems
Procedures for tracking of changes of ownership and/or relocations of SAVE80 systems have been implemented to address FAR Q1 of the first verification. In the monitoring spot checks, the monitoring team checked whether the contact details are still correct, and if not recorded the new contact details. From the new contact details it could be assured that the SAVE80 systems are still used within the project boundary.

SECTION D. Data and parameter

D.1. Data and parameters fixed ex ante

Data/parameter:	$B_{yappliance}$
Unit	tonnes/year
Description	Quantity of Biomass used in the absence of the project activity (per appliance)
Source of data	Baseline Survey
Value(s) applied)	4.6534
Choice of data or measurement methods and procedures	See Section B.4. Step 1 of PDD
Purpose of data	Baseline emission calculation
Additional comments	

Data/parameter:	L_y
Unit	fraction
Description	Leakage Correction Factor
Source of data	Derived from Leakage Assessment
Value(s) applied)	0.99
Choice of data or measurement methods and procedures	See Section B.4. Step 1 of PDD

Purpose of data	Baseline emission calculation
Additional comments	As per AMS II.G., v1, if leakage has to be considered then B_y is adjusted to account for the quantified leakage. Therefore, the Leakage Correction Factor L_y is applied to the project activity, and leakage emissions are already considered in the baseline emissions calculation.

Data/parameter:	η_{old}
Unit	Fraction
Description	Efficiency of the system being replaced
Source of data	Water-Boiling Test
Value(s) applied)	0.1
Choice of data or measurement methods and procedures	See Section B.4. Step 2 of PDD
Purpose of data	Baseline emission calculation
Additional comments	

Data/parameter:	$f_{NRB, y}$
Unit	Fraction
Description	Fraction of non-renewable biomass saved by the project activity
Source of data	FAO (2003): Experience of Implementing National Forestry Programmes in Nigeria (see ftp://ftp.fao.org/docrep/fao/005/AC918E/AC918E00.pdf)
Value(s) applied)	0.77
Choice of data or measurement methods and procedures	See Section B.4. Step 3 of PDD
Purpose of data	Baseline emission calculation
Additional comments	

Data/parameter:	$NCV_{biomass}$
Unit	TJ/t
Description	Net calorific value of non-renewable biomass that is substituted
Source of data	IPCC default value for fuel wood
Value(s) applied)	0.015 TJ/tonne
Choice of data or measurement methods and procedures	Default value that is provided in AMS II G
Purpose of data	Baseline emission calculation
Additional comments	

Data/parameter:	$EF_{projected\ fossil\ fuel}$
Unit	t CO_2/TJ
Description	Emission factor for the substitution of non-renewable biomass by similar consumers
Source of data	IPCC default value for Kerosene
Value(s) applied)	71.5 t CO_2/TJ
Choice of data or measurement methods and procedures	See Section B.4. Step 4 of PDD

