Component project activity design document form for small-scale CDM component project activities

(Version 05.0)

Complete this form in accordance with the Attachment "Instructions for filling out the component project activity design document form for CDM small-scale component project activities" at the end of this form.

COMPONENT PROJECT DESIGN DOCUMENT (CPA-DD)	
Title of the CPA	SimGas Biogas Programme of Activities, Kenya (CPA KE1)
Version number of the CPA-DD	Version 7.0
Completion date of the CPA-DD	Date: 13/10/2016
Title of the PoA to which the CPA is included	SimGas Biogas Programme of Activities
Host Party	The Republic of Kenya (Host)
Estimated amount of annual average GHG emission reductions	47,360
Applied methodology(ies) and, where applicable, applied standardized baseline(s)	Type I – Renewable Energy Projects (sectoral scope 1) – AMS-I.I. Version 4: Biogas/biomass thermal applications for households/small users – AMS-I.E. Version 4: Switch from non-renewable biomass for thermal applications by the user Type III – Other Project Activities (sectoral scope 15) – AMS-III.R. Version 2: Methane recovery in agricultural activities at household/small farm level Standardized baselines: not applicable
Sectoral scope(s) linked to the applied methodology(ies)	Sectoral scope 1: Energy industries (renewable - / non-renewable sources) Sectoral scope 15: Agriculture

SECTION A. General description of CPA

A.1. Title of the proposed or registered PoA

>>
SimGas Biogas Programme of Activities

Reference: PoA 7734

A.2. Title of the CPA

>>
SimGas Biogas Programme of Activities, Kenya (CPA KE1)

Version 7.0
Date: 13/10/2016

A.3. Description of the CPA

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This CDM Program Activity (CPA) is part of the SimGas Biogas Programme of Activities (PoA). Under the CPA a maximum of 10,000 biogas systems will be implemented across the Republic of Kenya, an estimated 4,000 of which will be manure-fed systems predominantly installed in rural regions and an estimated 6,000 of which will be organic waste-fed systems mainly implemented in urban areas. These biodigesters will be installed at households, communities and SMEs. Table 1 provides the implementation schedule that is foreseen for the implementation of this CPA. The actual pace of implementation may differ from the schedule below, as long the applicable limitations related to the micro-scale additionality guidelines are adhered to.

The size of CPA 1 will be kept below the micro-scale limit; the aggregate capacity of the CPA will not exceed 15MW_{th} for the Type I project activity or a total of 20,000 tCO_2e for the Type III project activity, whilst the thermal capacity of each individual digester will not exceed 4,500 kW_{th}. Given an average capacity of 1.44 kW_{th} of a biodigester and an average emission reduction potential of 0.93 tCO_2e derived from the Type III project activity, the micro-scale additionality criteria are satisfied given the anticipated implementation schedule of 10,000 units in this CPA.

Table 1: Indicative implementation schedule of the CPA

Type **Date**	*Manure-fed*	*Organic waste-fed*
Jan. – March 2013	1,000	1,500
Apr. – June 2013	1,000	1,500
Jul. – September 2013	1,000	1,500
Oct. – December 2013	1,000	1,500
Total	**4,000**	**6,000**

A.4. Entity/individual responsible for the operation of CPA

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The individuals responsible for the biogas systems are individual owners of the biogas equipment. Each biogas system owner agrees by a sales contract to transfer the ownership title of the generated emission reductions to SimGas IP BV.

The CPA implementer of this Component Project Activity is SimGas Tanzania Ltd.

A.5. Technical description of the CPA

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This SSC-CPA will implement biogas systems of two types: manure-fed systems and organic waste-fed systems. Other types of biogas digester may be included in future CPAs, as long as they are in line with the methodologies and micro-scale additionality guidelines.

Manure-fed biogas systems ("Rural systems") enable users to use the manure of their livestock to generate energy and organic fertiliser. A pit latrine can also be connected to the biogas system.

A manure-fed biogas system is an anaerobic digestion system designed for households/SMEs/communities in the (sub-) tropics. Anaerobic digestion is the biological conversion of complex organic material to methane, under anaerobic conditions. The biological conversion is performed by bacteria that are already present in the manure. The whole process takes place in a single gas-tight volume: the digester (see Figure **1**). For the users the operation of the system is very simple:

1. Collect manure, urine and water. Add biodegradable kitchen waste in small pieces.
2. Mix the manure and organic wastes 1:1 with the liquids and feed it into the digester.
3. Gas production will start immediately and pressure will build up in the digester.

Gas can be used throughout the day by a biogas cooker.

The build-up of gas will push out slurry from the other end of the biogas system. The slurry is an excellent fertiliser and can either be applied directly to crops or composted with other organic material.

