Monitoring report form for CDM programme of activities (version 01.0)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form for CDM programme of activities" at the end of this form.

MONITORING REPORT		
Title of the programme of activities (PoA)	Improved Cookstoves Program in Honduras "Vida Mejor con Ecofogones de Alto Rendimiento"	
UNFCCC reference number of the PoA	9176	
Version number(s) of the PoA-DD(s) applicable to this monitoring report	5	
Coordinating/managing entity (CME)	Envirofit International Ltd.	
Version number of this monitoring report	3.0	
Completion date of this monitoring report	15/03/2017	
Monitoring period number and dates covered by this monitoring report	Monitoring period: 01 15/06/2015 – 14/06/2016	
Monitoring report number for this monitoring period	1	
Host Party(ies)	Host Party(ies) of the PoA	Is this a host Party to a specific-case CPA covered in this monitoring report?(yes/no)
	Honduras	Yes
Sectoral scope(s)	Sectoral scope: 3: Energy demand	
Selected methodology(ies)	AMS-II.G ver 6.0: Energy efficiency measures in thermal applications of non-renewable biomass	
Selected standardized baseline(s)	Not applicable	
Total amount of GHG emission reductions or net GHG removals by sinks for all specific-case-case CPAs in the PoA covered in this monitoring report	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	0	38,179

PART I - Programme of activities

SECTION A. Description of PoA

A.1. Brief description of the PoA

>>

The goal of the PoA is to facilitate the transition away from inefficient conventional firewood stoves in Honduras by providing improved efficiency, clean burning firewood cooking stoves (ICS) to local households and SMEs. The ICSs applied in this PoA have been designed to match the traditional utensils and cooking habits of the target consumers in host country.

The ICS distributed included in the programme are more efficient in transferring heat from the fuel to the pot when compared to the stoves typically being used in the baseline. By replacing inefficient baseline stoves, the PoA saves on consumption of woody biomass which is the dominant fuel used for cooking in project households.

In accordance with version 6.0 of the small-scale CDM methodology AMS-II.G, in the absence of the project activity, the baseline scenario would be the projected use of fossil fuels to meet similar thermal energy needs. Therefore, by reducing the amount of fuel required for cooking and thus the use of non-renewable woody biomass, the more efficient ICS reduces the amount of greenhouse gases (GHG) emitted into the atmosphere.

Envirofit International Ltd (Envirofit) is the coordinating/managing entity (CME) for this PoA and coordinates the efforts of different Distribution Organizations (DOs) who are involved in distribution of ICS within the boundary of the PoA and comply with the requirements of this PoA. Each DO sells ICSs either directly or through retailers, entrepreneurs or other agents sub-contracted by the DO. Each DO acts individually, implementing the CPA(s) in accordance with local circumstances and the requirements prescribed by CME.

A.1.1. Generic CPA(s)

Title, identification/reference number and/or version number of the generic CPA(s) of the PoA	Sectoral scope(s)	Applied methodology(ies) or combination of methodologies and/or standardized baseline(s)
Title: Improved Cookstoves Program in Honduras “Vida Mejor con Ecofogones de Alto Rendimiento” – Genric CPA **Identification:** Part II of PoA-DD version 5.0 dated 16/01/2015 **Reference:** https://cdm.unfccc.int/filestorage/Y/4/S/Y4SOEA0NL6GWTFXVUPZD915JCR2B83/Untitled%20%28uploaded%2006%20Aug%2015%2011%3A36%3A51%29.pdf?t=bzB8bzZkbW5zfDCum2p60WwGbdjQFEr4OUe5 **Version:** 1.0	Sectoral Scope 3	AMS-II.G, version 6: Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass

A.1.2. Specific-case CPA(s) covered in this monitoring report

Reference number of the specific-case CPA included in the PoA as of the end of this monitoring period	Title, identification/ reference number and version number of the generic CPA to which the specific-case CPA applies	Crediting period dates of the specific-case CPA	Is this specific-case CPA covered in this monitoring report? (yes/no)
9176-0001	**Title:** Improved Cookstoves Program in Honduras "Vida Mejor con Ecofogones de Alto Rendimiento" – Genric CPA **Identification:** Part II of PoA-DD version 5.0 dated 16/01/2015 **Reference:** https://cdm.unfccc.int/filestorage/Y/4/S/Y4SOEA0NL6GWTFXVUPZD915JCR2B83/Untitled%20%28uploaded%2006%20Aug%2015%2011%3A36%3A51%29.pdf?t=bzB8bzZkbW5zfDCum2p60WwGbdjQFEr4OUe5 **Version:** 1.0	15/06/2015 – 14/06/2022	Yes

A.2. Contact information of the coordinating/managing entity (CME) and/or responsible persons(s)/entity(ies)

>>

Envirofit International Limited is the CME for the PoA. The person responsible for completing the CDM-PoA-MR-Form is as follows:

Rohit Lohia
Carbon Projects Development Manager
rohit.lohia@envirofit.org

SECTION B. Implementation of PoA

B.1. Implementation of the management system of the PoA

>>

Envirofit International Limited is the Coordinating and Managing Entity (CME) for the PoA. The CPA 9176-0001 is run in coordination with the local partner Fundación para el Desarrollo Integral de Honduras (FUNDEIH), the Distributing Organization (DO) for the CPA 9176-0001 and is responsible for implementing the SSC-CPA in accordance with agreement with CME. The implemented CPA follows the following management system:

1. Envirofit provided instructions to FUNDEIH to collect the end user information at the time of sale through CPA distribution records. Envirofit made them aware of requirements of end user data collection. Guidance was provided to them on the standard procedures to be followed during ICS distribution.

