



**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**

<b>Title of the PoA</b>	Energy Efficient Stoves Program (EESP)	
<b>UNFCCC reference number of the PoA</b>	9769	
<b>Version numbers of the PoA-DD applicable to this monitoring report</b>	06	
<b>Version number of this monitoring report</b>	03	
<b>Completion date of this monitoring report</b>	01/05/2019	
<b>Monitoring period number</b>	05	
<b>Duration of this monitoring period</b>	17/10/2017 - 16/10/2018 (first and last date included)	
<b>Monitoring report number for this monitoring period</b>	01	
<b>Coordinating/managing entity</b>	World Vision Australia	
<b>Host Parties</b>	<b>Host Party of the PoA</b>	<b>Is this the host Party of a CPA covered in this monitoring report? (yes/no)</b>
	Federal Democratic Republic of Ethiopia	Yes
<b>Sectoral scopes</b>	(3) Energy Demand	
<b>Applied methodologies and standardized baselines</b>	Applied methodologies: AMS-II.G "Energy efficiency measures in thermal applications of non- renewable biomass" Version 5.0.  Applied Standardized baselines: N/A	
<b>Amount of GHG emission reductions or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period</b>	<b>Amount achieved before 1 January 2013</b>	<b>Amount achieved from 1 January 2013</b>
	N/A	128,252
<b>Amount of GHG emission reductions or net anthropogenic GHG removals</b>	139,588	

estimated ex ante for this monitoring period in the CPA-DDs for the CPAs covered in this monitoring report	
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## **PART I      Monitoring of programme of activities (PoA)**

### **SECTION A.    Description of PoA**

#### **A.1.    General description of PoA**

The goal of the SSC-PoA is to distribute and install fuel efficient cook stoves to rural households cooking with firewood in the Federal Democratic Republic of Ethiopia. The stoves reduce the amount of non-renewable biomass used by households, therefore decreasing Greenhouse Gas (GHG) emissions.

The CPA implementers – World Vision Ethiopia and World Vision Australia are responsible for transporting and distributing stoves to households, and also providing training on how to use and maintain the stoves effectively.

World Vision Australia is also the Coordinating/Managing Entity (CME) for the PoA. Until the end of this monitoring period, the following number of stoves were distributed under each CPA:

CPA 1 : 18,401 (Tikikil) and 18,401 (Mirt)

CPA 2: 15,904 (Tikikil) and 15,904 (Mirt)

CPA 3: 15,551 (Tikikil) and 15,551 (Mirt).

Old Tikikil stoves that ended its operating life were replaced under CPA 1, CPA 2 and CPA3. In this monitoring period, 1,685 Tikikil stoves under CPA 1; 3,374 Tikikil Stoves under CPA 2; 8,767 Tikikil Stoves under CPA 3 were replaced as those stoves reached their end of operating life.

Stove producers are contracted to manufacture standardized stoves for each CPA. The CPA implementers are responsible for monitoring the distribution and installation of stoves in each CPA to ensure that each stove meets pre-determined quality standards and has a unique identification number.

World Vision Ethiopia and World Vision Australia are the project implementers of CPA 1, CPA 2 and CPA 3. World Vision Australia is the project implementer as well as the CME of the PoA. The project has utilised a cooperative mechanism for stove distribution. Stove user cooperatives were set up to enable people to purchase stoves at a subsidised price and in installments. Each CPAs were provided fuel-efficient stoves to households using fuel wood. These project stoves have replaced inefficient traditional open fire cooking.

“Tikikil” stove was designed by GIZ and the design is based on a traditional rocket stove, which achieves efficient combustion of fuel at a high temperature by ensuring that there is a good air draft into the fire, controlled use of fuel, complete combustion of volatiles, and efficient use of the resultant heat.

“Mirt” stove was designed by the Ethiopian Rural Energy Development and Promotion Centre (EREDPC) in conjunction with GIZ in response to the need for an improved stove that could cook the staple Ethiopian food of Injera along with the secondary needs of roasting grain.

The Mirt stove is made of cement and pumice (a volcanic ash) that binds well with cement and is a good insulator. A mould is used to create the cement components of the stove, which was then transported to the household where the pumice was used to install the stove within the kitchen.

The CPAs have reduced the consumption of energy by implementing energy efficient cook stoves that consumes less (fuel wood), thus reducing the greenhouse gas emissions associated with cooking food on inefficient, traditional open fires.

In this monitoring period, 128,252 tCO<sub>2-e</sub> (CPA 1+CPA2+CPA 3) was reduced by the implementation of the project activities in Ethiopia.

**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
<p>Title/ identification number of the generic CPAs not provided in the registered PoA-DD</p> <p>Each Generic CPA involves the distribution and installation of a number of stoves to households in the project boundary with annual energy savings of up to 180 GWh thermal.</p> <p>Version number of Generic CPA-DD: 06 (same as registered PoA-DD)</p>	06	(3) Energy Demand	AMS-II.G “Energy efficiency measures in thermal applications of non- renewable biomass” Version 5.0.

**A.1.2. CPAs included in the PoA**

Title and UNFCCC reference number of the CPA	Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Crediting period type and duration	Covered in this monitoring report? (yes/no)
CPA 9769-0001: Energy Efficient Stoves Program CPA 1	Energy Efficient Stoves Program 9769-xx	06	Crediting period type: Fixed Duration: 17/10/2013 – 16/10/2023	Yes
CPA 9769-0002 : Energy Efficient Stoves Program CPA 2	Energy Efficient Stoves Program 9769-xx	06	Crediting period type: Fixed Duration: 28/04/2014 – 27/04/2024	Yes
CPA 9769-0003 : Energy Efficient Stoves Program CPA 3	Energy Efficient Stoves Program 9769-xx	06	Crediting period type: Fixed Duration: 30/05/2014 – 29/05/2024	Yes

**A.2. Coordinating/managing entity**

## **SECTION B. Implementation of PoA**

### **B.1. Description of implemented PoA**

World Vision Australia, contracted Carbon & Clean Energy Solutions Pty Ltd to oversees the CPA implementation, ensuring that their technical and administrative processes meet the requirements under the PoA. World Vision Australia has implemented the PoA with the same set framework as originally described in the PoA-DD

Carbon & Clean Energy Solutions (CCES) has conducted following activities on behalf of the CME:

- Carry out a quality check on CPAs to be included in the Programme of Activities.
- Collect and compile monitoring records from all the CPA entities.
- Coordinate monitoring activities and data management during the lifetime of the PoA.
- Prepare and submit monitoring reports and facilitate the verification of the same.

The CPA implementers - World Vision Ethiopia and World Vision Australia are responsible to collate and record the data. All records and user agreements are stored in both electronic and hard copy format at the local level by the CPA implementers. The data is provided to the CME and stored in an electronic database. The electronic database is used to store information in relation to each user, who has purchased a stove, where the household is located within CPA, price and model of the stove, date of purchase, etcetera.

Double counting is avoided through the use of a unique serial number permanently embedded on or near each stove (depending on stove make/model) under every CPA included in the PoA, which is cross referenced to personal information of each participant.

### **B.2. Post-registration changes to PoA**

#### **B.2.1. Corrections**

The CME has made the following correction to the PoA-DD (PRC ref No. PRC-9769-001). The summary of the changes are as follows:

- Changed the ex-ante value of Mirt stove  $Sc_{new,Mirt,y}$  i.e. 508 g/kg to the lowest  $Sc_{new,Mirt,y}$  value i.e. 328.53 g/kg that was achieved during the 4 years of stove monitoring.

#### **B.2.2. Inclusion of monitoring plan**

N/A

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

The CME has made the following permanent changes to the PoA-DD (PRC ref No. PRC-9769-001). The summary of the changes are as follows:

Permanent changes to the registered monitoring plan:

- Revised the sample size of POSG and PESG based on the most recent monitoring data
- Stratified random sampling method has been applied for PESG (instead of simple random sampling method) as it was deemed to be more appropriate due to the fact that the timing of distribution of the stoves (i.e. vintage of the stoves) could impact the efficiency and specific fuel consumption parameters of stove type making the population non-homogenous.

**B.2.4. Changes to programme design**

N/A

**PART II Monitoring of CPAs**

This Monitoring Report covers all the three CPAs included in this monitoring period. These CPAs have the same project boundary and follow the generic CPA as identified in section A.1.1, Part I of this monitoring report. The following sections therefore represent all these three CPAs.