Maintenance needs are limited since the biogas systems have no moving parts. Over the years, some indigestible material will build up in the digester, limiting the reactor volume. This issue can be simply solved by scooping the indigestible material out and re-filling the biogas system with manure.

Manure-fed biogas systems come in different sizes, typically varying from 2 m^3 to 16 m^3, as demonstrated in Figure 2. Other sizes could be offered in future, as long as they are in line with the methodologies and micro-scale additionality guidelines.

Organic waste-fed biogas systems ("urban systems") have been designed to the same basic principles as above, but are used to generate biogas from organic domestic waste, such as biodegradable kitchen waste. Any biodegradable kitchen waste can be continually added to the biogas digester in small pieces. It is expected that these will mainly be used by households/SMEs/communities in cities. They are currently available in three sizes: 0.55 m^3, 2 m^3 and 3.5 m^3, see Figure 3. Other sizes could be offered in future, as long as they are in line with the methodologies and micro-scale additionality guidelines.

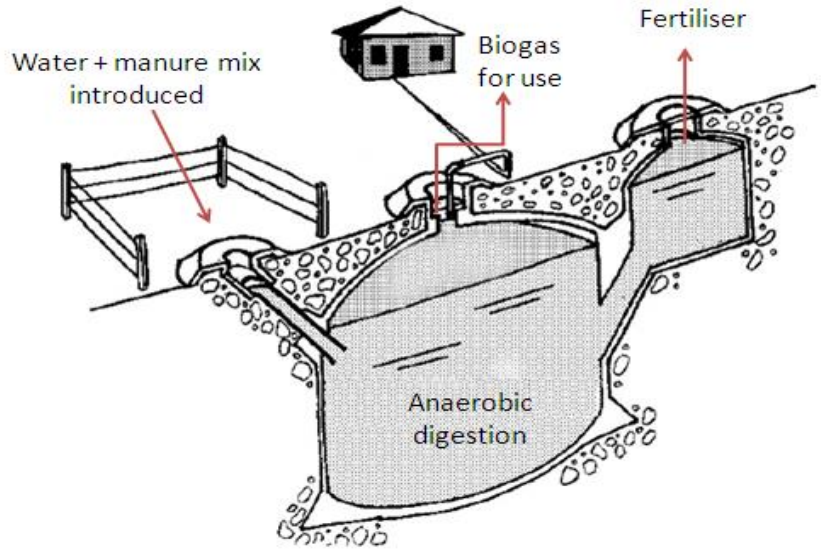

Figure 1: Schematic lay-out of a manure-fed biogas system

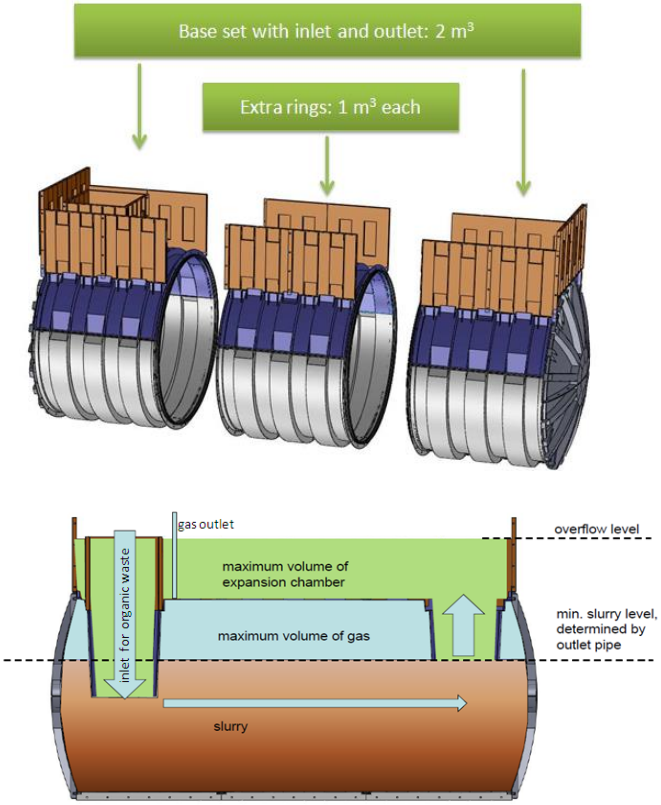

Figure 2 – Schematic layout of a scalable organic-waste fed biodigester system, showing how additional plastic rings can be included to increase the capacity of the biodigester, as well as the basic inner structure.