2. Envirofit maintains a PoA Distribution and Monitoring database. The database includes CPA wise list of stoves sales, including the following information (collected at the time of sale by FUNDEIH):
    a. Name of customer
    b. Address / location of the customer

c. Stove unique serial ID number
d. Stove Model
e. Stove distribution date
f. Type of old stove replaced by ICS, i.e. the fuel type used in the baseline stove – wood or charcoal.

3. Envirofit performed cross-checks on the ICS sales information received from the FUNDEIH via CPA distribution records. The CME's and DO's logo is clearly displayed on the CPA Distribution Record, with a copy retained by FUNDEIH. A unique stove id is punched on each stove and the same serial ID is mentioned on the CPA distribution record. Therefore it is possible to identify each stove in the PoA with its unique serial ID number. The unique serial number linked to each stove and its association with a unique CPA bearing a CPA ID number eliminates any risk of double-counting of ICSs between CPAs and within a CPA.

4. FUNDEIH obtained the customer's approval during distribution to exclusively assign carbon rights to the CME as per the disclaimer specified on CPA Distribution Records and /or stove boxes/warranty cards

5. Envirofit coordinated all ex-post monitoring activities in the PoA in coordination with FUNDEIH. In addition the Envirofit ;
    a. Implemented the monitoring plan,
    b. Determined the sample size as per sampling plan and identified the samples to be monitored
    c. Ensured the quality of monitoring data (QA/QC) obtained from field
    d. Used this data for emissions reduction calculations.

6. Monitoring staff checked and recorded the following key parameters in a CPA Monitoring Record. Key monitored parameters were:
    a. Efficiency of project stoves ($\eta_{new,i,a}$)
    b. Check if project stoves are operational and in use ($SOF_{i,a}$) to determine $N_{y,i,a}$
    c. Check fraction of end users continuing to use baseline stoves and extent of baseline stove usage to determine days of utilization of project stove ($\mu_{y,i}$)

7. Envirofit calculated emission reductions based on monitoring data collected by monitoring staff and prepared monitoring report

Thus, by carrying out the aforesaid, Envirofit and FUNDEIH ensured that the PoA Operational and Management plan as given in section A.4.4.1 of registered PoA-DD is duly implemented for concerned CPA.

B.2. Implementation of single sampling plan(s)

>>
Not Applicable.

SECTION C. Post-registration changes to the PoA (including the generic CPA(s))

C.1. Corrections

>>
Not Applicable

C.2. Inclusion of a monitoring plan to the registered PoA-DD (including its generic CPA-DD(s)), if a monitoring plan was not included at the time of registration

>>

Not Applicable

C.3. Permanent changes to the monitoring plan as described in the registered PoA-DD, applied methodology, or applied standardized baseline

>>

Not Applicable

C.4. Changes to the programme design of the registered PoA-DD (including corresponding changes to project design of the generic CPA-DD(s)) and updates to the eligibility criteria for inclusion of specific-case CPAs in the PoA

>>

Not Applicable

C.5. Types of changes specific to afforestation and reforestation activities

>>

Not Applicable

PART II - Specific-case component project activity(ies)

SECTION D. Description of specific-case CPA(s)

>>

This Monitoring Report covers the only CPA included in the PoA during the concerned monitoring period i.e. 9176-0001.

D.1. Brief description of implemented specific-case CPA(s)

>>

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

The purpose of the CDM Programme Activity (CPA) is dissemination of improved cooking stoves (ICS) in domestic households in Honduras. The CPA replaces cooking stoves using woodfuel with more efficient stoves using woodfuel.

The project ICS are more efficient in transferring heat from the fuel to the pot, thus saving woodfuel compared to the baseline stoves which would have been used in the absence of the project activity. Furthermore, the ICSs have been designed not only to increase heat transfer, but also to match traditional utensils and cooking habits of people in Honduras.

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

The Envirofit stoves have been designed with the specific intention of maximizing thermal efficiency while simultaneously minimizing the production of toxic emissions. While many interrelated factors need to be considered in order to achieve these goals, primary aspects of stove performance were explored during the development of the stoves: 1) fuel and air mixing 2) heat transfer to the pot. In order to maximize temperature, the combustion chamber shape, fuel amount, and air flow through the stove all need to be considered and correctly coordinated. In order to use the available thermal energy in the most efficient manner possible, specific stove geometry and configuration choices were made; including reducing stove thermal mass and minimizing heat flux through the sides and bottom of the

stove. In order to minimize emissions, the combustion chamber shape, fuel amount, and air flow rate through the stove all need to be considered and correctly coordinated in order to maintain a proper air to fuel mixture.

