Monitoring report form for CDM programme of activities

(Version 02.0)

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

MONITORING REPORT		
Title of the PoA	Dissemination of improved cook stoves and generation of charcoal	
UNFCCC reference number of the PoA	PoA 10292	
Version numbers of the PoA-DD applicable to this monitoring report	6	
Version number of this monitoring report	1	
Completion date of this monitoring report	28/03/2018	
Monitoring period number	1	
Duration of this monitoring period	01/09/2016 – 31/08/2017	
Monitoring report number for this monitoring period	1	
Coordinating/managing entity	Servals Automation Private Ltd.	
Host Parties	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	India	yes
Sectoral scopes	Scopes 1, 3 and 5* *as per EB88 Annex4	
Applied methodologies and standardized baselines	AMS-II.G vers.7, AMS–III.BG. vers. 3	
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
	-	48,389 tCO_2
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs	95,885 tCO_2	

covered in this monitoring report	

PART I Monitoring of programme of activities (PoA)

SECTION A. Description of PoA

A.1. General description of PoA

>>

The PoA 10292 aims at reducing the fuel wood consumption of traditional stove users by disseminating improved cook stoves, mainly micro wood gasifier stoves, at subsidized prices. Moreover the consumption of conventional charcoal by traditional charcoal users shall be reduced by providing them charcoal generated in micro wood gasifier stoves. Additionally, fuel wood consumption shall be reduced even more by providing ICS users with renewable biomass as a fuel.
Overall objectives are reduction of greenhouse gases, conservation of forests and woodlands as well as improved health conditions of ICS users due to improved indoor air quality.

The approved SSC baseline and monitoring methodologies applied under the PoA are:
AMS-II.G, version 07, “Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass”, Sectoral Scope 3: Energy Demand
AMS-I.E, version 06, “Switch from non-renewable biomass for thermal applications by the user”, Sectoral Scope 1: Energy Industries
Methodology AMS–III.BG., version 03: “Emission reduction through sustainable charcoal production and consumption”, Sectoral Scope 4: Manufacturing Industry

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
Generic component project activity (CPA), for a CPA applying three methodologies (i.e., claiming ER for the use of renewable biomass as fuel in ICS, among others)	6	Scopes 1, 3 and 5* *as per EB88 Annex4	AMS-II.G vers.7, AMS–III.BG. vers. 3, AMS-I.E, version 06
Generic component project activity (CPA), for a CPA applying two methodologies (i.e., claiming ER only for efficiency improvements and sustainable production of charcoal)	6	Scopes 1, 3 and 5* *as per EB88 Annex4	AMS-II.G vers.7, AMS–III.BG. vers. 3

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)
Dissemination of TLUD gasifier stoves and generation of charcoal in West Bengal, first	Generic component project activity (CPA), for a CPA applying two methodologies (i.e.,	6	Renewable; 01.09.2016 – 31.08. 2023	yes

CPA; Ref 10292-0001	claiming ER only for efficiency improvements and sustainable production of charcoal)			
Dissemination of improved cook stoves and generation of charcoal, CPA2; Ref 10292-0002	Generic component project activity (CPA), for a CPA applying two methodologies (i.e., claiming ER only for efficiency improvements and sustainable production of charcoal)	6	Renewable; 01.09.2017 – 31.08.2024	no

A.2. Coordinating/managing entity

>>
Joint focal point: Servals Automation Private Ltd. and atmosfair gGmbH

SECTION B. Implementation of PoA

B.1. Description of implemented PoA

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Implementation of the management system of the PoA

Managing Entity:

Servals as CME, contracted atmosfair gGmbH to perform their CME responsibilities such as:

- including CPAs, confirming that all eligibility requirements are met
- channeling funding for stove procurement
- coordinating and managing the implementation of the monitoring plan,
- coordinating with a DOE to verify emissions reductions from CPAs
- selling CERs.

Stove Procurement and distribution:

Servals Automation Pvt. Ltd (Servals) and Sapient Infotech (Sapient) are the main producers of ICS and Sapient Infotech (Sapient) is the main distributor of ICS and responsible for the charcoal sales. atmosfair provides funding and also provide support with CDM matters.

Sampling approach

A simple random sampling approach for monitoring of one CPA was applied.

Installed technology

The ICS to be implemented in this PoA is the TLUD Gasifier Cookstove. In the Top-Lit Up-Draft (TLUD) technology dry biomass fuel is ignited on the top of a vertical container, starting the process of pyrolysis. While a pyrolysis front moves downwards, the produced wood gas moves upward and as it exits the stove it is combusted in a flame appropriate for cooking. The TLUD allows for significant savings of firewood compared to traditional stoves and additionally generates

charcoal. The TLUD is especially suitable for the cooking habits of the people in the target region, since rice is the basic dish. Its design ensures efficient combustion of fuel and cleaner fire therefore uses considerably less fuel compared to traditional stoves. This means speedy cooking, time and fuel savings, cleaner pans, kitchen walls and indoor atmosphere.

B.2. Post-registration changes to PoA

B.2.1. Corrections

>>
No post registration changes.

B.2.2. Inclusion of monitoring plan

>>
No post registration changes.

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

>>
No post registration changes.

B.2.4. Changes to programme design

>>
No post registration changes.

PART II Monitoring of CPAs

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SECTION C. Implementation of CPAs

C.1. Description of implemented CPAs

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

The CPA aims at reducing the fuel wood consumption of households by disseminating improved wood gasifier cook stoves, called TLUD, at highly subsidized prices in West Bengal in India; moreover the consumption of conventional charcoal by selected traditional charcoal users shall be reduced by providing them charcoal generated in the wood gasifier stoves.