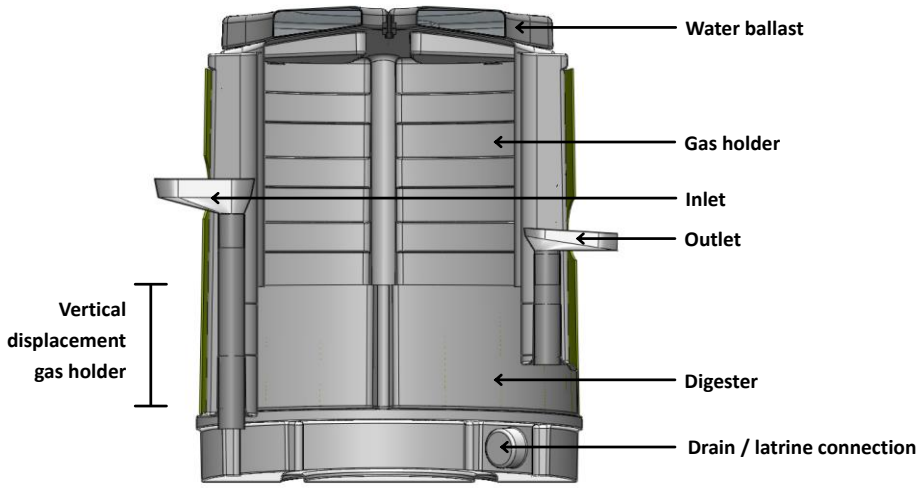

Figure 3: Schematic lay-out of a biodigester for organic waste

A.6. Party(ies)

Name of Party involved (host) indicates host Party	Private and/or public entity(ies) CPA implementer(s) (as applicable)	Indicate if the Party involved wishes to be considered as CPA implementer (Yes/No)
The Republic of Kenya (Host)	SimGas IP BV	No
The Netherlands	SimGas IP BV	No

A.7. Geographic reference or other means of identification

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The geographic boundary for the CPA is the Republic of Kenya.

Figure 1: Map of the Republic of Kenya

All of the biogas systems implemented under this CPA will contain a unique GPS coordinates that will be recorded in the CME's database. These will enable the verifier to identify systems listed in the database. The database will further include information regarding the information on the owner and its operational status.

A.8. Duration of the CPA

A.8.1. Start date of the CPA

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The starting date of the CPA is 20/01/2013, which is the expected commissioning date of the first biodigester under this CPA.

A.8.2. Expected operational lifetime of the CPA

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The expected operational lifetime of the CPA is 21 years.

A.9. Choice of the crediting period and related information

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Renewable crediting period.

A.9.1. Start date of the crediting period

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The starting date of the crediting period is 20/01/2013.

A.9.2. Length of the crediting period

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The crediting period for the CPA will be 7 years, renewable twice.

A.10. Estimated amount of GHG emission reductions

Emission reductions during the crediting period	
Years	Annual GHG emission reductions (in tonnes of CO_2e) for each year
1	25,501
2	51,003
3	51,003
4	51,003
5	51,003
6	51,003
7	51,003
Total number of crediting years	7
Annual average GHG emission reductions over the crediting period	**47,360**
Total estimated reductions (tonnes of CO_2e)	**331,519**

The emission reduction estimate of the CPA has been calculated based on values compiled from literature. As the CPA will collect baseline data from each participating household/community/SME *ex-ante*, the presented estimate is only illustrative and the actual emission reductions claimed will be based on the collected data.

A.11. Public funding of the CPA

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Suppliers are eligible to receive a subsidy from the Kenya National Domestic Biogas Programme (KENDBIP), which is partly receiving funds from the Dutch Ministry of Foreign Affairs. This public funding does not lead to the diversion of Official Development Assistance (ODA).

A.12. Debundling of small-scale component project activities

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The CPA is exempt from a de-bundling check due to each independent subsystem/measure being less than 1% of the small-scale of methodologies AMS-I.E, AMS-I.I and AMS-III.R. The thresholds for these methodologies are 45 MW_{th}, or 60,000 t CO_2e for AMS-III.R.

The average biogas systems implemented in this CPA are estimated to produce 2,25 m^3 of biogas per day, assuming the 6 m^3 unit. In order for a digester to exceed the 450 kWth limit an individual digester would need to produce more than 1,190 m3 of biogas per day.[1] 16 m3 biogas are estimated to produce 6 m^3 of biogas per day, far below the 1,190 m^3/day limit. . The calculation for this largest system is presented below:

$\mathbf{Th_{cap}} = \frac{\mathbf{E}}{\mathbf{t}}$ *where* $\mathbf{E} = \eta * \mathrm{H_b} * \mathrm{V_b}$		
Thermal capacity of the maximum size unit.		
Where:	Value:	Comments:
t = hours/day usage	5	Data provided by SimGas
η = efficiency of stove	55%	Data provided by SimGas[2]
H_b = heat of combustion per unit volume of biogas	21.0 MJ/m^3	Derived from IPCC defaults
V_b = volume of biogas	1,192 m^3/day	Maximum amount of methane

[1] See emission reduction calculation spreadsheet, sheet "Capacity Limit', cell C11

[2] SimGas Stove Efficiency Report (2011)

		that can be produced to reach 450 kW_{th}
E = Energy available from the biogas system	13,763 MJ/day	Calculated
E_{th} =	3,823 kWh/day	1 MJ = 0.2778 kWh
Th_{cap} =	450 kW_{th}	Given a 5 hour/day usage

The estimated emission reductions due to methane avoidance calculated per AMS-III.R. is 1.27 tonnes of CO_2e for the average size of biogas systems included in this CPA, which is far below the 600 t CO_2e limit.

