Monitoring report form for CDM programme of activities (Version 03.0)

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

MONITORING REPORT		
Title of the PoA	Improved cookstove program in Bangladesh supported by the Republic of Korea	
UNFCCC reference number of the PoA	10431	
Version numbers of the PoA-DD applicable to this monitoring report	4.0	
Version number of this monitoring report	3.0	
Completion date of this monitoring report	06/04/2020	
Monitoring period number	Second Monitoring Period	
Duration of this monitoring period	11/09/2018 – 10/09/2019 (both days inclusive)	
Monitoring report number for this monitoring period	1.0	
Coordinating/managing entity	Ecoeye Co., Ltd.	
Host Parties	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	Bangladesh	Yes
Applied methodologies and standardized baselines	Approved Methodology:AMS II.G. – "Energy efficiency measures in thermal applications of non-renewable biomass" (version 08.0) Standardized Baseline: Not applicable	
Sectoral scopes	Sectoral Scope 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
	NA	355,543 tCO_2e
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	1,616,688[1] tCO_2e	

[1] Refer "Ex-ante Estimation" tab under ER Calculator.

PART I Monitoring of programme of activities (PoA)

SECTION A. Description of PoA

A.1. General description of PoA

>>

The PoA involves distribution of biomass based improved cookstoves ("ICS") to households / SMEs in Bangladesh.

Biomass accounts for 90% of Bangladeshi households' energy needs with fuelwood being used in around 84% of households for cooking purposes (section 1.5, page 8, Country Action Plan for Clean Cookstoves). Also, more than 90% of households still use traditional stoves for cooking[2].

The current cooking practice in Bangladesh is the use of "three-stone" cooking stove, popularly known as traditional stoves. 98–99% of Bangladesh rural population burns biomass fuels by using traditional cookstoves for cooking and heating. Households generally construct traditional cookstoves themselves with locally available materials and use biomass fuels[3].

As per World Bank Report, ~95 percent of Bangladeshi households collect or purchase biomass to cook all or part of their meals, mainly using fixed clay stoves. The inherent inefficiency of such stoves, combined with the high moisture content of biomass cooking fuels, results in incomplete combustion, producing IAP[4]. Thus, biomass combustion with traditional cookstoves causes substantial environmental and health harm.

The PoA attempts to address the aforesaid issues, by effecting widespread adoption of ICS to households/SMEs across Bangladesh. These ICS burn fuel more efficiently and are designed to reduce smoke, PM and other gaseous emissions, thus creating cleaner indoor air for women and children. Due to their higher thermal efficiency relative to traditional stoves, ICS reduce the amount of non-renewable biomass fuel consumption for meeting the similar thermal energy needs. A reduction in consumption of non-renewable biomass contributes towards reduction in GHG emissions into the atmosphere. Thus, ICS reduce GHG emissions through their improved thermal efficiency as compared to the traditional/ baseline stoves.

This PoA is managed by Ecoeye Co., Ltd. (EECL) as the Coordinating/Managing Entity (CME) and focal point for communications with CDM Executive Board. EECL is a company registered in the Republic of Korea, under company number 314 81 73570, whose registered office is at B-1503, 70 Dusan-ro, Geumcheon-gu, Seoul, Korea. EECL coordinates with the CPA Implementers for managing the PoA. EECL, SK Securities Investment Asia Limited and/or other Korean Entity(ies) provide all the implementation costs including the operation and maintenance costs for the CPA implementation to ensure that the ICS are available at an affordable price to the potential users.

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 cookstove program in Bangladesh supported by the Republic of Korea – CPA # Generic CPA 01 Date 21/06/2018	Version 4.0 Date 21/06/2018	Sectoral Scope 3: Energy Demand	AMS II.G.: "Energy efficiency measures in thermal applications of non-renewable biomass" (version 08.0) Standardized Baseline: Not applicable

[2] Country Action Plan for Clean Cookstoves, November 2013, Power Division, Ministry of Power, Government of the People's Republic of Bangladesh, page 39

[3] Peer review paper published in PNAS, July 3, 2012, vol. 109, no. 27, 10815–10820, "Low demand for non-traditional cookstove technologies" by Mobarak et el

[4] Special Report - Restoring Balance: Bangladesh's Rural Energy Realities, Executive Summary, page xx

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)
Improved cookstove program in Bangladesh supported by the Republic of Korea – CPA 01 10431-P1-0001-CP1	Version 4.0 Date 21/06/2018	Improved cookstove program in Bangladesh supported by the Republic of Korea – CPA # Generic CPA 01 Date 21/06/2018	Fixed 31/08/2018 – 30/08/2028	Yes

A.2. Coordinating/managing entity

>>
Ecoeye Co., Ltd.

Ecoeye Co., Ltd., SK Securities Investment Asia Limited and/or other Korean Entity(ies) have fully sponsored the ICS to make ICS affordable to beneficiaries, as well covered the cost of operation and management of the CPAs in a financially sustainable condition.

SECTION B. Implementation of PoA

B.1. Description of implemented PoA

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Ecoeye Co., Ltd. (EECL) is the CME of the PoA. EECL managed the following responsibilities as the CME of the implemented PoA:

- EECL managed the PoA besides financing the PoA implementation costs.
- EECL identified Bangladesh Bondhu Foundation (BBF) as the CPA Implementor for CPA 10431-P1-0001-CP1 and established CER ownership agreement with BBF;
- EECL performed cross-checks on the Bondhu Chulha installation information received against Sales / Installation records received from the BBF.
- EECL performed the QA/QC of the monitoring data and ER calculations.
- EECL contracted the Designated Operational Entities (DoEs) for validation / verification of the PoA/CPA.
- Training and capacity development of BBF/local partners as required.

