Voluntary project activity design document form

(Version 08.1)

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

BASIC INFORMATION	
Title of the VPA	GS5801 African Biogas Carbon Programme (ABC) - Kenya - VPA006
Scale of the VPA	☐ Large-scale ☒ Small-scale
Version number of the VPA-DD	2.3
Completion date of the VPA-DD	21/01/2019
Title and UNFCCC reference number of the registered CDM PoA	African Biogas Carbon Programme (ABC) GS2747
Title and reference number of the corresponding generic VPA	N/A
Coordinating/managing entity	Hivos
Host Party	Kenya
Applied methodologies and standardized baselines	Gold Standard methodology "Technologies and Practices to Displace Decentralized Thermal Energy Consumption" (Version 1.0)
Sectoral scopes linked to the applied methodologies	1 Energy industries (renewable - / non-renewable sources) 15 Agriculture
Estimated amount of annual average GHG emission reductions	16,736

SECTION A. Description of component project activity (VPA)

A.1. General description of VPA

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The overall objective of the VPA is to contribute to the achievement of the Sustainable Development Goals (SDGs) through the dissemination of domestic biogas systems as a local, sustainable energy source, as well as the development of a commercially viable, market-oriented biogas sector. By encouraging the switch from traditional non-renewable biomass (NRB) fuels to renewable biogas the VPA is reducing greenhouse gas (GHG) emissions. Emission reductions are accounted for only from biogas used for cooking, although some customers use biogas also for lighting.

The Kenya Biogas Programme (KBP), is the sector leader with the responsibility of coordinating, facilitating and monitoring sector functions and supporting the technical, financial and institutional architecture necessary for development of the domestic biogas sector in Kenya.

The VPA is to be implemented based on private sector market oriented principles but developing governmental support for a favourable regulatory and policy environment, as well as general buy-in promotion and extension.

The Kenya VPA006 is part of the African Biogas Carbon (ABC) PoA. The VPA is located in Kenya.

The technologies/measures employed by the VPA
The VPA will stimulate the installation of domestic biogas systems of from 2 to 100 m^3 capacity. Digesters of any size are permitted as long as they are demonstrated to be below the small-scale limit. The VPA implementer has selected the appropriate biogas technology to be implemented through engagement with a wide range of stakeholders. Please refer to section A.3 for more details on the technology deployed by the VPA.

The project boundary
The project boundary of the VPA is the physical boundary of the Republic of Kenya.

The baseline scenario
With wood fuel (firewood and charcoal) accounting for 68% of the total primary energy consumption, biomass fuels are the most important source of household energy in Kenya[1]. Firewood is used by the majority of rural households, whereas kerosene and charcoal are used most in urban areas[2].The demand for wood fuel is frequently higher than the supply, as resources are depleted faster than they are replenished, and because of inefficient methods of charcoal production and consumption.[3] Next to the financial- and time- burden on families of relying on inefficient cook stoves, the use of biomass with basic cooking devices causes major health issues, disproportionally affecting women and children.[4] Meals are normally prepared by women, in a hut separate from the main house. Using traditional practices, cookstoves are able to both generate high intensity heat for boiling, and low intensity heat for simmering. Moreover, cookstoves are used all day and during all types of weather[5]. Most rural households use traditional 3-stone fireplaces for cooking, and/or different types of improved firewood cooking stoves[6].

[1] Global Alliance for Clean Cookstoves (2013) Kenya Country Action Plan (CAP) p. 16

[2] Global Alliance for Clean Cookstoves (2013) p. 18

[3] Global Alliance for Clean Cookstoves (2013) p. 16

[4] Global Alliance for Clean Cookstoves (2013) p. 17

[5] Global Alliance for Clean Cookstoves (2013) p. 18

[6] Global Alliance for Clean Cookstoves (2013) p. 23

The estimates of annual average and total GHG emission reductions for the chosen crediting period

Table 1 Estimated annual average GHG emission reductions

Emission reductions during the crediting period	
Years	Annual GHG emission reductions (in tonnes of CO_2e) for each year
2016	3,672
2017	9,214
2018	13,124
2019	16,989
2020	20,853
2021	24,718
2022	28,582
Total number of crediting years	7 (renewable twice)
Annual average GHG emission reductions over the crediting period	16,736
Total estimated reductions (tonnes of CO_2e)	**117,154**

A.2. Location of VPA

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This VPA will disseminate biogas systems over the entire territory of Kenya. The primary means to uniquely identify the activities under the VPA is by means of buyer information collected through a mobile phone application known as Taro works which relays collected data to Salesforce, an online cloud based archive. Information on Salesforce is then imported in a excel sheet that is used for data analysis. The information includes a serial number, customer name, address, date of sale, name of VPA implementer, biogas digester model and size.

The co-ordinates of Kenya are represented approximately by: 1 00 N, 38 00 E[7]. The VPA implementer is the Kenya Biogas Programme (KBP). The main offices are used to represent the physical location of the project: Along Lenana Road, ACS Plaza, Nairobi, P.O. Box 79875-00202 Nairobi Kenya. GPS Co-ordinates: S 1° 17'23'' S, E 36° 47'1''.

[7] Available from https://www.cia.gov/library/publications/the-world-factbook/geos/ke.html

Figure 1 *Location VPA implementer and border of Kenya*

A.3. Technologies/measures

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The VPA will stimulate the installation of domestic biogas systems country wide, of 2 to 100 m^3, as long as digesters remain below the small-scale limit. It will install and maintain biogas systems through over 100 biogas-related enterprises engaged in construction, appliances and parts. In order to make biogas technologies more affordable to the end-user, the full digester cost will not be charged to the end-user; technical assistance and after sales services (including a guarantee period) for example are not included in the digester price and are offered free of charge subsidized by carbon revenues.

The initial target of the VPA is to support the installation of some 5,030 biogas systems between 23 October 2015 and 31/12/2022 according the following indicative schedule:

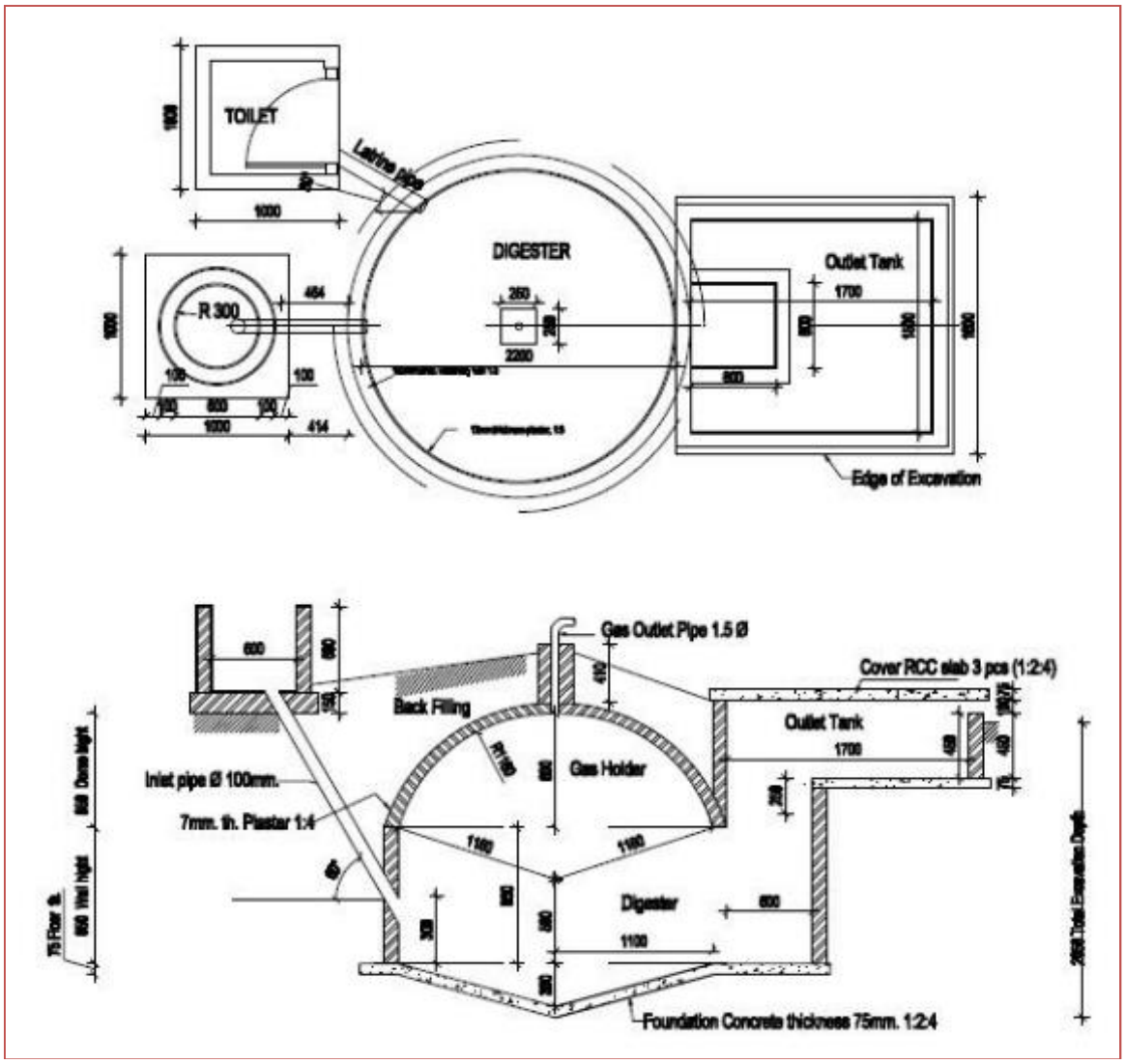
Table 2: Indicative implementation schedule

Year	23/10/2015 to 31/12/2015	2016	2017	2018	2019	2020	2021	2022
Units commissioned	66	1,091	671	640	640	640	640	640
Cumulative	66	1,157	1,828	2,468	3,109	3,749	4,390	5,030

Kenya Biogas Program selected the appropriate biogas technology to be implemented through engagement with a wide range of stakeholders. They agreed on a fixed dome digester design to be known as the Kenya National Biogas Model (KENBIM), although other types of biogas digester are permitted under this VPA as long as the technology used meets the eligibility criteria for VPA inclusion outlined in Section F. The average lifetime of the fixed dome technology is over 20 years[8]. A drawing of the KENBIM is shown in Figure 2.

[8] 20160330 Biogas Course Reader.pdf

Figure 2 *KENBIM biogas system technical drawing*



The biogas system is made up of several interconnected parts. The specific role of each component is summarised below:

Inlet – The main purpose of the inlet is to mix organic material and water into a semi solid state. This mixture is fed into the digester via an inlet pipe.

Digester – The digester holds the mixture of manure and water, creating a conducive environment for anaerobic digestion where microorganisms produce biogas. The digester is cylindrical in shape and is usually made of brick masonry with a concave concrete cover, or dome. Typically, the digester is built underground with only the plumbing, inlet and outlets visible.

Dome - The purpose of the dome is to collect the gas produced in the digester. This is typically plastered in several layers and painted with a special paint in order to prevent gas leakage. Gas accumulates under the dome creating pressure and pushing down the level of the slurry and increasing the slurry level in the connected slurry tank. It is the difference in slurry levels between the slurry tank and the inside of the dome that maintains the pressure to push the gas into the outlet pipe.

Outlet - The outlet valve releases the collected gas under the dome to biogas appliances such as stoves or lamps.

Slurry Tank - The slurry tank holds the slurry that the gas pressure from under the dome displaces. This slurry overflows into a composting tank as more manure is fed into the digester. This slurry can then be used as a fertiliser.

KENBIM is a hybrid of the modified CAMARTEC and AKUT biogas models; and incorporates the positive aspects of these and includes the following modifications:

- KENBIM has a conical floor for areas having weak soil conditions and a flat floor for relatively strong areas.
- There is no manhole on the top of the gas holder, instead the manhole is from the expansion chamber.
- The shape of expansion chamber is rectangular.
- The outlet passage is designed in such a way that it allows easy entrance inside the digester.
- The gas holder is designed to store at least 60% of the daily gas production.
- The overflow level in the expansion chamber is arranged in such a way that gravity assists the flow of slurry from the inlet to the slurry pit.
- The design incorporates options for direct feeding of dung from the cattle shed as well as separate mixing tank depending upon the site condition and user's demand/need.

A.4. Coordinating/managing entity

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The coordinating/managing entity for this VPA is Hivos International.

A.5. Parties and VPA implementers

Parties involved	VPA implementers	Indicate if the Party involved wishes to be considered as VPA implementer (Yes/No)
Kenya (host)	Kenya Biogas Programme (KBP)	No

A.6. Public funding of VPA

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The Directorate General for International Cooperation (DGIS) under the Netherlands Ministry of Foreign Affairs provides public funding. The VPA is being supported by DGIS through the Humanist Institute for Cooperation with Developing Countries (Hivos). There has been no diversion of Official Development Assistance (ODA) as demonstrated in the declarations provided to the DOE[9].