The CPA under this PoA is exempt from a de-bundling check due to each independent subsystem/measure being less than 1% of the small-scale of methodologies AMS-I.E, AMS-I.I and AMS-III.R, as per the PoA-DD,Part I. section C.

A.13. Confirmation for CPA

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The installation and commissioning procedure outlined in Part I. section Cof the PoA-DD ensures that all necessary data are gathered. Double counting is avoided through recording the unique GPS location of each biogas system in a centralised database system operated by the CME. Participating users will confirm that they are not taking part in other registered Programmes of Activities through signing of a sales contract for each biodigester system.

A.14. Contact information of responsible persons/ entities for completing the CDM-SSC-CPA-DD-FORM

>> The responsible entity for completing the CDM-SSC-CPA-DD-FORM is Climate Focus BV.
Contact information:

Climate Focus
Adriaan Korthuis
Sarphatikade 13
1017 WV AMSTERDAM
The Netherlands
Tel. +31 20 261 10 30
Email: a.korthuis (at) climatefocus.com

SECTION B. Environmental analysis

B.1. Analysis of the environmental impacts

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The project activity involves the introduction of small-scale biogas systems, which will reduce the use of kerosene and non-renewable biomass for cooking purposes. The environmental impacts of the project activity are therefore expected to be largely positive. No negative impacts are expected. The project activity will act in accordance with all relevant laws and regulations and principles of good practice, as outlined below:

The project proponent will ensure that all biogas systems brought into the country for use comply with the relevant Kenyan Standards. According to the Quality Inspection of Imports Order of 1998, all imports to Kenya shall be subjected to quality inspection by the Kenya Bureau of Standards at the port of entry. The imported commodities will be allowed into the country upon issuance of a certificate of release by the Kenya Bureau of Standards.

The project activity will also comply with the 2006 Environmental Management and Co-ordination (Waste Management) Regulations, which govern the general disposal of waste in Kenya. The Rules define a “waste generator” as any person whose activities or activities under his or her direction produces waste. As the use of the biogas systems is an activity that is being carried out under the project proponent’s direction, the project proponent is a ‘waste generator’ for purposes of the Act in case of effluent emissions.

The Rules set out various responsibilities of a waste generator. These include the collection, segregation and disposal of waste in the manner provided for under the Regulations.

In order to comply with the above-mentioned rules, the project activity will ensure:

- The design, operation and maintenance of waste storage facilities will comply with best operation and maintenance practices to minimise venting of methane from waste storage facilities for example through training of biogas system users on the best operation and maintenance practices.
- The design, operation, and maintenance of gas collection facilities will comply with best practices to minimise venting - emissions of biogas from leaks in the gas collection system for example through frequent monitoring to ensure biogas leakage during normal operation conditions is held at near-zero levels and minimisation of pipe distances (e.g. locating gas collection facilities as near as possible to energy recovery facilities).

The Kenyan environmental legislation does not require an Environmental Impact Assessment for this type of biogas digester construction activity. The programme is in line with Kenyan policies on environment, sustainable waste management, rural development and reduced dependency on wood and kerosene for energy.

Only the activities set out in the second schedule of the Environmental and Management Coordination Act No.8 of 1999, (EMCA) as requiring an environmental impact assessment are:

- General activities: an activity out of character with its surrounding; any structure of a scale not in keeping with its surrounding; or major changes in land use.
- Specific activities: projects on urban development, transportation, dams, rivers and water resources, aerial spraying, mining, forestry related activities, agriculture, processing and manufacturing industries, electrical infrastructure (i.e. electricity generation stations; electrical transmission lines; electrical sub-stations; and pumped-storage schemes), management of hydrocarbons, the establishment of natural conservation areas, nuclear reactors, major developments in biotechnology and lastly waste disposal (e.g. sites for solid, hazardous waste disposal, and works emitting offensive odours).