(b)Brief description of the installed technology and equipment;
The ICS to implemented in this CPA is the TLUD Gasifier Cookstove, which were distributed to households using fuelwood for cooking. In the Top-Lit Up-Draft (TLUD) technology dry biomass fuel is ignited on the top of a vertical container, starting the process of pyrolysis. While a pyrolysis front moves downwards, the produced wood gas moves upward and as it exits the stove it is combusted in a flame appropriate for cooking. The TLUD allows for significant savings of firewood compared to traditional stoves and additional generates charcoal. The TLUD is especially suitable for the cooking habits of the people in the target region, since rice is the basic dish. Its design ensures efficient combustion of fuel and cleaner fire and therefore uses considerably less fuel as

compare to traditional stoves. This means speedy cooking, time and fuel savings, cleaner pans, kitchen walls and indoor atmosphere.
TLUDs were produced by Servals Automation and by Sapient Infotech. The TLUDs Nominal power is of 1 kW. It is a batch-loaded stove; its canister can be filled with up to 1.5kg of woody biomass at once, allowing to cook on it for up to 1 hour without the need to reload the canister.
The TLUD has a thermal efficiency of 36.9% according to a water boiling test certified by the MSME (Ministry of Micro-, Small- and Medium Enterprises, see evidence in appendix 3), if charcoal produced by the TLUD stove is included in the calculation, as it is foreseen by the WBT protocol. However, due to the planned re-use of charcoal produced by the TLUD, efficiency will be calculated without accounting for charcoal generation, for which the certified water boiling test of MSME reveals 25.1% and 28% efficiency.
Charcoal generated in the TLUD is collected from TLUD users and sold to users of conventional charcoal such as local retailers or tobacco driers (bidi factories). No charcoal will be sold to large-scale industries.

(c)Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.)

Date	Milestone
August 16 2014	Local Stakeholder Consultation in Berachampa, West Bengal
September 26 2014	Starting Date of first CPA - signature of agreement atmosfair-Servals-Sapient on funding
November 10 2014	Start of sales of TLUD stoves
July 20 2016	PoA registration and CPA 1 inclusion date
August 31 2017	Sale of last TLUD stove included in this monitoring period
August 31 2017	End of the 1st monitoring period

C.2. Location of CPAs

>>
(a)Host Party: Republic of India

(b)Region/ State/ Province: The project activity is implemented in the state of West Bengal, India.

(c)City/ Town/ Community: The project activity will be implemented in several villages and households in the above described target area, according to their will to participate in the project.

(d)Physical/ Geographical location:

The coordinates of the center of the project activity in Berachampa (local office of Sapient) are used to represent the physical location of the project activity:

- Latitude: 22° 41’ 45.4236’’ N
- Longitude: 88° 41’ 18.78’’E

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

>>
There are no temporary deviations from the monitoring pan.

C.3.2. Corrections

>>
There are no corrections.

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

>>
There is no change to the start date.

C.3.4. Inclusion of monitoring plan

>>
There are no post registration changes.

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

>>
There are no permanent changes.

C.3.6. Changes to project design

>>
There are no changes to project design.

SECTION D. Description of monitoring system of CPAs

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There is a continuous documentation of all ICS distributions in a central stove database. For the preparation of monitoring reports, samples are drawn from the central stove database and the corresponding stoves are examined regarding the relevant parameters. Each TLUD is given a unique ID. This ID consists in a letter and a number of at least four digits.
Charcoal collection and sales are continuously documented in a separate charcoal database. Charcoal sales to retailers/end users is monitored through invoices/receipts from charcoal sales, moreover the number and weight of charcoal bags sold to the retailer/ and user is monitored.

The CME holds the responsibility for all procedures related to monitoring, but it cooperates with regional or local institutions involved in ICS distribution.

Central stove database

The central stove database is operated and maintained by the CME to ensure completeness and accuracy of monitoring information. The basic information for ICSs distributed to households are:

- Unique number (Stove-ID) of system
- Commissioning date of appliance (at the user's place)
- User details (name, address, phone number)
- Distributor

The information in these databases are updated continuously, whenever new data (distribution contracts) are available. Original copies of the distribution contracts (or whatever format is used to collect the data required) are kept and maintained for two years after the end of the crediting period.

Stove IDs

Each ICS has a unique number which facilitates its identification in the data base and avoid double counting. These unique numbers are provided by the CME and are inserted in the distribution contract at the moment of distributing the stove.

Monitoring Parameters

Variable	Parameters	Description
$N_{y,j}$	$N_{y,j}$	Adjusted total number of ICS of batch j deployed during period y
$DO_{ll.G,y}$	$DO_{ll.G,y}$	Statistically adjusted drop out from total population of appliances in period y
$B_{y=1,new,survey}$	$fillings_{y=1,}$	Average weekly fillings of the TLUD
	$load_{y=1}$	Average load of the TLUD per canister filling
$\eta_{new,j}$	$\eta_{new,j}$	Average efficiency of an ICS
$NCV_{charcoal}$	$NCV_{charcoal}$	Net calorific value of charcoal generated in ICSs in the project activity
$Q_{CCP,i,y}$	$Q_{CCP,i,y}$	Produced quantity of charcoal in year *y*

Direct Monitoring

The following parameters are monitored directly from the databases, thus no sampling is necessary: $N_{y,j}$, $Q_{CCP,i,y}$. For monitoring $NCV_{charcoal,i}$, three samples are drawn, therefore the sampling standard is not applicable.