Purpose of data	Baseline emission calculation
Additional comments	

D.2. Data and parameters monitored

Data/parameter:	$\mathbf{N}_{y,i}$
Unit	Number
Description	Number of SAVE80 systems in use per vintage The first vintage consists of all SAVE80 systems sold since the project start date until the end date for the first monitoring campaign, the second vintage of all SAVE80 systems sold until the end date for the second monitoring campaign, the third vintages of all SAVE80 systems sold until the end date for the third monitoring campaign, and so forth.
Measured/calculated/default	Calculated
Source of data	Purchase Contracts, Project Database records, Monitoring spot checks
Value(s) of monitored parameter	Vintage 1 01/07/2017 - 30/06/2018 1,865.02 Vintage 2 01/07/2017 - 30/06/2018 1,580.92 Vintage 3 01/07/2017 - 30/06/2018 1,470.02 Vintage 4 01/07/2017 - 30/06/2018 2.75 Vintage 5 01/07/2017 - 30/06/2018 2.75 Vintage 6 01/07/2017 - 30/06/2018 0.00 Vintage 7 01/07/2017 - 30/06/2018 0.00 Vintage 8 01/07/2017 - 30/06/2018 0.00 Vintage 9 01/07/2017 - 30/06/2018 0.00 Total $N_{y,i}$ = 4,921.46
Monitoring equipment	Monitoring consisted of data recording in an electronic database. Sales of the SAVE80 systems were recorded. The user signed a purchase contract, where the date, the name of the user and contact details (if available) are noted to doubtlessly identify the user. Every SAVE80 cooker has an identification number (Cooker-ID) which was also noted on the purchase contract. The information from the purchase contract was transferred to the electronic database.
Measuring/reading/recording frequency:	Purchaser Contracts/ Project Database: Continuous recording frequency Spot Checks: annually
Calculation method (if applicable):	$N_{y,i} = \sum_{j=1}^{Ny.i} n_{y,j} \cdot t_{y,j}$ Where $n_{y,j}$ Appliance operating per year and vintage (adjusted for Drop-Outs incl. Standard Error) $t_{y,j}$ Fraction of operation time per SAVE80 system per vintage (months/months per year) (see monitoring parameter below)

QA/QC procedures:	Database entries were made by staff from DARE. They were supervised by the CDM Monitoring Officer assigned by DARE, LHL and atmosfair. The database records and copies of the purchase contracts were transferred to Germany. LHL and atmosfair cross-checked the database entries with the purchase contracts. To check if the information in the database was correct and the SAVE80 systems are still operating, spot checks were conducted in the monitoring period. Conservative approach: To the share of households that were found not to use the SAVE80 in the Monitoring Sample group, the Standard Error was added. By multiplication with the total number of SAVE80 systems in use per vintage, the number of households that do not use the SAVE80 system per vintage was determined and was deducted from the number of appliances delivered per vintage.
Purpose of data:	Baseline emission calculation
Additional comments:	

Data/parameter:	$t_{y,j}$
Unit	fraction
Description	Operation time per SAVE80 system per vintage (months of the Monitoring Period/months per year).
Measured/calculated/default	Calculated
Source of data	Project Database records
Value(s) of monitored parameter	MP 8: 01/07/2017 – 30/06/2018

Delivery date	Vintage	Operational time ty,j
12/10/2009 – 30/06/2010	1	1.00
01/07/2010 – 30/06/2011	2	1.00
01/07/2011 – 30/06/2012	3	1.00
01/07/2012 - 30/06/2013	4	1.00
01/07/2013 - 30/06/2014	5	1.00
01/07/2014 - 30/06/2015	6	1.00
01/07/2015 - 30/06/2016	7	1.00
01/07/2016 - 30/06/2017	8	1.00
01/07/2017 - 30/06/2018	9	1.00

	No Save80 systems included in the project activity have been sold after June 2017. Thus $t_{y,j}$ =1 for all deployed systems in vintage 1-9.
Monitoring equipment	Not applicable
Measuring/reading/recording frequency:	To be conservative every SAVE80 system started to generate emission reductions in the month following delivery of the SAVE80 system, to account for delays between purchase and first use.
Calculation method (if applicable):	$t_{y,j}$ = months system was operating within the Monitoring Period/months per year
QA/QC procedures:	Not applicable
Purpose of data:	Baseline emission calculation
Additional comments:	