SECTION C. Local stakeholder consultation

C.1. Solicitation of comments from local stakeholders

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Identification of stakeholders

Based on the definition of Stakeholders as given in version 07 of the Glossary of CDM Terms (EB 70, Annex 7), the project identified the following stakeholders:

General public: the general public is a stakeholder because they will be the end-users of the SimGas biogas systems and, as such, they will be impacted by the products and services offered by SimGas.

Academia: universities and research institutions with experience and knowledge in the field of biogas systems and biogas projects are considered stakeholders because of the valuable inputs

they can provide in terms of the technical design of the biogas systems as well as the implementation of biogas projects in different cultural and social context.

Government representatives and Designated National Authority: Government representatives and the Designated National Authority are considered stakeholders because the implementation of the SimGas biogas project is expected to impact on the achievement of a number government policies and sustainable development goals in relation to poverty reduction and energy provision.

NGOs, community representatives, donor and development organizations: NGOs, community representatives, donors and development organizations are considered a stakeholder because of their potential role in up scaling the distribution of the SimGas biogas systems and in raising awareness about the biogas systems and carbon markets.

Microfinance institutions and SACCOs: Microfinance institutions and SACCOs are considered a stakeholder because of their potential role in providing micro-loans and other types of credit schemes to poor households.

Biogas related companies/organizations: Other biogas related companies and organizations are considered stakeholders due to their experiences in the biogas field in Kenya, they are able to share their lessons learnt and ways to make improvements to new biogas systems and ventures in the specifically to the Kenyan market.

How comments were invited

The project organized a stakeholder consultation meeting on 29 November 2011 at the Methodist Guest House and Conference Center in Nairobi, Kenya. The meeting provided an opportunity for stakeholders to provide comments and inputs to the project. Invitations for the meeting were extended through personal email invitations and a public notice published in the Daily Nation newspaper on 22 November 2011. Comments from stakeholders unable to attend the meeting were also invited by email and telephone as per the newspaper announcement. A copy of the Daily Nation advertisement is shown in annex 1 of this document.

C.2. Summary of comments received

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A total of 35 people participated in the stakeholder consultation meeting. The participants' list is given in annex 2. Pictures of the meeting are provided in annex 3. Participants included NGOs, community-based organizations, private sector representatives, SACCOs, academia and members of the general public. During the meeting, the project proponent presented some background on SimGas biogas project as a social enterprise and an overview of SimGas biogas project operations and distribution channels in Kenya. The carbon consultant also made a presentation on the background and fundamentals of the Clean Development Mechanism and how the SimGas biogas project is expected to generate carbon credits. After each presentation, stakeholders were provided with an opportunity to ask questions and provide comments and inputs. See the comments in sectionC.3 (below), together with how due account was take of the comments received.

C.3. Report on consideration of comments received

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Stakeholders were given an opportunity to give comments at the meeting. A small number of inputs were also received via email and phone. Comments received by stakeholders are summarized below. The overview also explains how the project proponent are taking due account of the comments received.

1. Stakeholders raised questions on the safety of the SimGas biogas systems, in particular the possibility of gas leakage and explosions.

The possibility of a gas explosion is very low. The SimGas systems are designed to avoid gas leakage. If there are leaks end users will be able to smell these and notify SimGas who will have the problem fixed. Technicians will be properly trained to deal with such situations. Other issues such as the entry of unwanted objects into the biogas systems will be addressed through user education and the placement of a grate over the inlet valve.

2. Questions were raised on how the project will use the revenue from the carbon credits and how the revenue will be shared with stakeholders.

The current plan is to use carbon credit revenue to discount the price of the biogas systems to end-users. The carbon revenue will further assist SimGas to invest in product development, conduct trainings for contractors and end users and offer after sale services and replacements for the systems. In this way, end-users are expected to benefit and indirectly share in the revenues from the carbon credits.

3. Even though the price of the SimGas biogas systems is competitive with that of similar systems, stakeholders still noted the overall cost of the biogas systems and the ability of households to afford them. They proposed that SimGas should look into ways that will make the biogas systems more affordable to the targeted consumers.

In addition to using the carbon revenue to help reduce the end-user price, SimGas will partner with local micro-finance institutions to provide loans or lease construction to its customers. Together this will keep the upfront payment required to a minimum. Also, SimGas will negotiate a bulk contract with financial institutions on behalf of end users of the systems. This will lower the threshold for households to apply since a bank will have less due diligence requirements and hence lower transaction costs. Risks for non-payment will also be kept at a minimum because the biogas system can also function as collateral in combination with the livestock. Repayment of the loans in small installments will better meet the cash flow situation of rural households.

4. Stakeholders suggested that trainings should be done during installation of the systems to enable end-users to effectively utilize the SimGas biogas systems.

SimGas will implement user education by making considerable investments to train contractors in the installation of the biogas systems and end-users on their operation.

5. Stakeholders proposed that SimGas should involve the local community and regional industries in the development, manufacture and production of the systems.

