



**Monitoring report form for CDM programme of activities
(Version 02.0)**

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

MONITORING REPORT

Title of the PoA	Ethiopia – Clean Cooking Energy Program	
UNFCCC reference number of the PoA	10268	
Version numbers of the PoA-DD applicable to this monitoring report	6.0	
Version number of this monitoring report	1.0	
Completion date of this monitoring report	05/09/2018	
Monitoring period number	1	
Duration of this monitoring period	01/04/2016 – 31/03/2018	
Monitoring report number for this monitoring period	1	
Coordinating/managing entity	Development Bank of Ethiopia	
Host Parties	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	Federal Democratic Republic of Ethiopia	Yes
Sectoral scopes	1: Energy industries (renewable - / non-renewable sources) 3: Energy Demand	
Applied methodologies and standardized baselines	AMS-I.E. Version 6 Switch from non-renewable biomass for thermal applications by the user AMS-I.I Version 4 Biogas/biomass thermal applications for households/small users AMS-II.G Version 6 Energy efficiency measures in thermal applications of non-renewable biomass	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0 tCO ₂ e	35,465 tCO ₂ e

Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs covered in this monitoring report	43,915 tCO ₂ e
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PART I Monitoring of programme of activities (PoA)

SECTION A. Description of PoA

A.1. General description of PoA

The Ethiopia – Clean Cooking Energy Program (the PoA) is a nationwide program for Ethiopia that targets poor and vulnerable households, who rely primarily on wood fuels for cooking; national statistics show that 85% of cooking fuel currently used in Ethiopia is either collected or purchased¹. The purpose of the PoA is to provide improved energy access to such households, with associated benefits for poverty alleviation, while simultaneously reducing greenhouse gas emissions from the exploitation of non-renewable biomass (NRB) resources and from fossil fuels.

The PoA seeks to promote the goals stated by the Government of Ethiopia (GoE) in its Growth and Transformation Plan 2010/11–2014/15 (GTP). Specifically, the PoA promotes the GTP goals for Alternative Energy Development and Promotion, where the GTP aims to disseminate the use of improved alternative technologies that can minimize deforestation, reduce indoor air pollution and associated health problems and save women's and children's working time collecting wood fuels.² The PoA also contributes to the GTP implementation strategy of supporting and motivating private investors to involve in bio-fuel development activities on the short term.

To this end, three alternative energy technologies are implemented under the PoA. Via the PoA, households are encouraged to adopt domestic biogas plants (DBPs), which generate biogas for cooking and lighting, ethanol stoves for cooking, and improved cookstoves fuelled by non-renewable biomass. These technologies permit the substitution or reduced use of wood fuels, including non-renewable biomass (NRB), or fossil fuels, by a renewable fuel, either biogas or ethanol, thereby reducing mainly CO₂ emissions. DBPs were selected for promotion because of the high prevalence of suitable conditions for successful DBPs among rural Ethiopian households. For example, 80% of the rural population is involved in animal husbandry and many regions have plentiful water availability³, both of which provide the necessary inputs for a household level biogas digester. The other technology, ethanol stoves, was chosen because of the excellent potential for bio-ethanol production in Ethiopia⁴, which is largely untapped but targeted for growth. Improved cookstoves were included for the households that do not have the waste biomass to support a DBP or access to biofuels such as ethanol.

The unique feature of this PoA is that it takes advantage of useful experience that GoE has accumulated with DBPs in Ethiopia through the National Biogas Program Ethiopia (NBP), which began in a demonstration phase in 2008, and since 2009 has been a national program

¹ Central Statistical Agency. *Welfare Monitoring Survey 2011*. Page 79 Table 8.7(a)

² Ministry of Finance and Economic Development. *Growth and Transformation Plan 2010/11 – 2014/15*. November 2010.

³ SNV – Ethiopia. *Report on the feasibility study of a national programme for domestic biogas in Ethiopia*. Page 10. May 2006.

⁴ The World Bank. *The Federal Democratic Republic of Ethiopia Joint IDA-IMF Staff Advisory Note on the Growth and Transformation Plan (GTP) (2010/11-2014/15)*. Page 37. August 15th 2011.

implemented by the Ministry of Water and Energy (MoWE) and financed by a combination of rural households contribution, Government of Ethiopia funds, and donor funds from development organizations SNV and Hivos. Since 2008, a total of 6,252 biogas plants have been installed, whereas the government program planned to install about double this amount. Donor funds subsidized directly about 36% of the cost of each DBP for its purchaser. However, the existing donor, Hivos, manifested that it will only fund the DBP subsidy through the end of 2013⁵, and the GoE is unable to provide funds to continue the existing subsidy. Carbon finance is sought to contribute to part of the budget shortfall to continue and expand NBP implementation.