<table>
<tr><td>Data/parameter:</td><td>$\eta_{new,i}$</td></tr>
<tr><td>Unit</td><td>fraction</td></tr>
<tr><td>Description</td><td>Efficiency of the SAVE80 system for each vintage</td></tr>
<tr><td>Measured/calculated/default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Water Boiling Tests are repeated in every monitoring campaign to confirm the efficiency of the SAVE80 system. 3 SAVE80 cookers from the first vintage, i.e. sold since the project start date until the end of the first monitoring period are tested in each monitoring campaign.
To measure the efficiency of the SAVE80, the Water Boiling Test, as described under Section B.4 of the registered PDD, is conducted.
The test results are always multiplied by a conservativeness factor of 0.943 as determined in the registered PDD, to account for uncertainties.
For clarity, in line with the registered monitoring plan, the following source of data is used to determine the efficiency:
<table>
<tr><th>Vintage</th><th>Value used</th></tr>
<tr><td>1st vintage:
All SAVE80 cookers sold since the project start date until the end date for the first monitoring campaign (= Monitoring period 1)</td><td>Efficiency value used:
From efficiency testing during monitoring for Monitoring period 8 (tests conducted 20.07.2018-23.07.2018)</td></tr>
<tr><td>2nd vintage:
All SAVE80 cookers sold after end date for the first monitoring campaign until the end date for the second monitoring campaign
(= Monitoring period 2, Part 1)</td><td>Efficiency value used:
From efficiency testing during monitoring for Monitoring period 7 (tests conducted 27-30/07/2017)</td></tr>
<tr><td>3rd vintage:
All SAVE80 cookers sold after end date for the second monitoring campaign until the end date for the third monitoring campaign
(= Monitoring period 2, Part 2)</td><td>Efficiency value used:
From efficiency testing during monitoring for Monitoring period 6 (tests conducted 25-30/07/2017)</td></tr>
<tr><td>4th vintage:
All SAVE80 cookers sold after end date for the third monitoring campaign until the end date for the fourth monitoring campaign (= Monitoring period 3)</td><td>Efficiency value used:
From efficiency testing during monitoring for Monitoring period 5 (tests conducted 06.-08/07/2016)</td></tr>
<tr><td>5th vintage:
All SAVE80 cookers sold after end date for the fourth monitoring campaign until the end date for the fifth monitoring campaign (= Monitoring period 4)</td><td>Efficiency value used:
From efficiency testing during monitoring for Monitoring period 4 (tests conducted 04.-08/07/2016)</td></tr>
<tr><td>6th vintage:
All SAVE80 cookers sold after end date for the fifth monitoring campaign until the end date for the sixth monitoring campaign (= Monitoring period 5)</td><td>Efficiency value used:
From efficiency testing during monitoring for Monitoring period 3 (tests conducted 16.-17/04/2014)</td></tr>
<tr><td>7th vintage:
All SAVE80 cookers sold after end date for the sixth monitoring campaign until the end date for the seventh monitoring campaign (= Monitoring period 6)</td><td>Efficiency value used:
From efficiency testing in Monitoring Period 2. Part 1 (test conducted on 09/08/2012)</td></tr>
<tr><td>8th vintage: All SAVE80 cookers sold after end date for the seventh monitoring campaign until the end date for the eighth monitoring campaign (= Monitoring period 7)</td><td>Efficiency value used: From efficiency testing in Monitoring period 2, Part 2 (test conducted on 05/07/2011)</td></tr>
<tr><td>9th vintage: All SAVE80 cookers sold after end date for the eighth monitoring campaign until the end date for the ninth monitoring campaign (= Monitoring period 8)</td><td>Efficiency value used: From efficiency testing in Monitoring campaign 1 (i.e. value from first monitoring period, test conducted on 21/05/2010)</td></tr>
</table>
</td></tr>
</table>