**SECTION C. Implementation of CPAs**

**C.1. Description of implemented CPAs**

By the end of fifth monitoring period the CPA implementers have distributed following number of cook stoves under each CPAs.

CPAs	Mirt stoves distributed	Tikikil stoves distributed
CPA 1	18,401	18,401
CPA 2	15,904	15,904
CPA 3	15,551	15,551

“Tikikil” stove was designed by GIZ and the design is based on a traditional rocket stove, which achieves efficient combustion of fuel at a high temperature by ensuring that there is a good air draft into the fire, controlled use of fuel, complete combustion of volatiles, and efficient use of the resultant heat.



Figure 1: Tikikil Stove

“Mirt” stove was designed by the Ethiopian Rural Energy Development and Promotion Centre (EREDPC) in conjunction with GIZ in response to the need for an improved stove that could cook the staple Ethiopian food of Injera along with the secondary needs of roasting grain. It is suitable for both domestic and industrial use and it significantly reduces the amount of smoke within the kitchen as opposed to the three stone open fire.



Figure 2: Mirt Stove

The Mirt stove is made of cement and pumice (a volcanic ash) that binds well with cement and is a good insulator. A mould is used to create the cement components of the stove, which was then transported to the household where the pumice was used to install the stove within the kitchen.

For CPA 1, stove distribution commenced from 9 September 2012.  
 For CPA 2, stove distribution commenced from 23 November 2012.  
 For CPA 3, stove distribution commenced from 9 February 2014.

Double counting is avoided through the use of a unique serial number permanently embedded on or near each stove (depending on stove make/model) under every CPA included in the PoA, which is cross referenced to personal information of each participant.

In order to avoid double counting, the CPA implementer has provided a unique stove ID for each new stoves. Unique IDs of both replaced (i.e. old stoves) and the new stoves are recorded in the project database including the date of replacement, name and address of the stove beneficiaries. In order to avoid the future usage of replaced Tikikil stoves by the project beneficiaries, the relevant cooperative groups have collected the replaced stoves (i.e. old stoves) from the project households.

In this monitoring period, 128,252 tCO<sub>2-e</sub> (CPA1 +CPA2+CPA 3) were reduced by the implementation of the project activities in Ethiopia. Breakdown of the emissions reduction is outline below for each CPAs.

CPAs	Emissions Reduction (tCO <sub>2</sub> -e)
CPA 1	43,682
CPA 2	42,927
CPA 3	41,643
Total	128,252

## C.2. Location of CPAs

All CPAs with this POA are located within the Host country, the Federal Democratic Republic of Ethiopia; Individual CPAs are located as follows:

CPA 9769-0001:

Area	GPS Coordinates
Ada Berga	9°24'22.68" N 38°26'07.56" E
Enemorena Ener	8°01'29.18" N 37°46'08.92" E
Guraghe	8°12'00.83" N 38°05'05.64" E
Nono	8°31'53.91" N 37°25'19.67" E
Wonchi	8°40'21.52" N 37°55'15.08" E
Yaya Gulele	9°34'54.97" N 38°36'20.35" E

CPA 9769-0002:

Area	GPS Coordinates
Ada Berga	9°24'22.68" N 38°26'07.56" E
Enemorena Ener	8°01'29.18" N 37°46'08.92" E
Guraghe	8°12'00.83" N 38°05'05.64" E
Nono	8°31'53.91" N 37°25'19.67" E
Wonchi	8°40'21.52" N 37°55'15.08" E
Yaya Gulele	9°34'54.97" N 38°36'20.35" E
Boset	8°34'55.50" N 38°29'23.04" E
Jeju	8°17'25.74" N 39°35'15.81" E
Tulo	9°6'42.34" N 41°1'44.83" E
Digeluna Tijo	7°43'57.57" N 39°29'35.58" E

CPA 9769-0003:

Area	GPS Coordinates
Tulo	9°6'42.34" N 41°1'44.83" E
Enemorena Ener	8°01'29.18" N 37°46'08.92" E
Boset	8°34'55.50" N 38°29'23.04" E
Digeluna Tijo	7°43'57.57" N 39°29'35.58" E
Sokoru	8°08'14.68" N 37°33'07.94" E
Shashemene	7°12'0.45" N 38°36'0.75" E
Jeju	8°17'25.74" N 39°35'15.81" 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**

N/A

**C.3.2. Corrections**

The CME has made the following correction to the CPA-DDs (PRC ref No. PRC-9769-002). The summary of the changes are as follows:

- Changed the ex-ante value of Mirt stove  $Sc_{new,Mirt,y}$  i.e. 508 g/kg to the lowest  $Sc_{new,Mirt,y}$  value i.e. 328.53 g/kg that was achieved during the 4 years of stove monitoring.

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

N/A

**C.3.4. Inclusion of monitoring plan**

N/A

**C.3.5. Permanent changes to the included monitoring plans, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools**

The CME has made the following permanent changes to the CPA-DDs (PRC ref No. PRC-9769-002). The summary of the changes are as follows:

Permanent changes to the registered monitoring plan:

- Revised the sample size of POSG and PESG based on the most recent monitoring data
- Stratified random sampling method has been applied for PESG (instead of simple random sampling method) as it was deemed to be more appropriate due to the fact that the timing of distribution of the stoves (i.e. vintage of the stoves) could impact the efficiency and specific fuel consumption parameters of stove type making the population non-homogenous.

**C.3.6. Changes to project design**

N/A

**SECTION D. Description of monitoring system of CPAs**

The CPA implementers - World Vision Ethiopia and World Vision Australia are responsible for recording of project specific data. Each stove purchaser signs a user agreement purchase contract, where the date, name of purchases, address where the stove is being used, and stove ID are recorded. This enables the user to be uniquely identified.



The World Vision Ethiopia project site officers record Cook Stove distribution information firstly in the paper form. The World Vision Ethiopia project officers then digitise the paper recording by inputting all project related data onto the excel database.

World Vision Ethiopia records the following parameters into the excel database:

<b>Particular</b>	
1	Customer ID
2	Customer Cooperative Membership Number
3	Customer Name and Address
4	Name of the Stove Distributor/ Cooperatives
5	Stove Distribution Location
6	Signed User Agreement (Agreement between CPA developer and those who will purchase/receive) stoves
7	Number and type of Stove distributed
8	Identification number of each type of Stove
9	Unit Price of each type of Stove
10	Type of non-operational Stove
11	Identification number of non-operational stove
12	Stove replacement data (If applicable)
13	Customer details (customer name, customer cooperative membership number and address), if different than previously submitted details

World Vision Ethiopia then submit the recorded data to the CME. CME reviews the data and in the case of any inconsistency found, the CME request the World Vision Ethiopia to review or correct the data. The following diagram depicts the information flow between World Vision Ethiopia and the CME.