SimGas is a joint venture with a regional East African plastic company. The plastic industry already has an established distribution chain and manufacturing sites for plastic containers. The regional industry will be responsible for mass producing the biogas systems and setting up distribution channels locally owing to its extensive experience in regional manufacture, production and distribution. With regards to product development, SimGas is currently testing its systems with selected end users in Kenya, the results of which will be considered in future design modifications. However, when it comes to some of the system tests the required facilities do not exist in Kenya.

6. Stakeholders suggested that SimGas should partner with local organization and companies dealing with biogas in the implementation of the project.

A number of existing biogas organizations have indicated their interest to collaborate with SimGas to assist in implementing the biogas systems on a large scale. SimGas also intends to involve local cooperatives, SACCOs, village leaders, extension officers and teachers in the distribution of the biogas systems.

SECTION D. Eligibility of CPA and estimation of emissions reductions

D.1. Reference of methodology(ies) and standardized baseline(s)

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The CPA will use three methodologies:

Type I – Renewable Energy Projects (sectoral scope 1)
- AMS-I.I. Version 4: Biogas/biomass thermal applications for households/small users
- AMS-I.E. Version 4: Switch from non-renewable biomass for thermal applications by the user

Type III – Other Project Activities (sectoral scope 15)
- AMS-III.R. Version 2: Methane recovery in agricultural activities at household/small farm level

D.2. Applicability of methodology(ies) and standardized baseline(s)

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All baseline and monitoring procedures applied will follow the guidelines laid out in these methodologies.

AMS-I.E	Justification
"This category comprises activities to displace the use of non-renewable biomass by introducing renewable energy technologies. Examples of these technologies include but are not limited to biogas stoves, solar cookers, passive solar homes, renewable energy based drinking water treatment technologies (e.g. sand filters followed by solar water disinfection; water boiling using renewable biomass)".	The PoA aims at implementing biogas systems fed with manure and/or organic waste at users that so far are using non-renewable biomass for cooking.
"Project participants are able to show that non-renewable biomass has been used since 31 December 1989, using survey methods or referring to published literature, official reports or statistics."	Demonstration of the use of non-renewable biomass since 31 December 1989 will be demonstrated specifically per host country in each SSC-CPA.

AMS-I.I	Justification
"This category comprises activities for generation of renewable thermal energy using renewable biomass or biogas for use in residential, commercial, institutional applications (e.g. for supply to households, small farms or for use in built environment of institutions such as schools). Examples of these technologies that displace or avoid fossil fuel use include but are not limited to biogas cook stoves, biomass briquette cook stoves, small scale baking and drying systems, water heating, or space heating systems."	The PoA aims at implementing biogas systems fed with manure and organic waste at users that so far are using LPG or kerosene for cooking. Users include households/SMEs/communities
"The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal."	Cumulative capacity of biogas systems per SSC-CPA will not exceed the limit of 45 MW thermal.

AMS-I.I	Justification
"Each unit (e.g. cook stove, heater) shall have a rated capacity equal to or less than 150 kW thermal."	The maximum output capacity of each biogas system is 3.85 kW_{th}, which is below the threshold (see Part I. Section C).

AMS-III.R	Justification
"This project category comprises recovery and destruction of methane from manure and wastes from agricultural activities that would be decaying anaerobically emitting methane to the atmosphere in the absence of the project activity. Methane emissions are prevented by: (a) Installing methane recovery and combustion system to an existing source of methane emissions; or (b) Changing the management practice of a biogenic waste or raw material in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system."	In contexts where the standard manure management practices lead to methane emissions, the biogas systems implemented in the SSC-CPA will change the management practice of handling manure through diverting use to anaerobic digestion for the production of biogas.
"The category is limited to measures at individual households or small farms (e.g. installation of a domestic biogas digester). Methane recovery systems that achieve an annual emission reduction of less than or equal to five tonnes of CO_2e per system are included in this category."	The PoA is limited to individual households and smallholder farms where the annual methane emissions are less than or equal to 5 tCO_2e.
This project category is only applicable in combination with AMS-I.C "Thermal energy production with or without electricity" and/or AMS-I.I "Biogas/biomass thermal applications for households/small users" and/or AMS-I.E "Switch from non-renewable biomass for thermal applications by the user"	AMS-I.E. will be applied in the SSC-CPA for all manure-fed biogas systems.
"The project activity shall satisfy the following conditions: (a) The sludge must be handled aerobically. In case of soil application of the final sludge the proper conditions and procedures that ensure that there are no methane emissions must be ensured; (b) Measures shall be used (e.g. combusted or burnt in a biogas burner for cooking needs) to ensure that all the methane collected by the recovery system is destroyed."	The sludge of the biogas system will be applied on the land as a fertiliser. Training will be given to users to apply the sludge in a proper way ensuring aerobic handling. The biogas will be used for cooking needs, and in some cases lighting, ensuring that all methane collected by the biogas system is destroyed.
"Aggregated annual emission reductions of all systems included shall be less than or equal to 60 kt CO_2 equivalent."	The avoided methane emissions of one SSC-CPA will not exceed 60 kt CO_2e.