Bangladesh Bondhu Foundation (BBF) is the CPA implementer of the implemented CPA 01 (10431-P1-0001-CP1) and performed the following responsibilities:

- BBF identified local partners for manufacturing and installation of ICS;
- BBF along with local partner executed the CER ownership agreement with users to establish BBF/EECL as the CER beneficiary;
- The BBF installed project Bondhu Chulha through a network of local partners and collected relevant information required by the registered monitoring plan.
- Further BBF, Implemented the monitoring plan, determined the sample size, conducted ex-post inspections, monitoring surveys and tests as per registered monitoring plan, performed QA/QC of collected data and calculated emissions reductions.
- Conducted training and capacity development of local partners as required, towards Bondhu Chulha production, installation, maintenance and after-sales service, data collection at the point of installation or otherwise

The local partners performed following responsibilities

- Manufactured / installed Bondhu Chulha at beneficiary households.
- Provided after sales maintenance services to ICS beneficiaries.
- Collected data at the point of installation and as requested by BBF.

Thus, EECL and BBF ensured that the PoA Operational and Management Plan as given in section B of the registered PoA-DD is duly implemented for the concerned CPA.

B.2. Post-registration changes to PoA

B.2.1. Corrections

>>
N/A

B.2.2. Inclusion of monitoring plan

>>
N/A

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

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N/A

B.2.4. Changes to programme design

>>
N/A

B.2.5. Changes specific to afforestation or reforestation activities

>>
N/A

PART II Monitoring of CPAs

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This Monitoring Report covers CPA 10431-P1-0001-CP1. This CPA follows the generic CPA as identified in section A.1.2, Part I of this monitoring report above.

SECTION C. Implementation of CPAs

C.1. Description of implemented CPAs

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

The purpose of the CPA 10431-P1-0001-CP1 is dissemination of high efficiency biomass (wood-fuel) fired ICSs (technology/measure) to replace the existing traditional (wood-fuel) cookstoves/three stone fires in beneficiary households/SMEs in Bangladesh. The higher thermal efficiency of these ICSs, results in reduction of non-renewable biomass consumption for meeting the similar thermal energy needs as that in the baseline. A reduction in consumption of non-renewable biomass contributes towards reduction in GHG emissions into the atmosphere. Thus, ICS reduce GHG emissions through their improved thermal efficiency as compared to traditional/ baseline stoves.

EECL, SK Securities Investment Asia Limited and/or other Korean Entity(ies) provide for all implementation costs for the CPA. EECL, SK Securities Investment Asia Limited and/or other Korean Entity(ies) have fully sponsored the stoves to make ICS affordable to households, as well as provided all the operation & maintenance costs of ICS production and distribution to CPA implementers, to operate the CPA in a financially sustainable condition.

b) Description of the installed technology, technical processes and equipment

The CPA includes dissemination of 1 Pot and 2 Pot (models), high efficiency wood-fuel ICS (Bondhu Chulha) for meeting the thermal energy needs of beneficiary households/SMEs. The Bondhu Chulhas replace traditional inefficient wood-fuel cookstoves/3-stone fires in the baseline.

Bondhu Chulha are designed to increase heat transfer to the cooking pot, while being suitable for traditional utensils and cooking habits of people in Bangladesh. The improvement in thermal efficiency is achieved by optimizing the dimensions of the Bondhu Chulha combustion chamber and ensuring effective airflow to aid complete combustion of biomass.

Description (Technical specification)	1 Pot Bondhu Chulha	2 Pot Bondhu Chulha
Portable / Fixed	Fixed	Fixed
Fuel grate present (Yes/no)	Yes	Yes
Chimney Present (Yes/no)	Yes	Yes
Fuel Type	Wood-fuel	Wood-fuel
Fabrication Material	Cement concrete	Cement concrete
Design Thermal Efficiency (Fraction)	0.3400	0.3462
Design Operational Lifetime	5-7 years	5-7 years

c) Information on implementation and actual operation of the CPAs including relevant dates for the CPA(s) (e.g. construction, commissioning, continued operation periods, etc.);

The following table details the implementation and actual operation status of the CPA along with technology involved:

CPA Ref No.	Type of ICS eligible	ICS models included	Total number of ICS
10431-P1-0001-CP1	Wood fuel	1 Pot	371,873
		2 Pot	199,885
Grand Total			571,758

d) Relevant dates

CPA	10431-P1-0001-CP1
Start Date (as per registered CPA-DD)	15/02/2018
Crediting Period Start Date	31/08/2018
Date of first stove installed under the CPA	15/02/2018

The ICSs are in continued operation since their installation.

C.2. Location of CPAs

>>
Host Party(ies): Bangladesh
Region/State/Province: All across Bangladesh
City/Town/Community: All across Bangladesh
Physical Geographical location: The geographical boundary of Bangladesh is depicted by the map given below[5].

[5] https://www.cia.gov/library/publications/the-world-factbook/attachments/maps/BG-map.gif

Each ICS has a unique serial number. The same is recorded in the database to trace the ICS later and avoid double counting. Further, for each ICS included under each CPA, the address of the user is recorded at the time of ICS installation. Thus, location of each ICS in CPA distribution database can be traced. The system of unique serial number for each ICS unit along with its location serves toward avoiding double counting of ICS under the PoA as well as ensures unique identification of the ICS as well as CPA.