A.7. History of VPA

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VPA006 is the second VPA in Kenya under the African Biogas Carbon Programme (ABC). VPA001 was registered on 11/06/2015 and includes approximately 11,400 digesters installed since 06/11/09 up to and including 31/12/2013.

Since then, KBP has continued to implement biogas digesters over the years 2014, 2015, 2016 and 2017 in accordance with the Gold Standard requirements. Hivos – the CME - had originally intended to include these digesters in VPA001, but it became clear during the inclusion that VPA001 was at the small-scale capacity limit, and that a new VPA would therefore need to be included to accommodate the digesters installed from 01/01/2014 onwards.

[9] *Please refer to the ODA declaration in Appendix 2*

On 22/01/2015, the Gold Standard issued a rule update "Revision in the rules and requirement for Prior Consideration of Carbon Revenues for GS-VER projects". This rule update states that "*In order to be eligible under Gold Standard, retroactive VPAs must submit the required documents to the Gold Standard (time of first submission) within one year from the project start date. Retroactive VPA documents submitted at a date later than one year from the project start date will not be eligible for Gold Standard certification. These requirements are applicable for VPAs that have a date of first submission on or after 1st June 2015*". This had implications for the digesters installed in Kenya from 01/01/2014, since these could not have been included in VPA001 due to the capacity limit. A memo[10] was therefore prepared to apply for an exception to this rule through demonstrating prior consideration of carbon revenues. The Gold Standard approved[11] the exception on 30 March 2017, and invited Hivos to open a new VPA under PoA GS2747 for the inclusion of biogas digesters installed in Kenya from 2014 onwards. However, only units from the 23 October 2015 were included because from that date onwards units are constructed under the new VPA implementer, KBP, which took over responsibilities from KENAFF.

The proposed VPA006 is not registered as a CDM or Gold Standard project activity, nor included in another registered CDM or Gold Standard PoA. The proposed VPA is not a project activity that has been deregistered. The proposed VPA was not a VPA that has been excluded from a registered CDM or Gold Standard PoA.

A.8. Debundling

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According to the Guidelines on assessment of de-bundling for SSC project activities published as annex 13 of the meeting report of EB 54[12] the VPA is exempted from performing a de-bundling check i.e. considered as being not a de-bundled component of a large-scale activity if the following condition applies:

10. If each of the independent subsystems/measures (e.g. biogas digester, solar home system) included in the VPA of a PoA is no greater than 1% of the small-scale thresholds defined by the methodology applied,[13] then that VPA of PoA is exempted from performing de-bundling check i.e. considered as not being a de-bundled component of a large scale activity.

Each of the biogas systems included in the VPA is not greater than 1% of the small-scale threshold which is 450 kW_{th} for thermal energy as demonstrated in the ER calculations spreadsheet, sheet 'capacity calculation'.

SECTION B. Application of selected methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

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Gold Standard methodology "Technologies and Practices to Displace Decentralized Thermal Energy Consumption" (Version 1.0)

[10] *Please see the file '20170131 Hivos Prior Consideration Memo Kenya' for the demonstration of prior consideration of carbon revenues for PoA GS2747 Kenya activities*

[11] *Please see the file '20170330 GS Confirmation Prior Consideration Kenya' for the approval of exception to the rule update by the Gold Standard*

[12] *EB 54 Annex 13*

[13] *i.e. 150 kW installed capacity or 0.6 GWh annual energy savings or 0.6 $ktCO_2e$ annual emission reductions. See EB65 Report, page 25. Guidelines changed from 15kW to 150kW electrical, or 450kW thermal*

This methodology is applicable to programs or activities introducing technologies and/or practices that reduce or displace greenhouse gas (GHG) emissions from the thermal energy consumption of households, communities and SMEs. This includes biogas digesters.

Table 3 *Methodological applicability conditions applied*

Applicability criteria	Justification
1. *Clearly identifiable project boundary:* The project boundary can be clearly identified, and the biodigesters counted in the project are not included in another voluntary market or CDM project activity (i.e. no double counting takes place). Project proponents must have a survey mechanism in place together with appropriate mitigation measures so as to prevent double-counting in case of another similar activity with some of the target area in common.	The project boundary is the physical, geographical site of the methane recovery and combustion systems, located within Kenya. The VPA shall demonstrate that it does not double-count any of its appliances, as specified in the eligibility criteria for inclusion in the PoA, for the ERs estimation by confirming that: – The GPS coordinates of each digester installed are recorded – the complete address of each biogas system is recorded – the biogas systems have a unique serial number, recorded in the project database – the VPA implementer has not included these biogas systems in another VPA or stand-alone project.
2. *Limited level of energy output per biodigester:* The biodigesters each have continuous useful energy outputs of less than 450 kWth per unit (defined as total energy delivered usefully from start to end of operation of a unit divided by time of operation).	The maximum energy output of the biodigesters implemented in the project activities is 43,80 kWth[14], below the indicated 450 kWth limit per unit.
3. *Continued use of baseline technology:* The use of the baseline cook stoves as a backup in parallel with the new, biogas fuelled cook stoves introduced by the project activity is permitted as long as a mechanism is put into place to encourage the removal of the old technology and the definitive discontinuity of its use. The project documentation must provide a clear description of the approach chosen and the monitoring plan must allow for a good understanding of the extent to which the baseline cook stove is still in use after the introduction of the improved technology. The success of the mechanism put into place must therefore be monitored, and the approach must be adjusted if proven unsuccessful.	Monitoring will include an assessment of the continued use of the baseline stove through survey methods and biennial Kitchen Performance Tests. All biogas digester users will be asked to provide feedback on the extent to which they continue to use their baseline cook stoves.
4. *Settling of ownership rights over generated emission reductions:* The project proponent must clearly communicate to all project participants to whom the ownership rights of the emission reductions resulting from the project activity belong. This must be communicated to the technology producers and the retailers of the by contract or clear written assertions in the transaction paperwork.	As set out in the operational and management plan explained in Section C of the PoA-DD, each end user of a biodigester will be asked to confirm that they transfer the right and title to VERs to the VPA Implementer as part of the Ownership Certificates[15]. Copies of these signed contracts will be kept by the VPA Implementer.
5. *Use of new biomass feedstock* Project activities making use of a new biomass feedstock in the project situation (e.g. shift from non-	This applicability criterion is not applicable as no new biomass feedstock is used in the project scenario.

[14] *As demonstrated in section B.3. of the PoA-DD*

[15] *Referred to as Warranty Certificates in this VPA*

Applicability criteria	Justification
renewable to green charcoal, plant oil or renewable biomass briquettes) must comply with relevant Gold Standard specific requirements for biomass related project activities, as defined in the latest version of the Gold Standard rules.	
6. Climate zones If more than one climate zone is included in the project activity, a distinction per climate zone must be considered. The distinct geographical boundary of each project area must be clearly documented in the project documentation, using representative GPS data.	The distinct geographical boundary of this VPA is the Republic of Kenya. The GPS co-ordinates of Kenya are represented approximately by: 1 00 N, 38 00 E

B.2. Project boundary, sources and greenhouse gases (GHGs)

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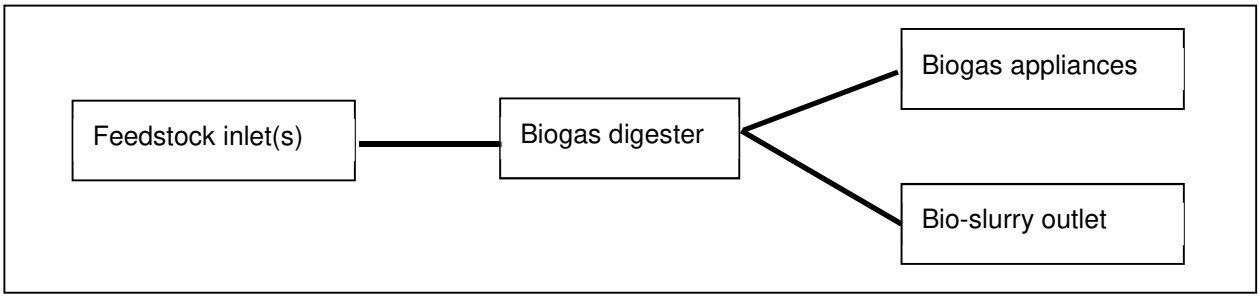
The gases included are carbon dioxide and methane in the VPA-boundary that is the physical, geographical site of the biogas system.

Table 4 *Inclusion of gases in the project boundary*

Source		Gas	Included?	Justification / Explanation
Baseline	Heat delivery Treatment of manure	CO_2	Yes	CO_2 emissions from - fossil fuel cook stoves - cook stoves using non-renewable biomass
		CH_4	Yes	CH_4 emissions from the baseline treatment methods of manure
		N_2O	No	Excluded, insignificant source of emissions.
Project Activity	Combustion of biogas	CO_2	Yes	CO_2 emissions from - fossil fuel cook stoves - cook stoves using non-renewable biomass
		CH_4	Yes	Emissions due to the manure not fed into the bio digester, as per the applied methodology.
		N_2O	No	Excluded, insignificant source of emissions.

The project boundary is the physical, geographical site of the use of biomass or the renewable energy as demonstrated in Figure 3.

Figure 3 *Schematic diagram of biogas system project boundary*



B.3. Establishment and description of baseline scenario

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In Kenya, over half of the total population of 48 million[16] has no access to electricity.[17] Most of the rural population almost completely depends on biomass, particularly non-renewable firewood for their daily energy consumption for cooking, boiling and heating.

To determine parameters $BB_{b,fuel}$ and $BB_{b,bio}$, this VPA applies Option 2 of the methodology. Under Option 2, $BB_{b,fuel}$ and $BB_{b,bio}$ shall be defined *ex-ante* on the VPA level through Baseline Performance Field Tests (BFT) directly. As per the PoA-DD, a separate BFT needs to be conducted per identified baseline scenario.

Baseline ratios
The baseline ratios are determined based on the most recent monitoring effort of VPA1, which is also located in Kenya. Monitoring was carried out in late 2016 by EcoFrontier.[18] The following Table illustrates the different baseline scenarios and their corresponding ratios, as per the survey results. This will be updated annually as part of the monitoring survey.

Table 5 ***Type of baseline scenarios and distribution per identified baseline scenario***[19]

Baseline scenario	Parameter	BFT results (%)
Households using firewood only	$BB_{b1,ratio}$	53.3%
Households using charcoal only	$BB_{b2,ratio}$	13.3%
Households using firewood + charcoal	$BB_{b3,ratio}$	26.7%
Households using mainly LPG	$BB_{b4,ratio}$	6.7%

Baseline Fuel Tests (BFT)
The BFTs measure real, observed fuel usage within the baseline via a Kitchen Performance Test (KPT). Consumption of fuels was measured with a representative sample of end users under the defined three baseline scenarios in the absence of the project technology ($BB_{b1,bio}$, $BB_{b2,bio}$ and $BB_{b3,bio}$). $BB_{b1,bio}$ is established based on the BFT carried out in late 2014 at inclusion of VPA1 (GS 2750). $BB_{b2,bio}$ and $BB_{b3,bio}$ is established based on the BFT carried out in late 2016 during the second monitoring of VPA1. $BB_{b4,fuel}$ was not assessed during the BFT, but it appeared that due to the Kenyan government LPG promotion program[20] that many of the recent biogas households use LPG prior to installing the digester[21]. It was therefore decided to include this scenario as a monitoring variable.

The BFTs randomly selected households from the project database to take part in the BFT. The surveyed households were identified as having a similar social and economic status as their neighbours that possess biodigesters, therefore making for a realistic baseline scenario. To establish the baseline fuels used, a questionnaire based on the Berkeley Air Kitchen Performance test questionnaire was used. This document is also referenced in the applied TPDDTEC methodology. For all three BFTs, calibration of the applied weights was done with the comparison of traditional

[16] *The World Bank (2016) Available from https://data.worldbank.org/indicator/SP.POP.TOTL?locations=KE*

[17] *The World Bank (2014) Available from https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?end=2014&start=2014&view=bar*

[18] *For more details, see the Monitoring Report 2 for VPA1*

[19] *See survey results from 'ABC VPA1 KE MP2 Surveys + Analysis', Sheet 'Analysis A'*

[20] Up to 50% subsidy is offered to poor households, see http://www.lpgbusinessreview.com/2017/04/25/lpg-consumption-in-kenya-is-there-a-case-for-subsidy/

[21] Preliminary results of the MPI monitoring survey VPA06.

weighing scale. The scales were also compared to each other and all weighing scales were found accurate. Amongst other things, the households were asked to report on their baseline biomass and fossil fuel consumption rates over the measurement campaign. Outliers were excluded using the Grubb's test.[22]

The results of all three BFTs are reported in Table 6. To derive the total biomass value for households using charcoal, the tonnes of charcoal used are multiplied by a factor of 8. In Kenya, the use of traditional kilns to produce charcoal is widespread. These traditional kilns have a low biomass-to-charcoal conversion efficiency. Traditional kilns used have an estimated conversion efficiency of only 8 – 12 %. To remain conservative the lower value is used (i.e. 8 kg of woodfuel from every 1 kg of fuelwood)[23].