	<table><tr><td>Vintage i=1</td><td>35.16%</td><td>Efficiency Tests MP8</td></tr><tr><td>Vintage i=2</td><td>36.95%</td><td>Efficiency Tests MP7</td></tr><tr><td>Vintage i=3</td><td>37.20%</td><td>Efficiency Tests MP6</td></tr><tr><td>Vintage i=4</td><td>33.77%</td><td>Efficiency Tests MP5</td></tr><tr><td>Vintage i=5</td><td>32.68%</td><td>Efficiency Tests MP4</td></tr><tr><td>Vintage i=6</td><td>33.33%</td><td>Efficiency Tests MP3</td></tr><tr><td>Vintage i=7</td><td>40.97%</td><td>Efficiency Tests MP2 Part 2</td></tr><tr><td>Vintage i=8</td><td>41.11%</td><td>Efficiency Tests MP2 Part 1</td></tr><tr><td>Vintage i=9</td><td>35.16%</td><td>Efficiency Tests MP1</td></tr></table> The efficiency applied in Monitoring Period 8 was calculated as the weighted average efficiencies of operational stoves per vintage during the monitoring period.
Value(s) of monitored parameter	36.35%
Monitoring equipment	<table><tr><td></td><td><u>Weighing Scale</u></td></tr><tr><td>Type</td><td>KD 8000</td></tr><tr><td>Accuracy class</td><td>+/- 1 g</td></tr></table> <table><tr><td></td><td>Thermocouple</td></tr><tr><td>Type</td><td>Greisinger Präzisionsthermometer GMH 3710</td></tr><tr><td>Temperature range</td><td>-199.99° C - +199.99° C</td></tr></table>
Measuring/reading/recording frequency:	Once per monitoring campaign
Calculation method (if applicable):	To determine the efficiency of one stove, the mean value of the three tests per stove were taken, multiplied by a conservativeness factor of 0.943 as determined in the registered PDD, to account for uncertainties. To determine the efficiency of stoves from the tested vintage the average of the three tested stoves was calculated. Efficiency of stoves from the tested vintage (1): $\eta_{new,i} = 1/3 * [(\eta_{new,1,1} + \eta_{new,1,2} + \eta_{new,1,3})/3 + (\eta_{new,2,1} + \eta_{new,2,2} + \eta_{new,2,3})/3 + (\eta_{new,3,1} + \eta_{new,3,2} + \eta_{new,3,3})/3)] * 0.943$ To calculate the efficiency of the monitoring period, the calculated stove efficiency of each vintage i was multiplied with the share of operational stoves[2] belonging to the vintage: The sum of so-obtained values for all vintages is the weighted average.

[2] Operational stoves per vintage divided by total number of operational stoves in the specific monitoring campaign of the monitoring period

$=N_{y,1}$ (in %)* $\eta_{new,1}$+ $N_{y,2}$ (in %)* $\eta_{new,2}$ + $N_{y,3}$ (in %)* $\eta_{new,3}$ + $N_{y,4}$(in %)* $\eta_{new,4}$ + $N_{y,5}$(in %)* $\eta_{new,5}$ + $N_{y,6}$(in %)* $\eta_{new,6}$ + $N_{y,7}$(in %)* $\eta_{new,7}$ + $N_{y,8}$(in %)* $\eta_{new,8}$ + $N_{y,9}$(in %)* $\eta_{new,9}$

vintage i	$N_{y,i}$	$N_{y,I}$ (%)	Efficiency ηnew,I
i=1	1,865.02	37.9%	35.16%
i=2	1,580.92	32.1%	36.95%
i=3	1,470.02	29.9%	37.20%
i=4	2.75	0.1%	33.77%
i=5	2.75	0.1%	32.68%
i=6	0.00	0.0%	33.33%
i=7	0.00	0.0%	40.97%
i=8	0.00	0.0%	41.11%
i=9	0.00	0.0%	35.16%
Weighted average efficiency			36.35%

QA/QC procedures:	The tests were supervised by the CDM Monitoring Officer. An instruction for the efficiency test was provided by atmosfair. The tests were carried out in the presence of an experienced researcher. Results from the tests were cross-checked with literature values and specifications from the manufacturer of the SAVE80 and values were found to be reasonable. Conservative approach: Test results were multiplied by a conservativeness factor of 0.943 to account for bias uncertainty.
Purpose of data:	Baseline emission calculation
Additional comments:	

D.3. Implementation of sampling plan

Please note that at time the project activity was registered (12/10/2009), the sampling standard (EB 65 Annex 2) was not yet adopted, neither were the sampling guidelines (EB 69 Annex 5). Therefore, the monitoring plan of the registered PDD does not contain a sampling plan.
Nonetheless, since data and parameters monitored which are described in section D.2 above are determined by a sampling approach, a description is provided on how the sampling efforts and surveys for those data and parameters were implemented.