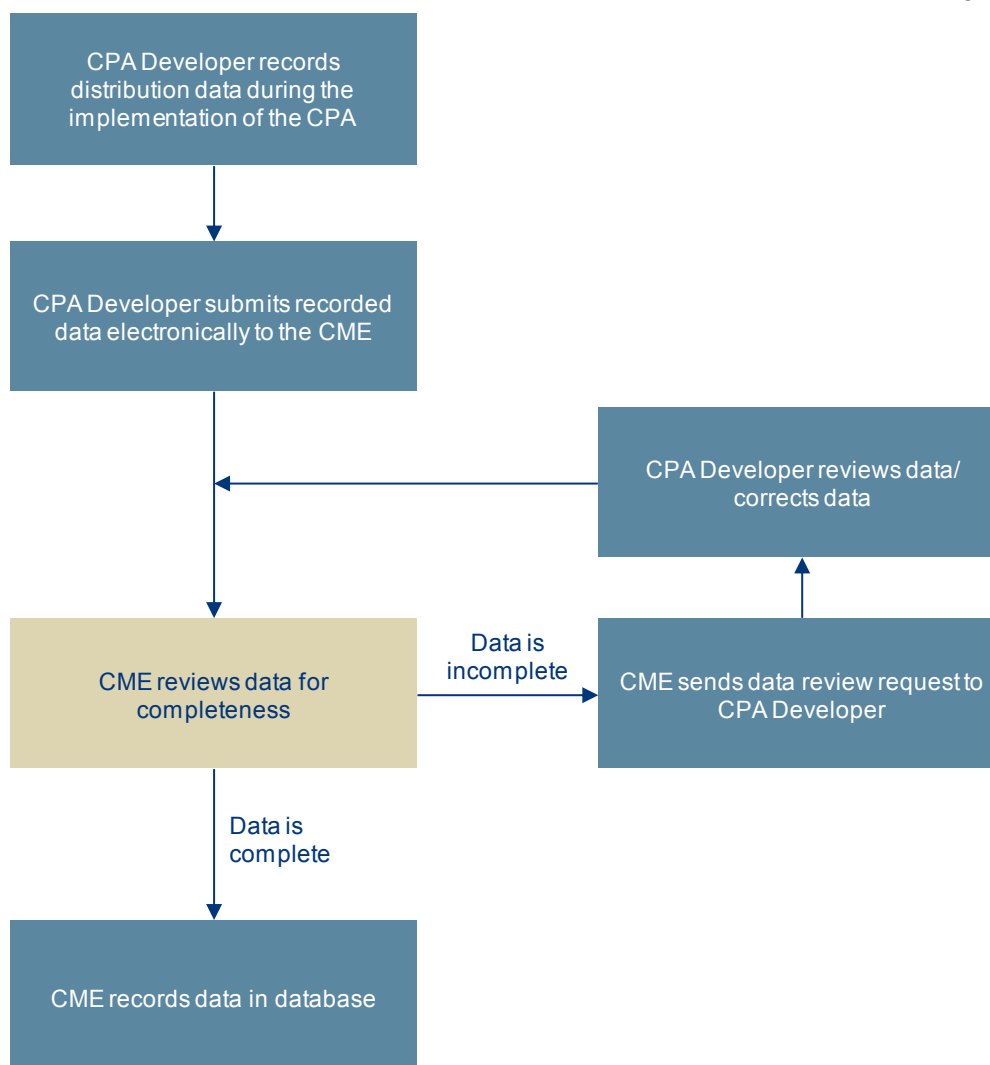


Diagram 1: Information Flow

In order to ensure that the baseline stoves are no longer used within the project boundary, all project households are required to sign an agreement stating that they are no longer allowed to use the baseline stove for cooking food.

As the householders sometime may use the baseline stove for non-cooking purposes such as the production of alcohol, therefore the proportion of fuel wood ( $FW_{\text{proportion}}$ ) consumed by cooking for each stove type is factored into the calculation of  $B_{y, \text{Device, Mirt}}$  (49.91% for Injera baking) and  $B_{y, \text{Device, Tikikil}}$  (41.50% for other cooking) to ensure that the emissions arising from cooking activities only are considered for emissions reduction calculations.

To ensure that the stove beneficiaries are using project stoves, the CPA implementers utilise the existing cooperative structure to monitor and encourage the use of project stove. Once the stoves are distributed, installed and the stove beneficiaries are trained on use and maintenance of the stove, a team of cooperative members visit each household within that village to ensure that the beneficiaries have disposed their baseline stove/s and are using project stoves for cooking. The household visit by the cooperative members also assists the stove beneficiaries in addressing any operational issues with the project stoves. The cooperative team makes such visit within one month from the date of project-stove distribution. Through the household visits, the cooperatives ensure that stove beneficiaries are using project stoves and they comply with the user agreement.

In the instances where a replacement stove is required by a purchaser, due to damage or theft, the household will be provided with a new stove (same model as the original stove) with an updated identification number to ensure no double counting of emission reductions. If a change of ownership occurs within the project area, then the old owner is replaced by the new one. All change of ownership and new ownership details are recorded in the electronic database as well as a copy of the user agreement kept at the CPA implementer's office.

The functionality Check survey was conducted by World Vision Ethiopia project staff in compliance with registered monitoring plan. The Project Efficiency Sample Group (PESG) survey was outsourced to the third party and was conducted jointly by Ministry of Water and Electricity Ethiopia and Ministry of Environment, Forestry and Climate Change. Once both surveys were completed, World Vision Ethiopia sent the survey findings to the CME. CME then used the finding of the survey in the emission reduction calculation and prepares the Monitoring Report.

**SECTION E. Data and parameters**

**E.1. Data and parameters fixed ex ante**

Fixed ex-ante data and parameters which are common for CPA 9769-0001, CPA 9769-0002 and CPA 9769-0003 are outlined below:

<b>Data/Parameter</b>	$f_{NRB,y}$
Unit	%
Description	Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass
Source of data	Using government data or default country specific fraction of non-renewable biomass (fNRB) values available on the CDM website.
Value(s) applied	88%
Choice of data or measurement methods and procedures	Default country specific fraction of non-renewable biomass (fNRB) value for the Federal Democratic Republic of Ethiopia available on the CDM website.  <a href="http://cdm.unfccc.int/DNA/fNRB/index.html">http://cdm.unfccc.int/DNA/fNRB/index.html</a>
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	$NCV_{biomass}$
Unit	TJ/t
Description	Net calorific value of the non-renewable biomass that is substituted on wet basis
Source of data	IPCC default for wood fuel (IPCC value 2006)
Value(s) applied	0.015
Choice of data or measurement methods and procedures	Default value as provided in paragraph 11 of AMS-II.G Version 5.0
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	$EF_{\text{projected\_fossilfuel}}$
Unit	tCO <sub>2</sub> /TJ
Description	Emission factor for the substitution of non-renewable biomass by similar consumers
Source of data	As per footnote 4 of AMS-II.G Version 5.0
Value(s) applied	81.6
Choice of data or measurement methods and procedures	Default value as provided in paragraph 11 of AMS-II.G Version 5.0
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	$SC_{\text{old}}$
Unit	g/kg
Description	Specific fuel consumption of the baseline devices
Source of data	CCT Results: Open Fire (specific fuel consumption). Please refer to page 6 of GTZ-SUN: Energy Mirt stove test report.
Value(s) applied	1031
Choice of data or measurement methods and procedures	The use of a pre-existing test report produced by STZ-SUN: Energy for traditional open fires have been used to determine $SC_{\text{old}}$
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	$\eta_{\text{old}}$
Unit	%
Description	Efficiency of the system being replaced
Source of data	Paragraph 12 of AMS-II.G Version 5.0
Value(s) applied	10
Choice of data or measurement methods and procedures	This CPA has chosen to apply the default value as given in AMS-II.G Version 5.0 to determine $\eta_{\text{old}}$
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	$L_y$
Unit	Fraction
Description	Leakage adjustment factor for period y
Source of data	Paragraph 29 (c) of AMS-II.G Version 5.0
Value(s) applied	0.95

Choice of data or measurement methods and procedures	<p>According to AMS-II.G Version 5.0, leakage related to the non-renewable woody biomass saved by the project activity shall be assessed based on (a) ex post surveys of users and the areas from which this woody biomass is sourced, or alternatively (b), where <math>B_{old}</math> can be multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.</p> <p>The methodology also requires leakage to be considered if equipment currently being utilized is transferred from outside the boundary to the project activity. This leakage source can be ruled out of this PoA as all stoves deployed in the program will be new.</p> <p>All CPAs to be included in this PoA will use the default net to gross adjustment factor of 0.95 to account for leakages.</p>
Purpose of data/parameter	Calculation of leakage
Additional comments	-