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

CPA	Type of Project stoves eligible	Stove models installed	Total number of stoves installed
9176-0001	Wood fuel	HM5000	27924

The following image illustrates a HM5000 stove

Figure D.1.1: HM5000 stove

Information required by Eligibility criteria

Eligibility criteria # 10, 11 and 14 that require information related to project technology / infrastructure are discussed below:

No.	Eligibility criteria		Assessment for CPAs	
	Description	Conditions to be met	Means of proof	Confirmation
#10	Requirement of Methodology AMS-II.G – single pot or multi pot portable or in-situ cook stoves with rated efficiency of at least 20 per cent.	The ICS disseminated under the CPA will be single pot, multi-pot or in-situ cookstoves that have a specified efficiency of at least 20% at the time of inclusion.	Document: Efficiency specification from manufacturer or certificate from a national standards body or alternatively, manufacturer specifications on efficiency based on water boiling test (WBT) may be used.	The efficiency of HM5000 has been already specified and validated in the registered CPA-DD 9176-0001
#11	Technical Requirement	Only ICS of the types below will be disseminated: • Biomass fuelled	Specification of stove type and compliance with the technological requirements of	The HM5000 is a biomass (woodfuel) fuelled stove and is portable. Only new

		ICS • Newly operational ICS • Either fix/portable operation.	AMS.II.G will be described in the specific CPA-DD. Document: 1. Statement from CME that only new stoves will be disseminated under the CPA 2. First ICS Sales Receipt (first CPA of PoA), including specific language confirming the stove received by the end-user is new.	stoves have been disseminated. The same has already been validated in the registered CPA-DD
14	Requirement of Methodology AMS-II.G SSC Limit for CPAs	The CPA will remain under the thermal threshold of 180 GWh_{th}/annum thermal energy savings (threshold as per clarification request SSC_233) throughout the crediting period of the CPA. If a CPA exceeds the applicable limit in any year, the claimable emission reduction shall be capped based on the estimated GHG reductions in the CPA-DD	The maximum number of operational ICS estimated is to be defined in the specific CPA-DD. The number of ICs in operation per year will not exceed the "ICS installation cap" established in the specific CPA-DD. This cap in essence will be the maximum number of ICS installed up to the threshold of 180 GWh_{th}/annum thermal energy savings.	The thermal energy savings achieved by the CPA is less than 180GWh_{th}. Please refer the ER calculations which show that the thermal energy savings achieved during the monitoring period is 158.0 GWh_{th} only.

For detailed information on complete list of eligibility criteria refer the CPA-DD available on UNFCCC website as mentioned in Section A.1.2, Part I of this monitoring report.

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

Description	CPA 9176-0001	Reference
Start Date	07/07/2013	Registered CPA-DD
Date of first stove distribution	10/07/2013	PoA / CPA distribution database

(d) ***Total GHG emission reductions or net GHG removals by sinks achieved in this monitoring period for the specific-case CPA(s), including information on how double counting is avoided***

CPA	Emission Reductions tCO_2e
9176-0001	38,179
Total	**38,179**

Each stove bears a unique serial ID punched on the stove. The same is recorded to trace the stove later and avoid double counting. Further, for each stove included under each CPA, information on the location of the stove has been collected by collecting address of the user at the time of sale in CPA Distribution Record. Thus, location of each stove in CPA distribution database can be traced. Please refer the ER calculator, worksheet 'Installation database' in which the sales information i.e. Stove unit details and the end user information for each stove is mentioned. The system of recording the unique serial on each stove along with its location serves toward avoiding couple counting of stoves within the PoA.

D.2. Geographical references or other means of identification of the location of the specific-case CPA(s)

>>

The physical boundary of the SSC-CPA is determined by the location of installed ICS. This SSC-CPA's geographic boundary is the national borders of Honduras, which is within the boundary of the PoA.

Figure D.2.1: Map of SSC-CPA project boundary –Honduras.[1]

The country is located in the Central American region with coordinates 14°6′N 87°13′W.

SECTION E. Post-registration changes to specific-case CPA(s)

E.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

>>

Not applicable

E.2. Corrections

>>

1. Minor Editorial Changes
2. Correcting FUNDEIH as the CPA Implementer (Distributing Organization)
3. Correcting the CPA Operational and management plan to indicate FUNDEIH as the Distributing Organization (DO) instead of Envirofit International Ltd. (FUNDEIH was earlier referred as a seller)

Refer revised CPA-DD, version 5.1 dated 11/01/2017 for CPA 9176-0001 for details.

[1] Map Source: Honduras map: http://geography.about.com/library/cia/blchonduras.htm

E.3. Changes to the start date of the crediting period of the specific-case CPA(s)

>>

Not applicable

E.4. Inclusion of a monitoring plan into the specific-case CPA(s) that was not included at registration

>>

Not applicable

E.5. Permanent changes to the monitoring plan as described in the registered specific-case CPA-DD(s), applied methodology or standardized baseline

>>

Not applicable

E.6. Changes to project design of the specific-case CPA(s)

>>

Not applicable

E.7. Types of changes specific to afforestation and reforestation specific-case CPA(s)

>>

Not applicable

SECTION F. Description of the monitoring system of specific-case CPA(s)

>>

At the CPA level, Envirofit provided instructions to the FUNDEIH to collect the end user information, at the time of sale, via CPA distribution records. Envirofit made them aware of requirements and procedures for end user data collection. Necessary data was correctly obtained from the customers at the time of sale and recorded in the CPA Distribution Record, firstly to avoid double counting and secondly to enable tracking of the ICS for monitoring purposes, ex-post. The data captured included:

a. Name of customer
b. Address / location of the customer
c. Stove unique serial ID number
d. Stove Model
e. Stove distribution date
f. Type of old stove replaced by ICS, i.e. the fuel type used in baseline stove – wood or charcoal.