(a) Description of implemented sampling design

Simple Random Sampling was applied in accordance with the registered PDD.
The Monitoring Sample was selected via a computerized randomizer in the project database (cut-off date 20/06/2018[3]), which selected households for the spot checks. The selected households were contacted either by phone or by physical inspection. In line with the registered PDD, the required number of households for each of the annual check was 1% of the population or at least

[3] No stoves were sold in this monitoring period. Therefore the database at cut off date 20/06/2018 contained the same number of database records (i.e. stoves sold) as at the end of the monitoring period, i.e. on 30/06/2018.

100: *"To check if the information in the database is correct and the SAVE80 systems are still operating, annual spot checks will be conducted. […]. Therefore, the spot checks will cover at least 1% of all households, at least 100."*
Therefore, the sample size is determined based on all the households, i.e. the total population which is 5,370 for monitoring period 7. 1% of 5,370= 53.70 which is less than the 100 required by the PDD. Therefore, the sample consisted of 100 households. Additionally, we applied oversampling as per EB 67 Annex 6, para 30 to compensate for, outliers or non-response associated with the sample, based on the experiences from former Monitoring Periods. Therefore, a total sample of 250 households was drawn from the project database.

The monitoring team undertook the monitoring of the parameters determined via sampling. Monitoring of the stove usage to calculate $N_{y,i}$ was done by phone interviews or personal interviews of stove users using a common questionnaire. In the questionnaire, the stove user was asked if their stove is in use. The answer is either "yes" or "no". If the answer is "no" the stove is counted as "drop-out". The percentage of drop-outs is used to adjust the total number of stoves in the database, since $N_{y,i}$. is defined as number of SAVE80 systems in use.

(b) Collected data

In total, spot checks to determine whether the SAVE80 systems are still operating were conducted to 100 households, which is equal to the required sample size of 100 households.

For the determination of η_{new}, the efficiencies of three stoves from the first vintage were tested using the water boiling test. Each of the 3 stoves was tested 3 times. The water boiling test was conducted as required in the PDD under the supervision of an experienced researcher. The test results were noted manually on a data entry form and later transferred into the efficiency calculation sheets. To determine stove efficiency the average of the 3 tests per stove was calculated and multiplied by a conservativeness factor (CF) of 0.943. To obtain the $\eta_{new,1}$ for vintage-1-stoves the average of the three tested stove efficiencies was calculated.

(c) Analysis of the collected data

The following results were obtained during the monitoring campaign for Monitoring Period 8, 01/07/2017 – 30/06/2018:

Parameter	n*	Value	Standard error
Drop Out	6	6%	2.35%
$\eta_{new,1}$ ($\eta_{new,1}$ including CF of 0.943)	9	37.29% (35.16%)	1.65%

*valid responses

(d) Demonstration that the confidence/precision has been met

The methodology (AMS II.G. ver. 1) does not stipulate any confidence/precision criteria, which need to be met. At time the project activity was registered (12/10/2009), the sampling standard (EB 65 Annex 2) was not yet adopted, neither were the sampling guidelines (EB 69 Annex 5). Therefore, the monitoring plan of the registered PDD does not contain a sampling plan. The PDD however requires that the standard error is added to the Drop Out Rate.

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

Simple Random Sampling was applied in accordance with the registered PDD.
The Monitoring Sample was selected via a computerized randomizer in the project database (cut-off date 20/06/2018), which selected households for the spot checks.

For further details please refer to the CER calculation spreadsheet.

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

Please note that the methodology ASM II.G., v1 does not provide specific equations for calculation of Baseline emissions, project emissions or leakage, only for Emission reductions. As Leakage was considered ex-ante, B_y was adjusted to account for the quantified leakage. Therefore, the Leakage Correction Factor L_y was applied to the project activity.