Table 6 *Biomass usage results in the baseline scenario*

Parameter	Unit	Description	Amount	Source
$BB_{b1,bio}$	tonnes/HH/year	Amount of firewood used in the baseline scenario b1	3.659	KPT primary data 29Sept2015 B1(firewood) (post-review), sheet '90/30 test'
$BB_{b2,bio}$	tonnes/HH/ year	Amount of charcoal used in the baseline scenario b2	7.480	20170322 B2 B3 BFT Results KE, sheet 'B2 - 90|30 test'
$BB_{b3,bio}$	tonnes/HH/year	Amount of charcoal _ firewood used in the baseline scenario b3	7.062	20170322 B2 B3 BFT Results KE, sheet 'B2 - 90|30 test'

Number of animals owned

As for the number of animals raised, the results have been gathered by the VPA1 (GS2750) monitoring conducted in 2016, which surveyed 135 households with biodigesters under the ABPP throughout Kenya. The results are summarised in the table below.

Table 7 ***Possession of livestock reported in the VPA1 Monitoring Survey 2016***

Animal T	Average amount
Dairy cow	5.33
Goat	1.30
Market swine	0.33
Sheep	2.53
Other cattle	1.39
Poultry	24.09

Methane conversion factor (MCF)

The baseline study results carried out in 2014 at inclusion of VPA1 (GS2750) indicate that daily spread is the most common manure handling method, followed by pasture/range/paddock, uncovered lagoon and dry lot. The system-specific methane conversion factors applicable to the

[22] *Further details in the supporting excel sheet, 'Grubb's test' sheets.*

[23] United Nations World Food Programme (2010) Safe Access to Firewood and Alternative Energy in Kenya: An Appraisal Report (pg 21), World Bank; and Africa Renewable Energy Access Program (AFREA) (2011), see https://www.womensrefugeecommission.org/firewood/resources/734-safe-access-to-firewood-and-alternative-energy-in-kenya-an-appraisal-report Wood-Based Biomass Energy Development for Sub-Saharan Africa (Section 3.2.2, pg 21) https://openknowledge.worldbank.org/handle/10986/26149 and International Network for Sustainable Energy (INFORSE) (2011) Case: Kenya Afforestation for Charcoal [online] Available from: http://www.inforse.org/Case/Case-Kenya-Afforestation.php3

baseline are provided in the IPCC Guidelines for National Greenhouse Gas Inventories. The applicable MCF, which is an input for the emission reduction calculation explored below, is chosen from default values presented in Table 10.17, Chapter 10, Volume 4 of the 2006 IPCC Guidelines.

Table 8 Average *MCF calculation*

Method	Uncovered lagoon	Liquid slurry	Solid storage	Dry lot	Pasture/ Range / Paddock	Daily spread	Burned for fuel	Composting
Fraction observed	2 %	2 %	6 %	30 %	0 %	45 %	0 %	16 %
MCF (at 20 C)	78.0%	50%	4.0%	1.5%	1.5%	0.5%	10.0%	0.5%

$MCF_{x,k}$	3.39 %

B.4. Estimation of emission reductions

B.4.1. Explanation of methodological choices

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Please see section B.4.3 below.

B.4.2. Data and parameters fixed ex ante

Data/Parameter	**$BB_{b1,bio}$**
Data unit	Tonnes/year
Description	Amount of woody biomass used in the baseline scenario b1
Source of data	KPT primary data 29Sept2015 B1(firewood), sheet '90/30 test'
Value(s) applied	3.66
Choice of data or measurement methods and procedures	Households have been asked how much fuelwood they use for cooking, and undergo a Kitchen Performance Test as per the requirements of the TPDDTEC methodology.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data/Parameter	**$BB_{b2,bio}$**
Data unit	Tonnes/year
Description	Amount of charcoal (in fuel-wood equivalents) used in the baseline scenario b2
Source of data	20170322 Survey C BFT Sample Size - KE, sheet 'B2 - 90|30 test'
Value(s) applied	7.48
Choice of data or measurement methods and procedures	Households have been asked how much charcoal they use for cooking and undergo a Kitchen Performance Test as per the requirements of the TPDDTEC methodology.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data/Parameter	$BB_{b3,bio}$
Data unit	Tonnes/year
Description	Amount of fuelwood and charcoal (in fuel-wood equivalents) used in the baseline scenario b3
Source of data	20170322 Survey C BFT Sample Size - KE, sheet 'B2 - 90|30 test'
Value(s) applied	7.06
Choice of data or measurement methods and procedures	Households have been asked how much fuelwood and charcoal they use for cooking, and how much charcoal they use, and undergo a Kitchen Performance Test as per the requirements of the TPDDTEC methodology.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data/Parameter	$EF_{b, bio}$
Data unit	tCO_2/TJ
Description	Emission factor of the woody biomass used in baseline scenario b
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	112
Choice of data or measurement methods and procedures	As per requirement of the methodology and Table 2.3, Chapter 2, Volume 2 of the 2006 IPCC Guidelines. The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of the baseline scenario
Additional comment	IPCC (2006); May be updated according to any future changes by the IPCC. CO_2 and non-CO_2 emissions factors for charcoal may be estimated from project specific monitoring or alternatively by researching a conservative wood to charcoal production ratio (from IPCC, credible published literature, project-relevant measurement reports, or project-specific monitoring) and multiplying this value by the pertinent EF for wood.

Data/Parameter	$EF_{p, bio}$
Data unit	tCO_2/TJ
Description	Emission factor of the woody biomass used in project scenario p
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	112
Choice of data or measurement methods and procedures	As per requirement of the methodology and Table 2.3, Chapter 2, Volume 2 of the 2006 IPCC Guidelines. The IPCC is a standard, credible source of emissions factors
Purpose of data	Calculation of project emissions
Additional comment	IPCC (2006); May be updated according to any future changes by the IPCC.

Data/Parameter	NCV_{bio}
Data unit	TJ/tonne
Description	Net calorific value of the non-renewable biomass used in the baseline scenario
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.015

Choice of data or measurement methods and procedures	As per requirement of the methodology and Table 2.3, Chapter 2, Volume 2 of the 2006 IPCC Guidelines. The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data/Parameter	**$EF_{b, fuel}$**
Data unit	tCO_2/TJ
Description	Emission factor of fossil fuels used in baseline scenario b
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	Kerosene = 71.9 LPG = 63.1
Choice of data or measurement methods and procedures	As per requirement of the methodology and Table 2.3, Chapter 2, Volume 2 of the 2006 IPCC Guidelines. The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of baseline emissions
Additional comment	IPCC (2006); May be updated according to any future changes by the IPCC

Data/Parameter	**$EF_{p, fuel}$**
Data unit	tCO_2/TJ
Description	Emission factor of fossil fuels used in project scenario b
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	Kerosene = 71.9 LPG = 63.1
Choice of data or measurement methods and procedures	As per requirement of the methodology and Table 2.3, Chapter 2, Volume 2 of the 2006 IPCC Guidelines. The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of project emissions
Additional comment	IPCC (2006); May be updated according to any future changes by the IPCC

Data/Parameter	**NCV_{fuel}**
Data unit	TJ/tonne
Description	Net calorific value of fossil fuels used in the baseline scenario
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	Kerosene = 0.0438 LPG = 0.0473
Choice of data or measurement methods and procedures	As per requirement of the methodology and Table 2.3, Chapter 2, Volume 2 of the 2006 IPCC Guidelines. The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of baseline emissions
Additional comment	IPCC (2006); May be updated according to any future changes by the IPCC

Data/Parameter	**VS_T**
Data unit	kg/head/day

Description	Daily volatile solid excreted for livestock category T
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	**Animal T** / **Average kg/head/day** Dairy Cow / 1.90 Goat / 0.35 Market swine / 0.30 Sheep / 0.31 Other cattle / 1.50 Poultry / 0.02
Choice of data or measurement methods and procedures	As per requirement of the methodology and sourced from Tables 10. A-4 through A-9, Chapter 10, Volume 4 of the 2006 IPCC Guidelines The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of baseline emissions
Additional comment	IPCC (2006); May be updated according to any future changes by the IPCC. National data can replace the IPCC value, if available

Data/Parameter	**Bo_T**
Data unit	m^3 CH_4/kg
Description	Maximum methane producing capacity for manure produced by animal type T
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	**Animal T** / **Average m^3 CH_4/kg** Dairy Cow / 0.13 Goat / 0.13 Market swine / 0.29 Sheep / 0.13 Other cattle / 0.10 Poultry / 0.24
Choice of data or measurement methods and procedures	As per requirement of the methodology and sourced from Tables 10. A-4 through A-9, Chapter 10, Volume 4 of the 2006 IPCC Guidelines The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of baseline emissions
Additional comment	IPCC (2006); May be updated according to any future changes by the IPCC. National data can replace the IPCC value, if available

Data/Parameter	**$EF_{awms,T}$**
Data unit	m^3 CH_4/head
Description	Emission factor for the defined livestock population category T by average temperature (Kenya: 20°C)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories; Temperature: World Weather Online, http://www.worldweatheronline.com/v2/weather-averages.aspx?q=Nairobi,%20Kenya

Value(s) applied	<table><tr><th>Animal T</th><th>Value</th></tr><tr><td>Dairy Cow</td><td>1</td></tr><tr><td>Other cattle</td><td>1</td></tr><tr><td>Market swine</td><td>1</td></tr><tr><td>Breeding swine</td><td>1</td></tr><tr><td>Goats</td><td>0.017</td></tr><tr><td>Sheep</td><td>0.015</td></tr><tr><td>Poultry</td><td>0.02</td></tr></table>
Choice of data or measurement methods and procedures	As per requirement of the methodology and sourced from Tables 10.A-4 through A-9., Chapter 10, Volume 4 of the 2006 IPCC Guidelines The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of baseline emissions
Additional comment	IPCC (2006); May be updated according to any future changes by the IPCC

Data/Parameter	**MCF**
Data unit	kg CH_4
Description	Average Methane Conversion Factor for the defined livestock population category T by average temperature (Kenya: 20°C)
Source of data	'Survey A Monitoring', sheet 'Analysis' (Kenya VPA1 2014 Baseline Survey Results) 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Temperature: World Weather Online, http://www.worldweatheronline.com/v2/weather-averages.aspx?q=Nairobi,%20Kenya
Value(s) applied	3.39 %
Choice of data or measurement methods and procedures	As per requirement of the methodology and sourced from Tables 10.A-4 through A-9., Chapter 10, Volume 4 of the 2006 IPCC Guidelines The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of baseline emissions
Additional comment	IPCC (2006); May be updated according to any future changes by the IPCC

Data/Parameter	**$\eta_{biogas\ stove}$**
Data unit	Fraction
Description	Combustion efficiency of the new biogas stove introduced by the programme
Source of data	US-EPA (1998) Greenhouse Gases from Small-Scale Combustion Devices in Developing Countries by Kirk R. Smith. R. Uma. V.V.N. Kishore. K. Lata. V. Joshi. Jufeng Zhang. R.A. Ramussen and M. A. K. Khalil referenced in Centre for Energy Studies, Institute of Engineering for the Nepal Biogas Support Programme (NBSP)[24].

[24] https://www.researchgate.net/profile/Asheesh_Kumar4/post/what_are_all_the_methods_that_we_can_employ_to_increase_the_combustion_efficiency_when_LPG_is_used_as_the_fuel/attachment/59d6207e79197b807797ef48/AS%3A273821083340822%401442295441788/download/efficiency_measurement_of_biogas_kerosene_and_lpg_stoves_nepal_2001.pdf

Value(s) applied	99.4%
Choice of data or measurement methods and procedures	KBP does not specify the type of biogas stove that should be installed by a household. Users however are trained on proper usage of the stove. It is reasonable to assume the combustion efficiency is maintained as incompletely combusted biogas is easily detectable due to its strong foul odor, prompting the user to examine issues with the stove.
Purpose of data	Calculation of project emissions
Additional comment	NBSP is the mother programme of KBP.