All other monitoring activities have been carried out at the CPA level as detailed in section G.3 below.

SECTION G. Data and parameters

G.1. Data and parameters fixed ex ante, at registration, inclusion or renewal of crediting period

Data / Parameter:	$B_{old,i}$
Data unit:	tonnes / year / project device
Description:	Quantity of woody biomass that would be used in the absence of the project activity for Residential users
Source of data:	Registered CPA-DD 9176-0001, section D.6.2
Value(s) applied:	3.10 for Residential biomass user stoves used for residential purposes

Choice of data or Measurement methods and procedures	The value is based on historical data as reported in the "Energy Efficiency in Central America: Progress and Action towards the fulfilment of Goals of the Central American Sustainable Energy Strategy" by Victor Hugo Ventura and Ryan Carvalho, published by UN-CEPAL, 2014 report
Purpose of data	Calculation of Baseline Emissions
Additional comment	

Data / Parameter:	η_{old}
Data unit:	Percentage
Description:	Efficiency of the system being replaced as part of the SSC-CPA
Source of data:	Registered CPA-DD 9176-0001, section D.6.2, AMS II.G. version 6
Value(s) applied:	10%
Choice of data or Measurement methods and procedures	Default value as prescribed by methodology applied
Purpose of data	Calculation of Baseline Emissions
Additional comment	This parameter is applicable as AMS-II.G step-6 option-2 is chosen for this CPA.

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/tonne
Description:	Net calorific value for biomass
Source of data:	AMS-II.G. version 6, default value
Value(s) applied:	0.015
Choice of data or Measurement methods and procedures	Default value as prescribed by methodology applied
Purpose of data	Calculation of Baseline Emissions
Additional comment	None

Data / Parameter:	$EF_{projected\_fossil\_fuel}$
Data unit:	tCO2/TJ
Description:	Emission factor for the substitution of non-renewable woody biomass by similar consumers.
Source of data:	AMS-II.G. version 6, default value
Value(s) applied:	81.6
Choice of data or Measurement methods and procedures	Default value as prescribed by methodology applied
Purpose of data	
Additional comment	None

Data / Parameter:	$f_{NRB,y}$
Data unit:	Fraction
Description:	Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable
Source of data:	Registered CPA-DD 9176-0001, section D.6.2
Value applied:	0.8382

Choice of data or Measurement methods and procedures	Fixed ex-ante at the PoA level
Purpose of data	Calculation of Baseline Emissions
Additional comment	

Data / Parameter:	LE_y
Data unit:	tCO_2e
Description:	Leakage
Source of data:	AMS II.G. para 30
Value applied:	0
Choice of data or Measurement methods and procedures	Not applicable
Purpose of data	Account for leakage adjustment in calculation of baseline emissions
Additional comment	A default leakage correction factor (LCF) of 0.95, as per AMS II.G. paragraph 30, has already been applied to adjust the $B_{old,i}$ during period y instead of separate calculation of LE_y

G.2. Data and parameters monitored

Data / Parameter:	$N_{y,i,a}$
Data unit	Number
Description	Number of project devices of type *i* and age *a* that are operating in year y
Measured/calculated/ default	Measured
Source of data	Stove sales database and Monitoring survey records
Value(s) of monitored parameter	$N_{y,i=HM5000,a=1}$: 8615 $N_{y,i=HM5000,a=2}$: 11513 $N_{y,i=HM5000,a=3}$: 3291
Monitoring equipment	Not applicable. The stove installations are monitored via CPA distribution record and operational rate is monitored on sampling basis using questionnaire survey
Measuring/reading/ recording frequency	An Annual monitoring frequency was selected using 90/10 confidence / precision.
Calculation method (if applicable)	CME maintains the database of all stoves installed. The number of operating stoves for each age category has been determined on a sampling basis. The stove population in the database was categoried on the basis of age and startifed random sampling was applied to identify the samples for each age. The identified samples were monitored for operational status of stove. The results from monitoring were used to calculate $N_{y,i,a}$ as follows $N_{y,i,a} = (n_{y,i,a,operational} / n_{y,i,a,total}) * N_{y,i,a,installed}$ Where: N = number of stoves n = number of samples Please refer ER calculator for more details.
QA/QC procedures	The CME conducted QA/QC of the installation database to remove

	incompleted, erroneous entries. The CME provided training, guidelines and monitoring survey templates to ensure that the Monitoring team responsible for survey followed appropriate standard procedure for measurement of operational status of project stove.
Purpose of data	Calculation of Baseline Emissions.
Additional comments	In the Ex-post sampling based monitoring, none of the sampled household was found using more than one unit of HM5000 stoves.