Sampling campaigns

Sampling campaigns consist in generating extracts of the central stove database and the charcoal database for checks in order to prepare the monitoring reports. A representative number of units (ICS or charcoal collectors) will be selected randomly for site visits in order to check the following monitoring parameters:

Proportional parameters:

- $DO_{ll.G,y}$

Mean parameters:

- $\eta_{new,j}$
- $fillings_{y=1}$
- $load_{y=1}$

  The latter two parameters will be used to determine $B_{y=1,new,survey}$

Different sample sizes can be selected for each of these parameters.

For all sampled parameters directly related to stoves, the sampling procedure is a simple random sampling process.

Random samples are drawn from the central stove database via a computerized randomizer.

SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

(Copy this table for each data or parameter.)

Data/Parameter	μ_y
Unit	#
Description	Number of days of utilization of the ICS during the year '*y*'.
Source of data	AMS-II.G, version 07, and final response of the SSC WG on request 713.
Value(s) applied	365
Choice of data or measurement methods and procedures	μ_y is set to 365, following the final response of the SSC-WG on request 713, stating that it may be set to 1 (365/365) if the number of days for which project stoves operation does not face any constraint. (Moreover, since equation 7 of AMS-II.G version 7 is applied, ER are based on the woody biomass used in the project devices which is monitored accurately anyways). In the case where the efficient project stove was operated only for a part of the year due to logistics of the stove distribution during the initial phase of the project implementation, as also mentioned in final response of the SSC-WG on request 713, the provisions for monitoring of parameter $N_{y,i,j}$ in section B.7.1 guarantee that only the real operation time is considered.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	η_{old}
Unit	%
Description	Efficiency of the baseline system being replaced
Source of data	AMS-II.G, version 07, default value
Value(s) applied	0.10
Choice of data or measurement methods and procedures	According to AMS II.G, ver. 7, Table 14, a default value of 0.10 can be used, if the "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". Traditional stoves in India meet these conditions.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	***NCVwood*** or ***NCVbiomass***
Unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass that is substituted
Source of data	AMS-II.G, version 07, default value
Value(s) applied	0.015
Choice of data or measurement methods and procedures	This is the IPCC default value for wood fuel as provided by AMS II.G version 07, para. 11.
Purpose of data/parameter	Calculation of baseline emissions

Additional comments	

Data/Parameter	$NCV_{charcoal,default}$
Unit	GJ/tonne
Description	Default net calorific value of charcoal
Source of data	AMS–III.B
Value(s) applied	29.5
Choice of data or measurement methods and procedures	Default value according to AMS–III.BG, appendix 1 option 1, from IPCC 2006, Volume 2, Table 1.2
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	$f_{NRB,y}$
Unit	%
Description	Fraction of woody biomass saved by the project activity in period y that can be established as non-renewable biomass
Source of data	Calculated
Value(s) applied	The value will be defined in each CPA. For preliminary calculations, a value of 96.24% is applied (value for West Bengal)
Choice of data or measurement methods and procedures	See B.6.1
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	$EF_{projected\_fossilfuel}$
Unit	tCO_2/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	AMS-II.G, version 07, default value under para. 11.
Value(s) applied	81.6
Choice of data or measurement methods and procedures	Default value as provided by AMS II.G version 07, par.11
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	L_y
Unit	Fraction
Description	Leakage adjustment factor period y
Source of data	Default value

Value(s) applied	0.95
Choice of data or measurement methods and procedures	According to AMS-II.G, version 07, para 28, $B_{y,i,j,savings}$ can be multiplied by a net to gross adjustment factor 0.95 to account for leakage in which case surveys are not required.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	***CF***
Unit	-
Description	Conversion factor fuelwood to conventional charcoal
Source of data	AMS–III.BG, version 3
Value(s) applied	6
Choice of data or measurement methods and procedures	Default value given in AMS–III.BG, version 3
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	GWP_{CH4}
Unit	t CO_2e/t CH_4
Description	Global warming potential of methane
Source of data	www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14
Value(s) applied	25
Choice of data or measurement methods and procedures	IPCC default value www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	$SMG_{y,b}$
Unit	t CH_4/t
Description	Specific methane generation for the baseline charcoal generation process in the year *y*
Source of data	AMS–III.BG, version 3.
Value(s) applied	0.030
Choice of data or measurement methods and procedures	Default value given in AMS–III.BG, version 3.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	M_d
Unit	t CH_4/t
Description	Factor to account for any legal requirement for capture and destruction of methane in the charcoal production facility
Source of data	AMS–III.BG, version 03.
Value(s) applied	0
Choice of data or measurement methods and procedures	There is obviously no requirement on capture and destruction of methane in micro gasifier stoves
Purpose of data/parameter	
Additional comments	

E.2. Data and parameters monitored

(Copy this table for each data or parameter.)