The CME of the PoA is the Development Bank of Ethiopia (DBE), a public enterprise that comprises a specialized financial institution established to promote the national development agenda through development finance and technical support to viable projects from the priority areas of the government. DBE mobilizes funds from domestic and foreign sources while ensuring its sustainability. The Carbon Initiative for Development (Ci-Dev) of the World Bank supports the PoA and will assist the program through direct support and capacity building to register the carbon component of the program in a timely manner and potentially purchase the generated credits.

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
Title: NBP Ethiopia Domestic Biogas Plants CPA CPA Type: Generic CPA Type 1	6.0	1	AMS-I.E. Version 6 Switch from non-renewable biomass for thermal applications by the user ⁶
Title: NBP Ethiopia Ethanol Stove CPA CPA Type: Generic CPA Type 2	6.0	1	AMS-I.E. Version 6 Switch from non-renewable biomass for thermal applications by the user ⁹
Title: NBP Ethiopia Ethanol Stove Switch CPA CPA Type: Generic CPA Type 3	6.0	1	AMS-I.I Version 4 Biogas/biomass thermal applications for households/small users ¹²
Title: NBP Clean Cookstoves CPA Type: Generic CPA Type 4	6.0	3	AMS-II.G. Version 6 Energy efficiency measures in thermal applications of non-renewable biomass ¹³

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)
NBP Ethiopia Domestic Biogas Plants CPA 1 Reference Number:	Title: NBP Ethiopia Domestic Biogas Plants CPA	6.0	Type: Renewable Duration: 01/04/2016 to	Yes

⁵ Hivos. Annual Plan 2013 Implications. Page 2. December 17th 2012

⁶ <https://cdm.unfccc.int/methodologies/DB/9LFOR81TCT5FLI1AJYP46CQY8O2J79>

⁹ <https://cdm.unfccc.int/methodologies/DB/9LFOR81TCT5FLI1AJYP46CQY8O2J79>

¹² <https://cdm.unfccc.int/methodologies/DB/3WJ6C7R0JFA62VYA2Z2K6WE1RK1PXI>

¹³ <https://cdm.unfccc.int/methodologies/DB/DCO8WRRQVTGLH1GHQBCL035F5M13R8>

10268-0001	Reference Number: Generic CPA Type 1		31/03/2023	
NBP Ethiopia Domestic Biogas Plants CPA 2	Title: NBP Ethiopia Domestic Biogas Plants CPA	6.0	Type: Renewable	No
Reference Number: 10268-0002	Reference Number: Generic CPA Type 1		Duration: 01/05/2017 to 30/04/2024	

A.2. Coordinating/managing entity

The CME is the Development Bank of Ethiopia (DBE). DBE is a state owned financial institution. The DBE is headquartered in Addis Ababa, with further staff in the branches and regions of Ethiopia. The address of the DBE is the following:

Development Bank of Ethiopia
Kirkos
Addis Ababa
Ethiopia

SECTION B. Implementation of PoA

B.1. Description of implemented PoA

The Ethiopia – Clean Cooking Energy Program is a nationwide program for Ethiopia that targets poor and vulnerable households, who rely primarily on wood fuels for cooking. The purpose of the PoA is to provide improved energy access to such households, with associated benefits for poverty alleviation, while simultaneously reducing greenhouse gas emissions from the exploitation of non-renewable biomass (NRB) resources and from fossil fuels.

The Development Bank of Ethiopia, the CME, has worked to implement the PoA as per the management system in the PoA-DD. At the time of monitoring, two CPAs have been included under the PoA., namely two Type 1 CPAs, covering biogas digesters. This monitoring report covers only the first biogas CPA included at the time of registration. The PoA was registered on 18/03/2016.