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

>>
N/A

C.3.2. Corrections

>>
N/A

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

>>
N/A

C.3.4. Inclusion of monitoring plan

>>
N/A

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

>>
N/A

C.3.6. Changes to project design

>>
N/A

C.3.7. Changes specific to afforestation or reforestation CPA

>>
N/A

SECTION D. Description of monitoring system of CPAs

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BBF maintains a CPA database where information of each Bondhu Chulha installed under the CPA is recorded. BBF directly or via its local partners collects the agreement cum sales record for each Bondhu Chulha at the point of installation. The Sales Record contains:

1) Name of Customer
2) Address/Location of the customer, including contact details, if any
3) Unique identification number of Bondhu chulha (serial number)
4) Bondhu Chulha Model (1 Pot / 2 Pot)
5) Bondhu Chulha Date of installation
6) Type of stove replaced by Bondhu Chulha and fuel used in baseline
7) Confirmation on presence of only one Bondhu Chulha in the project household

The aforesaid data is reviewed by the BBF database team (at head office) and archived, as deemed appropriate. In case of any concern, the BBF database team coordinates with BBF Operations (District Managers / Assistant District Managers) to collect / rectify any information in the sales record. The BBF Operation team (Field Officers) conduct post installation, inspection visits to Bondhu Chulha users to confirm its location, proper installation and presence of only one Bondhu Chulha in the project household/SMEs. The aforesaid ensures that the Bondhu Chulha Installation database is free from any material errors.

All other monitoring activities are carried out at the CPA level on a sampling basis as explained in section E.3 below.

Training were conducted / Monitoring team with prior monitoring experience was selected to ensure that monitoring staff had the appropriate skills and expertise to administer relevant surveys / tests and quality checks, ensuring the integrity of information flow to the CME.

SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

Data/Parameter	$B_{old,p}$
Unit	tonnes/person/year
Description	Annual quantity of woody biomass that would have been used per person in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices
Source of data	Registered CPA-DD section B.4.2
Value(s) applied	0.50
Choice of data or measurement methods and procedures	Default value specified by the methodology AMS II.G. version 8.0
Purpose of data/parameter	To calculate baseline emission (For parameter $B_{old,HH}$)
Additional comments	-

Data/Parameter	$N_{p,HH}$
Unit	Number
Description	Average number of persons served per household prior to the project implementation
Source of data	Registered CPA-DD section B.4.2
Value(s) applied	4.6
Choice of data or measurement methods and procedures	Published information / literature defining the average household size in the project region available at: https://www.unicef.org/bangladesh/MICS_Final_21062015_Low.pdf

Purpose of data/parameter	To calculate baseline emission (For parameter $B_{old,HH}$)
Additional comments	-

Data/Parameter	$B_{old,HH}$
Unit	tonnes/household/year
Description	Annual quantity of woody biomass that would have been used in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices
Source of data	Calculated
Value(s) applied	2.3
Choice of data or measurement methods and procedures	Calculated as = $B_{old,HH} * N_{p,HH}$
Purpose of data/parameter	To calculate baseline emission (For parameter $B_{old,i,j}$)
Additional comments	As only one ICS unit is distributed per household, hence $B_{old,HH} = B_{old,i,j}$ The presence of multiple project ICS in a household determined ex-post during surveys and the total ICS population discounted by the fraction of sampled household found using more than one project ICS.

Data/Parameter	$f_{NRB,y}$
Unit	Fraction
Description	Fraction of woody biomass saved by the project activity during year y that can be established as non-renewable biomass
Source of data	Registered CPA-DD section B.4.2
Value(s) applied	0.843
Choice of data or measurement methods and procedures	Calculated as per para 27 – 30 of AMS II.G. version 08.0 and Tool: Calculation of the fraction of non-renewable biomass, EB 97, Annex 9
Purpose of data/parameter	To calculate baseline emission
Additional comments	-

Data/Parameter	$EF_{project\_fossilfuel}$
Unit	tCO_2e/TJ
Description	Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers
Source of data	Registered CPA-DD section B.4.2
Value(s) applied	81.6
Choice of data or measurement methods and procedures	Default value specified by the methodology AMS.II-G ver 08.0, equation (2) on page 5
Purpose of data/parameter	To calculate baseline emission
Additional comments	-

Data/Parameter	LAF_y
Unit	Fraction
Description	Leakage adjustment factor
Source of data	Registered CPA-DD section B.4.2

Value(s) applied	0.95
Choice of data or measurement methods and procedures	As per the methodology AMS II.G ver 08.0, Gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required
Purpose of data/parameter	Leakage calculation
Additional comments	-

Data/Parameter	$NCV_{biomass}$
Unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass, briquettes or charcoal used in project devices.
Source of data	Registered CPA-DD section B.4.2
Value(s) applied	0.015
Choice of data or measurement methods and procedures	IPCC default for wood fuel, 0.015 TJ/tonne, based on the gross weight of the wood that is 'air-dried' has been used as fuel used in project device is also woody biomass.
Purpose of data/parameter	To calculate baseline emission
Additional comments	-

Data/Parameter	$\eta_{old,i,j}$
Unit	Fraction
Description	Efficiency of pre - project device, which is a three-stone fire using fuelwood (not charcoal), or a conventional device with no improved combustion air supply or flue gas ventilation
Source of data	Registered CPA-DD section B.4.2
Value(s) applied	0.11
Choice of data or measurement methods and procedures	Calculated
Purpose of data/parameter	To calculate baseline emission
Additional comments	-

E.2. Data and parameters monitored

Data/Parameter	$N_{y,i,j}$
Unit	Number
Description	Number of project devices of type i and batch j operating during year y
Measured/calculated/ default	Calculated
Source of data	Sales database and monitoring survey
Value(s) of monitored parameter	**$N_{y,i,j}$** / **Monitored Value** $N_{y,1\ Pot,\ 2018}$ / 42,211 $N_{y,2\ Pot,\ 2018}$ / 35,930 $N_{y,1\ Pot,\ 2019}$ / 325,825 $N_{y,2\ Pot,\ 2019}$ / 161,191
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	At least once every two years (biennial)