Data/Parameter	$B_{y=1,new,survey}$
Unit	t/year
Description	Quantity of woody biomass used by project devices in tonnes per project device
Measured/calculated/ default	Calculated
Source of data	Survey on $fillings_{y=1}$ and $load_{y=1}$, as described below.
Value(s) of monitored parameter	1.76 tons/a
Monitoring equipment	$fillings_{y=1}$: No monitoring equipment was used for the questionnaires used to determine the parameter. $load_{y=1}$: the average weight of a TLUD fuelwood load was determined by applying the average value obtained over all WBTs conducted to determine $\eta_{new,j}$. For equipment used durthing the conduction of the WBT, please refer to $\eta_{new,j}$.
Measuring/reading/recording frequency	Once in the first year of the crediting period. Data collection during the sampling campaign.
Calculation method (if applicable)	$B_{y=1,new,survey}$ = $fillings_{y=1}$ * $load_{y=1}$ * 0.052 (conversion factor to from kg /week to t/a)
QA/QC procedures	It will be assured that all requirements of the sampling plan of the CPA are met. Cross checks will be performed to confirm the plausibility of data obtained with cooking habits and the amount of charcoal collected from ICS users
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	$\eta_{new,j}$
Unit	%
Description	Efficiency of the device and batch j implemented as part of the project activity. calculated without accounting for the remaining charcoal
Measured/calculated/ default	Measured

<table>
<tr><td>Source of data</td><td>Data collection during sampling campaign by dedicated monitoring team. Eficiency testing was carried out separately for each batch j of stove following the Water Boiling Test (WBT) protocol version 4.2.3. All WBTs were conducted under field conditions.
Since charcoal is not burned in the TLUD stove, the WBT results were evaluated without accounting for remaining charcoal</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><td></td><td>batch year</td><td>Efficiency $\eta_{new,j}$</td></tr>
<tr><td>batch j=1</td><td>2014</td><td>26.92%</td></tr>
<tr><td>batch j=2</td><td>2015</td><td>27.82%</td></tr>
<tr><td>batch j=3</td><td>2016</td><td>28.02%</td></tr>
<tr><td>batch j=4</td><td>2017</td><td>27.68%</td></tr>
<tr><td colspan="2">Weighted average efficiency</td><td>27.71%</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><td></td><td><u>Precision Balance</u></td></tr>
<tr><td>Type/Name</td><td>Simandar Technology/ Shri Sai</td></tr>
<tr><td>Accuracy class</td><td>+/- 1 g</td></tr>
<tr><td>Serial number</td><td>63330</td></tr>
</table>
<table>
<tr><td></td><td><u>Thermometer</u></td></tr>
<tr><td>Type/Name</td><td>Greisinger Präzisionsthermometer GMH 3710</td></tr>
<tr><td>Accuracy class</td><td>0,01°C, Temperature range -199.99° C - +199.99° C</td></tr>
<tr><td>Serial number</td><td>32403242</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Annually</td></tr>
<tr><td>Calculation method
(if applicable)</td><td>Efficiency was calculated from the testing results according to the WBT protocol. The applied value is derived from the average of all conducted WBT.

Efficiency losses will be monitored according to AMS-II.G version 07 para 21 c. Thus eficiency is tested for the first batch of stoves annually. The rate of loss in efficiency is applied correspondingly to all batches.</td></tr>
<tr><td>QA/QC procedures</td><td>It will be assured that all requirements of the sampling plan of the CPA are met.
Data will be collected using the standard procedures and will be stored for the crediting period and an additional two years.
Only calibrated equipment will be used, according to requirements in the project standard vers. 09.0.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comments</td><td></td></tr>
</table>

Data/Parameter	**$N_{y,j}$**
Unit	Number
Description	Adjusted total number of ICS of batch j deployed during period y. The adjustment accounts for the fact that each ICS starts saving CO_2 from its sales date onwards.
Measured/calculated/ default	Calculated
Source of data	Central stove database, including all ICS sold and the corresponding sales date. (see annex 2); also copies of sales contracts. .

Value(s) of monitored parameter	8,508 The adjusted value of $N_{y,j}$ per batch j is: $N_{y,j}$ = 8,508 batch j=1: 1,000 batch j=2: 3,000 batch j=3: 1,916 batch j=4: 2,592
Monitoring equipment	No monitoring equipment was used except the central stove database
Measuring/reading/recording frequency	annual
Calculation method (if applicable)	$N_{y,j} = Nsoldtotal_j * d_{average,y} / mplength_y$ Where: $Nsoldtotal_{y,i,j}$ total number of ICS of batch j sold within monitoring period y $d_{average,y}$ average number of days the ICS sold in period y were operational in period y, derived from sales dates on sales contracts $mplength_y$ length of period y
QA/QC procedures	Data and contracts will be collected using the standard procedures and will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	$DO_{II.G,y}$
Unit	%
Description	Statistically adjusted drop out from total population of ICS in period y
Measured/calculated/ default	Calculated
Source of data	Data collection during sampling campaigns through interviews by dedicated monitoring team and database
Value(s) of monitored parameter	0%
Monitoring equipment	Questionnaire
Measuring/reading/recording frequency	Annual
Calculation method (if applicable)	The Drop outs were determined by asking the stove users, if the appliances are still operational. The percentage od drop outs found in the sample is applied to all stoves in the central stove database.
QA/QC procedures	It will be assured that all requirements of the sampling plan of the CPA are met.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	$Q_{CCP,y}$
Unit	tonnes
Description	Produced quantity of charcoalin year *y*
Measured/calculated/ default	Measured
Source of data	Measurement from project activity production and delivery to eligible charcoal buyers
Value(s) of monitored parameter	2,650 tons/a in total, 0.31 tons/a per device
Monitoring equipment	Data is received from sales invoices
Measuring/reading/recording frequency	Option 1 described in the CPA DD was used to determine the parameter: Option1: Direct measurement (e.g. use of a scale) of the weight of charcoal products supplied; at the site of the charcoal users or retailers $Q_{CCP,y}$ was derived from invoices/receipts of sales of charcoal generated in the CPA to charcoal users and retailers. The weight of charcoal delivered was indicated on invoices.
Calculation method (if applicable)	n.a
QA/QC procedures	The entire chain of charcoal collection is documented, demonstrating how the amount of charcoal delivered to users of conventional charcoal relates to the amount generated by users. The numbers are cross checked with: - total quantity of charcoal generated by the micro gasifiers based on monitored fuelwood consumption and the observed conversion-rate to charcoal. - the average amounts of charcoal collected from stove users based on records of field assistant collecting charcoal
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	$NCV_{charcoal}$
Unit	GJ/ton
Description	Net calorific value of charcoal generated in ICSs in the project activity
Measured/calculated/ default	Measured
Source of data	
Value(s) of monitored parameter	29.58
Monitoring equipment	
Measuring/reading/recording frequency	Monitored once during the first year of the crediting period. Measurement was undertaken by Italab private limited, an Industrial testing and analytical laboratory based in Kolkata according to relevant national/international standards. Saples where taken monthly from the stocks of charcoal collected from users before selling it to charcoal users/retailers. The average value was be used for the rest of the crediting period since there is no change in the biomass types used for charcoal i production.
Calculation method (if applicable)	Average of 12 measurements