Data/Parameter	**PL**
Data unit	%
Description	Physical leakage of the biodigester
Source of data	IPCC
Value(s) applied	Estimated using a 10% default rate of total methane production
Choice of data or measurement methods and procedures	N/A
Purpose of data	Calculation of project emissions
Additional comment	N/A

B.4.3. Ex ante calculation of emission reductions

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6.4.3.1 Emission reduction component 1: Accounting for emission reductions due to the displacement of fossil fuels and non-renewable biomass

Emission reductions are credited by comparing fuel consumption in a project scenario to the three baseline scenarios of VPA006. As the baseline fuel and the project fuel and the corresponding emission factors are different, the overall GHG reductions achieved by VPA006 in year *y* are calculated as follows:

$$\mathbf{ER_{CO2,y}} = \sum_{b,p1} N_{p1,y} * U_{p1,y} * \left(f_{NRB} * \ ER_{b,p1,y,CO2} + ER_{b,p1,y,non-CO2}\right) - \sum LE_{p1,y} \qquad \textbf{(1)}$$

Where:

$ER_{CO2,y}$ Cumulative CO_2 emission reductions from the substitution of non-renewable biomass and fossil fuels

$\sum_{b,p1}$ Sum over all relevant (baseline b1,b2,b3/project p1) couples

$N_{p1,y}$ Cumulative project operational rate included in the project database for project scenario p1 against baseline scenario b1 in year y

$U_{p1,y}$ Cumulative usage rate for technologies in project scenario p1 in year y, based on cumulative adoption rate and drop off rate (fraction)

$ER_{b,p1,y,CO2}$ Specific CO_2 emission savings for an individual technology of project p1 against an individual technology of baseline b1, b2, b3, b4 in year y, in tCO_2/year, and as derived from the statistical analysis of the data collected from the field tests

$ER_{b,p1,y,non\text{-}CO2}$ Specific non-CO_2 emission savings for an individual technology of project p1 against an individual technology of baseline b1, b2, b3,b4 in year y, converted

in tCO_2/year, and as derived from the statistical analysis of the data collected from the field tests

f_{NRB} Fraction of biomass used that can be established as non-renewable biomass

$LE_{p1,y}$ Leakage for project scenario p1 in year y (tCO_2e/yr)

As specific non-CO_2 emission savings are treated in a separate equation (equation **7** onwards), the VPA006 can apply the following formula for calculating emission reductions:

$$\sum \mathrm{ER}_{\mathrm{CO2,y}} = (\sum \mathrm{BE}_{\mathrm{b,CO2,y}} - \sum \mathrm{PE}_{\mathrm{p1,CO2,y}} - \sum \mathrm{LE}_{\mathrm{p1,CO2,y}}) * \mathrm{N}_{\mathrm{p1,y}} * \mathrm{U}_{\mathrm{p1,y}} \quad \textbf{(2)}$$

Where:

$\sum ER_{CO2,y}$ Cumulative CO_2 emission reductions from the substitution of non-renewable biomass and fossil fuels

$\sum BE_{b,CO2,y}$ Cumulative baseline emissions as calculated below under formula (**3**) of the VPA PDD

$\sum PE_{p1,CO2,y}$ Cumulative project emissions as calculated below under formula (**4**) of VPA PDD

$\sum LE_{p1,CO2,y}$ Cumulative leakage as per methodology guidance[25]

$N_{p1,y}$ Cumulative project operational rate included in the project database for project scenario p1 against baseline scenario b1 in year y

$U_{p1,y}$ Cumulative usage rate for technologies in project scenario p1 in year y, based on cumulative adoption rate and drop off rate (fraction)

Baseline emissions:

Applicable baseline scenarios for this VPA006 are defined by the typical baseline fuel consumption patterns in a population that is targeted for adoption of the biodigester technology. The amount of baseline scenarios for this VPA has been defined through a series of baseline Kitchen Performance Tests, and a survey. The survey determines the ratio of users for each identified baseline scenario. The following formula calculates the three baseline emissions per household:

Error! Digit expected. Where:

$BE_{b,CO2,y}$ Cumulative baseline CO_2 emissions from the use non-renewable biomass and fossil fuels at households during year y

$BB_{b,fuel}$ The quantity of fossil fuel consumed in the baseline scenario, in tonnes/year

NCV_{fuel} Net calorific value of fossil fuel, in TJ/tonne

$EF_{b,fuel}$ CO_2 emission factor of fossil fuel in baseline scenario, in tonnes/TJ

$BB_{b,bio}$ The quantity of biomass consumed in the baseline scenario, in tonnes/year

NCV_{bio} Net calorific value of biomass, in TJ/tonne

$EF_{b,bio}$ CO_2 emission factor of biomass in baseline scenario, in tonnes/TJ

f_{NRB} Fraction of non-renewable biomass, in percentage

[25] Technologies and practices to displace decentralized thermal energy – 11/04/2011' p.11 - 12

Project emissions:
The project scenario is defined by the fuel consumption of end users within the targeted population that adopts the biodigester technology. This formula calculates the project emissions per household:
$$PECO2,y=Up1,y*(BBp1,fuel*NCVfuel*EFp1,fuel)+(BBp1,bio*NCVbio*EFp1,bio*fNRB)$$
Where:

$PE_{p1,CO2,y}$	Cumulative project CO_2 emissions from the use non-renewable biomass and fossil fuels at households during year y
$BB_{p1,fuel}$	The quantity of fossil fuel consumed in the project scenario 1, in tonnes/year
NCV_{fuel}	Net calorific value of fossil fuel, in TJ/tonne
$EF_{p1,fuel}$	CO_2 emission factor of fossil fuel in project scenario 1, in tonnes/TJ
$BB_{p1,bio}$	The quantity of biomass consumed in the project scenario 1, in tonnes/year
NCV_{bio}	Net calorific value of biomass, in TJ/tonne
$EF_{p1,bio}$	CO_2 emission factor of biomass in project scenario 1in tonnes/TJ
f_{NRB}	Fraction of non-renewable biomass, in percentage

Fuel usage data for the three baseline scenarios and project scenario was collected by the KPT survey, as explained above. The results include the baseline usage of firewood only (b1), charcoal only (b2) and both firewood and charcoal (b3).

Ex-ante, the f_{NRB} is estimated to be 92.0%, as per the UNFCCC's default fNRB values. This value is expired and will be assessed during the first monitoring period. The f_{NRB} value is applicable to CO_2 emissions from firewood and charcoal consumption and production. Methane and nitrous oxide emission are not included in the emission reduction calculation for conservativeness. The calculated ex-post baseline emissions are shown in next table:

Table 9 ***Emission reductions due to the displacement of fossil fuels and non-renewable biomass***

Baseline emissions from fuel use (tCO_2e/yr)	**Project emissions from fuel use (tCO_2e/yr)**	**Leakage emissions from fuel use (tCO_2e/yr)**	**Emissions from fuel switch to biogas (tCO_2e/yr)**
7.468	1.665	0.000	5.804

For more details, please see the emission reduction calculation spreadsheet.

6.4.3.2 Emission reduction component 2: Accounting for emission reductions due to the avoidance of methane emissions from manure handling.

The emissions from the animal waste management system of the baseline are determined using the IPCC 2006 Tier 2 approach The Tier 2 approach is applicable to situations where baseline data for an estimation of the methane emission factor per category of livestock are available. The baseline emissions per household shall be calculated as follows:
$$BECH4,h,y=VST*365*(B0,T*0.67kg/m3*MCFx,k*MST,x,k*GWPCH4*NT(h))1000$$
Where:

$BE_{b,CH4,h,y}$	Baseline emissions from manure handling during the year y in tCO_2e for manure handling method h
VS_T	Daily volatile solid excreted for livestock category T in kg dry matter per animal per day
$B_{0,T}$	Maximum methane producing capacity for manure produced by livestock category T in m^3 CH_4
$MCF_{x,k}$	Methane conversion factors for the animal waste handling system in the baseline situation by climate zone k, (%)
$MS_{T,x,k}$	Fraction of livestock category T's manure handled using manure management system x in climate region k (determined through survey method ex-post)
GWP_{CH4}	Global Warming Potential of methane
$N_{T,h}$	Number of livestock category T in premise h

$MCF_{x,k}$, $MS_{T,x,k}$ and $N_{T,h}$ is defined *ex-ante* on the VPA level referencing a baseline survey applicable to the target user . The conversion factors applicable to the baseline scenario will be sourced from default values presented in Table 10.17 of the IPCC Guidelines for National Greenhouse Gas Inventories.

VS_T and $B_{0,T}$ can be defined *ex-ante* as per the default values presented in the IPCC Guidelines for National Greenhouse Gas Inventories, where no country-specific data is available. These can be found in Tables 10A-4 through 10A-9 of the referenced report.

Step 1: Determination of $N_{T,h}$
According to the Monitoring Survey 2016 for VPA1, the dominant type of cattle owned by the respondents was dairy cows. See Section B.3. for an overview of the values applied.

Step 2: Determination of manure characteristic of targeted animals
Manure characteristics are determined by default IPCC values as no national specific data is available. These include the amount of volatile solids (VS) produced in the manure from animal category T and the maximum amount of methane able to be produced from that manure (B_{OT}).

Table 10 ***Manure characteristics of different livestock categories***[26]

Animal type	**VS** (kg/head/day)	$\mathbf{B_O}$ (m^3 CH_4/kg VS)
Dairy Cow	1.9	0.13
Goat	0.35	0.13
Market swine	0.3	0.29
Sheep	0.32	0.13
Other cattle	1.5	0.1
Poultry	0.02	0.24

Step 3: Determination of the applicable Methane Conversion Factor (MCF)
The system-specific methane conversion factors applicable to the baseline are provided in the IPCC Guidelines for National Greenhouse Gas Inventories[27]. The applicable MCF is chosen from the default values presented in Table 10.17, Chapter 10, Volume 4 of the 2006 IPCC Guidelines. Average temperatures are defined at the country level. The resulting average MCF is 3.39%.

[26] Chapter 10: Emissions from Livestock and Manure Management. 2006 IPCC Guidelines for National Greenhouse Gas Inventories

[27] IPCC Guidelines for National Greenhouse Gas Inventories: Chapter 10: Emissions from Livestock and Manure Management (2006)

Step 4: Determining baseline emissions from manure handling
With the data from the previous tables the baseline emission can be determined. The emission per household of all the animals under the VPA are calculated and depicted in the next table.

The baseline methane emissions per household per year under the VPA006 are[28]:

1.85 * 0.00067 * 3.39% * 1 * 25 = 0.382 tCO_2e/year

Step 5: Determining project emissions from manure handling

Project emissions of the methane avoidance component include both the physical leakage of biogas from the biodigester and the incomplete combustion of biogas. These shall be accounted for in accordance with equation (8) of the PoA-DD:
PECH4,y=GWPCH4*(NT,h,y*EFawms,T)*PLy+(NT,h,y*EFawms,T)*(1-ηnewstove)(1-PLy)

$$\mathbf{PE_{p,CH4,y}} = \mathrm{GWP_{CH4}} * \sum (\mathrm{N_{T,h,y}} * \mathrm{EF_{awms,T}}) * \mathrm{PL_y} + \sum (\mathrm{N_{T,h,y}} * \mathrm{EF_{awms,T}}) * (1 - \eta_{\mathrm{new\ stove}}) * (1 - \mathrm{PL_y}) \quad \textbf{(6)}$$

Where:

$PE_{p,CH4,y}$	Project emissions from manure handling during the year y in tCO_2e
GWP_{CH4}	Global Warming Potential of methane
$N_{T,h}$	Number of livestock category T in premise h
$EF_{awms,\ T}$	Emission factor for the defined livestock population category T
PL_y	Physical leakage of the biodigester (through measurement or application of 10% default)
$\eta_{\ new\ stove}$	Combustion efficiency of the used type of biogas stove
$PE_{awms,NT}$	Project emission from the animal waste not treated in the biodigester

In the above equation, $EF_{awms,\ T}$ is further defined as:

$$\mathrm{EF_{awms,h}} = \frac{(\mathrm{VS_T} * 365) * (\mathrm{B_{0,T}} * 0.67 \mathrm{kg/m^3} * \mathrm{MCF_{x,k}} * \mathrm{MS_{T,x,k}})}{1000} \quad \textbf{(7)}$$

Where:

$EF_{awms(T)}$	CH_4 emission factor for livestock category *T*, (tCH_4per animal per year)
$VS_{(T)}$	Daily volatile solid excreted for livestock category *T*, (kg dry matter per animal per day)
365	Basis for calculating annual VS production, (days per year)
$Bo_{(T)}$	Maximum methane production capacity for manure produced by livestock category *T*, (m_3CH_4 per kg of VS excreted)
D_{CH4}	CH_4 density (0.00067 t per m_3 at room temperature

[28] Figures may not add up due to rounding – see emission reduction calculation

$MCF_{(BL,k)}$	Methane conversion factors for the animal waste handling system in the baseline situation by climate zone *k*, (%)
$MS_{(T,S,k)}$	Fraction of livestock category *T*'s manure treated in the animal waste management system, in climate region *k* (dimensionless)

The project emissions from manure handling per household per year under the VPA006 are therefore[29]:

25 * 0.01 * 0.1 + 0.01 * (1 - 0.994) * (1 - 0.10) = 0.028 tCO_2e

Project emissions from the animal waste not treated in the bio digester in the project scenario will be zero since the non-treated animals in the project scenario will have the same situation as they would have had in the baseline.