Calculation method (if applicable)	The CPA implementer is maintaining database of all the ICS installed. A usage monitoring survey was conducted in September & October 2019 to determine the number of operating stoves of type i and batch j on a sampling basis. The formula used to calculate the monitored value of operational ICS of type i and batch j is as follows: $N_{y,i,j} = (n_{i,j,operational} / n_{i,j,total}) * N_{y,i,j,installed}$ Where: N = total number of stoves in population n = number of samples monitored
QA/QC procedures	A 95 /10 confidence / margin of error is applied for the sampling parameter as per para 22 of Standard: Sampling and surveys for CDM project activities and programmes of activities, Version 07.0
Purpose of data/parameter	To calculate baseline emissions
Additional comments	All data sources will be archived till two years after the end of the crediting period. At the point of Bondhu Chulha installation, the presence of existing Bondhu Chulha, if any, is checked in the Sales record. Subsequent (second) Bondhu Chulha, if any, is not included in the CPA. Also, the presence of one Bondhu Chulha per household is further cross-checked on sampling basis during the Ex-post monitoring survey. The total Bondhu Chulha population is discounted by the fraction of sampled household found using more than one Bondhu Chulha. In the current monitoring no sample with more than one Bondhu Chulha was found.

Data/Parameter	μ_y
Unit	Fraction
Description	Adjustment to account for any continued use of pre-project devices during the year y
Measured/calculated/ default	Calculated
Source of data	Monitoring survey records
Value(s) of monitored parameter	**μ_y** / **Monitored Value** $\mu_{y\ 1\ Pot}$ / 1.00 $\mu_{y\ 2\ Pot}$ / 1.00 No baseline stove was found being used in the monitored samples during the monitoring survey conducted in September & October 2019.
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	At least once every two years (biennial)
Calculation method (if applicable)	The sampled households were checked for presence of baseline stove and if it was being used along with project stove for cooking. • For samples where baseline stove was found not being used, μ_y = 1.0. • For samples where the baseline stove is found to be in use, has been determined as: ○ ratio of frequency of usage (i.e. number of meals cooked on ICS Vs total number of meals cooked on ICS and baseline stove)
QA/QC procedures	A 95 /10 confidence / margin of error is achieved for the sampling parameter as per para 22 of Standard: Sampling and surveys for CDM project activities and programmes of activities, Version 07.0
Purpose of data/parameter	To calculate baseline emissions

Additional comments	All data sources will be archived till two years after the end of the crediting period.

Data/Parameter	$\eta_{new,i,j}$
Unit	Fraction
Description	Efficiency of the project device of each type i and batch j
Measured/calculated/ default	Measured
Source of data	Efficiency test records and results

Value(s) of monitored parameter

$\eta_{new,i,j}$	Monitored Value	Comment (determined using option C of para 25 of methodology)
$\eta_{new,\ 1\ Pot,\ 2018}$	0.3321	Based on monitored value $\eta_{new,\ 1\ Pot,\ 2018(age\ 2)}$
$\eta_{new,\ 2\ Pot,\ 2018}$	0.3366	Based on monitored value $\eta_{new,\ 2\ Pot,\ 2018(age\ 2)}$
$\eta_{new,\ 1\ Pot,\ 2019}$	0.3331	Based on monitored value $\eta_{new,\ 1\ Pot,\ 2018(age\ 1)}$
$\eta_{new,\ 2\ Pot,\ 2019}$	0.3375	Based on monitored value $\eta_{new,\ 2\ Pot,\ 2018(age\ 1)}$

Monitoring equipment

The following equipment was used for conducting WBTs

For WBTs conducted in February 2019 (age 1)			
Specifications	Digital Thermometer	Digital Weighing Scale	Digital Moisture Meter
Manufacturer	Riters	Venezia	Dr. Meter
Model/Serial No.	TP300	SF-550	MD912 (1702074398, 1702074434)
No. of units	2	2	2
Accuracy	+/- 1^0C	0.5g	0.5%

For WBTs conducted in September 2019 (age 2)			
Specifications	Digital Thermometer	Digital Weighing Scale	Digital Moisture Meter
Manufacturer	Yuyao Shuanghe	MEGA	Smart Sensor
Model/Serial No.	SH-113V1	T-20 (1145, 204, 208)	AR971 (03402507, 03402745, 03402739)
No. of units	3	3	3
Accuracy	+/- 1^0C	Level III	+/- 2%

The equipment was newly purchased (08 October 2018 for WBTs conducted in February 2019, 08 September 2019 for WBTs conducted in September 2019) at the time of use so measurements were done with the necessary guarantees.

Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	AMS II.G., para 25, Option (c) as specified in the PoA-DD has been used to determine $\eta_{new,i,j}$ WBT protocol as available at GACC website has been used for testing the thermal efficiency
QA/QC procedures	The equipment used for testing was newly purchased
Purpose of data/parameter	To calculate baseline emissions

Additional comments	All data sources will be archived till two years after the end of the crediting period. In the concerned monitoring period, for the ICS' installed in 2019 (which are in first year of their age), the value of $\eta_{new,i,2019}$ has been determined using the value monitored for $\eta_{new,i,2018(age\ 1)}$. This is in line with option c of para 25 of the methodology wherein the efficiency drop for a representative sample of the first batch (ICS installed in 2018) of project devices is applicable to all subsequent batches (in this case, ICS installed in 2019) for a given age (in this case, age 1). In the concerned monitoring period, for the ICS' installed in 2018 (which are in second year of their age), the value $\eta_{new,i,2018}$ has been determined using the value monitored for $\eta_{new,i,2018(age\ 2)}$, in line with option c para 25 of the methodology. The efficiency drop for all ages has been determined with respect to the rated efficiency specified in registered CPA-DD and has been applied accordingly. Please refer ER sheet for details. Thus, the CME/PP, monitored the thermal efficiency of 1-pot and 2-pot stoves models, in line with option (c) para 25 of meth and shall continue with the same approach henceforth.