QA/QC procedures	Charcoal generated from other than purely woody sources will not be accepted by users of conventional charcoal since it will not be comparable to conventional charcoal. The consistency of the measurements will be checked by comparing the measurement results with relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements will be conducted and/or justification will be provided.
Purpose of data/parameter	Confirm applicability of way of calculation of baseline emissions
Additional comments	

E.3. Implementation of sampling plan

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

10292-0001: Dissemination of TLUD gasifier stoves and generation of charcoal in West Bengal, first CPA

(b)Description of implemented sampling design;

Due to the high number of ICS to be deployed an annual check of all appliances is not feasible. Therefore representative samples were monitored to determine the annual values for $DO_{II.G,y}$, $\eta_{new,j}$, $fillings_{y=1}$ and $load_{y=1}$.

For all sampled parameters directly related to stoves, the sampling procedure is a simple random sampling process. Random samples are drawn from the central stove database and the charcoal database via a computerized randomizer.

$N_{y,j}$ was monitored through sales/distribution records for all appliances deployed till the end of the Monitoring period, whereas the other parameters were determined through a sampling campaign.

$Q_{CCP,y}$ was monitored using Option1 described in the CPA DD: $Q_{CCP,y}$ was derived from invoices/receipts of sales of charcoal generated in the CPA to charcoal users and retailers. The weight of charcoal delivered was indicated on invoices.

Coverage of sampling requirements in the applicable methodology:

As per applicable methodology AMS-II.G ver 7. par. 36, *"when biennial inspection is chosen a 95% confidence interval and a 10% margin of error requirement shall be achieved for the sampling parameter. On the other hand when the project proponent chooses to inspect annually, a 90% confidence interval and a 10% margin of error requirement shall be achieved for the sampled parameters. In cases where survey results indicate that 90/10 precision or 95/10 precision is not achieved, the lower bound of a 90% or 95% confidence interval of the parameter value may be chosen as an alternative to repeating the survey efforts to achieve the 90/10 or 95/10 precision".*

Additional requirement for PoAs as per sampling standard:

In case a single sampling plan for more than one CPA is used, *"parameter values shall be estimated by sampling in accordance with the requirements in the applied methodology separately and independently for each of the CPAs included in a PoA except when a single sampling plan*

covering a group of CPAs is undertaken applying 95/10 confidence/precision for the sample size calculation", as per EB 50 Annex 30 STAN, version 05.0.

Random distribution

The method of selecting users to be included in the sample for deployed ICS will be random using simple random sampling or multistage sampling. For sampling of $\boldsymbol{weightbags_{y,i}}$, clusters of charcoal bags will be selected randomly.

All random selections will be stored for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later. In this way the traceability of the selection is assured.

Sampling for CPA 10292-0001

As described in the PoA DD, a central stove database was established, including data on all TLUD stoves sold since the start date of the project, including information on:

- Stove ID (unique number of stove)
- Delivery date of appliance (to user)
- Field assistant who sold the stove
- User details (Name, Address, phone number if available etc.)

A total of 18,919 stoves have been sold until the end of the monitoring period. No stove replacements occurred during the monitoring period.

The required sample sizes were calculated prior to conducting the sample survey using the equations for simple random sampling as per EB 67 Annex 6, par. 16 to 26 for the proportional and mean value parameters of interest. The number of ICS/charcoal bag clusters monitored during sampling was determined for each of the parameters separately. Different sample sizes are expected due to different variations of values. According to the PDD, a common sample was drawn from the central stove database for the collection of data for parameters $\boldsymbol{DO_{II.G,y}}$ and $\boldsymbol{fillings_{y=1}}$. The largest number for the sample size was chosen for the sampling effort with one common survey. According to AMS-II.G vers 7 one sub-sample per batch of stoves (stoves sold in one caleder year) was drawn to monitor parameters gained from efficiency testing, $\eta_{new,j}$ and $\boldsymbol{load_{y=1}}$.

Since we only have one CPA, no across CPA sampling was necessary. Since we chose annual sampling, the relevant confidence and precision of the values are 90/10.

In cases where the required precisions cannot be met with the original sample, additional random samples will be drawn.
Alternatively, the lower bound can also be used instead of conducting additional surveys to achieve the required confidence/precision level.