Project emissions from bio-slurry

In order to estimate the project emissions occurring from bioslurry, the following steps are followed:

Step 1: estimation of the total amount of VS entering the biodigester

To estimate the total amount of Volatile Solids (VS) that enters the biogas digester, for each animal, the VS excretion in kg/day is multiplied with the average number of animals owned by households with a biodigester. This results in a total amount of VS excreted per animal per day. Next, these totals are multiplied with the share of bioslurry fed into the biodigester for each animal, resulting in the total VS entering the biodigester per day. The sum of VS entering the biodigester from all animals combined is 9.48 $kgVS.day^{-1}$.

Step 2: assessment of remaining VS content of bio-slurry

The second step is the assessment of remaining VS content. The figure is calculated by subtracting the percentage of VS that is destroyed in the biodigester from the total VS entering the biodigester. The resulting total VS in bio-slurry is:

9.48 $kgVS.day^{-1}$ * 45% = 4.26 $kgVS.day^{-1}$.

Step 3: assessment of the methane potential of bioslurry

To assess the methane potential of bio-slurry under the project scenario, for each animal the maximum methane producing capacity of the manure is multiplied by the remaining CH4 production capacity of liquid digestate (Fww,CH4) (EB 96 Annex 7). The resulting figure is multiplied with the total VS entering the biodigester per animal and proportionally weighted, resulting in an average methane potential per digester of 0.026 $m^3CH_4/kgVS$ per day.

Step 4: calculation of bio-slurry emissions

Next, to calculate the total project bio-slurry emissions, the following formula is applied:

$PE_{p1\ bio\text{-}slurry}$ = (total VS in biodigesters * 365) * $Bo,_{dig}$ * ΣDMS * MCF *(D_{ch4} /1000) * GWP_{CH4}

Where:

$PE_{p1\ bio\text{-}slurry}$	Project emissions from bio-slurry
$Bo,_{dig}$	Maximum methane production capacity for the biodigester ($m^3CH4/kgVS$)
DMS	Bioslurry management practice, as a fraction
MCF	Methane conversion factor

[29] Figures may not add up due to rounding – see emission reduction calculation

D_{ch4} Density of methane conversion factor

GWP_{CH4} Global Warming Potential of methane

Therefore:

$PE_{p1\ bio\text{-}slurry}$ = (4.26 *365) * 0.026 * 2.48% * (0.67/1000) * 25
$PE_{p1\ bio\text{-}slurry}$ = 0.017

As this is less than 1% of emissions reductions per digester, emissions from bio slurry are excluded.

Emission Reduction

Emission reductions per VPA will be calculated as:

$$\mathbf{ER_{CH4,y}} = \left(\mathrm{BE_{b,CH4,y}} - \mathrm{PE_{p,CH4,y}}\right) * \mathrm{N_{p,y}} * \mathrm{U_{p,y}} \quad \textbf{(8)}$$

Where:

$ER_{CH4,y}$ Methane emissions reductions in year y (tCO_2)

$BE_{b,CH4,y}$ Baseline methane emissions during the year y (tCO_2)

$PE_{p,CH4,y}$ Project methane emissions during the year y (tCO_2)

$N_{p,y}$ Cumulative project operational rate included in the project database for project scenario p against baseline scenario b in year y

$U_{p,y}$ Cumulative usage rate for technologies in project scenario p in year y, based on cumulative adoption rate and drop off rate (fraction)

The emission reductions from methane avoidance per household per year under the VPA006 are 0.354 tCO_2e/year.[30]

6.4.3.3 Leakage emissions

The project proponent investigated the following potential sources of leakage:

Table 11 ***Leakage emission assessment***

#	Leakage source	Applicability
a	The displaced baseline technologies are reused outside the project boundary in place of lower emitting technology or in a manner suggesting more usage than would have occurred in the absence of the project.	The baseline technologies are not reused outside the project boundary. The baseline technologies include three-stone fires and basic, inefficient cookstoves.[31]
b	The non-renewable biomass or fossil fuels saved under the project activity are used by non-project users who previously used lower emitting energy sources.	Most household rely on wood and charcoal in Kenya. The small share of household that use a lower emitting energy source,

[30] Figures may not add up due to rounding – see emission reduction calculation

[31] GACC (2013) p. 23

		such as LPG, will not switch back to NRB due to the project activity.
c	The project significantly impacts the NRB fraction within an area where other CDM or VER project activities account for NRB fraction in their baseline scenario.	The project is not large enough to significantly impact the NRB component of another CDM or VER project. It is therefore not likely that the NRB fraction is impacted significantly.
d	The project population compensates for loss of the space heating effect of inefficient technology by adopting some other form of heating or by retaining some use of inefficient technology	Space heating does not occur in Kenya to a large Degree.
e	By virtue of promotion and marketing of a new technology with high efficiency, the project stimulates substitution within households who commonly used a technology with relatively lower emissions, in cases where such a trend is not eligible as an evolving baseline.	The baseline is not fixed in this project, and the combustion of biogas always leads to lower emissions compared to all baseline fuels as it is 100% renewable.
F	Physical leakage emissions	It is considered as project emissions - see ER spreadsheet
G	Emissions from biogas slurry	It is considered as project emissions –see ER spreadsheet

B.4.4. Summary of ex ante estimates of emission reductions

The cumulative ex-post emission reductions are calculated with the following calculation in order to take into account the proportional ratio of each identified baseline scenario:

$$\mathbf{ER_{Total}} = \left(\left(\mathrm{ER_{b1,CO2,y}} + \mathrm{ER_{CH4,y}}\right) * BB_{b1,ratio}\right) + \left(\left(ER_{b2,CO2,y} + ER_{CH4,y}\right) * BB_{b2,ratio}\right) + \left(\left(ER_{b3,CO2,y} + ER_{CH4,y}\right) * BB_{b3,ratio}\right) * \mathrm{N_{p,y}} * \mathrm{U_{p,y}}$$

Where:

$ER_{bx,CO2,y}$	CO_2 emissions reductions in year y for the respective baseline scenario (tCO_2)
$ER_{CH4,y}$	Methane emissions reductions in year y (tCO_2)
$BB_{bx,ratio}$	The ratio of project population exhibiting the respective baseline scenario (%)
$N_{p,y}$	Cumulative project operational rate included in the project database for project scenario p against baseline scenario b in year y
$U_{p,y}$	Cumulative usage rate for technologies in project scenario p in year y, based on cumulative adoption rate and drop off rate (fraction)

The ex-ante usage and operation rate applied is from VPA01 MRII is 78% (year 2015) and 98% respectively. The next table shows the ex-ante estimate of the emission reductions over the crediting period[32]:

[32] Figures may not add up due to rounding

Table 12 *Project emissions, baseline emissions, leakage and overall emissions per year*

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2016	4,682	1,010	-	3,672
2017	11,748	2,533	-	9,214
2018	16,733	3,608	-	13,124
2019	21,660	4,671	-	16,989
2020	26,587	5,733	-	20,853
2021	31,514	6,796	-	24,718
2022	36,441	7,858	-	28,582
Total	**149,363**	**32,210**	-	**117,154**
Total number of crediting years				**7**
Annual average over the crediting period				16,736

B.5. Monitoring plan

B.5.1. Data and parameters to be monitored

Data/Parameter	**$f_{NRB,y}$**
Data unit	%
Description	Fraction of biomass used in the absence of the project activity in year y that can be established as non-renewable biomass using nationally approved methods
Source of data	Default **$f_{NRB,y}$** factors from the CDM, available from http://cdm.unfccc.int/DNA/fNRB/index.html
Value(s) applied	Kenya: 92% (ex-ante)
Choice of data or measurement methods and procedures	N/A
Purpose of data	Calculation of baseline and project emissions
Additional comment	The fNRB value expired in on 18th of September 2017. During the first monitoring period, an updated fNRB value will be calculated for the first crediting period

Data/Parameter	**$U_{p1,y}$**
Data unit	Fraction
Description	Cumulative usage rate for technologies in project scenario p1 in year y, based on cumulative adoption rate and drop off rate (fraction)
Source of data	Collected through the annual Monitoring Survey.
Value(s) applied	78% ex-ante from VPA01 MPII

Measurement methods and procedures	An assessment of the drop-off rate of usage requires that digesters of different age groups are assessed. Monitoring shall be carried out on a random sample of digesters of different ages. The minimum total sample size is 100, with at least 30 samples for biogas digesters of each age bracket (measured in annual increments) being surveyed. The usage rate of thermal applications will be monitored annually using survey methods to satisfy the requirements put forth by the methodology 'Technologies and practices to displace decentralized thermal energy consumption' V. 1
Monitoring frequency	Annual
QA/QC procedures	To account for void responses and lack of availability of some households on the day of the survey, additional households within each age group should be questioned. To ensure conservativeness, participants in a usage survey with technologies in the first year of use (age 0-1) must have technologies that have been in use on average longer than 0.5 years. For technologies in the second year of use (age 1-2), the usage survey must be conducted with technologies that have been in use on average at least 1.5 years, and so on.
Purpose of data	Calculation of project emissions
Additional comment	A single usage parameter is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario.

Data/Parameter	**$N_{p1,y}$**
Data unit	Number
Description	Cumulative number of project technology-days years included in the project database for project scenario p1 against baseline scenario b in year y
Source of data	Total sales record from the Project Database
Value(s) applied	1,828 (units built as per 31/12/2017)
Measurement methods and procedures	New biogas digesters included under the PoA will be entered into the Project Database as and when they come online. This will enable a running cumulative total of biogas digesters installed to be kept. The operational rate is determined on a sampling basis through annual monitoring surveys. In addition, households are required to notify provincial office staff in a situation when a biodigester stops working. This information is recorded in the Project database, allowing the identification per included biodigester the amount of operational days per year. In a scenario where the biodigester stops operating, the number of non-operational days is recorded in the database.
Monitoring frequency	Continuous
QA/QC procedures	$N_{p,y}$ shall be calculated from (a) the number of installed system (parameter $No_{p,y}$); and (b) the average operational days of the system ($O_{p,y}$). The equation is therefore ($N_{p,y} = No_{p,y} * (O_{p,y})$). The average operational days will be confirmed upon verification.
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data/Parameter	**$No_{p1,y}$**
Data unit	Number

Description	Cumulative number of project technologies included in the project database for project scenario p1 in year y
Source of data	Project Database
Value(s) applied	N/A Calculated on a monthly interval for digesters built.
Measurement methods and procedures	The date presented in the Sales Agreement for each biogas digester is recorded in the Project Database. On average, biogas is produced and used 15 days after completion. $\mathbf{N_{0p,y}}$ will be calculated from this date.
Monitoring frequency	Continuous
QA/QC procedures	As per procedures of the Project Database
Purpose of data	Calculation of project emissions
Additional comment	The actual cumulative number of biodigester operational days will be confirmed upon verification.

Data/Parameter	$\mathbf{O_{p1,y}}$
Data unit	Number
Description	The average technology-days during which the biodigesters are operational for project scenario p1 against baseline scenario b1 in year y
Source of data	Project Database (ex-ante value applied from VPA01 MPI)
Value(s) applied	357.7 (98%*365)
Measurement methods and procedures	The operational rate is determined on a sampling basis through annual monitoring surveys.
Monitoring frequency	Continuous
QA/QC procedures	The average operational days will be confirmed upon verification.
Purpose of data	As per procedures of the Project Database.
Additional comment	The actual cumulative number of biodigester non-operational days will be confirmed upon verification. The equation to calculate this is ($O_{p,y}$ = 365 – non-operational days)

Data/Parameter	$\mathbf{LE_{p1,y}}$
Data unit	tCO_2e/year
Description	Leakage in project scenario p1 during year y
Source of data	N/A
Value(s) applied	0.0
Measurement methods and procedures	N/A
Monitoring frequency	N/A
QA/QC procedures	N/A
Purpose of data	Calculation of leakage
Additional comment	According to the methodology applied “leakage risks deemed very low can be ignored as long as the case for their insignificance is substantiated” (p.13). Section *6.4.3.3* of the VPA-DD provides an overview of potential sources of leakage, including their applicability and justification for excluding the sources of leakage.