<b>Data/Parameter</b>	$N_{eater, household}$
Unit	-
Description	Average number of eaters (residents) per household
Source of data	UN Data
Value(s) applied	6
Choice of data or measurement methods and procedures	<p>An average household size of 6 based on a fertility rate of 4.8 live births per woman in 2011, as per UN Data available at:  <a href="http://data.un.org/Data.aspx?q=Fertility+rate&amp;d=WDI&amp;f=Indicator_Code%3aSP.DYN.TFRT.IN">http://data.un.org/Data.aspx?q=Fertility+rate&amp;d=WDI&amp;f=Indicator_Code%3aSP.DYN.TFRT.IN</a></p>
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	$FW_{\text{proportion, Mirt}}$
Unit	%
Description	The proportion of household fuel wood consumed by stove type i
Source of data	Letter from the Alternative Energy Technology Promotion And Dissemination Directorate, Ministry of Water and Energy, The Federal Democratic Republic of Ethiopia
Value(s) applied	49.91
Choice of data or measurement methods and procedures	Official letter from the Alternative Energy Technology Promotion And Dissemination Directorate, Ministry of Water and Energy, The Federal Democratic Republic of Ethiopia confirming the survey results from the Woody Biomass Inventory and Strategic Planning Project (WBISPP) for Injera baking.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	$FW_{\text{proportion, Tikikil}}$
Unit	%
Description	The proportion of household fuel wood consumed by stove type i
Source of data	Letter from the Alternative Energy Technology Promotion And Dissemination Directorate, Ministry of Water and Energy, The Federal Democratic Republic of Ethiopia
Value(s) applied	41.50
Choice of data or measurement methods and procedures	Official letter from the Alternative Energy Technology Promotion And Dissemination Directorate, Ministry of Water and Energy, The Federal Democratic Republic of Ethiopia confirming the survey results from the Woody Biomass Inventory and Strategic Planning Project (WBISPP) for other types of cooking.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	$HC_{\text{fuelwood, usage, y}}$
Unit	Tonnes
Description	Host country national fuel wood consumption in tonnes during year y.
Source of data	UN Data ( <a href="http://data.un.org/Data.aspx?d=EDATA&amp;f=cmID%3aFW%3btrID%3a06">http://data.un.org/Data.aspx?d=EDATA&amp;f=cmID%3aFW%3btrID%3a06</a> ) and the wood density factor as given by the FAO ( <a href="http://www.fao.org/docrep/009/j8227e/j8227e11.htm#P1131_70563">http://www.fao.org/docrep/009/j8227e/j8227e11.htm#P1131_70563</a> )
Value(s) applied	55,325,475

Choice of data or measurement methods and procedures	This is calculated based on national household fuel wood consumption of 76,311,000m <sup>3</sup> (national consumption in 2007 multiplied by the wood density factor of 0.725t/m <sup>3</sup> - <a href="http://www.fao.org/docrep/009/j8227e/j8227e11.htm#P1131_70563">http://www.fao.org/docrep/009/j8227e/j8227e11.htm#P1131_70563</a> ) It is important to note that the fuel wood consumption per capita is an average value for all Ethiopian households, whether they are using fuel wood or not and is therefore conservative.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	HC <sub>population,y</sub>
Unit	-
Description	Host country national population in year y.
Source of data	Official national census statistics
Value(s) applied	73,750,932
Choice of data or measurement methods and procedures	This is the population of Ethiopia at the time of the last census in 2007 ( <a href="http://unstats.un.org/unsd/demographic/products/vitstats/seratab2.pdf">http://unstats.un.org/unsd/demographic/products/vitstats/seratab2.pdf</a> )
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

## E.2. Data and parameters monitored

### CPA 9769-0001:

<b>Data/Parameter</b>	N <sub>y,Mirt</sub>
Unit	-
Description	Number of Mirt stoves that are operating in year y
Measured/calculated/default	Calculated
Source of data	Database records (to determine the total number of stoves distributed, and the number of days that stoves have been operational) and the results of the Project Operationality Sample Group (POSG).
Value(s) of monitored parameter	16,207
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Annually

Calculation method (if applicable)	<p><math>N_{y,Mirt}</math> is calculated as follows:</p> $N_{y,Mirt} = N_{y, Mirt,distributed} \times POSG_{operational,Mirt} \times (t_{y,Mirt,average}/365)$ <p>Where:</p> <p><math>N_{y, Mirt,distributed}</math> = The number of Mirt stoves that are distributed and operational during year y, as per the electronic database.</p> <p><math>POSG_{operational,Mirt}</math> = The fraction of Mirt stoves that are operational as determined by the POSG</p> <p><math>t_{y,Mirt,average}</math> = The average number of days that all Mirt stoves are operational during year y. To account for potential delays in between distribution and utilisation of Mirt stoves, the number of days will be taken from the 1<sup>st</sup> day of the next month following the date of distribution of the cook stove up until the end of the monitoring period. For example, for a Mirt stove distributed on the 7<sup>th</sup> of September 2013 the number of days will be counted from the 1<sup>st</sup> of October up until the end of the crediting period.</p>
QA/QC procedures	All records of stoves distributed will be stored in a secure database. Survey results will be stored in an electronic database for a minimum of 2 years after the end of the crediting period of the CPA.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	A total number of 18,401 Mirt stoves were distributed under CPA1, however, the number of Mirt stoves under CPA 1 is capped to 16,651 as per post registration change (PRC ref No. PRC-9769-002). Therefore, $N_{y,Mirt,distributed}$ is the capped value of Mirt stoves (i.e.16,651).

<b>Data/Parameter</b>	$N_{y,Tikikil}$
Unit	-
Description	Number of Tikikil stoves that are operating in year y
Measured/calculated/default	Calculated
Source of data	Database records (to determine the total number of stoves distributed, and the number of days that stoves have been operational) and the results of the Project Operationality Sample Group (POSG).
Value(s) of monitored parameter	15,943
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Yearly



Calculation method (if applicable)	<p><math>N_{y,Tikikil}</math> is calculated as follows:</p> $N_{y,Tikikil} = N_{y,Tikikil,distributed} \times POSG_{operational,Tikikil} \times (t_{y,Tikikil,average}/365)$ <p>Where:</p> <p><math>N_{y,Tikikil,distributed}</math> = The number of Tikikil stoves that are distributed and operational during year y, as per the electronic database.</p> <p><math>POSG_{operational,Tikikil}</math> = The fraction of Tikikil stoves that are operational as determined by the POSG</p> <p><math>t_{y,Tikikil,average}</math> = The average number of days that all Tikikil stoves are operational during year y. To account for potential delays in between distribution and utilisation of Tikikil stoves, the number of days will be taken from the 1<sup>st</sup> day of the next month following the date of distribution of the cook stove up until the end of the monitoring period. For example, for a Tikikil stove distributed on the 7<sup>th</sup> of September 2013 the number of days will be counted from the 1<sup>st</sup> of October up until the end of the crediting period.</p>
QA/QC procedures	All records of stoves distributed will be stored in a secure database. Survey results will be stored in an electronic database for a minimum of 2 years after the end of the crediting period of the CPA.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	A total number of 18,401 Tikikil stoves were distributed under CPA1, however, the number of Tikikil stoves under CPA 1 is capped to 16,651 as per post registration change (PRC ref No. PRC-9769-002). Therefore, $N_{y,Tikikil,distributed}$ is the capped value of Tikikil stoves (i.e.16,651).

<b>Data/Parameter</b>	$\eta_{new,Tikikil,y}$
Unit	%
Description	Efficiency of the Tikikil stove being deployed as part of the project activity in year y
Measured/calculated/default	Measured
Source of data	Results of the Water Boiling Test (WBT) conducted by Ministry of Water and Electricity Ethiopia, Ministry of Environment, Forestry and Climate Change. Please refer to "Final Report on WBT Results for Tikikil Stoves In 9 Sample Households".
Value(s) of monitored parameter	25.05%
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	<p>Water Boiling Test (WBT) v.3.0. of Shell Foundation's Household Energy Program was used to carry out the WBT.</p> <p>The results of the WBT were taken from a representative sample under the Project Efficiency Sample Group (PESG).</p>
QA/QC procedures	Results of the WBT under the PESG will be stored in an electronic database and will be stored for a minimum of 2 years after the end of the crediting period of the CPA. Monitoring equipment i.e. Infrared Thermometer (IR), Weighing Balance and Probe Thermometer used for the test were calibrated.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	SC <sub>new,Mirt,y</sub>
Unit	g/kg
Description	Specific fuel consumption in year y of the Mirt stove as part of the project that is fuel consumption per quantity of item/s processed (e.g. food cooked)
Measured/calculated/default	Measured
Source of data	The specific fuel consumption rate for Mirt stove monitored in the current monitoring period is 328.26 g/kg which is slightly lower than ex-ante value. Therefore, to be conservative, ex-ante specific fuel consumption rate value of Mirt Stove i.e. 328.53g/kg (that results into lower ER claim) has been applied for this monitoring period”.
Value(s) of monitored parameter	328.53  (For ER estimation ex-ante value of 328.53 g/kg has been used, please refer to the above statement)
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	Controlled Cooking Test (CCT) protocol, version 2.0, by the Shell Foundation was used to carry out the CCT.  The results of the CCT were taken from a representative sample under the Project Efficiency Sample Group (PESG).
QA/QC procedures	Results of the CCT under the PESG will be stored in an electronic database and will be stored for a minimum of 2 years after the end of the crediting period of the CPA. Monitoring equipment i.e. Infrared Thermometer (IR), Weighing Balance and Probe Thermometer used for the test were calibrated.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Results of the Controlled Cooking Test (CCT) for this monitoring period was conducted by Ministry of Water and Electricity Ethiopia, Ministry of Environment, Forestry and Climate Change. Please refer to the report “Final Report on Controlled Cooking Test (CCT) Results On Mirt Stoves in 28 Sample Households”