Data/Parameter	Date of commissioning of project device i
Unit	Date
Description	Actual date of commissioning of project device
Measured/calculated/ default	Measured
Source of data	ICS Installation database
Value(s) of monitored parameter	Refer the ICS installation database
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Recorded at the time of installation of project devices
Calculation method (if applicable)	Not applicable
QA/QC procedures	N/A
Purpose of data/parameter	To calculate baseline emissions
Additional comments	All data sources will be archived till two years after the end of the crediting period.

E.3. Implementation of sampling plan

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a. List of CPA to which the sampling plan was applied

At present there is only one CPA implemented and covered under this monitoring report. The number of units installed under the CPA is as follows:

CPA Ref No.	Type of ICS eligible under CPA	Total number of ICS in the CPA	CPA monitoring period covered under this PoA monitoring period
10431-P1-0001-CP1	Wood fuel	571,758	11/09/2018 – 10/09/2019 (both days inclusive)

b. Description of implemented sampling design

Due to the large number of ICS installed under the CPA it was not economically feasible to monitor each individual ICS unit installed, therefore, a representative sampling was undertaken as part of the CPA Sampling Plan. The Sampling Standard version 07.0 (paragraph 22) mandates application of 95/10 confidence/precision for CPAs solely composed of micro-scale CDM units hence the same was applied as a conservative measure despite the methodology taking precedence.

The objective of the sampling was to obtain an unbiased and reliable estimate of the proportion or mean value of the following parameters over the course of the monitoring period, and with 95/10 confidence/precision. The sampling plan consists of monitoring the following parameters as mentioned below:

S.No.	Monitoring Parameter	Description of Monitoring Parameter
1.	$N_{y,i,j}$	Number of project devices of type i and batch j operating during year y
2.	μ_y	Adjustment to account for any continued use of pre-project devices during the year y
3.	$\eta_{new,i,j}$	Efficiency of the project device of each type i and batch j

The target population is the total ICS population served under the CPA (and covered under the monitoring report), and the sampling frame consists of aggregated data of end-users of the ICS as recorded in the CPA Databases.

The sampling was conducted using stratified random sampling technique over the sampling frame. The ICS in the sampling frame were stratified by ICS model i (1 pot or 2 pot) and batch j i.e. year of installation (2018 and 2019). Thus, the population was categorised into applicable sampling strata for identifying samples for various monitoring parameters, as applicable. The sample size was calculated as per section B.5.2 of the registered CPA-DD. The expected parameter values (mean, standard deviation and proportion) have been determined based on project developer's knowledge and experience as per para 12(b) and 12(c) of the Sampling and surveys for CDM project activities and programmes of activities, Version 07.0

Parameter	Total population (N)	Expected results	Reliability	Sample Size (n) required[6]	Samples covered during monitoring
$\eta_{new,1\ pot,\ 2018(age\ 1)}$	46,048	0.3350 (mean); 0.0335 (SD)	95/10	4	5
$\eta_{new,2\ pot,\ 2018(age\ 1)}$	38,694	0.3450 (mean); 0.0345 (SD)	95/10	4	4
$\eta_{new,1\ pot,\ 2018(age\ 2)}$	46,048	0.3300 (mean); 0.0330 (SD)	95/10	4	4
$\eta_{new,2\ pot,\ 2018(age\ 2)}$	38,694	0.3400 (mean); 0.0340 (SD)	95/10	4	5
$N_{y,1\ pot,\ 2018}$	46,048	0.90 (proportion)	95/10	4	12
$N_{y,2\ pot,\ 2018}$	38,694	0.90 (proportion)	95/10	3	14
$N_{y,1\ pot,\ 2019}$	325,825	0.90 (proportion)	95/10	25	48
$N_{y,2\ pot,\ 2019}$	161,191	0.90 (proportion)	95/10	13	42
$\mu_{y,1\ pot}$	371,873	0.90 (proportion)	95/10	28	59
$\mu_{y,2\ pot}$	199,885	0.90 (proportion)	95/10	16	55

The sample size is determined using the following formulas:

[6] In case of mean parameters, the 'sample size required' mentioned above is the Student T-distribution adjusted sample size, as the initially calculated sample size was less than 30. This is in accordance with para 13 of Sampling and surveys for CDM project activities and programmes of activities, Version 07.0

$$n \geq \frac{z^2 * N * V}{(N-1) * precision^2 + z^2 * V}$$

Where,

n = number of ICS to be sampled

N = Total number of ICS in the population

Z = Constant referring to level of confidence (1.96 for 95 % confidence)

Precision = Required precision (e.g. 10% = 0.1)

For Proportion based parameters ($N_{y,i,j}$ and μ_y)

$V = \frac{SD^2}{\overline{p}^2}$ Where:

$$SD^2 = \frac{\sum_{i=1}^{k} g_i * p_i * (1 - p_i)}{N}$$

$$\overline{p} = \frac{\sum_{i=1}^{k} g_i * p_i}{N}$$

Where,

g_i = weight of strata i in the population

p_i = expected proportion of strata i in the population

k = total number of strata in the population

For Mean based parameters ($\eta_{y,i,j}$)

$$V = \left(\frac{SD}{Mean} \right)^2$$

Where

$$SD^2 = \frac{\sum_{i=1}^{k} g_i * SD_i^{\,2}}{N}$$

$$Mean = \frac{\sum_{i=1}^{k} g_i * m_i}{N}$$

Where

SD_i = expected standard deviation of strata i in the population

m_i = expected mean of strata i in the population

Each ICS in the target strata, uniquely identifiable by its Stove ID number, was allocated a sample number, starting at 1 and increasing up to the total number of ICS in the strata (1 to 371,873 for 1 Pot population, and 1 to 199,885 for 2 Pot population). Random numbers were generated (using online random number generator and the numbers obtained were used to identify the samples from the corresponding strata for monitoring. A higher number of samples were selected for monitoring than that required to ensure that the desired precision / confidence is achieved as well as have cover for no-responses. The following tables demonstrate the sample size determined:

Monitoring Parameter	Stove Efficiency $\eta_{new,i,2018(age\ 1)}$			
Sampling Frame requirement as per PoA-DD	Given stove model and vintage population			
Sampling approach	Stratified random sampling across stove model and vintage			
Sampling Category	Sampling frame size	Expected Mean Efficiency(Fraction)	Expected SD	Calculated Sample Size
1 Pot,2018(age 1)	46048	0.3350	0.0335	4
2 Pot,2018(age 1)	38694	0.3450	0.0345	4
Sample size determination				
Estimated efficiency (mean)				0.34
Estimated Standard Deviation of efficiency (SD)				0.03
$V_{mean} = (SD/mean)^2$				0.01
Minimum Sample Size required (efficiency)				4
tDistribution sample size adjustment			Iteration 1	11
			Iteration 2	5
			Iteration 3	8
			Iteration 4	6
			Iteration 5	7
			Iteration 6	6
			Iteration 7	7

Monitoring Parameter	Stove Efficiency $\eta_{new,i,2018(age\ 2)}$			
Sampling Frame requirement as per PoA-DD	Given stove model and vintage population			
Sampling approach	Stratified random sampling across stove model and vintage			
Sampling Category	Sampling frame size	Expected Mean Efficiency(Fraction)	Expected SD	Calculated Sample Size
1 Pot,2018(age 2)	46048	0.3300	0.0330	4
2 Pot,2018(age 2)	38694	0.3400	0.0340	4
Sample size determination				
Estimated efficiency (mean)				0.33
Estimated Standard Deviation of efficiency (SD)				0.03
$V_{mean} = (SD/mean)^2$				0.01
Minimum Sample Size required (efficiency)				4
tDistribution sample size adjustment			Iteration 1	11
			Iteration 2	5
			Iteration 3	8
			Iteration 4	6
			Iteration 5	7
			Iteration 6	6
			Iteration 7	7

Monitoring parameter(s)		Stove Operating Fraction for determination of $N_{y,i,j}$		
Sampling frame(s)		Given stove model and vintage population		
Sampling approach		Stratified random sampling across stove model and vintage		
Stove Type	Year	Stove population	Expected operational proportion (SoF)	Calculated Sample Size (n)
1 Pot	2018	46048	0.90	4
2 Pot	2018	38694	0.90	3
1 Pot	2019	325825	0.90	25
2 Pot	2019	161191	0.90	13
Sample size determination				
Estimated SOF (p)				0.90
Estimated Standard Deviation of SOF (SD)				0.300
$V_{SOF} = (SD/p)^2$				0.111
Sample Size required (SOF)				43

Monitoring parameter(s)	Utilization of Project stoves - μ_y		
Sampling frame(s)	Given stove model population		
Sampling approach	Stratified random sampling across stove models		
Sampling Population (i)	Stove population	Expected value	Calculated Sample Size (n)
1 Pot	371873	0.90	28
2 Pot	199885	0.90	16
Sample size determination			
Estimated utilization (p)			0.90
$V_{Utilization} = p(1-p)/p^2$			0.11
Minimum Sample Size required (days of utilization)			43

c. Collected data;

Data was collected for $N_{y,i,j}$ and μ_y following a specially design survey form. The information collected was introduced into an electronic database, the CPA Monitoring Record. The survey forms were designed to allow the surveyor to collect the necessary information from field visit for

the ER calculations. The monitoring surveys (for determining $N_{y,i,j}$ and μ_y) were done during September-October 2019.

For the thermal efficiency of the stoves to determine $\eta_{new,i,j}$, water boiling tests were conducted using WBT testing protocol given by GACC (WBT 4.2.3). The WBTs (for measuring $\eta_{new,i,2018(age\ 1)}$) were conducted during February 2019 and WBTs (for measuring $\eta_{new,i,2018(age\ 2)}$) were conducted during September 2019.

d. Analysis of data collected and confidence/precision achieved;

Analysis of the data monitored through sampling revealed the following results:

Sampling Constants	Values
Monitoring period start	11/09/18
Monitoring period end	10/09/19
Level of Sampling	CPA
Confidence (%) (90 or 95)	95%
Margin of Error (%)	10%
Z value	1.960

Monitoring Parameter	Stove Efficiency $\eta_{new,i,2018(age\ 1)}$			
Monitoring results				
Sampling Category	Sampling frame size	Monitored Sample Size	Monitored Efficiency (Fraction)	Monitored Standard Deviation
1 Pot,2018(age 1)	46048	5	0.3331	0.0018
2 Pot,2018(age 1)	38694	4	0.3375	0.0017
Reliability Check				
Samples Monitored				9
Mean Efficiency				0.3351
Standard error of mean				0.06%
Relative precision (Margin of error) (%)				0.01%
Result				Ok, reliability level met
Lower Bound confidence value				Not applicable

Monitoring Parameter	Stove Efficiency $\eta_{new,i,2018(age\ 2)}$			
Monitoring results				
Sampling Category	Sampling frame size	Monitored Sample Size	Monitored Efficiency (Fraction)	Monitored Standard Deviation
1 Pot,2018(age 2)	46048	4	0.3321	0.0022
2 Pot,2018(age 2)	38694	5	0.3366	0.0016
Reliability Check				
Samples Monitored				9
Mean Efficiency				0.3341
Standard error of mean				0.07%
Relative precision (Margin of error) (%)				0.01%
Result				Ok, reliability level met
Lower Bound confidence value				Not applicable