For $\boldsymbol{DO_{II.G,y}}$ a sample size of 15 was calculated, for $\boldsymbol{fillings_{y=1}}$ the calculated sample size was 7. According to the sampling standard and the CPA DD the minimum sample size for percentage parameters is 30. Taking into account possible non response rate, we increased the sample size for the common survey of $\boldsymbol{DO_{II.G,y}}$ and $\boldsymbol{fillings_{y=1}}$ to 38.
For $\eta_{new,j}$, the calculated sample size was 5, for the parameter $\boldsymbol{load_{y=1}}$ it was 3. Taking into account possible non response rate, we increased the sample size for the common survey for $\eta_{new,j}$, and $\boldsymbol{load_{y=1}}$ to 10. Resulting in a total sample size of 40.

(c)(d)(e) Collected data, analysis of the collected data and demonstration on whether the confidence/precision level has been met

Parameter	n*	Value	Standard deviation	Confidence	Precision	90/10 precision?	Comment
$DO_{II,G,y}$	30	100	n.a	90%	0%	yes	
$fillings_{y=1}$	30	31.13	4.56	90%	4.54%	yes	
$load_{y=1}$	20	1.088	0.017	90%	0.98%	yes	
$\eta_{new,1}$	5	26.92	0.007	90%	2.64%	yes	
$\eta_{new,2}$	5	27.82	0.016	90%	5.44%	yes	
$\eta_{new,3}$	5	28.02	0.011	90%	3.74%	yes	
$\eta_{new,4}$	5	27.68	0.018	90%	6.20%	yes	

*valid responses;

The list of samples for the common sample for $DO_{II,G,y}$ and $fillings_{y=1}$ included 38 households. 30 of them could be interviewed during the time of the interview period. This is the minimum sample size reauested in the sampling standard and the CPA DD and more than required from the sample size calculation. $DO_{II,G,y}$ was 100%, meaning that all distributed stoves are in use.
The list of samples for the common sample for $\eta_{new,j,y}$ and $load_{y=1}$ included 40 households, 10 households per batch. 5 households per batch could be reached, meaning the calculated minimum sample size was reached.

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

The users were randomly selected via a computerized randomizer from the sales record databases containing the full ICS population considered under CPA 10292-0001for this Monitoriong Period and as described in G.3. a) and e). Simple random sampling was applied for all stove related parameters.

SECTION F. Calculation of emission reductions or net anthropogenic removals

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

>>
Emission reductions are calculated by summarizing ER from the stove efficiency-component (applying AMS-II.G) and the charcoal-production-component (applying AMS–III.BG).

(equation 1)

$$ER_{total} = ER_{II.G} + ER_{III.BG}$$

Where:

ER_{total}	Total emission reductions of the CPA
$ER_{II.G}$	Emission reductions of the stove efficiency component
$ER_{III.BG}$	Emission reductions of the charcoal generation component

Subscripts "i" referring to stove types are omitted in this CPA-DD since only one type of ICS was distributed in this CPA.

Emission reductions from the Stove Efficiency Improvements Component (AMS-II.G)

It is formally assumed that in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs. Therefore, emission reductions are

calculated by multiplying the thermal energy from annual biomass savings stemming from non-renewable biomass with an emission factor for fossil fuels.
The following equation applies as per AMS-II.G par. 11:

(equation 2)

(equation 2)

$$ER_{II.G,y} = \sum_j ER_{II.G,y,j} - LE_y$$

Where:

j	Indices for the situation where there is more than one batch of project device

and

(equation 3)

$$ER_{II.G,y,j} = B_{y,savings,j} \times N_{y,j} \times \frac{\mu_{y,j}}{365} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossil\,fuel}$$

Where:

$B_{y,savings,j}$	=	Quantity of woody biomass that is saved in tonnes per cook stove device 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 (f_{NRB}) 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')
$EF_{projected\_fossilfuel}$	=	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 CO2/TJ
$N_{y,j}$	=	Number of project devices of *batch j* operating during year *y*,
$\mu_{y,j}$	=	Number of days of utilization of the project device batch *j* during the year *y*.
LE_y	=	Leakage emissions in the year *y*

$N_{y,j}$ is monitored directly, for $NCV_{biomass}$ and $EF_{projected\_fossilfuel}$, the indicated default values are used, and LE_y is set to zero, since leakage is considered by multiplying $B_{y,savings,j}$ with net to gross adjustment factor of 0.95. $\mu_{y,j}$ is set to 365, following the final response of the SSC-WG on request 713, stating that It may be set to 1 (365/365) if the number of days for which the project stove's operation does not face any constraint. (Moreover, since AMS-II.G vers. 07 equation 7 is applied, ER are based on the woody biomass used in the project devices which is monitored accurately anyways).

$B_{y,savings,j}$ and $f_{NRB,y}$ are determined as follows:

Determination of $B_{y,savings,j}$

According to AMS-II.G, four options are given to determine $B_{y,savings,j}$. Here, the third option (para 17, WBT) is chosen, with the corresponding formula (equation 7 of AMS-II.G version 7):

(equation 4)

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

Where:

$B_{y=1,new,survey}$	=	Quantity of woody biomass used by project devices in tonnes per device.
$\eta_{old,j}$	=	Efficiency of the old devices being replaced by project devices of batch *j*.
$\eta_{new,j}$	=	Efficiency of the project device of batch *j*. Charcoal generated in the ICS will not be considered to derive $\eta_{new,j}$ if this charcoal will be used outside the ICS, according to AMS–III.BG.
$B_{y=1,new,i,survey}$	=	Quantity of woody biomass used by project devices in tonnes per device of type *i*.
$\eta_{old,i,j}$	=	Efficiency of the old devices being replaced by project devices of type *i* and batch *j*.
$\eta_{new,i,j}$	=	Efficiency of the project device *i* and batch *j*. Charcoal generated in the ICS will not be considered to derive $\eta_{new,i,j}$ if this charcoal will be used outside the ICS, according to AMS–III.BG.