**CPA 9769-0002:**

<b>Data/Parameter</b>	N <sub>y,Mirt</sub>
Unit	-
Description	Number of Mirt stoves that are operating in year y
Measured/calculated/default	Calculated
Source of data	Database records (to determine the total number of stoves distributed, and the number of days that stoves have been operational) and the results of the Project Operationality Sample Group (POSG).
Value(s) of monitored parameter	15,900
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Annually

Calculation method (if applicable)	<p><math>N_{y,Mirt}</math> is calculated as follows:</p> $N_{y,Mirt} = N_{y, Mirt,distributed} \times POSG_{operational,Mirt} \times (t_{y,Mirt,average}/365)$ <p>Where:</p> <p><math>N_{y, Mirt,distributed}</math> = The number of Mirt stoves that are distributed and operational during year y, as per the electronic database.</p> <p><math>POSG_{operational,Mirt}</math> = The fraction of Mirt stoves that are operational as determined by the POSG</p> <p><math>t_{y,Mirt,average}</math> = The average number of days that all Mirt stoves are operational during year y. To account for potential delays in between distribution and utilisation of Mirt stoves, the number of days will be taken from the 1<sup>st</sup> day of the next month following the date of distribution of the cook stove up until the end of the monitoring period. For example, for a Mirt stove distributed on the 7<sup>th</sup> of September 2013 the number of days will be counted from the 1<sup>st</sup> of October up until the end of the crediting period.</p>
QA/QC procedures	All records of stoves distributed will be stored in a secure database. Survey results will be stored in an electronic database for a minimum of 2 years after the end of the crediting period of the CPA.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

<b>Data/Parameter</b>	$N_{y,Tikikil}$
Unit	-
Description	Number of Tikikil stoves that are operating in year y
Measured/calculated/default	Calculated
Source of data	Database records (to determine the total number of stoves distributed, and the number of days that stoves have been operational) and the results of the Project Operationality Sample Group (POSG).
Value(s) of monitored parameter	15,704
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Yearly

Calculation method (if applicable)	<p><math>N_{y,Tikikil}</math> is calculated as follows:</p> $N_{y,Tikikil} = N_{y,Tikikil,distributed} \times POSG_{operational,Tikikil} \times (t_{y,Tikikil,average}/365)$ <p>Where:</p> <p><math>N_{y,Tikikil,distributed}</math> = The number of Tikikil stoves that are distributed and operational during year y, as per the electronic database.</p> <p><math>POSG_{operational,Tikikil}</math> = The fraction of Tikikil stoves that are operational as determined by the POSG</p> <p><math>t_{y,Tikikil,average}</math> = The average number of days that all Tikikil stoves are operational during year y. To account for potential delays in between distribution and utilisation of Tikikil stoves, the number of days will be taken from the 1<sup>st</sup> day of the next month following the date of distribution of the cook stove up until the end of the monitoring period. For example, for a Tikikil stove distributed on the 7<sup>th</sup> of September 2013 the number of days will be counted from the 1<sup>st</sup> of October up until the end of the crediting period.</p>
QA/QC procedures	All records of stoves distributed will be stored in a secure database. Survey results will be stored in an electronic database for a minimum of 2 years after the end of the crediting period of the CPA.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

<b>Data/Parameter</b>	$\eta_{new,Tikikil,y}$
Unit	%
Description	Efficiency of the Tikikil stove being deployed as part of the project activity in year y
Measured/calculated/default	Measured
Source of data	Results of the Water Boiling Test (WBT) conducted by Ministry of Water and Electricity Ethiopia, Ministry of Environment, Forestry and Climate Change. Please refer to “Final Report on WBT Results for Tikikil Stoves In 9 Sample Households”.
Value(s) of monitored parameter	25.05%
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	<p>Water Boiling Test (WBT) v.3.0. of Shell Foundation’s Household Energy Program was used to carry out the WBT.</p> <p>The results of the WBT were taken from a representative sample under the Project Efficiency Sample Group (PESG).</p>
QA/QC procedures	Results of the WBT under the PESG will be stored in an electronic database and will be stored for a minimum of 2 years after the end of the crediting period of the CPA. Monitoring equipment i.e. Infrared Thermometer (IR), Weighing Balance and Probe Thermometer used for the test were calibrated.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	$SC_{new,Mirt,y}$
Unit	g/kg

Description	Specific fuel consumption in year y of the Mirt stove as part of the project that is fuel consumption per quantity of item/s processed (e.g. food cooked)
Measured/calculated/default	Measured
Source of data	The specific fuel consumption rate for Mirt stove monitored in the current monitoring period is 328.26 g/kg which is slightly lower than ex-ante value. Therefore, to be conservative, ex-ante specific fuel consumption rate value of Mirt Stove i.e. 328.53g/kg (that results into lower ER claim) has been applied for this monitoring period".
Value(s) of monitored parameter	328.53  (For ER estimation ex-ante value of 328.53 g/kg has been used, please refer to the above statement)
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	Controlled Cooking Test (CCT) protocol, version 2.0, by the Shell Foundation was used to carry out the CCT.  The results of the CCT were taken from a representative sample under the Project Efficiency Sample Group (PESG).
QA/QC procedures	Results of the CCT under the PESG will be stored in an electronic database and will be stored for a minimum of 2 years after the end of the crediting period of the CPA. Monitoring equipment i.e. Infrared Thermometer (IR), Weighing Balance and Probe Thermometer used for the test were calibrated.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Results of the Controlled Cooking Test (CCT) for this monitoring period was conducted by Ministry of Water and Electricity Ethiopia, Ministry of Environment, Forestry and Climate Change. Please refer to the report "Final Report on Controlled Cooking Test (CCT) Results On Mirt Stoves in 28 Sample Households"

**CPA 9769-0003:**

<b>Data/Parameter</b>	$N_{y,Mirt}$
Unit	-
Description	Number of Mirt stoves that are operating in year y
Measured/calculated/default	Calculated
Source of data	Database records (to determine the total number of stoves distributed, and the number of days that stoves have been operational) and the results of the Project Operationality Sample Group (POSG).
Value(s) of monitored parameter	15,551
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Annually

Calculation method (if applicable)	<p><math>N_{y,Mirt}</math> is calculated as follows:</p> $N_{y,Mirt} = N_{y, Mirt,distributed} \times POSG_{operational,Mirt} \times (t_{y,Mirt,average}/365)$ <p>Where:</p> <p><math>N_{y, Mirt,distributed}</math> = The number of Mirt stoves that are distributed and operational during year y, as per the electronic database.</p> <p><math>POSG_{operational,Mirt}</math> = The fraction of Mirt stoves that are operational as determined by the POSG</p> <p><math>t_{y,Mirt,average}</math> = The average number of days that all Mirt stoves are operational during year y. To account for potential delays in between distribution and utilisation of Mirt stoves, the number of days will be taken from the 1<sup>st</sup> day of the next month following the date of distribution of the cook stove up until the end of the monitoring period. For example, for a Mirt stove distributed on the 7<sup>th</sup> of September 2013 the number of days will be counted from the 1<sup>st</sup> of October up until the end of the crediting period.</p>
QA/QC procedures	All records of stoves distributed will be stored in a secure database. Survey results will be stored in an electronic database for a minimum of 2 years after the end of the crediting period of the CPA.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

<b>Data/Parameter</b>	$N_{y,Tikikil}$
Unit	-
Description	Number of Tikikil stoves that are operating in year y
Measured/calculated/default	Calculated
Source of data	Database records (to determine the total number of stoves distributed, and the number of days that stoves have been operational) and the results of the Project Operationality Sample Group (POSG).
Value(s) of monitored parameter	15,062
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Yearly