Three alternative energy technologies are implemented under the PoA. Via the PoA, households are encouraged to adopt domestic biogas plants (DBPs), which generate biogas for cooking and lighting, ethanol stoves for cooking, and improved cookstoves fuelled by non-renewable biomass. These technologies permit the substitution or reduced use of wood fuels, including non-renewable biomass (NRB), or fossil fuels, by a renewable fuel, either biogas or ethanol, thereby reducing mainly CO₂ emissions. DBPs were selected for promotion because of the high prevalence of suitable conditions for successful DBPs among rural Ethiopian households.

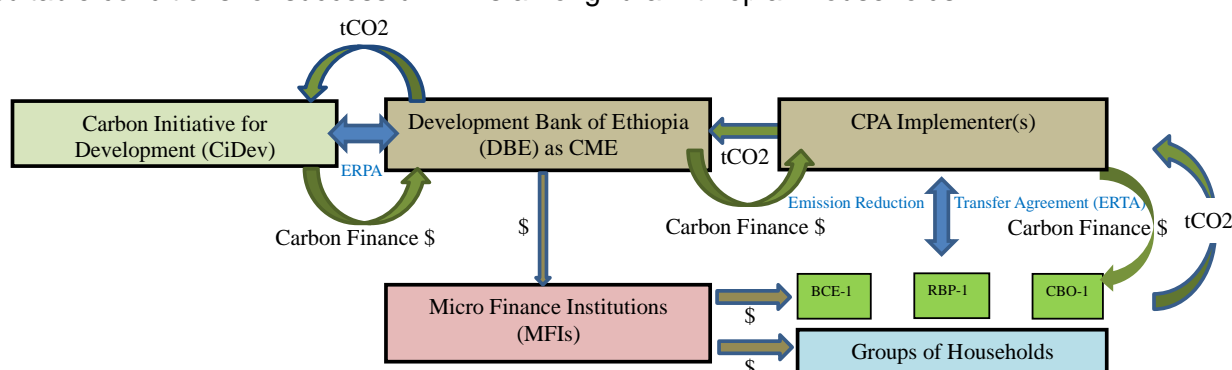


Figure 1. General implementation framework of the PoA

DBE, as the CME, will serve as the central warehouse for program information, the clearinghouse for carbon finance, and as the source of loan finance funds for micro-finance institutions (MFIs). The implementation of CPAs will rely upon CPA Implementers, separate entities from DBE, which will communicate implementation information directly to DBE. In the case of domestic biogas plants, the CPA implementer will be the National Biogas Program Ethiopia (NBP), which will utilize and expand upon its existing implementation framework. In the case of ethanol stoves, a variety of entities may serve as CPA implementers. The CME will use the implementation information it receives to assign carbon finance to the CPA implementers, from where it will be redistributed to the subsequent levels of implementation.

B.2. Post-registration changes to PoA

B.2.1. Corrections

Reference Number: PRC-10268-001

Date of Approval: 03/01/2018

Summary of Changes:

The additionality argument has been revised from the positive list applying to small-scale projects, to use Methodological Tool 19 Version 7 *Demonstration of additionality of microscale project activities*.

The CPAs are now exempt from a debundling check through application of the microscale limit at the CDM Unit level.

The time limit boundary for all CPA types was originally specified as covering technologies installed or disseminated over a two-year period. As the restriction on CPA size limits has been revised to apply either at the CPA level or at the CDM unit level, the time limit on the CPAs has been revised to be specified at the specific CPA.

The measures to avoid double counting were specified as the recording of GPS coordinates and serial numbers. The measures to avoid double counting have been revised to be specified for the specific CPA, with GPS coordinates and serial numbers given as an example of the measure.

In addition, the size limit for all CPA types under the PoA was revised to reflect Methodological Tool 19 Version 7 *Demonstration of additionality of microscale project activities* in the eligibility criteria.

Summary of Changes Submitted under Issuance Track:

The monitoring plan and guidance on sampling has been added to generic CPA Type 1 at the time of the first verification of the first CPA.

For generic CPA 1, the equation for calculation of baseline emissions was revised to remove the double application of the leakage adjustment factor.

B.2.2. Inclusion of monitoring plan

There is a post-registration change to include a monitoring plan for generic CPA Type 1 only into the PoA-DD. The post-registration change is being submitted with this monitoring report.

PoA-DD Version Number: 8.0
 PoA-DD Completion Date: 05/09/2018
 DOE Validation Report Date: DD/MM/YYYY

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

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

B.2.4. Changes to programme design

There are no changes to the programme design included in this monitoring report.