Monitoring parameter(s)	Stove Operating Fraction for determination of $N_{y,i,j}$			
Monitoring results				
Stove Type	Year	Sampling frame size	Monitored Sample Size ($n_{i,j,total}$)	Monitored Operating Fraction ($n_{i,j,operational}/n_{i,j,total}$)
1 Pot	2018	46048	12	0.92
2 Pot	2018	38694	14	0.93
1 Pot	2019	325825	48	1.00
2 Pot	2019	161191	42	1.00
Reliability Check				
Samples Monitored				116
SoF Measured				0.9885
Standard Error of SoF				0.79%
Relative precision (Margin of error)				1.57%
Result				Ok, reliability level met
Lower Bound confidence value				Not applicable

Monitoring parameter(s)	Utilization of Project stoves - μ_y		
Monitoring results			
Sampling Population	Sampling frame size	Monitored Sample Size	Monitored Utilization
1 Pot	371873	59	1.00
2 Pot	199885	55	1.00
Reliability Check			
Samples Monitored			114
Utilization Measured			1.00
Standard Error of Utilization			0.00%
Relative precision (Margin of error)			0.00%
Result			Ok, reliability level met
Lower Bound confidence value			Not applicable

For detailed calculations refer ER calculator, worksheet 'Monitoring Survey' and 'WBT Summary'.

1. **Demonstration of whether the samples were randomly selected and are representative of the population.**

ICS were selected randomly after arranging them in chronological order of date of sale and assigning a sampling number to each ICS in each strata. Random numbers were generated using online random number generator available at http://stattrek.com/statistics/random-number-generator.aspx separately for each strata and the ICS corresponding to random number received were selected from sampling strata for monitoring. The approach ensured that each ICS in the sampling strata and the target population had equal chances of being selected and the samples picked represent the ICS 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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The emission reductions are calculated as follows:

As per the registered PoA-DD, emission reductions for the SSC-CPA (10431-P1-0001-CP1) has been calculated as per the following formulas given in the applicable meth, AMS-II.G. version 08.0;

$$ER_y = \sum_i \sum_j ER_{y,i,j} - LE_y$$

Where

i	=	Indices for the situation where more than one type of project device is introduced to replace the pre-project devices[7]
j	=	Indices for the situation where there is more than one batch of project device
ER_y	=	Emission reductions during year *y* in t CO_2e
$ER_{y,i,j}$	=	Emission reductions by project device of type *i and* batch *j* during year *y* in t CO_2e
LE_y	=	Leakage emissions in the year *y*

Where

$$ER_{y,i,j} = B_{y,savings,i,j} \times N_{y,i,j} \times \mu_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossil\ fuel}$$

Where

$B_{y,savings,i,j}$	=	Quantity of woody biomass that is saved in tonnes per cook stove device of type *i* and batch *j* during year *y*
$f_{NRB,y}$	=	Fraction of woody biomass that can be established as non-renewable biomass using survey methods or government data or default country specific fraction of non-renewable woody biomass (fNRB) values available on the CDM website
$NCV_{biomass}$	=	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne, based on the gross weight of the wood that is 'air-dried')

[7] For example, in some instances, full replacement of the pre-project device would require the implementation of more than one project device (e.g. one stove suitable for cooking and the other stove suitable for cooking/boiling water)

$EF_{projected\_fossilfuel}$ = Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 t CO_2/TJ

$N_{y,i,j}$ = Number of project devices of type *i* and batch *j* operating during year *y*

μ_y = Adjustment to account for any continued use of pre-project devices during the year *y* when applying equations 6 (fraction).

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

Where

$B_{old,i,j}$ = Annual quantity of woody biomass that would have been used in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project device type *i* and batch *j*

$\eta_{new,i,j}$ = Efficiency of the device of each type i and batch j implemented as part of the project activity.

$\eta_{old,i,j}$ = Efficiency of pre - project device, which is a three-stone fire using firewood (not charcoal), or a conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney;

$$B_{old,i,j} = B_{old,HH} = B_{old,p} \times N_{p,HH}$$

Where

$B_{old,HH}$ = Annual quantity of woody biomass that would have been used in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices

$B_{old,p}$ = Annual quantity of woody biomass that would have been used per person in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices

$N_{p,HH}$ = Average number of persons served per household prior to the project implementation

Data Ex Ante	Unit	Value	Source
$B_{old,p}$	tonnes/person/ year	0.50	Registered CPA-DD, section B.4.2
$N_{p,HH}$	Number	4.60	Registered CPA-DD, section B.4.2
$B_{old,i,j} = B_{old,HH}$	tonnes/household/ year	2.30	Registered CPA-DD, section B.4.2
$f_{NRB,y}$	Fraction	0.84	Registered CPA-DD, section B.4.2
$Ef_{project\_fossil\ fuel}$	tCO_2e/TJ	81.60	Registered CPA-DD, section B.4.2
LAF_y	Fraction	0.95	Registered CPA-DD, section B.4.2
$NCV_{biomass}$	TJ/tonne	0.015	Registered CPA-DD, section B.4.2
$\eta_{old,i,j}$	Percentage	11%	Registered CPA-DD, section B.4.2
Conversion factor	--	0.2777	GWh/TJ