Calculation method (if applicable)	<p><math>N_{y,Tikikil}</math> is calculated as follows:</p> $N_{y,Tikikil} = N_{y,Tikikil,distributed} \times POSG_{operational,Tikikil} \times (t_{y,Tikikil,average}/365)$ <p>Where:</p> <p><math>N_{y,Tikikil,distributed}</math> = The number of Tikikil stoves that are distributed and operational during year y, as per the electronic database.</p> <p><math>POSG_{operational,Tikikil}</math> = The fraction of Tikikil stoves that are operational as determined by the POSG</p> <p><math>t_{y,Tikikil,average}</math> = The average number of days that all Tikikil stoves are operational during year y. To account for potential delays in between distribution and utilisation of Tikikil stoves, the number of days will be taken from the 1<sup>st</sup> day of the next month following the date of distribution of the cook stove up until the end of the monitoring period. For example, for a Tikikil stove distributed on the 7<sup>th</sup> of September 2013 the number of days will be counted from the 1<sup>st</sup> of October up until the end of the crediting period.</p>
QA/QC procedures	All records of stoves distributed will be stored in a secure database. Survey results will be stored in an electronic database for a minimum of 2 years after the end of the crediting period of the CPA.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

<b>Data/Parameter</b>	$\eta_{new,Tikikil,y}$
Unit	%
Description	Efficiency of the Tikikil stove being deployed as part of the project activity in year y
Measured/calculated/default	Measured
Source of data	Results of the Water Boiling Test (WBT) conducted by Ministry of Water and Electricity Ethiopia, Ministry of Environment, Forestry and Climate Change. Please refer to "Final Report on WBT Results for Tikikil Stoves In 9 Sample Households".
Value(s) of monitored parameter	25.05%
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	<p>Water Boiling Test (WBT) v.3.0. of Shell Foundation's Household Energy Program was used to carry out the WBT.</p> <p>The results of the WBT were taken from a representative sample under the Project Efficiency Sample Group (PESG).</p>
QA/QC procedures	Results of the WBT under the PESG will be stored in an electronic database and will be stored for a minimum of 2 years after the end of the crediting period of the CPA. Monitoring equipment i.e. Infrared Thermometer (IR), Weighing Balance and Probe Thermometer used for the test were calibrated.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<b>Data/Parameter</b>	$SC_{new,Mirt,y}$
Unit	g/kg

Description	Specific fuel consumption in year y of the Mirt stove as part of the project that is fuel consumption per quantity of item/s processed (e.g. food cooked)
Measured/calculated/default	Measured
Source of data	The specific fuel consumption rate for Mirt stove monitored in the current monitoring period is 328.26 g/kg which is slightly lower than ex-ante value. Therefore, to be conservative, ex-ante specific fuel consumption rate value of Mirt Stove i.e. 328.53g/kg (that results into lower ER claim) has been applied for this monitoring period".
Value(s) of monitored parameter	328.53  (For ER estimation ex-ante value of 328.53 g/kg has been used, please refer to the above statement)
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	Controlled Cooking Test (CCT) protocol, version 2.0, by the Shell Foundation was used to carry out the CCT.  The results of the CCT were taken from a representative sample under the Project Efficiency Sample Group (PESG).
QA/QC procedures	Results of the CCT under the PESG will be stored in an electronic database and will be stored for a minimum of 2 years after the end of the crediting period of the CPA. Monitoring equipment i.e. Infrared Thermometer (IR), Weighing Balance and Probe Thermometer used for the test were calibrated.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Results of the Controlled Cooking Test (CCT) for this monitoring period was conducted by Ministry of Water and Electricity Ethiopia, Ministry of Environment, Forestry and Climate Change. Please refer to the report "Final Report on Controlled Cooking Test (CCT) Results On Mirt Stoves in 28 Sample Households"

### E.3. Implementation of sampling plan

Project Operationality Sample Group (POSG) is monitored at the CPA level. The POSG survey was conducted from 12 December 2018 to 25 December 2018.

The objective of POSG sampling was to determine:

- i) the proportion of Mirt and Tikikil project cook stoves still operating within the CPA during the crediting period to determine  $N_{y,Mirt}$  and  $N_{y,Tikikil}$ . The proportion of operating Mirt and Tikikil cook stoves was monitored with 90% confidence and 10% precision as annual sampling was selected. The Project Operationality Sample Group (POSG) determined the number of operational Mirt and Tikikil cook stoves.

#### Sampling Method



Simple random sampling was applied to randomly select sample size required for obtaining representative samples for the Mirt and Tikikil stoves for POSG.

### **Sample Size Calculation:**

#### **POSG Sample Size:**

Annual sampling has been chosen for the POSG, and therefore the sample size for obtaining results with 90% confidence and 10% precision was calculated as per “Guidelines for sampling and surveys for CDM project activities and Programme of Activities” (version 04.0).

$$n = \frac{1.645^2 N \times p(1-p)}{(N-1) \times 0.1^2 \times p^2 + 1.645^2 p(1-p)}$$

Where:

n = the minimum sample size required

N = Total number of households

p = Expected proportion

#### **For CPA 1:**

N = Total number of households (18,401 households)

p = Expected proportion

In the Monitoring Period 4, following values were monitored for expected proportion (p) for:

p (Tikikil Stove) : 0.9689

p (Mirt Stove): 0.9379

Putting these values in the sample size calculator available in the CDM website:

<https://cdm.unfccc.int/Reference/Guidclarif/index.html>

n (the minimum sample size required for Tikikil stove) = 9

n (the minimum sample size required for Mirt stove) = 18

#### **For CPA 2:**

N = Total number of households (15,904 households)

p = Expected proportion

In the Monitoring Period 4, following values were monitored for expected proportion (p) for:

p (Tikikil Stove) : 0.98621

p (Mirt Stove): 0.95862

Putting these values in the sample size calculator available in the CDM website:

<https://cdm.unfccc.int/Reference/Guidclarif/index.html>

n (the minimum sample size required for Tikikil stove) = 4

n (the minimum sample size required for Mirt stove) = 12

**For CPA 3:**

N = Total number of households (15,551 households)

p = Expected proportion

In the Monitoring Period 4, following values were monitored for expected proportion (p) for:

p (Tikikil Stove) : 0.96897

p (Mirt Stove): 0.98276

Putting these values in the sample size calculator available in the CDM website:

<https://cdm.unfccc.int/Reference/Guidclarif/index.html>

n (the minimum sample size required for Tikikil stove) = 9

n (the minimum sample size required for Mirt stove) = 5

As per paragraph 13 of “Standard:Sampling and surveys for CDM project activities and programmes of activities, Version 07.0” if the sample size calculation returns a value of less than 30 samples, a minimum sample size of 30 shall be chosen when the parameter of interest is a proportion. Therefore, a minimum of 30 operationality checks will be conducted for both the Mirt and Tikikil cook stoves implemented under the CPA. Based on the monitoring results of the POSG, the CME may choose to adjust the sample size in subsequent sampling periods. If the sample size monitored does not reach 90/10 confidence/precision, the CME may choose to take additional samples until the required confidence and precision is met. Alternatively, the lower bound of the confidence interval may be used as per AMS-II.G Version 5.0

Therefore, 30 was the minimum number of samples required to be surveyed under CPA 1, CPA 2 and CPA3 respectively. However, 38 samples were randomly selected for each of the CPAs separately which is more than the required minimum sample size of 30 to address site-specific issues such as non- response (e.g. households not available on the sampling day etc).Sample size calculation spreadsheet has been submitted to the DOE for verification.

**Reliability Check:**

The Reliability checking procedure is based on Guideline on Sampling and surveys for CDM project activities and programmes of activities (Version 04.0), Appendix 4

A confidence interval for a proportion: sample proportion  $\pm$  z-value x standard error of the proportion.

For 90% confidence value of z = 1.6449

Standard error of the proportion =  $\sqrt{(1-f) \frac{pq}{n}}$  (Equation 2)

Where,

f is the sampling fraction

p is the sample proportion

q is the proportion of cook stoves that are not operational

Detail calculation on reliability for CPA 1, CPA 2 and CPA 3 are provided to the DOE in an excel spreadsheet. Summary of key parameters and reliability test results for CPAs are provided below:

<b>CPA 1</b>	
<b>Tikikil Stoves</b>	
<b>CDM-PoA-MR-FORM</b>	
Relative Precision	4.38%
Precision met	Yes
<b>Mirt Stoves</b>	
Relative Precision	4.38%
Precision met	Yes

<b>CPA 2</b>	
<b>Tikikil Stoves</b>	
Relative Precision	0.00%
Precision met	Yes
<b>Mirt Stoves</b>	
Relative Precision	0.00%
Precision met	Yes

<b>CPA 3</b>	
<b>Tikikil Stoves</b>	
Relative Precision	0.00%
Precision met	Yes
<b>Mirt Stoves</b>	
Relative Precision	0.00%
Precision met	Yes

**PESG Sample Size:**

For PESG, a stratified random sampling has been randomly selected to calculate the minimum sample size required for obtaining representative samples for each stove of type *i* for the group of CPAs.