Data/parameter	$\eta_{new,i,a}$
Unit	%
Description	Efficiency of the device of type *i* and age *a* being deployed as part of the project activity
Measured/calculated/ default	Measured on sampling basis
Source of data	WBT records for the monitoring period
Value(s) of monitored parameter	$\eta_{new,i=HM5000,a=1}$ 28.00% $\eta_{new,i=HM5000,a=2}$ 27.21% $\eta_{new,i=HM5000,a=3}$ 26.32%
Monitoring equipment	**Thermometer:** Brand: Omega Model: Omegaette HH308 Type K Accuracy: +/- 0.3% reading +1^{0}C Number of units: 1 S/N: 141106595 **Mass balance** Brand: LW Measurements Model: MCT-33 Accuracy: +/- 2 division, +/- 0.002 lbs Number of units: 1 S/N: MC1506041 **Moisture Meter** Brand: Lignomat Model: Mini Ligno DX Accuracy: +/- 1.0% Number of units: 1 S/N: not available The equipments used (thermometer, weighing scale and moisture meter) were newly purchased thereby not requiring calibration at the time of use so measurements were done with the necessary guarantees.
Measuring/reading/ recording frequency	WBTs were carried out for a sample of installed ICSs in operation in line with the PoA Sampling Plan on an annual basis.
Calculation method (if applicable)	n/a
QA/QC procedures	WBTs were conducted in line with the guidance provided by the CME and according to a methodology supported by PCIA. Documentation can be found on PCIA website http://www.pciaonline.org/testing The team performing WBTs was trained by testing experts from Colorado State University Biomass Lab
Purpose of data	Calculation of baseline emissions

Additional comments	

Data/parameter	$\mu_{y,i}$
Unit	Days
Description	number of days of utilization of the project device during the year 'y'
Measured/calculated/ default	Measured on sampling basis
Source of data	Monitoring survey records
Value(s) of monitored parameter	316
Monitoring equipment	Not applicable. utilization is monitored on sampling basis using questionnaire survey
Measuring/reading/ recording frequency	Annual
Calculation method (if applicable)	The sampled households were checked for presence of baseline stove and if it was being used along with HM5000 for cooking. For samples where baseline stove was found not being used, project stove utilization factor has been taken as 1.0 For samples where the baseline stove was found to be in use, project stove utilization factor has been taken as 0.5 (as both project stove and baseline stoves were found being used daily for these samples. Refer Additional comments below) $\mu_{y,i}$ = Average utilization factor * 365
QA/QC procedures	The CME provided training, guidelines and monitoring survey templates to ensure that the Monitoring team responsible for survey followed appropriate standard procedure for measurement of utilization rate of project stove.
Purpose of data	Calculation of baseline emissions
Additional comments	All samples reporting use of both baseline stove and project stove reported using them daily. Hence, a default utilization factor of 0.5 has been applied in line with Clarification SSC 711 (https://cdm.unfccc.int/filestorage/K/4/G/K4GAP31N2I96LOUDCXFJM7B08TSQEW/Final%20response.pdf?t=aUp8b21qYnJjfDDc8S-dEINdT5ehJUwuZEkK) as follows: If project proponents wish to account for $\mu_{y,i}$ through the use of interviews/questionnaires, the following simplified accounting method may be used: a. the days where only project stoves are used are counted; b. the days where only baseline stoves are used are not counted; and c. the days where both devices are used may be counted as 0.5

G.3. Implementation of specific-case CPA level sampling plan

>>

a) Description of implemented sampling design;

Due to the large number of ICS distributed under the CPA it was not economically feasible to monitor each individual ICS unit distributed. Therefore, representative sampling was undertaken as

part of a CPA-wide Sampling Plan. The sampling plan consisted of monitoring the following parameters mentioned in section G.2.

Sl.No.	Parameter	Description of parameter
1	$N_{y,i,a}$	Number of project devices of type *i* and age *a* that are operating in year y
2	$\eta_{new,i,a}$	Efficiency of the device of type *i* and age *a* being deployed as part of the project activity
3	$\mu_{y,i}$	number of days of utilization of the project device during the year 'y'

Based on the registered CPA-DD, 90/10 reliability level was selected for CPA sampling for the parameters mentioned above.

The initial target population were the stoves distributed and recorded under CPA 9176-0001. As per page 31 of the CPA-DD, *"the ICS shall be stratified by region, target user group, stove category (fuel) and ICS model combination (model and age)"*. Thus, following strata were defined.

Stratification Condition	Characteristic of Population	Stratification
Region - Country	all units have been distributed in the same country, i.e. Honduras	Not applicable
Fuel Type – charcoal / wood fuel	There is only one fuel type in the population: Woodfuel.	Not applicable
End user – domestic / small-medium enterprises / community	all units are for domestic (household) usage as per their design	Not applicable
Stove Type – model and age	There is only one model in the CPA i.e HM5000. However these have been sold over a period of time (2013 – 2015)	The population was divided in strata based on age: 1. stoves installed in year 2013, 2. stoves installed in year 2014 3. stoves installed in year 2015

Stratifed Random Sampling approach (the population was divided into three strata based on age) was applied to determine the sample size for the parameters $N_{y,i,a}$ and $\eta_{new,i,a}$. For parameter $\mu_{y,i}$, the population was considered as one stratum as the methodology does not require determination of this parameter based on different ages.