As specified under B.7.1, $B_{y=1,new,survey}$ may be monitored directly or it may be calculated based on average weekly fillings ($fillings_{y=1}$) andand the average load of a batch-fed ICS ($load_{y=1}$).

Combined equation for $ER_{II.G}$

(equation 5)

$$ER_{II.G,y} = \sum_j B_{y=1,new,survey} \times \left(\frac{\eta_{new,j}}{\eta_{old,j}} - 1\right) \times 0.95 \times N_{y,j} \times \frac{\mu_{y,j}}{365} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossil\ fuel}$$

Determination of the Share of Non-Renewable Biomass

According to AMS II.G, par. 26, equation 9, the following equation shall be used to calculate f_{NRB}:

(equation 6)

$$f_{NRB,y} = \frac{NRB}{NRB + DRB}$$

where:

$f_{NRB,y}$: fraction of non-renewable biomass (%)
NRB: non renewable biomass (tons)
DRB: Demonstrably renewable biomass (tons)

We directly apply this formula by using official data on fuelwood availability and demand. The specific values and sources are indicated in the table below.

Item	Value	Unit	Source
Fuelwood available from trees outside forests	0.529	million tonnes	Table 7.4.3 of chapter 7 of the Forest Survey of India (socioeconomic contribution of forests) http://www.fsi.org.in/cover_2011/chapter7.pdf
Fuelwood production from forests	0.003	million tonnes	Table 7.4.2 of the report mentioned above
Total fuelwood consumption	14.158	million tonnes	Table 7.4.7 of the report mentioned above
DRB	0.532	million tonnes	Sum of fuelwood supply inside and outside forests
NRB	13.626	million tonnes	Calculated as total fuelwood consumption – DRB
fNRB	**96.24**	%	Calculated as NRB/(NRB+DRB) = 1 – (0.529+0.003)/14.158

The low value of fuelwood supply from forests is due to the fact that mainly timber is harvested from forests which is not included in the calculation.

Qualitative assessment of non-renewable woody biomass (NRB)

Further below, we present qualitative evidence that firewood extraction in the project are is not sustainable, according to AMS II.G., par. 25. As required in the paragraph, we demonstrate that two of four conditions described are fulfilled in the project area:

a) A trend showing an increase in time spent or distance travelled for gathering fuel-wood by users (or fuel-wood suppliers) or alternatively, a trend showing an increase in the distance the fuel wood is transported to the project area:

According to a scientific study[1], the average distance to collect fuelwood increased significantly within 5 years in the project area. Data from the Sundarbans (representing the core project area) are reported, showing an increase from 0.37 to 6.48 km in Hingalganj. The following table is taken from Santhakumar et al. (2005), page 35, see footnote 4.

Table 4.8 Item-wise Average Distance Travelled, Cost Incurred, and Time Spent per Respondent

Block	Item	Average distance travelled (at present) km	Average distance travelled (five years back) km	Average time spent (in month)	Average cost per respon-dents (in Rs)
Gosaba	Fuel Wood	2.61	1.59	0.44	150.00
	Fish	13.94	7.43	4.14	1317.78
	Honey	8.80	7.56	1.03	451.52
	Prawn Larvae	2.09	1.23	5.30	247.80
	Crab	14.68	8.97	3.23	1940.00
	O.W.	6.75	2.00	1.00	220.00
Basanti	Fuel Wood	11.00	-	1.00	-
	Fish	21.15	9.30	4.06	3784.6
	Honey	23.83	11.00	1.54	916.67
	Prawn Larvae	6.40	4.81	3.83	852
	Crab	17.87	10.47	2.43	2410
	O.W.	-	-	-	-
Hingalgunj	Fuel Wood	6.48	0.37	0.62	210.00
	Fish	22.55	4.33	3.64	2372.73
	Honey	23.50	2.40	0.88	600.00
	Prawn Larvae	14.01	4.97	5.48	1224.1
	Crab	14.72	4.20	1.70	1200
	O.W.	-	-	-	-
Hasnabad	Fuel Wood	-	-	-	-
	Fish	22.00	5.50	5.00	3550.50
	Honey	-	-	-	-
	Prawn Larvae	32.00	35.50	6.00	3240.40
	Crab	-	-	-	-
	O.W.	-	-	-	-

d) Trends in the types of cooking fuel collected by users that indicate a scarcity of woody biomass.

No quantitative evidence from official sources could be found. It is however mentioned in a study on participatory forest management in West Bengal[2] that:
"The rural population, who make up almost 72% of the state population, continue to depend substantially on the energy and wood from the forest. With this shortage, they use leaves, forest

[1] Santhakumar V, Enamul Haque AK, Rabindranath Bhattacharya (2005): An economic analysis of mangroves in South Asia. www.econis.eu/PPNSET?PPN=50466414X

[2] University of East Anglia (2004): Participatory Forest Management in *West Bengal.* http://www.uea.ac.uk/dev/People/staffresearch/ospringate-baginskiresearch/PFM-Nepal-India/3-pfm-in-west-bengal

floor organic matter and cow-dung for cooking, so depriving the soil of the natural ingredients that enrich it and thereby increase agricultural and forest productivity."