PART II Monitoring of CPAs

Title: NBP Ethiopia Domestic Biogas Plants CPA 1

Reference Number: 10268-0001

SECTION C. Implementation of CPAs

C.1. Description of implemented CPAs

The CPA targeted poor and vulnerable households mainly in rural areas¹⁴, who relied primarily on wood fuels for cooking, to provide improved energy access to such households, with associated benefits for poverty alleviation, while simultaneously reducing greenhouse gas emissions from avoiding the exploitation of non-renewable biomass (NRB) resources and from reduced use of fossil fuels. This CPA includes the installation of domestic biogas plants that generate biogas for cooking and lighting, for households or other end-users in Ethiopia. To date, the CPA includes 4,812 domestic biogas plants installed throughout Ethiopia in 2015 and 2016.¹⁵ The table below shows the distribution across the four regions of Ethiopia in which digesters were installed. The typical size of a digester under the CPA is 6m³.

Table 1. Volumes of Digesters Installed by Region under the CPA¹⁶

Region	2015 Vintage	2016 Vintage
Tigray	782	490
Amhara	601	723
SNNPR	513	603
Oromia	364	736
Total	2,260	2,552

¹⁴ Urban and peri-urban households may also benefit from the activity

¹⁵ ER Calculations (post-BUS).xlsx

¹⁶ ER Calculations (post-BUS).xlsx

The CPA reduces GHGs by substituting the renewable fuel biogas for the use of wood fuels, including NRB, for cooking. This substitution reduces mainly CO₂ emissions. It also will reduce the use of fossil fuel kerosene for lighting; however, these emission reductions are not quantified under the CPA. In the baseline scenario, end-users, targeted by the CPA, use wood fuels for cooking.

The following diagram shows the different monitoring points of the CPA.

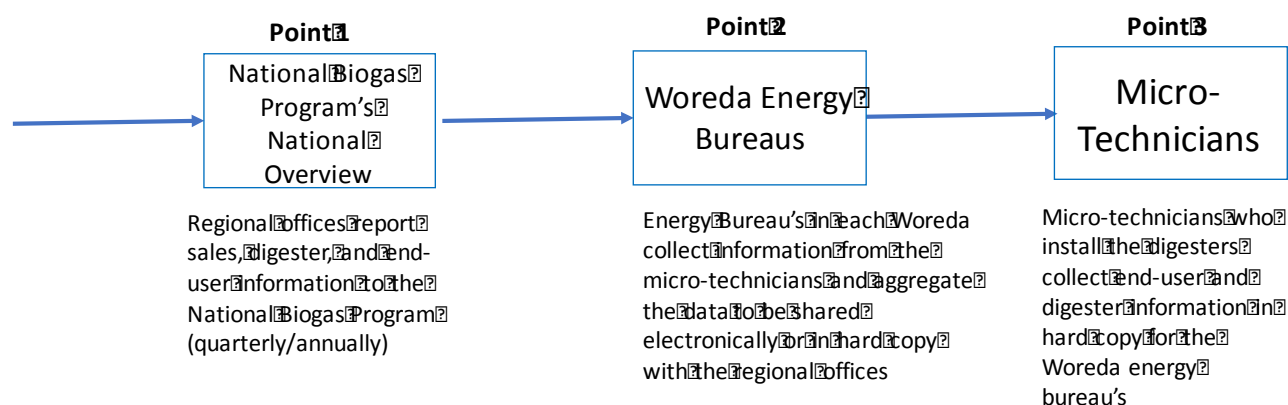


Figure 2. Monitoring Points of the CPA

The emission reduction calculations are based on the NBP's overview of the regional office reports from Monitoring Point 1. The volumes installed can be validated from records at the Woreda Energy Bureaus at Monitoring Point 2. The details of the individual installations can be checked at the hard copy records kept by the regional or Woreda bureaus, and with the micro-technicians.

Operationality of the digesters installed as per the installation records from Monitoring Point 1 was assessed through a Biogas User Survey (BUS) across all four regions.

C.2. Location of CPAs

The geographical boundary is the borders of the Federal Democratic Republic of Ethiopia. The CPA was implemented across Ethiopia, as shown in Figure 1 below.



Figure 2. Map of Ethiopia

The capital city, Addis Ababa, is located at 9.0300° N and E 38.7400° E.

C.3. Post-registration changes to CPAs

C.3.1. Temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies or standardized baselines

There are no temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies or standardized baselines during this monitoring period, for any CPAs covered in this monitoring report.