The following is the number of samples covered during the monitoring activity. The required sample sizes mentioned below have been derived using equation (19), (20), (21), (22) and (27) of Appendix 3 of the Guideline: Sampling and surveys for CDM project activities and programmes of activities, Version 04.0 for mean based parameter ($\eta_{new,i,a}$) as follows:

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

Where,

n = number of stoves to be sampled

N = Total number of ICS in the population

z = Constant referring to level of confidence (e.g. 1.645 for 90 %; 1.96 for 95 % confidence)

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

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

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

k = total number of strata in the population

The required sample sizes mentioned below have been derived using equation (1), (2), (3), (4) and (9) of Appendix 3 of the Guideline: Sampling and surveys for CDM project activities and programmes of activities, Version 04.0 for proportion based parameter ($N_{y,i,,a}$ and $\mu_{y,i}$) as follows:

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

Where,

n = number of stoves to be sampled

N = Total number of ICS in the population

z = Constant referring to level of confidence (e.g. 1.645 for 90 %; 1.96 for 95 % confidence)

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

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

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

The following section lists the number of samples covered during the monitoring activity. Refer ER calculator worksheet 'MP#1 Sample Size Cal and Results' for more details on calculation of sample size for each parameter. 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 "Standard:Sampling and surveys for CDM project activities and programmes of activities", Version 05.0 available at:
https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20151023110717966/meth_stan05.pdf
and page 34 of the CPA-DD

Parameter	Size of population in strata	Expected values assumed for sample size calculation	Reliability	Required Sample Size (n)	Monitored samples
$N_{y,i=HM5000,a=1}$	10338	Proportion: 90%	90/10	17	18
$N_{y,i=HM5000,a=2}$	13198	Proportion: 85%	90/10	21	47
$N_{y,i=HM5000,a=3}$	4388	Proportion: 80%	90/10	7	20
$\eta_{new,i=HM5000,a=1}$	10338	Mean: 29, SD: 2.9	90/10	2	2
$\eta_{new,i=HM5000,a=2}$	13198	Mean: 28, SD: 2.8	90/10	3	4
$\eta_{new,i=HM5000,a=3}$	4388	Mean: 27, SD: 2.7	90/10	1	3
$\mu_{y,i=HM5000}$	27924	Proportion: 85%	90/10	48	71

The stoves were selected by randomly assigning, in corresponding stratum, a number to each stove and sorting in increasing order from lower to higher number. Random numbers were generated using online random number generator for each stratum and the numbers obtained were used to identify the samples from the population. A higher number of samples were monitored than that required to ensure that the desired precision / confidence is achieved.

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

Data was collected for $N_{y,i,a}$ and $\mu_{y,i}$ following a specially design survey form. The information collected was introduced into an electronic database, the CPA Monitoring Record. The survey form was design to allow the surveyor collect the necessary information from field visit for the ER calculations. In order to achieve the 90/10 reliability level, additional stoves were sampled from the database than that required to cover for non responses, if any.

As for the thermal efficiency of the stoves, water boiling tests were conducted using WBT as given by GACC. Refer ER calculator worksheet "Survey summary" and "WBT Summary" for details on data collected during monitoring. Those involved in field survey monitoring were adequately trained to ensure that the surveys are performed correctly. The WBTs were carried out by in-house monitoring officers who were trained by testing experts from Colorado State University, Biomass Lab. The monitoring surveys and WBTs were conducted from 08 Jan 2016 to 13 July 2016.

b) Analysis of the collected data;

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

Sampling Constants	Values
Monitoring period start	15-Jun-15
Monitoring period end	14-Jun-16
Monitoring frequency (years)	1.00
Level of sampling	CPA
Confidence (%) (90 or 95)	90%
Margin of Error (%)	10%
Z value	1.645

Monitoring parameter(s)	Stove Operating Fraction for determination of $N_{y,i,a}$

Sampling frame	Given stove model and age population		
Sampling approach	Stratified random sampling across stove model and age		
Sampling Frame	Stove population	expected operational proportion (SoF)	Calculated Sample Size (n)
HM 5000 Batch 1 (Age 3)	4388	0.80	7
HM 5000 Batch 2 (Age 2)	13198	0.85	21
HM 5000 Batch 3 (Age 1)	10338	0.90	17
Sample size determination			
Estimated SOF (p)			0.86
Estimated Standard deviation of SOF (SD)			0.345
$V_{SOF} = (SD/p)^2$			0.160
Sample Size required (SOF)			43
Monitoring results			
Sampling Population (Batch)	Sampling frame size	Monitored Sample Size	Monitored Operating Fraction
HM 5000 Batch 1 (Age 3)	4388	20	0.75
HM 5000 Batch 2 (Age 2)	13198	47	0.87
HM 5000 Batch 3 (Age 1)	10338	18	0.83
Reliability Check			
Samples Monitored		85	
SoF Measured		0.84	
Standard Error of SoF		4.26%	
Relative precision (Margin of error)		4.18%	
Result		Ok, reliability level met	
Lower Bound confidence value		Not applicable	