D.3. Sources and GHGs

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In the baseline scenario CO_2 and CH_4 are released into the atmosphere. The burning of charcoal, firewood and fossil fuels for cooking purposes is responsible for CO_2 emissions, while current manure handling practices cause CH_4 emissions from anaerobic decomposition.

In the project scenario, CH_4 from the physical leakage of the biogas system and the CO_2 emissions from the continued use of fossil fuels in the project activity need to be accounted for.

Emission sources and greenhouse gases within the boundary of the SSC CPA are outlined below in accordance with Part II. section B.3.of the PoA-DD:

Scenario	Source	Gas	Included?	Justification
Baseline Scenario	CO_2 emissions from - fossil fuel cook stoves cook stoves using non-renewable biomass	CO_2	Yes	Major source of emissions according to AMS-I.I. and AMS-I.E.
	CH_4 emissions from manure management	CH_4	Yes	Major source of emissions according to AMS-III.R.
		N_2O	No	Not relevant under any of the applied methodologies.
Project Scenario		CO_2	Yes	Relevant under AMS-I.I. where there is continued use of fossil fuels.
	Methane leakage from biogas systems where AMS-III.R. is applied	CH_4	Yes	Emissions due to physical leakage of methane from the biogas system, as per AMS-III.R.
		N_2O	No	Not relevant under any of the applied methodologies.

The project boundary of the SSC-CPA is the geographical boundary of the Republic of Kenya.

The database managed by the CME will record the geographical coordinates of each installed biogas system to confirm that the CPA covers only biogas systems located within this boundary.

D.4. Description of the baseline scenario

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The baseline scenario for this CPA is identified in accordance with the following approved methodologies:

- AMS-I.E applies for the replacement of non-renewable biomass with biogas;
- AMS-I.I applies for the replacement of fossil fuels with biogas;
- AMS-III.R applies for the avoidance of methane emissions from manure handling.

The CME will identify the baseline scenarios per individual biogas system through the Commissioning Protocol that is completed upon commissioning of the system. More than one baseline scenario is possible, depending on the type of fuel replaced and manure management practices before installation, as follows:

Replacement of non-renewable biomass with biogas (AMS-I.E applies):

The baseline scenario is the use of thermal energy households, communities and/or SMEs that use NRB as a fuel source. Without the project activity, it can be assumed that fossil fuel use will continue and that non-renewable biomass use could be displaced by fossil fuel use as well. AMS-I.E states that the baseline scenario is, in the absence of the project activity, the use of fossil fuels meeting similar thermal energy demands.

Replacement of fossil fuels with biogas (AMS-I.I applies);

The baseline scenario is the use of thermal energy at households, communities and/or SMEs that use fossil fuel as a fuel source. Without the project activity, it can be assumed that fossil fuel use

will continue. AMS-I.I states that the baseline scenario is the fuel consumption of the thermal application used or that would have been used in the absence of the project activity, times an emission factor for the fossil fuel displaced.

Avoidance of methane emissions from manure handling (AMS-III.R applies):

The baseline scenario is the situation where, in the absence of the project activity, organic matter is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere. AMS-III.R establishes that baseline emissions are calculated (as per the option in paragraph 9 (a) and relevant formulae shown in paragraph 10 of AMS-III.D "Methane recovery in animal manure management systems" is used to calculate baseline emissions) by using the amount of the waste that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach.[3] For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (VS) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure (B_0); this has been determined through a survey of a sample group with a 90% confidence interval and a 10% margin of error, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (version 03.0).[4]

The baseline emissions will be determined at individual installation level.

The baseline study carried out for the PoA includes all the criteria specified by UNFCCC for sampling and survey projects[5].