C.3.2. Corrections

Reference Number: PRC-10268-001

Date of Approval: 03/01/2018

Summary of Changes:

The additionality argument has been revised from the positive list applying to small-scale projects, to use Methodological Tool 19 Version 8 *Demonstration of additionality of microscale project activities*.

The CPA is now exempt from a debundling check through application of the microscale limit at the CDM Unit level.

The time limit boundary for the CPA was originally specified as covering technologies installed or disseminated over a two-year period. As the restriction on CPA size limits has been revised to apply either at the CPA level or at the CDM unit level, the time limit on the CPAs has been revised to be specified at the specific CPA

The measures to avoid double counting were specified as the recording of GPS coordinates and serial numbers. The measures to avoid double counting have been revised to be specified for the specific CPA, with GPS coordinates and serial numbers given as an example of the measure.

In addition, the size limit for all CPA types under the PoA was revised to reflect Methodological Tool 19 Version 8 *Demonstration of additionality of microscale project activities* in the eligibility criteria.

The eligibility criterion surrounding securing CER rights for the CPA has been clarified to match the PoA design document.

Revisions have been made to various sections of the design document as the document was updated to the latest template. From Version 4.0 to Version 8.0.

The emission reduction calculations under Appendix 4 have been revised to remove the debundling calculation.

Summary of Changes Included under Issuance Track:

Revisions have been made to various sections of the design document as the document was updated to the latest template. From Version 8.0 to Version 8.1.

The equation for determining emission reductions in section B.4.3 of the specific CPA was revised to match the methodology.

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

There are no changes to the start date of the crediting period fixed at the inclusion of any of the CPAs covered in this monitoring report.

C.3.4. Inclusion of monitoring plan

There have been post-registration changes to include a monitoring plan into the CPA-DD, for which the delayed submission of the monitoring plan was chosen by the CME at the time of inclusion of the CPA.

CPA-DD Version Number: 7.0

CPA-DD Completion Date: 05/09/2018

DOE Validation Report Date: DD/MM/YYYY

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

There are no permanent changes to the monitoring plans included in the CPA-DD, or permanent deviation of monitoring from the applied methodologies, or standardized baseline, or other applied standards or tools for the CPA covered in this monitoring report.

C.3.6. Changes to project design

There are no changes to the project design of the CPA included in this monitoring report.

SECTION D. Description of monitoring system of CPAs

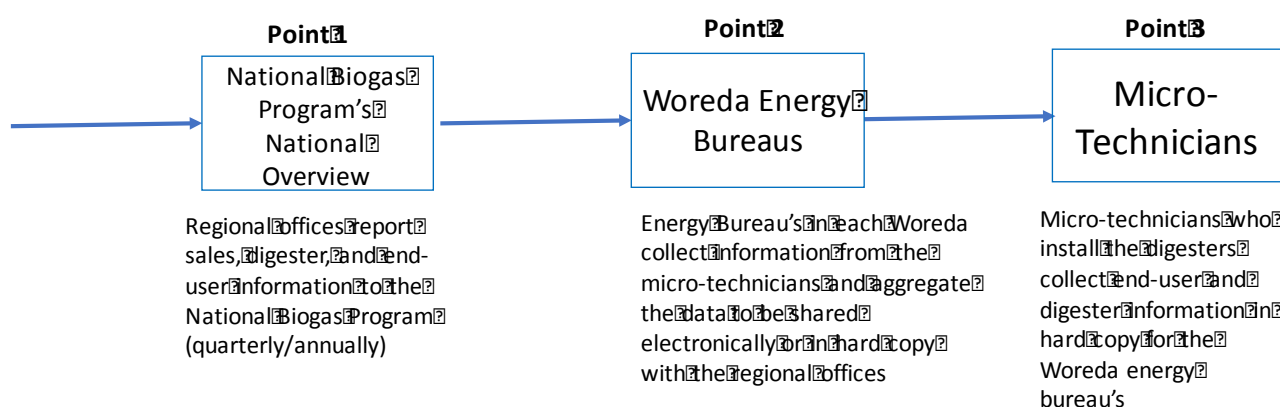
The information collected for the monitoring of the CPA for each digester is the following.