Emission reductions from the charcoal generation component (AMS III.BG)

AMS–III.BG. will be applied according to the provisions for charcoal production in micro gasifier stoves.

The applicable main formula given in AMS–III.BG, version 03 is:

(equation 7)

$$ER_{III.BG,y} = \sum_i Q_{CCP,i_y} \times \left[\left(CF \times NCV_{wood} \times \frac{NCV_{charcoal}}{NCV_{charcoal,default}} \times f_{NRB,BL,wood} \times EF_{projected\_fossilfuel} \right) + \left(SMG_{y,b} - M_d \right) \times \left(1 - f_{NRB,BL,wood} \right) \times GWP_{CH4,y} \right] - PE_{y,fugitive} - PE_{y,flaring} - PE_{FF,y} - PE_{El,y} - PE_{BC,y}$$

Where:

$ER_{III.BG,y}$	=	Emission reductions in year *y* (t CO_2e/yr)
Q_{CCP,i_y}	=	Quantity of charcoal type i produced and used in year *y* (t)
CF	=	Default wood to charcoal conversion factor
NCV_{wood}	=	Net calorific value of wood(TJ/t)
$NCV_{charcoal}$	=	Net calorific value of the charcoal produced during the project (TJ/t)
$NCV_{charcoal,default}$	=	Default net calorific value of charcoal (TJ/t)
$f_{NRB,BL,wood}$	=	Fraction of biomass used in the absence of the project activity that can be established as non-renewable biomass; determined as per the procedure found in the latest version of AMS-I.E. Determined here as described in this section B.6.1 under AMS-II.G.
$EF_{projected\_fossilfuel}$	=	Emission factor for the substitution of non-renewable woody biomass by similar consumers (t CO_2/TJ)
$GWP_{CH4,y}$	=	Global warming potential of methane applicable to the crediting period (t CO_2e/t CH_4)
$SMG_{y,b}$	=	Specific methane generation for the baseline charcoal generation process in the year *y*; a default value of 0.030 t CH_4/t charcoal may be used.
M_d	=	Factor to account for any legal requirement for capture and destruction of methane in the charcoal production facility (tonne of CH_4/tonne of raw material)
$PE_{y,flaring}$	=	If applicable, emissions due to the flare inefficiency. In case captured pyrolysis gas is gainfully used (e.g. used for production of heat as in the case of micro-gasifier), then it can be taken as zero.
$PE_{FF,y}$	=	Project emissions due to fossil fuel consumption in charcoal production facilities in year *y* (t CO_2)
$PE_{El,y}$	=	Project emissions due to electricity consumption in charcoal production facilities in year *y* (t CO_2)
$PE_{BC,y}$	=	Project emissions due to biomass cultivation in year *y* (t CO_2)

$PE_{y,flaring}$ is not applicable since pyrolysis gas is used for cooking. M_d is set to zero since there is obviously no legal requirement to capture methane in micro gasifier stoves. $PE_{FF,y}$ and $PE_{El,y}$ are not considered since no fossil fuels or electricity are used in the ICS; $PE_{BC,y}$ is not applicable since no biomass will be cultivated for charcoal production since it is produced as a by-product of daily cooking.

$PE_{y,fugitive}$ is calculated as follows :

(equation 8)

$$PE_{y,fugitive} = \sum_i Q_{CCP,iy} \times GWP_{CH4,y} \times SMG_{y,b} \times f$$

Where:

$PE_{y,fugitive}$	=	Fugitive emissions from operation of charcoal producing facility (physical leakage) in the year *y* (t CO_2e)
f	=	A fraction attributed to project charcoal production technology, use a default value of 0.1.

Equations 7 and 8 can thus be combined and simplified:

(equation 9)

$$ER_y = \sum_i Q_{CCP,iy} \times \left[\left(CF \times NCV_{wood} \times \frac{NCV_{charcoal}}{NCV_{charcoal,default}} \times f_{NRB,BL,wood} \times EF_{projected\_fossilfuel} \right) + SMG_{y,b} \times (0.9 - f_{NRB,BL,wood}) \times GWP_{CH4,y} \right]$$

$f_{NRB,y}$ is determined as described in this section B.6.1 under AMS-II.G.

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

>>
No project emissions have to be considered according to AMS-II.G and AMS–III.BG.

F.3. Calculation of leakage emissions

>>
According to AMS-II.G the following potential sources of leakage have to be considered:

A) Use of NRB savings by non-project households

According to AMS-II.G para. 28 the default net to gross adjustment factor of 0.95 is applied to account for leakage and therefore surveys are not required.

B) Transfer of Equipment

"If equipment currently being utilised is transferred from outside the boundary to the project activity, leakage is to be considered."

This leakage source can be ruled out since no used improved cook stoves will be transferred or deployed from outside the geographical project boundary to the project activity.
Since charcoal generated in ICS is a by-product of daily cooking, there are no leakage effects, according to AMS III.BG. According to the methodological tool (EB83, annex 15), para. 22,

"competing uses for biomass are not relevant, where the biomass is generated as part of the project activity".

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
Ref 10292-0001	48,389	0	0		48,389	48,389
Total	48,389	0	0		48,389	48,389

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 (t CO_2e)
Ref 10292-0001	48,389	95,885
Total	48,389	95,885

F.6. Remarks on increase in achieved emission reductions

>>
n.a.

Document information

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