Data Ex Post	Unit	Value	Source
$N_{y,\ 1\ Pot,\ 2019\ Installed}$	Number	325825	ICS Installation Database
$N_{y,\ 2\ Pot,\ 2019\ Installed}$	Number	161191	ICS Installation Database
$N_{y,\ 1\ Pot,\ 2018\ Installed}$	Number	46048	ICS Installation database
$N_{y,\ 2\ Pot,\ 2018\ Installed}$	Number	38694	ICS Installation Database
$B_{old,\ 1\ Pot,\ 2019}$	Tonnes/HH/year	2.19	Calculated
$B_{old,\ 2\ Pot,\ 2019}$	Tonnes/HH/year	2.19	Calculated
$B_{old,\ 1\ Pot,\ 2018}$	Tonnes/HH/year	2.19	Calculated
$B_{old,\ 2\ Pot,\ 2018}$	Tonnes/HH/year	2.19	Calculated
$\eta_{new\ 1\ Pot,\ age\ 0}$	Fraction	0.3400	Rated Efficiency as per Registered CPA-DD
$\eta_{new\ 2\ Pot,\ age\ 0}$	Fraction	0.3462	Rated Efficiency as per Registered CPA-DD
$\eta_{new\ 1\ Pot,\ 2018(age\ 1)}$	Fraction	0.3331	Efficiency test records and results
$\eta_{new\ 2\ Pot,\ 2018(age\ 1)}$	Fraction	0.3375	Efficiency test records and results
Efficiency Loss $_{1\ Pot,\ 2018(age\ 1)}$	Fraction	0.0069	Calculated wrt to rated efficiency
Efficiency Loss $_{2\ Pot,\ 2018(age\ 1)}$	Fraction	0.0087	Calculated wrt to rated efficiency
$\eta_{new\ 1\ Pot,\ 2018(age\ 2)}$	Fraction	0.3321	Efficiency test records and results
$\eta_{new\ 2\ Pot,\ 2018(age\ 2)}$	Fraction	0.3366	Efficiency test records and results
Efficiency Loss $_{1\ Pot,\ 2018(age\ 2)}$	Fraction	0.0079	Calculated wrt to rated efficiency
Efficiency Loss $_{2\ Pot,\ 2018(age\ 2)}$	Fraction	0.0096	Calculated wrt to rated efficiency
$\eta_{new\ 1\ Pot,\ 2018}$	Fraction	0.3321	calculated using rated efficiency and efficiency loss
$\eta_{new\ 2\ Pot,\ 2018}$	Fraction	0.3366	calculated using rated efficiency and efficiency loss
$\eta_{new\ 1\ Pot,\ 2019}$	Fraction	0.3331	calculated using rated efficiency and efficiency loss
$\eta_{new\ 2\ Pot,\ 2019}$	Fraction	0.3375	calculated using rated efficiency and efficiency loss
$B_{y,saving,\ 1\ Pot,\ 2019}$	Tonnes/year	1.464	Calculated
$B_{y,saving,\ 2\ Pot,\ 2019}$	Tonnes/year	1.473	Calculated
$B_{y,saving,\ 1\ Pot,\ 2018}$	Tonnes/year	1.461	Calculated
$B_{y,saving,\ 2\ Pot,\ 2018}$	Tonnes/year	1.471	Calculated
$Stove_{year}$	fraction	0.416	Calculated
$\mu_{y,1\ Pot}$	fraction	1.00	Monitoring survey records
$\mu_{y,2\ Pot}$	fraction	1.00	Monitoring survey records
$N_{y,1\ Pot,2019,\ operational}$	Number	325825	Sales database and monitoring survey records
$N_{y,2\ Pot,2019,\ operational}$	Number	161191	Sales database and monitoring survey records
$N_{y,1\ Pot,2018,\ operational}$	Number	42211	Sales database and monitoring survey records
$N_{y,2\ Pot,2018,\ operational}$	Number	35930	Sales database and monitoring survey records
ER_y	tCO_2	355543	Calculated
Emission Reduction (ER)	**tCO_2e**	**355543**	

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

>>

N/A

F.3. Calculation of leakage emissions

>>

N/A

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	Total amount
10431-P1-0001-CP1	355,543	0	0	0	355,543	355,543
Total	**355,543**	**0**	**0**	**0**	**355,543**	**355,543**

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)
10431-P1-0001-CP1	355,543	1,616,688
Total	**355,543**	**1,616,688**

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

>>

The ex-ante estimate for the monitoring period has been calculated as follows:

= (1,525,139[8]*(354[9]/365)) + (4,575,416[10]*(11[11]/366))

= 1,616,688 tCO_2e

F.6. Remarks on increase in achieved emission reductions

>>

There is no increase in the GHG emission reductions or net GHG removals by sinks achieved by the specific-case CPA(s) during this monitoring period.

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

>>

The CPA covered in the monitoring period is a Type II small-Scale CPA, solely composed of micro-scale units. The thermal energy saving by each of the ICS is only 0.0061 GWh_{th} which is far less than the 1.8 GWh_{th} annual energy saving limit per ICS.

[8] Ex-ante ER for year 1 as per CPA-DD (Section B.4.3)

[9] Number of monitoring days in Year 1 = Days(31-08-2019,11-09-2018)+1 = 354

Total Number of days in Year 1 = 365

[10] Ex-ante ER for year 2 as per CPA-DD (Section B.4.3)

[11] Number of monitoring days in Year 2 = Days(31-08-2020,10-09-2019)+1 = 11

Total Number of days in year 2 = 366

Appendix 1: Contact information (Additional)

Entity responsible for completing the CDM-PoA-MR-FORM	
Organization name	Climate-Secure Services
Street/P.O. Box	Club Road
Building	Pragati Apartments
City	West Delhi
State/Region	Delhi
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E-mail	info@climate-secure.com
Website	www.climate-secure.com
Contact Person	Rohit Lohia

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Document information

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

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