The justification for this approach is as follows:

As per "Guideline: Sampling and surveys for CDM project activities and programmes of activities (Version 04.0)", stratified simple random sampling is suited to populations when the population under study is not homogeneous but instead consists of several sub-populations which are known (or thought) to vary. Although the CPAs that are grouped will have same type of cook-stove technology distributed and the CPAs will share the same geographical boundary, however, timing

of distribution of the stoves (i.e. vintage of the stoves) may impact the efficiency and specific fuel consumption parameters of stove type i making the population non-homogenous. Therefore, stratified random sampling is deemed to be more suitable for PESG.

A stratified random sample for each type of cook stoves (Mirt and Tikikil) based on its year of distribution was randomly selected for monitoring of the PESG.

Groups of CPAs (CPA 1, CPA 2 and CPA 3) were monitored with 95% confidence and 10% precision, and the sample size was calculated as per equation 19, Appendix 3 of “Guideline: Sampling and surveys for CDM project activities and programmes of activities (Version 04.0)”:

$$n \geq \frac{1.96^2 NV}{(N - 1) \times 0.1^2 + 1.96^2 V}$$

Where:

$$V = \frac{SD^2}{\bar{m}^2} = \frac{\text{weighted overall expected variance}}{\text{weighted overall expected mean, squared}}$$

N = Total population

Where pre-existing test data exists, the CME may choose to recalculate V and the resultant sample size based on this data. As per “Standard: Sampling and surveys for CDM project activities and programmes of activities (Version 07.0)” paragraph 13, if the resulting sample size is less than 30, the Student’s t- distribution shall be used to ascertain the final sample size. If the sample size that is monitored does not meet the confidence/precision requirements, the CME may choose to take additional samples until the required confidence and precision is met. Alternatively, the lower bound of the confidence interval may be used as per AMS-II.G Version 5.0.

Pre-existing test data from the latest monitoring period (i.e. MP4) were applied to calculate the minimum sample size.

The sample size was calculated as per equation 19, Appendix 3 of “Guideline: Sampling and surveys for CDM project activities and programmes of activities (Version 04.0)” (as stated above).

Where,

Mean	329.7
Standard Deviation (SD)	70.96
V	0.0463
Minimum Sample Size required	18

Since the calculated sample size is less than 30 and in accordance with “Standard: Sampling and surveys for CDM project activities and programmes of activities (Version 07.0)” paragraph 13, a Student’s t- distribution test was carried out to adjust the sample size of 18, bringing the total calculated sample size to 21 samples. A higher samples were surveyed to address the site-specific issues such as non-response from the sample households etc. Please refer to the sample size calculation spreadsheet for calculation details.

**Sample Size for PESG – Tikikil Stove**

Groups of CPAs were monitored with 95% confidence and 10% precision, and the sample size was calculated as per equation 19, Appendix 3 of “Guideline: Sampling and surveys for CDM project activities and programmes of activities (Version 04.0)”:

$$n \geq \frac{1.96^2 NV}{(N - 1) \times 0.1^2 + 1.96^2 V}$$

Where:

$$V = \frac{SD^2}{\bar{m}^2} = \frac{\text{weighted overall expected variance}}{\text{weighted overall expected mean, squared}}$$

N = Total population

Pre-existing test data from the latest monitoring period (i.e. MP4) were applied to calculate the minimum sample size. The sample size was calculated as per equation 19, Appendix 3 of “Guideline: Sampling and surveys for CDM project activities and programmes of activities (Version 04.0)”.

Where,

Mean	0.2541
Standard Deviation (SD)	0.022
V	0.00749
Minimum Sample Size required	3

Since the calculated sample size is less than 30 and in accordance with “Standard: Sampling and surveys for CDM project activities and programmes of activities (Version 07.0)” paragraph 13, a Student’s t- distribution test was carried out to adjust the sample size of 3, bringing the total calculated sample size to 6 samples. A higher samples were surveyed to address the site- specific issues such as non-response from the sample households etc . Please refer to the sample size calculation spreadsheet for calculation details.

**Reliability Check:**

Equation 44, Equation 47 and Equation 50 from “Guideline: Sampling and surveys for CDM project activities and programmes of activities” (Version 4.0), has been applied to check the reliability.

$$m_{Strat} = \sum_{i=a}^k \frac{g_i}{N} \times m_i$$

Where:

- $m_{Strat}$  = The stratified estimated overall mean
- $g_i$  = Size of the  $i^{th}$  group (CPA) where  $i=a, \dots, k$
- $N$  = Population total
- $m_i$  = Mean of the  $i^{th}$  group (CPA) where  $i=a, \dots, k$

[Equation 44]

$$s.e.(m_{Strat}) = \sqrt{\sum_{i=a}^k \left(\frac{g_i}{N}\right)^2 \times \left(1 - \frac{n_i}{g_i}\right) \times \frac{SD_i^2}{n_i}}$$

Equation (47)

Where:

- $s.e.(m_{Strat})$  = Standard error of the stratified estimated overall mean
- $g_i$  = Size of the  $i^{th}$  group (CPA) where  $i=a, \dots, k$
- $N$  = Population total
- $n_i$  = Number of sampled units in the  $i^{th}$  group (CPA) where  $i=a, \dots, k$
- $SD_i^2$  = Variance of the  $i^{th}$  group (CPA) where  $i=a, \dots, k$

$$Reliability = \frac{0.5 \times Width\ of\ Confidence\ Interval}{Estimated\ Stratified\ Overall\ Mean} \times 100$$

Equation (50)

Reliability check has been performed in an excel sheet which has been submitted to the DOE for verification. Summary of key parameters from the reliability check are provided below:

**Mirt Stove:**

Relative Precision	2.08%
Reliability met	Yes

**Tikikil Stove:**

Relative Precision	4.42%
Reliability met	Yes

**POSG Survey:****CPA 1:**

A random sample of 38 households were randomly selected using random number generator for spot checks to determine the number of Mirt and Tikikil stoves that were operational. More number of samples was randomly selected than the required minimum sample size of 30 to addresses site-specific issues such as non- response (e.g. households not available on the sampling day etc). Please note that as multiple stove types (i.e. Mirt and Tikikil) had been distributed to each household within CPA 1, the sample size randomly selected is the number of households to be surveyed where both the Mirt and Tikikil stoves was checked for operationality within each household. The CPA implementer World Vision Ethiopia conducted the POSG survey for CPA 1.

**CPA 2:**

A random sample of 38 households were randomly selected using random number generator for spot checks to determine the number of Mirt and Tikikil stoves that were operational. More number of samples was randomly selected than the required minimum sample size of 30 to addresses site-specific issues such as non- response (e.g. households not available on the sampling day etc). Please note that as multiple stove types (i.e. Mirt and Tikikil) had been distributed to each household within CPA 2, the sample size randomly selected is the number of households to be surveyed where both the Mirt and Tikikil stoves was checked for operationality within each household. The CPA implementer World Vision Ethiopia conducted the POSG survey for CPA 2

**CPA 3:**

A random sample of 38 households were randomly selected using random number generator for spot checks to determine the number of Mirt and Tikikil stoves that were operational. More number of samples was randomly selected than the required minimum sample size of 30 to addresses site-specific issues such as non- response (e.g. households not available on the sampling day etc). Please note that as multiple stove types (i.e. Mirt and Tikikil) had been distributed to each household within CPA 3, the sample size randomly selected is the number of households to be surveyed where both the Mirt and Tikikil stoves was checked for operationality within each household. The CPA implementer World Vision Ethiopia conducted the POSG survey for CPA 3

**PESG Survey:**

Project Efficiency Sample Group (PESG) is monitored at the PoA level. The PESG survey was conducted from 20 December 2018 to 26 January 2019 and was conducted jointly by Ministry of Water and Electricity Ethiopia and Ministry of Environment, Forestry and Climate Change. Monitoring equipment used for testing stoves were calibrated, the clarification certificate has been submitted to the DOE for verification. Moisture meter that was used for testing is auto-calibrated hence doesn't require calibration. The Moisture meter manufacturer has confirmed the auto-

calibration nature of this equipment via email, a copy of the manufacturer’s email has been submitted to the DOE for verification.