Monitoring Parameter		Stove Efficiency $\eta_{new,i,a}$		
Sampling frame		HM5000 population		
Sampling approach		Stratified random sampling across stove model & age		
Sampling Population (Batch)	Sampling frame size	Expected Mean Efficiency(%)	Expected SD	Calculated Sample Size
HM 5000 Batch 1 (Age 3)	4388	27.0	2.7	1
HM 5000 Batch 2 (Age 2)	13198	28.0	2.8	3
HM 5000 Batch 3 (Age 1)	10338	29.0	2.9	2
Sample size determination				
Estimated efficiency (mean)				28.21
estimated standard deviation of efficiency (SD)				2.82
$V_{mean} = (SD/mean)^2$				0.01
Minimum Sample Size required (efficiency)				3
tDistribution sample size adjustment			Iteration 1	9
			Iteration 2	4
			Iteration 3	6
			Iteration 4	5
			Iteration 5	5
			Iteration 6	**5**
Monitoring results				
Sampling Population (Batch)	Sampling frame size	Monitored Sample Size	Monitored Efficiency (%)	Monitored Standard Deviation
HM 5000 Batch 1 (Age 3)	4388	3	26.32	1.42
HM 5000 Batch 2 (Age 2)	13198	4	27.21	2.24

HM 5000 Batch 3 (Age 1)	10338	2	28.00	1.03
Reliability Check				
Samples Monitored			9	
Mean Efficiency			27.36	
Standard error of mean			0.61	
Relative precision (Margin of error) (%)			2.06%	
Result			Ok, reliability level met	
Lower Bound confidence value			Not applicable	

Monitoring parameter(s)	Utilization of Project stoves - $\mu_{y,i}$		
Sampling frame	HM5000 population		
Sampling approach	Stratified random sampling across stove models		
Sampling Frame	Stove population	Expected value	Calculated Sample Size (n)
HM5000	27924	0.85	48
Estimated results based sample size determination			
Estimated utilization (p)			0.85
$V_{Utilization}= p(1-p)/p^2$			0.18
Minimum Sample Size required (days of utilization)			48
Monitoring results and Reliability Check			
Samples Monitored			71
Utilization Measured			0.87
Standard Error of utilization			0.04
Relative precision (Margin of error)			3.83%
Result			Ok, reliability level met
Lower Bound confidence value			Not applicable

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

c) *Demonstration of whether the samples were randomly selected and are representative of the population*

The population was categorised age wise. Stoves were selected randomly after arranging them in chronological order of date of sale and assigning a number to each stove. Random numbers were generated using online random number generator available at http://stattrek.com/statistics/random-number-generator.aspx for each sampling category and the random numbers received were selected from each category to identify the samples to the monitored. The approach ensured that the samples picked are stratified random and representative of the population.

SECTION H. Calculation of GHG emission reductions or net GHG removals by sinks

H.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

Emission reductions are calculated as follows:

$$ER_y = \sum_i ER_{y,i} \qquad \text{Equation (1)}$$

Where:

i = Indices for the situation where more than one type of project device is introduced to replace the pre-project devices

ER_y = Emission reductions during year *y* in tCO_2e

$ER_{y,i}$ = Emission reductions by project device of type *i* during year *y* in t CO_2e

Equation (2)

$$ER_{y,i} = \sum_{a=1}^{a=y} B_{y,savings,i,a} \times N_{y,i,a} \times \frac{\mu_{y,i}}{365} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossilfuel} - LE_y$$

Where:

a = 'a' is the indices for the age (in years) of the cook stoves that are operating in the year 'y' of the crediting period.

$B_{y,savings,i,a}$ = Quantity of woody biomass that is saved in tonnes per cook stove device of type i and age a in year y (tonnes)

$f_{NRB,y}$ = Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass

$NCV_{biomass}$ = 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') (TJ/tonnes)

$EF_{projected\_fossilfuel}$ = 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 tCO_2/TJ

$N_{y,i,a}$ = Number of project devices of type i and age a operating in year y

$\mu_{y,i}$ = Number of days of utilization of the project device during the year 'y'.

LE_y = Leakage emissions in the year y, to be taken as 0 as leakage correction factor of 0.95 shall be directly applied to $B_{y,savings,i,a}$

Using AMS-II.G, <u>Option 2</u>:

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

Equation (3)

Where:

$B_{old,i}$ = Annual quantity of woody biomass that would be used in the absence of the project activity to generate thermal energy equivalent to that provided by the project device type *i*, if the project device operates throughout the year *y*. (tonnes)

η_{old} = Efficiency of the pre-project device (fraction)

$\eta_{new,i,a=1}$ = Thermal efficiency of the device of type *i* being deployed as part of the project activity (fraction)

$\Delta\eta_{y,i,a}$ = Factor to consider the efficiency loss of the project device type *i* due to its aging at the year *y*, as expressed as follows:

$$\Delta\eta_{y,i,a} = \frac{\eta_{new,i,a}}{\eta_{new,i,a=1}}$$

where $\eta_{new,i,a}$ is the thermal efficiency of the device '*i*' with age '*a*' determined using the WBT