Information	Source	Required for
System Size (m ³)	National Biogas Program Records	CPA Eligibility Criterion
Unique Identifier (GPS/Serial Number)	National Biogas Program Records	Methodology Eligibility
Installation Date	National Biogas Program Records	Parameter Determination

The information flow under the CPA is defined as follows. The end-user information and system information specified in the table above is recorded by the biogas technician or mason at the time of installation/construction. The information and carbon waiver form are collected by the technicians or mason and delivered to the Woreda's local biogas office. The local Woreda office periodically transfers the hard copies of the end-user information and carbon waiver form to the regional biogas office.

At the regional biogas office, the information collected is stored electronically by the National Biogas Program in a format approved by DBE. The hard copies of the documents will remain at the regional offices. The electronic end-user information is sent by the regional offices to the National Biogas Office where it is compiled into a master file and sent to DBE where a second master file is maintained and accessible by MOWIE and the REBs. At the time of monitoring the technicians or mason who installed the systems to be visited will conduct the inspection to certify if the system is still in operation.

The quality of the information maintained in the database managed by the National Biogas Program is crucial to the successful monitoring of the CPA. The information should be cross-checked as frequently as possible with hard copy records or sales reports from the regional biogas offices to ensure its accuracy.



The parameters determined during monitoring are based on the regional data supplied to the NBP in Monitoring Point 1. The number of full-time digesters (N_d) is calculated in the emission reduction

calculations provided.¹⁷ The usage factor (UF_d) was determined through the BUS which was conducted in all the regions covered under the CPA. The description of the sample size and survey principles is shown in section E.3.

Monitored Parameters

The number of full-time operational biogas facilities is determined for each monitoring period through actual data. It is calculated through a summation of the operational fraction of each biogas digester in the monitoring period. The operational fraction of each biogas digester is determined through the installation date. For digesters under the CPA, the month of installation is not known, as such digesters under the CPA are deemed operational from the start of the next year following their installation. For example, a digester installed in 2015 is deemed operational from January 1st 2016. This is a conservative assumption. For the different regions covered by the CPA (Tigray, Amhara, SNNPR, Oromia), the Amhara region did not provide monthly installation data, therefore for digesters installed in Amhara they are deemed operational in the following year.

The full-time operational biogas digesters are then multiplied by a Usage Factor, which measures and accounts for households not using the biogas digester to replace fuelwood completely.

Of the 4,812 digesters installed under the CPA, only 4,112 digesters had a unique identifier as required by the CPA in the form of a serial number and/or GPS coordinates. The digesters without a unique identifier were removed from the database.

The utilization rate of the biogas is monitored and determined through sampling surveys. The sampling surveys are conducted across all digesters, regardless of age. The survey will determine, first, if the biogas digesters are operational and, second, how much of the energy demand of the household or SME is met by the biogas digester. The result of each household survey is a fraction which represents the proportion of the households' energy needs satisfied by the biogas system. Systems which cannot be located or are not operational are given a fraction of zero. The average usage fraction across all biogas systems in the sample is the value of parameter UF_d .

Alternatively, a Biogas Use Survey (BUS) can be conducted by a 3rd party to determine UF_d . Such a survey will need to adhere to the rules below.

The survey principles required by the methodology are the following:

- The sampling size is determined by a minimum 90 percent confidence interval and 10 per cent margin of error
- Sampling must be statistically robust and representative of the target population
- The method to select respondents must be random
- The survey is conducted as a site visit

As described above biogas systems must be linked to a unique serial number and/or a unique GPS coordinate in the installation records. Systems not linked to a serial number cannot be included in the monitoring of the CPA. Once the monitored parameters are determined, the emission reductions can be calculated, summarized in the monitoring report, and submitted for verification.