In line with the registered monitoring plan, the samples for the PESG are randomly selected from a group of CPAs that implement the same technology type and the same geographical boundary. CPA 9769-0001, CPA 9769-0002 and CPA 9769-0003 implement the same type of cook-stove technology in the same geographical boundary. Therefore, for PESG, samples were randomly selected from the combined group of CPA 9769-0001, CPA 9769-0002 and CPA 9769-0003.

The objective of PESG sampling was to determine:

- i) the mean annual quantity of woody biomass used per Mirt and Tikikil device. This was done by monitoring the thermal efficiency of the Tikikil stove with the parameter  $\eta_{new,Tikikil,y}$ , and the specific fuel consumption of the Mirt stove with the parameter  $SC_{new,Mirt,y}$  and applying these values to the equations for calculating  $B_{y,savings,Tikikil}$  and  $B_{y,savings,Mirt}$ . These parameters were monitored with 95% confidence and 10% precision as annual sampling was selected for CPA groups (i.e. CPA 9769-0001, CPA 9769-0002 and CPA 9769-0003). The Project Efficiency Sample Group (PESG) determined the mean thermal efficiency of the Tikikil stove and the mean specific fuel consumption of the Mirt stove.

Sampling Method

Simple random sampling was applied for to select the POSG samples and Stratified Random Sampling method based on cook stove distribution year was used to select the PESG samples.

Sample Size for PESG

A sample of 28 Mirt stoves based on its year of distribution and 9 Tikikil stoves based on its year of distribution were randomly selected from the combined project cook stove distribution database using random number generator. Water Boiling Test (WBT) and Control Cooking Test (CCT) were utilised to determine the thermal efficiency of the Tikikil stove and the specific fuel consumption of the Mirt stove respectively. A higher number of samples were randomly selected than the required minimum sample size to addresses site-specific issues such as non- response (e.g. households not available on the sampling day etc). The WBT and CCT were jointly conducted by Ministry of Water and Electricity Ethiopia and Ministry of Environment, Forestry and Climate Change. The test reports on WBT and CCT has been submitted to the DOE for verification.

**SECTION F. Calculation of emission reductions or net anthropogenic removals**

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

The equations in the methodology do not calculate baseline and project emissions separately and instead calculate direct emissions reductions as shown in the equation below:

$$ER_{y,i} = B_{y,savings,i} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossilfuel} \times N_{y,i} \quad (1)$$

Where:

$ER_{y,i}$  Emission reductions by project device of type *i* during year *y* in tCO<sub>2</sub>e



$B_{y,savings,i}$	Quantity of woody biomass that is saved in tonnes per device of type $i$
$f_{NRB,y}$	Fraction of woody biomass saved by the project activity in year $y$ that can be established as non-renewable biomass using survey methods or government data or default country specific fraction of non-renewable woody biomass (fNRB) values available on the CDM website
$NCV_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne, wet basis)
$EF_{projected\_fossilfuel}$	Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO <sub>2</sub> /TJ
$N_{y,i}$	Number of project devices of type $i$ operating in year $y$

$N_{y,Mirt}$ ,  $N_{y,Tikikil}$  and  $N_{y,Tikikil}$  is calculated as follows:

$$N_{y,Mirt} = N_{y,Mirt,distributed} \times POSG_{operational,Mirt} \times (t_{y,Mirt,average}/365)$$

$$N_{y,Tikikil} = N_{y,Tikikil,distributed} \times POSG_{operational,Tikikil} \times (t_{y,Tikikil,average}/365)$$

These equations are stated in Section D.7.1 of the CPA-DD.

Where,

$POSG_{operational,Mirt}$  = The fraction of Mirt stoves that are operational as determined by the POSG

$POSG_{operational,Tikikil}$  = The fraction of Tikikil stoves that are operational as determined by the POSG

$t_{y,Mirt,average}$  = The average number of days that all Mirt stoves are operational during year  $y$ . To account for potential delays in between distribution and utilisation of Mirt stoves, the number of days was taken from the 1<sup>st</sup> day of the next month following the date of distribution of the cook stove up until the end of the monitoring period.

$t_{y,Tikikil,average}$  = The average number of days that all Tikikil stoves are operational during year  $y$ . To account for potential delays in between distribution and utilisation of Tikikil stoves, the number of days will be taken from the 1<sup>st</sup> day of the next month following the date of distribution of the cook stove up until the end of the monitoring period.

The quantity of woody biomass that is saved in tonnes per Mirt stove is calculated as per equation 5 of AMS-II.G Version 05.0. Option 3 for calculating  $B_{y,savings,i}$  has been applied.

Option 3, calculated using equation 5 of AMS-II.G Version 05.0 as follows:

$$B_{y,savings,i} = B_{old,i} \times \left( 1 - \frac{SC_{new,i}}{SC_{old}} \right) \quad (5)$$

Where:

$B_{old,i}$  Quantity of woody biomass used in the absence of the project activity in tonnes per device of type  $i$

$SC_{old}$  Specific fuel consumption or fuel consumption rate of the baseline devices i.e. fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour, respectively. Use weighted average values if more than one type of device is being replaced.

$SC_{new,i,y}$  Specific fuel consumption or the fuel consumption rate in year  $y$  of the devices of type  $i$  deployed as part of the project i.e. fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour respectively. Use weighted average values if more than one type of system is being introduced by the project activity.

The quantity of woody biomass that is saved in tonnes per Tikikil stove is calculated as per equation 5 of AMS-II.G Version 05.0. Option 2, calculated using equation 3 of AMS-II.G Version 5 as follows:

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

$B_{old,i}$  Quantity of woody biomass used in the absence of the project activity in tonnes per device of type  $i$

$\eta_{old}$  1. Efficiency of the system being replaced (fraction), measured using representative sampling methods or based on referenced literature values use weighted average values if more than one type of device is being replaced;

2. A default value of 10% may be optionally used if the replaced device is a three stone fire, or a conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney; for other types of devices, a default value of 0.2 may be optionally used

$\eta_{new,i,y}$  Efficiency of the device of type  $i$  being deployed as part of the project activity (fraction), as determined annually using the water boiling test (WBT) protocol carried out in accordance with national standards (if available) or international standards or guidelines. Use weighted average values if more than one type of system is being introduced by the project activity.

Please refer to CER calculation spreadsheets for emission reduction and aggregate energy savings achieved by CPA 1, CPA 2 and CPA 3.

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

Project emissions are not calculated because the methodology calculates emission reductions directly.

**F.3. Calculation of leakage emissions**

Leakage does not need to be calculated separately because it has already been removed as a 0.95 net to gross factor from the parameter Bold, used in direct emissions reductions calculations using Equation 1 under Section H.1.

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

CPA UNFCCC reference number	Baseline GHG emissions or baseline net GHG removals (t CO <sub>2</sub> e)	Project GHG emissions or actual net GHG removals (t CO <sub>2</sub> e)	Leakage GHG emissions (t CO <sub>2</sub> e)	GHG emission reductions or net anthropogenic GHG removals (t CO <sub>2</sub> e)		
				Before 01/01/2013	From 01/01/2013	Total amount
CPA 9769-0001	43,682	-	-	-	43,682	43,682
CPA 9769-0002	42,927	-	-	-	42,927	42,927
CPA 9769-0003	41,643	-	-	-	41,643	41,643
<b>Total</b>	128,252	-	-	-	128,252	128,252

**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 <sub>2</sub> e)	Amount estimated ex ante (t CO <sub>2</sub> e)
CPA 9769-0001	43,682	46,528
CPA 9769-0002	42,927	46,530
CPA 9769-0003	41,643	46,530
<b>Total</b>	128,252	139,588

**F.6. Remarks on increase in achieved emission reductions****CPA 9769-0001**

Emission Reductions for CPA 9769-0001 are lower than the values estimated in ex-ante calculation.

**CPA 9769-0002**

Emission Reductions for CPA 9769-0002 are lower than the values estimated in ex-ante calculation.

**CPA 9769-0003**

Emission Reductions for CPA 9769-0003 are lower than the values estimated in ex-ante calculation.

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**Document information**

<i>Version</i>	<i>Date</i>	<i>Description</i>
02.0	7 June 2017	Revision to: <ul style="list-style-type: none"><li>• Ensure consistency with version 01.0 of the “CDM project standard for programmes of activities (CDM-EB93-A07-STAN);</li><li>• Make editorial improvements.</li></ul>
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