Data/Parameter	$\mathbf{N_{,T,h}}$
Data unit	Number of animals

Description	Number of livestock category T in premise h
Source of data	ABC VPA1 KE MP2 Surveys + Analysis, sheet 'Analysis A'
Value(s) applied	**Animal T** / **Average amount** Dairy cow: 5.3 Goat: 1.3 Market swine: 0.3 Sheep: 2.5 Other cattle: 1.4 Poultry: 24.1
Measurement methods and procedures	Households/communities/SMEs will be asked how many animals of different categories they own.
Monitoring frequency	Annual
QA/QC procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data/Parameter	**$BB_{b\ ratio}$**
Data unit	%
Description	Baseline scenario ratios
Source of data	ABC VPA1 KE MP2 Surveys + Analysis, sheet 'Analysis A'
Value(s) applied	B1: households using firewood only = 53.3% B2: households using charcoal only = 13.3% B3: households using firewood + charcoal only = 26.7% B4: Households using mainly LPG = 6.7%
Measurement methods and procedures	Households/communities/SMEs will be asked which baseline scenario they fell into before receiving a biogas digester. The four baseline scenarios are defined by asking the households *"what is your primary fuel source for cooking purposes?"*. The purpose of this question is to allocate a household to a baseline scenario, whereby 'primary' fuel consumption is defined as that fuel meeting more than 50% of their fuel needs for cooking purposes. The households that respond *"firewood"*, for example, are subsequently allocated to the baseline scenario b1. This means that households in, for example, baseline scenario b1 may also use small amounts of fossil fuels (i.e. secondary and tertiary fuels) for cooking, which will be included in the baseline emissions.
Monitoring frequency	Annually
QA/QC procedures	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, additional households should be questioned.
Purpose of data	Calculation of baseline emissions
Additional comment	The ratio to apply for each baseline scenario in the project population will be determined as part of the monitoring survey on a sampling basis. The survey results will be applied to the project population to calculate the emission reductions.

Data/Parameter	**$BB_{b4,fuel}$**
Data unit	Tonnes/year

Description	Amount of fossil fuels used in baseline scenario b4
Source of data	To be executed
Value(s) applied	0
Choice of data or measurement methods and procedures	It is not practical to establish LPG consumption using the KPT for reasons of safety. Instead, households will be asked how often they buy a bottle and the bottle size will be recorded. Annual consumption was be calculated as: $$Annual\ LPG\ consumption\ (\frac{kg}{year}) = \frac{Bottle\ size\ (kg)}{Usage\ period\ (days)} \times 365$$
Monitoring frequency	Once per crediting period
QA/QC procedures	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	Calculation of baseline emissions
Additional comment	The baseline scenario will be established once in the crediting period. In case the VPA implementer did not establish this scenario, the emissions will not be accounted for which is conservative. This approach is based on GS751 (National Biodigester Programme of Cambodia) in which it was allowed to use this method.

Data/Parameter	**$BB_{b1,2,3,4}$**
Data unit	Tonnes/year
Description	Amount of fossil fuel used in the baseline scenarios b1, b2, b3 and b4
Source of data	KPT primary data 29Sept2015 B1(firewood) (post-review), sheet '90/30 test'; 20170322 B2 B3 BFT Results KE, sheet 'B2 - 90|30 test'
Value(s) applied	0.00
Measurement methods and procedures	*H*ouseholds/communities/SMEs have been asked how much woody biomass they use, and undergo a Kitchen Performance Test as per the requirements of the TPDDTEC methodology.
Monitoring frequency	Not applicable: Option B BFT conducted once upfront and parameter fixed throughout the crediting period.
QA/QC procedures	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	To calculate project emissions
Additional comment	As per Annex 5 of the Technologies and Practices to Displace Decentralized Thermal Energy Consumption methodology.

Data/Parameter	**$BB_{p1,\ bio}$**
Data unit	Tonnes/year
Description	Amount of woody biomass used in the project scenario p1 (one value)
Source of data	VPA01 MRI ABC_Kenya_CPI_MR1_1FEB17.pdf
Value(s) applied	1.08
Measurement methods and procedures	*H*ouseholds/communities/SMEs have been asked how much woody biomass they, and undergo a Kitchen Performance Test as per the requirements of the TPDDTEC methodology.
Monitoring frequency	*Ex post,* once every two years

QA/QC procedures	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	To calculate project emissions
Additional comment	Project Performance Field Test (PFT) will be updated once every two years.

Data/Parameter	**$BB_{p1,fuel}$**
Data unit	Tonnes/year
Description	Amount of fossil fuels used in the project scenario p1
Source of data	Survey C PFT Sample Size - KE, sheet 'Project - 90|30 test'
Value(s) applied	0
Measurement methods and procedures	*H*ouseholds/communities/SMEs have been asked how much fossil fuels they use, and undergo a Kitchen Performance Test as per the requirements of the TPDDTEC methodology.
Monitoring frequency	*Ex-post*, once every two years
QA/QC procedures	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	Calculation of project emissions
Additional comment	Project Performance Field Test (PFT) will be updated once every two years.

Data/Parameter	**$MS_{T,S,k}$**
Data unit	%
Description	Fraction of livestock category T's manure fed into the bio-digester, S in climate region k
Source of data	ABC VPA1 KE MP2 Surveys + Analysis, sheet 'Analysis A'
Value(s) applied	**Animal T** / **Fraction** Dairy cattle / 81.7% Other cattle / 42.4% Market swine / 50.0% Breeding swine / 62.5% Poultry / 0.0% Sheep / 0.0% Goat / 0.0%
Measurement methods and procedures	Households/communities/SMEs have been asked to estimate the fraction of their animal's manure that is fed into the biogas digester for the different relevant livestock categories.
Monitoring frequency	Annual
QA/QC procedures	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	Calculation of project emissions
Additional comment	Applicable to VPAs applying Tier 2 only

Data/Parameter	**$MS_{P,S,K}$**
Data unit	%

Description	Fraction of livestock category T's manure not fed into the bio-digester, in climate region k
Source of data	ABC VPA1 KE MP2 Surveys + Analysis, sheet 'Analysis A'
Value(s) applied	**Animal T** / **Fraction** Dairy cattle / 18.3% Other cattle / 57.6% Market swine / 50.0% Breeding swine / 37.5% Poultry / 100.0% Sheep / 100.0% Goat / 100.0%
Measurement methods and procedures	Households/communities/SMEs have been asked to estimate the fraction of their animal's manure that is not fed into the biogas digester for the different relevant livestock categories.
Monitoring frequency	Annual
QA/QC procedures	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data/Parameter	**GWP_{CH4}**
Data unit	Unit
Description	Global Warming Potential of methane
Source of data	IPCC Fourth Assessment Report
Value(s) applied	25
Measurement methods and procedures	The IPCC guidelines will be checked on an annual basis during verification to determine if the GWP of methane has changed from the above.
Monitoring frequency	Annual
QA/QC procedures	As per the Gold Standard's rule update 'The application of Global Warming Potentials for Gold Standard project activities'
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data/Parameter	**Bio**
Data unit	N/A
Description	Use of bio-slurry
Source of data	Monitoring Survey
Value(s) applied	Not applicable, no effect on emission reductions
Measurement methods and procedures	Households/communities/SMEs will be asked how they use the bio-slurry produced as a bio-product of the anaerobic digestion process.
Monitoring frequency	Annual
QA/QC procedures	Sampling in accordance with the procedures in the methodology applied shall be carried out.
Purpose of data	Calculation of project emissions

Additional comment	To be used for the calculation of project emissions associated with bio-slurry usage – the CH_4 emissions from the anaerobic decay of the residual organic content of digestate subjected to anaerobic storage.

The VPA will also monitor the following social and environmental parameters, as defined under the Gold Standard[33]:

Data/Parameter	**GS-01 Air quality**
Data unit	Percentage
Description	Perceived improvement in health by the user. (incidence of eye problems and respiratory illness)
Source of data	Annual monitoring surveys
Value(s) applied	Not applicable, no effect on emission reductions
Measurement methods and procedures	Users of the biogas digesters will be asked if they feel the incidence of eye problems and respiratory illness have a) increased, b) stayed the same or c) decreased as a result of getting a biogas digester.
Monitoring frequency	Annual
QA/QC procedures	Not applicable
Purpose of data	Monitoring of sustainable development benefits
Additional comment	N/A

Data/Parameter	**GS-03 Soil condition**
Data unit	%
Description	Percentage of biogas users who use slurry as a fertilizer
Source of data	Annual monitoring surveys
Value(s) applied	Not applicable, no effect on emission reductions
Measurement methods and procedures	The occurrence of application of slurry to agricultural land will be monitored through sampling as part of the annual monitoring effort. Stakeholders will be asked how they use the slurry, if at all.
Monitoring frequency	Annual
QA/QC procedures	N/A
Purpose of data	Monitoring of sustainable development benefits
Additional comment	N/A

Data/Parameter	**GS-06 Quality of employment**
Data unit	Number
Description	Number of masons attending training programs
Source of data	Annual monitoring
Value(s) applied	Not applicable, no effect on emission reductions
Measurement methods and procedures	Masons will be trained and certified after having shown competence by constructing a number of digesters. The list of certified masons will be used as basis of the scoring on this GS parameter.
Monitoring frequency	Annual
QA/QC procedures	N/A
Purpose of data	Monitoring of sustainable development benefits
Additional comment	N/A

[33] Refer to accompanying Gold Standard PoA-Passport for further details.

Data/Parameter	GS-07 Livelihood of the poor
Data unit	%
Description	Percentage of users reporting changes in expenditure on fuel for cooking
Source of data	Monitoring survey
Value(s) applied	Not applicable, no effect on emission reductions
Measurement methods and procedures	Users will be asked: Has your expenditure of fuel for cooking a) increased, b) decrease or c) stayed the same since purchasing the biogas digester?
Monitoring frequency	Annual
QA/QC procedures	N/A
Purpose of data	Monitoring of sustainable development benefits
Additional comment	N/A

Data/Parameter	GS-08 Access to affordable and clean energy services
Data unit	Number
Description	Number of biogas units installed
Source of data	Electronic Project Database
Value(s) applied	To be determined per VPA
Measurement methods and procedures	The total number of biogas digesters will be determined via the electronic Project Database.
Monitoring frequency	Annual
QA/QC procedures	N/A
Purpose of data	Monitoring of sustainable development benefits
Additional comment	N/A

Data/Parameter	GS-10 Quantitative employment and income generation
Data unit	Person-days
Description	Cumulative number of masons working days
Source of data	Project database
Value(s) applied	Not applicable, no effect on emission reduction calculations
Measurement methods and procedures	This will be calculated by multiplying the number of digesters constructed times the default number of days required for the construction
Monitoring frequency	Annual
QA/QC procedures	N/A
Purpose of data	Monitoring of sustainable development benefits
Additional comment	N/A

Data/Parameter	GS-12 Technology transfer and technological self-reliance
Data unit	Number
Description	Number of masons attending training programmes
Source of data	Electronic Project Database
Value(s) applied	Not applicable, no effect on emission reduction calculations
Measurement methods and procedures	All vocational training attendees will be issued with a certificate proving their attendance, and a record of their names, contact details and gender, will be kept as part of the CME's consolidated monitoring database. This will be updated as and when trainings are conducted.

Monitoring frequency	Annual
QA/QC procedures	N/A
Purpose of data	Monitoring of sustainable development benefits
Additional comment	N/A

B.5.2. Sampling plan

>>
The data collection will follow the standard "Sampling and surveys for CDM project activities and programme of activities (Version 07)"[34].

Objectives and reliability requirements
The objective of the sampling effort is to meet the monitoring requirements set forth in the methodology '*Technologies and Practices to Displace Decentralized Thermal Energy Consumption'*. Monitoring will be carried out on an annual basis, with those parameters that can be monitored on a biennial basis monitored once every two years.

Target population
The target population for the application of monitoring procedure is the households, local communities and SMEs with installed biodigesters, as identified through the Project Database managed by the CME.

Sampling method
KBP, with support from Hivos, is responsible for the production of periodical monitoring reports for each VPA. Multi-stage sampling will be applied within the PoA, where clusters consist of regions and the subunits (biogas digesters) within them. It is more cost effective to monitor several subunits within each region. In order to account for the fact that not all regions have the same number of biogas digesters commissioned, sampling will be employed proportionate to cluster size. Clusters will be selected with a probability proportionate to the size of the target population within each cluster such that larger clusters have a greater probability of selection, and smaller clusters a lower probability. This helps to ensure that sampling remains representative of the entire population.

Sample size
In order to combine monitoring with an assessment of the drop-off rate of usage (which requires that digesters of different age groups are assessed), monitoring should be carried out on a random sample of digesters of different ages. The minimum total sample size is 100, with at least 30 samples for biogas digesters of each age bracket (measured in annual increments) being surveyed. Alternatively, the monitoring survey and usage rate survey sample groups can be selected separately, such that at least 100 biogas digester users are surveyed for the monitoring survey, and at least 30 biogas digester users within each age group of digesters are surveyed.