¹⁷ Installation Records and ER Calculations.xls

SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

Data / Parameter:	$B_{y, hh}$
Data unit:	Tonnes/household/year
Description:	Mass of fuelwood consumed per household per year in the baseline
Source of data:	Study for Biomass Energy Strategy in Ethiopia in cooperation with the Ethiopian Ministry of Water and Energy
Value(s) applied:	6.15
Choice of data or Measurement methods and procedures:	<p>The total fuelwood consumption by rural households in Ethiopia is estimated to be 89,115,753 tonnes per year and urban households are estimated to use 11,167,516 tonne per year.¹⁸</p> <p>The total population of Ethiopia is 79.8 million with 84 per cent of the population living in rural areas.¹⁹</p> <p>The average household size in Ethiopia was found to be 5.0 in 2005.²⁰</p> <p>The average fuelwood consumed per household in the baseline is derived as follows:</p> <p>Average Rural Household Consumption = $89,115,753 \text{ tonnes/year} / (79,800,000 \text{ people} * 0.84 \text{ rural population}) / 5 \text{ people per household}$</p> <p>Average Rural Household Consumption = 6.49 tonnes/rural household/year</p> <p>Average Urban Household Consumption = $11,167,516 \text{ tonnes/year} / (79,800,000 \text{ people} * 0.16 \text{ urban population}) / 5 \text{ people per household}$</p> <p>Average Urban Household Consumption = 4.37 tonnes/urban household/year</p> <p>Average Household Consumption = $(6.49 * 0.84 + 4.37 * 0.16) \text{ tonnes/household/year}$</p> <p>Average Household Consumption = 6.15 tonnes/household/year</p>
Purpose of data	Calculation of baseline emissions
Additional comment:	

Data / Parameter:	$EF_{\text{projected_fossilfuel}}$
Data unit:	tCO ₂ /TJ
Description:	Emission factor for the substitution of non-renewable woody biomass by similar consumers
Source of data:	AMS-I.E. v 6.0
Value(s) applied:	81.6

¹⁸ European Union Energy Initiative. *Biomass Energy Strategy Ethiopia*. Table 7 and 8. 23rd December 2013.

¹⁹ European Union Energy Initiative. *Biomass Energy Strategy Ethiopia*. Page 7. 23rd December 2013.

²⁰ USAID. *Trends in Demographic and Reproductive Health in Ethiopia*. Figure 2.3. Accessed at <http://dhsprogram.com/pubs/pdf/TR4/TR4.pdf>

Choice of data or Measurement methods and procedures:	Methodology default value
Purpose of data	Calculation of baseline emissions
Additional comment:	

Data / Parameter:	η_{old}
Data unit:	-
Description:	Efficiency of the system being replaced (conventional stove)
Source of data:	AMS-I.E. v 6.0
Value(s) applied:	0.1
Choice of data or Measurement methods and procedures:	Methodology default value
Purpose of data	Calculation of baseline emissions
Additional comment:	

Data / Parameter:	LE_y
Data unit:	-
Description:	Leakage related to the non-renewable woody biomass saved by the project activity
Source of data:	AMS-I.E. v 6.0
Value(s) applied:	0.95
Choice of data or Measurement methods and procedures:	Methodology default value
Purpose of data	Calculation of leakage
Additional comment:	

Data / Parameter:	f_{NRB}
Data unit:	-
Description:	Fraction of non-renewable biomass in year y
Source of data:	CDM Executive Board
Value(s) applied:	0.88
Choice of data or Measurement methods and procedures:	Value endorsed by the DNA of Ethiopia and approved by the Board is available at http://cdm.unfccc.int/DNA/fNRB/index.html
Purpose of data	Calculation of leakage
Additional comment:	

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/Ton
Description:	Net calorific value of the non-renewable woody biomass that is substituted
Source of data:	AMS-I.E. v 6.0
Value(s) applied:	0.015

Choice of data or Measurement methods and procedures:	Methodology default value
Purpose of data	Calculation of baseline emissions
Additional comment:	

E.2. Data and parameters monitored

Data/Parameter	N_d
Unit	Unit-Years
Description	Full-time equivalent digesters in the monitoring period
Measured/calculated/default	Calculated
Source of data	Installation records
Value(s) of monitored parameter	3,068
Monitoring equipment	N/A
Measuring/reading/recording frequency	Continuously
Calculation method (if applicable)	Summation of the full-time equivalent of all digesters in the monitoring period, multiplied by the fraction of digesters deemed operational during the monitoring period, i.e parameter UF_d
QA/QC procedures	The serial number or GPS may be cross-checked with the installation records
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	UF_d
Unit	Fraction
Description	Fraction of digesters found to be operational during the monitoring period
Measured/calculated/default	Measured
Source of data	BUS Survey
Value(s) of monitored parameter	0.77
Monitoring equipment	Surveys, in-person inspection
Measuring/reading/recording frequency	Annually or biennially
Calculation method (if applicable)	Calculated as the fraction of lamps in operation through sampling
QA/QC procedures	<p>The survey will conform to 90/10 confidence / precision requirements for annual inspection and 95/10 confidence / precision requirements for biennial inspection</p> <p>Only digesters with a unique identifier can be counted as operating and in service, taking into account the additional comments</p>
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Digesters that had been replaced as part of a regular maintenance or warranty program can be counted as operating at the time of the survey