Data Ex Ante	Value	Unit	Source
$B_{old,i}$	3.10	tonnes/year	Ex-ante, CPA-DD
$f_{NRB,b,y}$	0.84	fraction	Ex-ante, CPA-DD
$NCV_{biomass}$	0.015	TJ/tonne	Ex-ante, CPA-DD
$EF_{proejcted\_fossil\ fuel}$	81.6	tCO2/TJ	Ex-ante, CPA-DD
η_{old}	0.100	fraction	Ex-ante, CPA-DD
Leakage Correction Factor (LCF)	0.95	fraction	Ex-ante, CPA-DD

Data Ex Post	Value	Unit	Source
$N_{y,i=HM5000,a=1}$	8615	number	"Monitoring Survey"
$N_{y,i=HM5000,a=2}$	11513	number	"Monitoring Survey"
$N_{y,i=HM5000,a=3}$	3291	number	"Monitoring Survey"
$\eta_{new,i=HM5000,a=0}$	29.40%	percentage	CPA-DD
$\eta_{new,i=HM5000,a=1}$	28.00%	percentage	"Monitoring Survey"
$\eta_{new,i=HM5000,a=2}$	27.21%	percentage	"Monitoring Survey"
$\eta_{new,i=HM5000,a=3}$	26.32%	percentage	"Monitoring Survey"
$\triangle\eta_{y,i=HM5000,a=1}$	0.95	fraction	calculated
$\triangle\eta_{y,i=HM5000,a=2}$	0.93	fraction	calculated
$\triangle\eta_{y,i=HM5000,a=3}$	0.90	fraction	calculated
$\mu_{y,i=HM5000}$	316	days/year	"Monitoring Survey"
$STOVE_{year}$	0.98	fraction	Calculated
$B_{y,savings,i=HM5000,a=1}$	1.993	t biomass	Calculated
$B_{y,savings,i=HM5000,a=2}$	1.961	t biomass	Calculated
$B_{y,savings,i=HM5000,a=3}$	1.922	t biomass	Calculated
Annual Thermal Energy savings	158.0	GWh_{th}	Calculated
ER_y	**38,179**	**tCO2e**	

For more detail, refer ER calculator

H.2. Calculation of project emissions or actual net GHG removals by sinks

>>

Not applicable

H.3. Calculation of leakage

>>

Not applicable

H.4. Summary of calculation of GHG emission reductions or net GHG removals by sinks

Specific-case CPA reference number	Baseline emissions or baseline net GHG removals by sinks (tCO_2e)	Project emissions or actual net GHG removals by sinks (tCO_2e)	Leakage (tCO_2e)	GHG emission reductions or net GHG removals by sinks (tCO_2e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
9176-0001	38,179	0	0	0	38,179	38,179
Total	**38,179**	**0**	**0**	**0**	**38,179**	**38,179**

H.5. Comparison of GHG emission reductions or net GHG removals by sinks with estimates in the included CPA-DD(s)

Specific-case CPA reference number	Value estimated in ex ante calculation in the included CPA-DD(s)	Actual values achieved by the specific-case CPA(s) during this monitoring period
9176-0001	42,222	38,179
Total	**42,222**	**38,179**

H.6. Remarks on difference from the estimated value in the included CPA-DD(s)

>>

The actual achieved ERs are less than the estimated value in the included CPA-DD as stated above.

Appendix 1. Contact information of coordinating/managing entity and/or responsible persons/entities

Coordinating/managing entity and/or responsible person/entity	☒ Coordinating/managing entity ☐ Person/entity responsible for completing the CDM-MR-FORM
Organization name	Envirofit International Ltd.
Street/P.O. Box	109 N Colleage Ave Suite 200
Building	-
City	Fort Collins
State/Region	Colorado
Postcode	CO 80524
Country	United States of America
Telephone	-
Fax	+1 970 221-1550
E-mail	-
Website	www.envirofit.org
Contact person	Nathan Lorenz
Title	Vice-president - Engineering
Salutation	-
Last name	Lorenz
Middle name	-
First name	Nathan
Department	-
Mobile	-
Direct fax	+1 970 221-2874
Direct tel.	+1 970 372-2874
Personal e-mail	nathan.lorenz@envirofit.org

Coordinating/managing entity and/or responsible person/entity	☐ Coordinating/managing entity ☒ Person/entity responsible for completing the CDM-MR-FORM
Organization name	Envirofit International Ltd.
Street/P.O. Box	109 N Colleage Ave Suite 200
Building	-
City	Fort Collins
State/Region	Colorado
Postcode	CO 80524
Country	United States of America
Telephone	-
Fax	+1 970 221-1550
E-mail	

Website	
Contact person	Rohit Lohia
Title	Carbon Project Development Manager
Salutation	Mr
Last name	Lohia
Middle name	-
First name	Rohit
Department	-
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	rohit.lohia@envirofit.org

- - - - -

Document information

Version	*Date*	*Description*
01.0	1 April 2015	Initial publication.

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