To determine the average fuel savings as per the Kitchen Performance Test (i.e. the Project Field Test), the sample size shall be determined through ensuring that the results comply with a 90% confidence interval and 30% margin of error, as per Annex 4 of the applied methodology.

For more details on the sample size determination, refer to Section B.7.2 of the PoA-DD.

Sampling frame
The sampling frame shall be defined based on the information in the Project Database, which outlines the location of each biogas digester and the number installed in each geographical region. The sample selection consists of two stages: the first step considers the larger sample units (country regions) whilst the second step involves randomly selecting biogas digesters to be monitored within these units.

[34] CDM-EB50-A30-STAN

B.5.3. Other elements of monitoring plan

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Data collection: field measurements

KBP will collect the data necessary for the monitoring and for the emission reductions calculation. Field measurements and data to be collected are listed in section B.5.1 above. To account for seasonal fluctuations, monitoring of fuel wood consumption (KPT) should by preference be carried out during the dry season. This ensures conservativeness since during this season less wood is needed for cooking purposes as the wood fuel, the primary fuel for cooking pur2poses of most households, contains less moisture. Seasonality does not impact usage rate of other fuels such as LPG and kerosene. Measurements conducted during the dry season can therefore be assumed to be conservative. In case monitoring of fuel wood consumption is not taking place during the dry season moisture meters should be used.

The parameters to be monitored within VPA006, as outlined in the applied methodology, will be collected through a Monitoring Survey. This shall be completed periodically and covers the following data:

- Number of users applying the final biodigester slurry on agricultural fields;
- Perceived improvement of living conditions;
- Number of individuals attending trainings;
- Percentage of biodigester in use in the given year (y).
- The number of operational days of the biodigesters in the given year (y).
- The fraction of manure that is not treated in the biodigester.
- Ratio of households falling in separate baseline fuel scenarios.
- Continued use of baseline stoves: biogas digester users will be asked to confirm whether they use their baseline stove in addition to (or instead of) their biogas digester, and if so, how often they use it.
- Quantity of biomass and fossil fuel that is used for cooking in a given project scenario in a given year (y) – once every two years;

The application of bioslurry shall be monitored according to the applied methodology. If there is any anaerobic use/storage of bioslurry under anaerobic conditions reported from the monitoring survey, project emissions shall be accounted for accordingly. The following approach shall be followed:

- Estimation of the total amount of VS entering the biodigester;
- Assessment of remaining VS content of digestate;
- Assessment of methane potential of bio-slurry;
- MCF of the digestate management systems;
- Calculation of project emissions using the information obtained in the previous steps.

Quality assurance/Quality control

The CME will provide the necessary training to the VPA implementers and the parties involved in the monitoring to ensure that the data recorded is complete and accurate. The VPA Implementer, KBP, will prepare data collection protocols to be given to the research assistants to guide them during the data collection exercise.

Response rates will be maximized by sampling over the minimum required number to compensate for any non-responses. In special cases where participants refuse to participate in the monitoring, the surveyor will explain that monitoring is part of the requirements of the programme and try to arrange an alternative date for a site visit, or carryout monitoring with another member of the households, community or SME.

Sales Agreements will be stored by the KBP with copies sent to the CME, if requested. A back-up of the project database will also be stored on an electronic medium by the CME. All data monitored and required for verification and issuance will be kept for at least five years after the end of the crediting period or the last issuance of VERs for the project activity, whichever is later.

Analysis
All the sales data and the survey data will be captured in a computerised database. The analysis will include a calculation of the proportion of biogas system in use and of the emission reductions according to the methodology applied. For the Project Field Test, outliers will be excluded using the Grubb's Test.[35]

Implementation plan

KBP will be responsible for the collection of all Sales Agreement data and the creation of the Monitoring Report at the end of each Monitoring Period. KBP will also be responsible for entering user data into the Project Database and for ensuring that the information in the Sales Agreements is complete and correct. The total number of Sales Agreements will reveal the quantity of biogas systems sold at the end of a Monitoring Period. Appropriate record keeping procedures will be implemented to ensure that each Monitoring Period dataset can be transparently attributed to its corresponding VPA, preventing any occurrences of double counting.

Monitoring Responsibilities
KBP is responsible for all the monitoring activities carried out within this VPA, including data collection, data monitoring, and writing the Monitoring Report.

SECTION C. Start date, crediting period type and duration

C.1. Start date of VPA

>>
The start date of the project is the earliest date at which either the implementation or construction or real action of a project begins. Therefore, the start date of VPA006 is 23/10/2015, the day on which the first biogas digester was commissioned under the VPA. Retroactive inclusion is pursued as permitted by the Gold Standard.[36]

C.2. Expected operational lifetime of VPA

>>
The expected operational lifetime of the VPA is the full duration of the crediting period, at 21 years. A well maintained fixed-dome biogas system has an operational lifetime of over 30 years[37]. This means that the systems should be operational beyond the potential crediting period of the VPA.

C.3. Crediting period of VPA

C.3.1. Type of crediting period

>>
Renewable crediting period.

C.3.2. Start date of crediting period

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[35] For more on the Grubbs' test, please refer to http://www.itl.nist.gov/div898/handbook/eda/section3/eda35h1.htm.

For a cross-check of the significance of the results, please refer to an online tool available on: http://www.graphpad.com/quickcalcs/Grubbs1.cfm.

[36] See GS confirmation of Prior Consideration of Carbon Revenues, 30 March 2017

[37] ETC Group, Promoting Biogas Systems in Kenya, A feasibility study, Final Draft, 20 August 2007

The start date of the crediting period is on 01/01/2016 (estimated date) or 2 years prior to the end date of the inclusion review period, whichever is later.[38]

C.3.3. Duration of crediting period

>>
The crediting period for the VPA is 7 years, renewable twice. The duration of the crediting period will not exceed the end date of the programme.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

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An environmental impact assessment is not required for activities implementing household biodigesters in Kenya, as stipulated by the Environmental Management and Coordination Act, 1999, which states that only projects that fall under the Second Schedule are required to submit a Project Report and then potentially an Environmental Impact Assessment (EIA). The VPA will not be required to submit an EIA as the activities are not contained in the Second Schedule.

D.2. Environmental impact assessment

>>
N/A

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

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The Kenya VPA006 is retroactively included in the African Biogas Carbon Programme (ABC) PoA, and is the second VPA of the PoA located in Kenya. The design and implementation of the Kenya VPA006 is exactly as per the design and implementation of VPA001 of the ABC PoA. Moreover, the geographical location of VPA001 and VPA006 are identical, as both cover the entire territory of Kenya. The reason for inclusion of VPA006 is simply that VPA001 has reached capacity; the project remains the same in all other aspects.

As part of the registration process of VPA001, a Local Stakeholder Consultation (LSC) was carried out on 19 October 2011 in Nairobi. There were 38 participants. A further LSC was carried out on 29 May 2015[39] as part of an effort to account for carbon reductions from soil carbon sequestration occurring as a result of bioslurry usage as fertilizer. There were 75 participants.

Given that the LSCs carried out in 2011 and 2015 covers the people and area affected by the VPA001, there is no need to carry out an additional local stakeholder consultation for the registration of the VPA006. The 2011 and 2015 LSCs are used as stakeholder input for VPA006. Additionally, Hivos has carried out a Stakeholder Feedback Round for the Kenya VPA006, seeking feedback from stakeholders through electronic communication.

The following description of the modalities for the LSC applies to the implementation of the 2011 and 2015 LSCs.

<u>19 October 2011 at Panafric Hotel, Nairobi</u>
Comments were solicited from stakeholders in accordance with the Gold Standard's procedures. Stakeholders were invited to attend a public meeting to be informed and give their comments on the

[38] The Gold Standard's Annex F (V2.2) states that "A VPA submitted for Gold Standard inclusion/registration under the regular/retroactive project cycle is potentially eligible to receive credits for realised emission reductions generated prior to Gold Standard inclusion/registration for a maximum period of two years."

[39] See report '2015 LSC Report Bioslurry Kenya'

SSC-VPA. The meeting was held on 19/10/2011 at 09:00 AM, at Panafric Hotel, Nairobi. Invitations were distributed to specific stakeholders via e-mail and telephone between 05/10/11 – 07/10/11 and a public invitation was advertised in the weekly regional newspaper the East African on 10/10/11. The process for identifying stakeholders is described in more detail in the Local Stakeholder Consultation report. 38 people who represented a wide range of stakeholders attended the meeting. Women were well represented and were outspoken in the meeting, making up 39% of the attendees. Stakeholders included representatives from government ministries, non-governmental organisations, private businesses, financiers and farmers including some that had already installed biogas systems.

Participants were briefed on the background to the CDM mechanism, the basic concept of which is the ability to generate carbon credits for a programme which applies also under the Gold Standard, and the PoA-DD with questions and answer sessions for each topic. Participants were then presented with the specifics of the VPA and invited to make comments and ask any questions. The participants then engaged in an exercise to examine the sustainability of the VPA, as per Gold Standard requirements. Participants were also invited to provide written feedback, evaluation forms were received in English. Stakeholders that were unable to attend the meeting were invited to send in comments via e-mail.

A follow-up Stakeholder Feedback Round was also organized from 9th January to 9th March 2015. Stakeholders were invited to review the LSC Report, PDDs and Passports for the PoA and VPA.

29 May 2015 at Heron Portico Hotel, Nairobi

Comments were solicited from stakeholders in accordance with the Gold Standard's procedures. Stakeholders were invited to attend a public meeting to be informed and give their comments on the SSC-VPA. The meeting was held on 29/05/2015 at 09:00 AM, at the Heron Portico Hotel, Nairobi. Invitations were distributed to stakeholders via an advertisement in the Daily Nation paper, e-mail and telephone from 19/05/2015 onwards. The consultation was also advertised on the ABPP website (africabiogas.org). 75 people, representing a wide range of stakeholders, attended the meeting.

Participants were briefed on the background to the Gold Standard mechanism, the basic concept of which is the ability to generate carbon credits for a programme which applies also under the Gold Standard, with questions and answer sessions for each topic. Participants were then presented with the specifics of the VPA and invited to make comments and ask any questions. The participants then engaged in an exercise to examine the sustainability of the programme, as per Gold Standard requirements. Participants were also invited to provide written feedback, and evaluation forms were received.

2018 Stakeholder Feedback Round

A Stakeholder Feedback Round was organized from 26th February 2018 – 25th April 2018. Stakeholders were invited to review the 2011 and 2015 LSC reports, the VPA6 PDD and VPA6 Passport.

E.2. Summary of comments received

>>

The table below summarizes the comments received during the 2011 and 2015 Local Stakeholder Consultation, as well as the response by the programme. The comments received were overall very positive. Their responses mainly called for KENDBIP[40] to be expanded beyond domestic fixed dome installations.

Table 13 *Summary of comments received during the stakeholder consultations*

Stakeholder comment	Was comment taken into account (Yes/ No)?	Explanation (Why? How?)

[40] Please note that KBP has now assumed the role of VPA implementer

Poor construction could lead to effluent seepage into the groundwater	Yes	It was agreed that for the KENDBIP[41] project this was a relatively low risk considering the quality control procedures required and training provided to all masons.
It was mentioned that the extra water required by the biogas system might put added pressure on household's water resources	Yes	Agreed this can be considered a minor risk as these systems would be installed in areas where there is a ready supply of water. The demands of water from each biogas system are also not extremely high, and a decreased rate of deforestation would help to improve watersheds.
The project will result in increased access to clean energy services however biogas systems even subsidised will not be affordable to the poorest.	No	The project already offers biogas digesters at a reduced cost and works with microfinance institutions to allow farmers the ability to access capital for the purchase of a digester.
Do you have a standard for quality control?	Yes	There are a number of different quality controls built into the programme. On the carbon credits side of the project it will be registered with Gold Standard. also have a number of quality control checks to ensure quality of construction. When new digesters are included for other VPAs they will need to go through a quality check to ensure they will have a long lifetime.
Where does carbon credit go?	No – only a clarification was required	The households own the carbon credits initially, but in providing a subsidy the ownership of the credit is transferred to KENDBIP. Currently, we are working on tools to explain the process of the carbon credit transfer to households, it is intended this will be done in a pictogram in English and local language. [42] ACES-Biogas is working on ways to ensure that benefits will be passed on to households.[43]
Why does the programme only cover small domestic installations would it not be more effective at a larger scale on community or industrial level?	No – only a clarification was needed.	The programme has been initially designed and funded for domestic installations and therefore we are limited in scope. In the future we would be keen to promote these larger scale digesters.

E.3. Consideration of comments received

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[41] Please note that KBP has now assumed the role of VPA implementer

[42] Please note that KBP is no longer working on this

[43] ACES-Biogas is not actively participating in this project anymore, Hivos has taken over this role. As such, Hivos will use carbon revenues to support affordability of the bio digesters and ensure sustainable after sales support.