The Emission reductions calculations as per the AMS II.G., v1 and as stated in the registered PDD is as follows:

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

Where:

ER_y	Emission reductions during the year in t CO_2e
$B_{y,savings}$	Quantity of biomass that is saved in tonnes
$f_{NRB,y}$	Fraction of biomass saved by the project activity in year y that can be established as non-renewable biomass using survey methods
$NCV_{biomass}$	Net calorific value of non-renewable biomass that is substituted (IPCC default value for fuel wood 0.015 TJ/tonne, i.e. 15 MJ/kg wood)
$EF_{projected\_fossilfuel}$	Emission factor for the substitution of non-renewable biomass by similar consumers

Calculation of Biomass Savings ($B_{y,savings}$):

$$B_{y,savings} = \sum_{i=1}^{n} B_{y,adjusted,i} \cdot (1 - \frac{\eta_{old}}{\eta_{new,i}})$$

$$= \sum_{i=1}^{n} B_{y,appliance} \cdot L_y \cdot N_{y,i} \cdot (1 - \frac{\eta_{old}}{\eta_{new,i}})$$

Where:

$B_{y,adjusted,i}$	Adjusted quantity of biomass used in the absence of the project activity (tonnes/year/vintage)
$B_{y,appliance}$	Average annual biomass consumption per appliance (tonnes/year) (remains fixed throughout the crediting period)

L_y	Leakage Correction Factor (remains fixed throughout the crediting period)
$N_{y,i}$	Number of appliances operating per year and vintage
η_{old}	Efficiency of the system being replaced, measured using representative sampling methods or based on referenced literature values (fraction) (remains fixed throughout the crediting period)
$\eta_{new,i}$	Efficiency of the system

Number of appliances operating per year ($N_{y,i}$):

$$N_{y,i} = \sum_{j=1}^{Ny,i} n_{y,j} \cdot t_{y,j}$$

Where:

$n_{y,j}$	Appliance operating per year and vintage
$t_{y,j}$	Fraction of operation time per SAVE80 system per vintage (months/months per year)

Total Emission Reductions for this Monitoring Period are summarised in the table below:

Parameter	Unit	Value
$B_{yappliance}$	t/a	4.6534
L_y		0.99
$N_{y,i}$		4,921.46
$B_{yadjusted,i}$	t	22,672.52
η_{old}		0.1
$\eta_{new,i}$		0.3635
$B_{y,savings}$	t	16,434.64
$f_{NRB,\,y}$		0.77
$NCV_{biomass\ (TJ7t)}$	TJ/t	0.015
$EF_{projected\ fossil\ fuel}$	t CO2/TJ	71.5
$ER_{y(monitoring\ period\ 6)}$	**t CO2e**	**13,572**

Note:
$N_{y,i}$ ("stove-years") is calculated by summing up the number of appliances operating / in use ($n_{y,j}$, i.e. number of systems delivered adjusted for drop-outs and Standard error) multiplied with their operational time $t_{y,j}$. Please refer to the CER calculation spreadsheet.

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

Not applicable, as methodology ASM II.G., ver. 1 does not consider project emissions.

E.3. Calculation of leakage emissions

Leakage Correction Factor L_y as determined ex-ante and stated in the registered PDD was applied to the project activity to calculate Emission Reductions of this Monitoring Period.

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

	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	Total amount
Total	**13,572**	Not applicable	Not applicable	0	**13,572**	**13,572**

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

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante (t CO_2e)
13,572	34,027

E.6. Remarks on increase in achieved emission reductions

The actual GHG emission reductions achieved is not greater than the amount based on the ex-ante estimation in the registered PDD. The reason is that compared to the estimates in the PDD,

- the number of appliances deployed and recorded in the database (SAVE 80 system) were less than originally planned
- no drop-outs were assumed in the ex-ante calculation.

Hence the CER generated in the monitoring period is less than estimated value in registered PDD.