E.3. Implementation of sampling plan

The parameter UF_d was determined through sampling. The BUS survey details the calculation method and sampling method to determine the parameter. As per the requirements of the methodology, a survey on operationality of the biogas digesters was undertaken at least once every two years. The monitoring period covers spans the 2-year period from 01/04/2016 through 31/03/2018 during which one survey was undertaken. The survey has conformed to 95/10 confidence / precision requirements.

The minimum sample size for 95/10 confidence/precision for the a population size of 4,812 is 95. The BUS report sampled a total of 200 digesters. This exceeds the minimum required sample size.²¹

The survey was undertaken by a 3rd party to ensure no bias in the undertaking of the survey. The 3rd party randomly selected the sample to be surveyed from the list of digesters provided by the regional offices to the NBP.²² The sample was randomly selected to meet the minimum sample size and be representative of the volumes of digesters installed in each region.

Inspection of the digesters for the BUS was conducted in person by trained representatives of the 3rd party organization to verify the existence and operationality of the selected digesters. The sample selection procedure and survey methodology has been summarized in the BUS report from the 3rd party.²³

SECTION F. Calculation of emission reductions or net anthropogenic removals

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

The number of full-time equivalent digesters in the monitoring period is 7,139 unit-years. The operational fraction from the BUS Report is 0.77 for digesters of vintages 2015 and 2016.²⁴

As such, parameter N_d is determined as follows:

$$N_d = 7,139 \text{ unit-years} * 0.77 = 5,635.63 \text{ unit-years}$$

The amount of woody biomass is calculated as:

$$\begin{aligned} B_y &= B_{y, hh} * N_d * L_y \\ &= 6.15 \text{ tonnes/household/year} * 5,635.63 \text{ unit-years} * 0.95 \\ &= 32,926.17 \text{ tonnes} \end{aligned}$$

And emission reductions are calculated as follows:

$$\begin{aligned} ER_y &= B_y * f_{NRB,y} * NCV_{\text{biomass}} * EF_{\text{projected_fossilfuel}} - PE_{BC,y} \\ &= (32,926.17 \text{ tonnes/year}) * 88\% * 0.015 \text{ TJ/tonne} * 81.6 \text{ tCO}_2/\text{TJ} - 0 \text{ tCO}_2 \\ &= 35,465 \text{ tCO}_2 \end{aligned}$$

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

²¹<https://www.calculator.net/sample-size-calculator.html?type=1&cl=95&ci=10&pp=50&ps=4812&x=52&y=17>

²² ER Calculations (post-BUS).xlsx

²³ ER Calculations (post-BUS).xlsx

²⁴ ER Calculations (post-BUS).xlsx

Project emissions are considered zero as, per paragraph 13, no biomass is sourced from plantations.

F.3. Calculation of leakage emissions

Leakage has been considered by using a net gross adjustment factor of 0.95 as per the methodology. The parameter B_y was multiplied by 0.95 in section F.1, above.

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

CPA UNFCCC reference number	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)		
				Before 01/01/2013	From 01/01/2013	Total amount
10268-0001	35,465	0	0	0	35,465	35,465
Total	35,465	0	0	0	35,465	35,465

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 ₂ e)	Amount estimated ex ante (t CO ₂ e)
10268-0001	35,465	43,915
Total	35,465	43,915

F.6. Remarks on increase in achieved emission reductions

The emission reductions achieved by the CPA during the monitoring period are 35,465 tCO₂e. The estimated ex ante emissions were estimated as follows:

01/04/2016 – 31/12/2016 : 12,450 tCO₂e

2017 : 25,172 tCO₂e

01/01/2018 – 31/03/2018 : 25,172 tCO₂e * 3 / 12 = 6,293 tCO₂e

The total ex ante estimated emission reductions for the monitoring period are 43,915 tCO₂e.

The achieved emissions are about 19 per cent less than estimated ex ante. This is due to a lower than expected functionality of the digesters during the operational of the CPA for the monitoring period in question. The expected functionality ex ante was 1.00 and surveys confirmed the proportion of functional digesters to be 0.77.

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Document information

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