All comments received were taken into account within the overall design of the VPA. No comments required modifying the design of the VPA.

SECTION F. Eligibility for inclusion

This VPA follows the stated goal of the PoA and eligibility criteria for inclusion in the PoA as determined in Section B.2. of the PoA-DD:

Table 14 *VPA eligibility check*

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion	Description of this VPA in relation to the criterion and supporting evidence
1	The geographical boundary of the VPA including any time-induced boundary consistent with the geographical boundary set in the PoA	All biogas systems included in the VPA will demonstrate they fall within the geographical boundary of the PoA through: – Recording the address/location of the system in the Sales Agreement – Recording the GPS coordinates of the systems – Physically attaching a Programme or VPA logo to the digester which identifies it as being part of the African Biogas Partnership Programme on a national scale.	One of the following documents shall be provided: – Business plan – Implementation document – Contractual agreement between CME and VPA Implementer – Declaration from VPA implementer and confirmation check by CME – Sales Agreement	The following document is provided: – Implementation document (KBP) Programme Implementation Document ‘ – Ownership certificates
2	Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations	The VPA shall demonstrate that it does not double-count any of its appliances for the ERs estimation by confirming that: – The complete address of each biogas system will be recorded – The biogas systems have unique serial numbers – The VPA implementer has not included these biogas systems in another VPA or carbon project.	– Contractual agreement between CME and VPA Implementer. – Declaration from VPA implementer – Sales Agreement	The following documents are provided: – Contractual agreement between CME and VPA implementer – Declaration from VPA implementer – Ownership certificates

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion	Description of this VPA in relation to the criterion and supporting evidence
3	The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications	The biogas systems disseminated are renewable energy generation units to provide thermal energy and will be required to conform to any applicable national standards.	The following documents shall be provided: – Technical documentation describing the operation of the biogas system. – Evidence of compliance with national standard (if applicable).	The following document is provided: – Technical documentation describing the operation of the biogas system (Operation Manual of Biogas plants) There are no national standards regulating biogas digester technologies in Kenya.
4	Conditions to check the start date of the VPA through documentary evidence	The VPA implementer will demonstrate the start date of the VPA is on or after the start date of the PoA. The start date of the VPA will be defined as the date on which the first Sales Agreement is signed under the VPA.	– Sales Agreements for the first digester included under the VPA.	The following documents are provided: – Warranty certificate of the first digester as recorded in sales force. These certificates are issued once the digester has been commissioned and capture the same information as the sales agreement – Project Database
5	Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by VPAs	The VPA complies with the baseline and monitoring methodology requirements of the 'Technologies and Practices to Displace Decentralised Thermal Energy Consumption' (version 1.0). and should meet its eligibility criteria as discussed in Section B.2 of the PoA-DD.	The following documents shall be provided as evidence: – Project database – Sales Agreement	The following documents are provided as evidence: – Project Database Warranty certificate of the first digester as recorded in sales force. These certificates are issued once the digester has been commissioned and capture the same information as the sales agreement

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion	Description of this VPA in relation to the criterion and supporting evidence
6	The conditions that ensure that VPAs meet the requirements pertaining to the demonstration of additionality	The VPA will prove additionality as per the following approach: ***1) Positive List[44]*** 1. Biogas system rated capacity is less than 2.25MWth each 2. Biogas systems are disseminated to households or communities or Small and Medium Enterprises (SMEs).	The following evidences shall be provided: 1. Calculation showing the capacity of the biogas system(s) in MW 2. Business plan / Implementation document	The following evidence is provided: 1. Calculation showing the capacity of the biogas system(s) in MW 2. Implementation document (KBP Programme Implementation Document)
7	The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis	1. The VPA, organised a local stakeholder consultation (LSC) in accordance with Gold Standard requirements 2. The VPA, or a group of VPAs, got environmental clearance for the project related activities, if applicable	The following documents shall be provided: 1. Local Stakeholder Report including comments of stakeholders and how the comments were taken into account by the VPA implementer 2. Environmental clearance letter and/or EIA if required by national regulations	The following document is provided: – Local Stakeholder Report (Kenya) for VPA6 An environmental impact assessment is not required for activities implementing household biodigesters in Kenya, as stipulated by the Environmental Management and Coordination Act, 1999 (see Section B.1 above)
8	Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance	The VPA will demonstrate that any Official Development Assistance received for the VPA has not occurred on the condition that the resulting credits are transferred to the donor country[45].	Verifiable evidence: – ODA Declaration	The following document is provided: – ODA Declaration

[44] As per TOOL21 "Demonstration of Additionality of Small-Scale Project Activities" Version 10.0, EB83 Annex 14

[45] Gold Standard Toolkit, Version 2.1, Section 1.2.5.

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion	Description of this VPA in relation to the criterion and supporting evidence
9	Where applicable, target group (e.g. domestic / commercial / industrial, rural / urban, grid connected / off-grid) and distribution mechanisms (e.g. direct installation)	The VPA will demonstrate which target group(s) is/are to be targeted by the VPA and the distribution mechanism. Target groups shall include: – Households – Small/Medium Enterprises – Communities	Any of the following documents shall be provided: – Sales forecast – Marketing plan – Description of technology (e.g. domestic or institutional biogas system) – Implementation document	The following document is provided: – Implementation document (KBP Programme Implementation Document) – . – The biogas digesters are directly installed at the user's household.
10	Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys	The VPA Implementer will agree to support the sampling and survey activities of CME in accordance with B.7.2 of the PoA-DD.	Contractual agreement between CME and VPA Implementer	The following document is provided: 20151219 CME _KBP declaration ABC VPA6
11	Where applicable, the conditions that ensure that every VPA in aggregate meets the small-scale threshold criteria and remains within those thresholds throughout the crediting period of the VPA	The VPA Implementer will ensure that each VPA remains below the small scale limits. For activities falling under Type I[46], each VPA in aggregate will remain below 15 MW ($45MW_{th}$) per year. For activities falling under Type III[47], each VPA will achieve below 60,000 tCO_2e in emission reductions annually.	Any of the following documents shall be provided: – Contractual agreement between CME and VPA Implementer – Sales forecast – Calculation showing the capacity of the biogas system(s) – Project database	The following documents are provided: – Capacity calculation of the biogas system(s), showing that the VPA Type I installed capacity is below the 15MW ($45MW_{th}$)[48] threshold. – Emission reduction calculation, showing that the VPA Type III emissions are below the 60,000 tCO_2e threshold.[49]

[46] Type I activities are "renewable energy project activities with a maximum output capacity of 15 MW (or an appropriate equivalent)", CDM Project Standard for Programmes of Activities (version 01.0)

[47] Type III activities are "other project activities not included in Type I or Type II that result in GHG emission reductions not exceeding 60 kt CO_2e per year in any year of the crediting period", CDM Project Standard for Programmes of Activities (version 01.0)

[48] Explanation: Section B.3. of the PoA-DD indicates that the thermal capacity of the largest possible biodigester allowed under the programme (100 m^3) is 44.77 kW_{th}. In VPA-6, the average biodigester size is 8.67 m^3 of units built until 31/12/2017, resulting in a capacity of 2,21 kW_{th} per unit. During the first crediting period 5,030 units are expected to be built totalling around 11.1 MWth, which is much lower than the 45 MWth threshold

[49] Explanation: Of the total annual emission reduction of 28,582 at the end of the first crediting period tCO_2e, only 1,780 tCO_2e are attributed to methane avoidance (Type III) – 0.354 tCO_2e from TIER 2 emission reductions multiplied by 5,030 digesters installed.

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion	Description of this VPA in relation to the criterion and supporting evidence
12	Where applicable, the requirements for the debundling check, in case VPAs belong to small-scale (SSC) or microscale project categories.	The VPA implementer will demonstrate that the VPA is not a de-bundled component via the following approach: 1. The biogas systems are less than 1% of the SSC threshold (as per paragraph 10 EB54 Annex 13)	The following evidence shall be provided: 1. Calculation showing the capacity of the biogas system(s) 2. Project Database showing size of systems.	The following evidence is provided: 1. Calculation showing the capacity of the biogas system(s)
13	The proposed VPA must ensure that sufficient training has been carried out to ensure the construction / installation of the biogas system is done by competent persons	The VPA implementer will provide sufficient evidence of training or qualification to implement the proposed VPA.	Any of the following documents shall be provided: – Training certificates – Training records – Qualification certificates – Planned training schedules	The following documents are provided: – Training records – Planned training schedules
14	Transfer of rights to carbon credits.	The end user of each biogas digester has been properly informed during the stake holders consultation on the transfer of credit ownership and agreed to transfer all rights to any carbon credits to the VPA Implementer.	The following documents are provided: – Sales Agreement – Contractual agreement between CME and the VPA Implementer	The following documents are provided: Warranty certificate of the first digester as recorded in sales force. These certificates are issued once the digester has been commissioned and capture the same information as the sales agreement 20151219 CME _KBP declaration ABC VPA6
15	Prior consideration of carbon revenues	For retroactive VPAs, prior consideration of carbon revenues shall be checked at the time of inclusion by checking that carbon revenues are considered in early project documentation before the date of VPA inclusion (e.g. in a feasibility report, a programme implementation document or similar documentation).	The following documents are provided: – Feasibility study – Business plan – Implementation document – Any other such documents demonstrating compliance	The following documents are provided: – KBP Programme Implementation Document – Memo demonstrating the prior consideration of carbon revenues

Appendix 1. Contact information of VPA implementers

Organization name	Kenya Biogas Program (KBP)
Country	Kenya
Address	P.O. Box 79875-00202 Nairobi
Telephone	0791496964
Fax	Not applicable
E-mail	info@kbp.co.ke
Website	http://kenyabiogas.com
Contact person	Kevin Kinusu

Affirmation regarding public funding

The Gold Standard

ANNEX D - OFFICIAL DEVELOPMENT ASSISTANCE DECLARATION

Date: **21 December 2017**

The Gold Standard Foundation

79 Avenue Louis Casai

Geneva Cointrin, CH-1216

Switzerland

RE: Declaration of Non-Use of Official Development Assistance (ODA) by Project Owner of GS5801 African Biogas Carbon Programme (ABC) – Kenya – VPA006 ("Project")

Humanist Institute for Development Co-operation (HIVOS)

As Project Owner of the above-referenced Project, and acting on behalf of all Project Participants, I now make the following representations:

Coordinating/Managing Entity

I hereby declare that I am duly and fully authorized by the Project Owner of the above-referenced project to act on behalf of all Project Participants and make the following representations:

I. The Gold Standard Documentation

I am familiar with the provisions of The Gold Standard Documentation relevant to ODA. I understand that the above-referenced Project is not eligible for Gold Standard registration if the Project receives or benefits from ODA with the condition that some, or all, of the carbon credits [CERs, ERUs, or VERs] coming out of the Project are transferred to the ODA donor country. I hereby expressly declare that no financing provided in connection with the above-referenced Project has come from or will come from ODA that has been or will be provided under the condition, whether express of implied, that any or all of the carbon credits issued as a result of the Project's operation will be transferred directly or indirectly to the country of origin of the ODA.

In the event the Project is a Programmes of Activities where the CME is also implementing one or more Component Project Activities (CPAs) or Voluntary Project Activities (VPAs), I further acknowledge and understand that this Declaration is applicable to all of the CPAs/VPAs where the CME and the CPA/VPA implementing entity is the same.

II. Duty to Notify Upon Discovery

If I learn or if I am given any reason to believe at any stage of project design or implementation that ODA has been used to support the development or implementation of the Project covered by this Declaration, or that an entity providing ODA to the host country may at some point in the future benefit directly or indirectly from the carbon credits generated from the Project as a condition of

The Gold Standard

investment, I will notify The Gold Standard immediately using the Amended ODA Declaration Form provided below.

III. Investigation

The Gold Standard reserves the right to conduct an investigation into any project it reasonably believes may be receiving ODA with the condition that some or all of the carbon credits from the Project will be transferred to the ODA donor country.

IV. Sanctions

I am fully aware that the sanctions identified in The Gold Standard Terms and Conditions may be applied to me or the above-referenced Project in the event that any of the information provided above is false or I fail to notify The Gold Standard of any changes to ODA in a timely manner.

I swear that all of the statements contained herein are true to the best of my knowledge.

Signed: _____ i.o. Mirka Hovius Manager SCI 19/12/17

Name: _Carol Gribnau, _____

Title: _Program Director Green Society_____

On behalf of: _Hivos _____

Place: _The Hague, The Netherlands_____

Appendix 2. Applicability of methodologies and standardized baselines

Please see section B.1. of the VPA-DD for details.

Appendix 3. Further background information on ex ante calculation of emission reductions

No further background information necessary

Appendix 4. Further background information on monitoring plan

No further background information necessary

Appendix 5. Summary of post-registration changes

N/A