D.5. Demonstration of eligibility for a CPA

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As stated in the PoA-DD, the CPA shall meet the following criteria to become eligible for inclusion:

Eligibility Criteria Standard	Eligibility Criteria	CPA-DD Indicator
1. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA;	All biogas digesters in each CPA are located within the geographical boundaries of one Host Country, namely Kenya. This will be confirmed by the CME by ensuring that each individual installation: • Is located at an address that lies within the geographical boundaries of Kenya as demonstrated by providing the address of all biogas digesters in the CPA database; • Has GPS coordinates that are situated within the geographical boundaries of Kenya as demonstrated by providing the GPS coordinates of all biogas digesters in the CPA database. •	☑ [tick when met] _____ Verifiable evidence: – Commissioning Protocol – CPA Database
2. Conditions that avoid	Each biogas digester in the CPA has a	☑ [tick when met]

[3] See chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*

[4] EB 69, Annex 4

[5] *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4).

double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)	programme logo engraved or permanently attached as a nameplate. [*and*] The GPS coordinates of the location of each biogas digester is recorded in the CPA database. [*and*] The CME has an agreement in place with the owner of each individual biogas digester in the CPA in which the owner of each biogas digester transfers the rights to the emission reductions to the CME	_____ Verifiable evidence: – Commissioning Protocol – CPA Database – CME Manual – Sales Contract
3. Conditions to check the start date of the CPA through documentary evidence	The start date of the CPA is the date at which the commissioning of the first biogas digester is completed. This is recorded in the Commissioning Protocol, which is archived and the date recorded in the CPA database. The database allows for easy verification that the earliest commissioning date is the start date of the CPA.	☑ [tick when met] _____ Verifiable evidence: – Commissioning Protocol – CPA Database
4. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis	A local stakeholder consultation has been carried out on Host Country level. Evidence is provided that the programme activities are exempt from an environmental impact analysis (EIA).	☑ [tick when met] Sections B.1 and C of the CPA-DD. _____ Verifiable evidence: – Stakeholder consultation report – EIA exemption notice
5. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance	A written confirmation has been issued for the CPA that no funding from Annex 1 parties has been used for this CPA or that, if used, this did not result in a diversion of official development assistance.	☑ [tick when met] _____ Verifiable evidence: – ODA declaration
6. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.	The proposed small scale CPA of the PoA is not a debundled component of a large scale activity because: Each of the independent subsystems/measures included in the CPA of a PoA is no larger than 1% of the small-scale thresholds defined by the applied methodology (not exceeding 450 kW thermal for SSC type I; not exceeding 600 tCO_{2e} for SSC type III methodologies).	☑ [tick when met] Section A.12.of the CPA-DD _____ Verifiable evidence: – Sales Contract – Emissions reduction calculation spreadsheet demonstrating the size of each unit;
7. The conditions that	The CPA demonstrates additionality as	

	ensure that CPAs meet the requirements pertaining to the demonstration of additionality.	detailed in the Guidelines for demonstrating additionality of microscale project activities (EB 68, Annex 26) More details below:	
		The CPA will stay below the scale limits, defined as follows: (a) Where AMS-I.E or AMS-I.I applies, the size of the CPA is less than or equal to 15 MW_{th}; and (b) Where AMS-III.R applies, the size of the CPA is less than or equal to 20 ktCO2/yr. Whichever CPA capacity is reached first will define the limits of the CPA.	☑ [tick when met] _____ Verifiable evidence: – Sales Contract – CPA Database – Emissions reduction calculation spreadsheet
		(b) Where AMS-I.E or AMS-I.I apply, an individual household biogas system in the CPA has a maximum thermal capacity of 4,500 $kW_{th;}$	☑ [tick when met] _____ Verifiable evidence: – Sales Contract
		(c) Where AMS-III.R applies, each of the independent biogas systems in the project activity achieves an estimated annual emissions reduction equal to or less than 600 tCO_2e per year	☑ [tick when met] _____ Verifiable evidence: – Sales Contract – CPA Database – Emissions reduction calculation spreadsheet
		(d) End users of the subsystems or measures are households/communities/SMEs.	☑ [tick when met] _____ Verifiable evidence: – Sales Contract
8.	The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications	The CPA will install biogas digesters of the following types: – Manure-fed biogas systems, which generate biogas and organic fertiliser, and measure 2 – 16 m^3. Other sizes could be offered in future, as long as they remain below the maximum output capacities in criteria 9 below – Organic-waste fed biogas systems, which generate biogas from domestic organic waste, and measure 0.54 – 6m^3. Other sizes could be offered in future, as long as they remain below the maximum output capacities in criteria 9 below. – Other types of biogas digester that are approved by the CME, as long as they are in line with the methodologies and micro-scale additionality guidelines.	☑ [tick when met] _____ Verifiable evidence: – Sales Contracts – Technical specification documents detailing digester models
9.	Conditions that ensure compliance with	Only if AMS-I.E applie	All biogas digesters in the CPA are replacing non-renewable biomass.	☑ [tick when met] _____ Verifiable evidence: – Commissioning

applicability and other requirements of single or multiple methodologies applied by CPAs.	s:		protocol;
	Only if AMS-I.E applies:	The CPA demonstrates that non-renewable biomass has been used since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.	☑ [tick when met] See section D.6.3 of the CPA-DD _____ Verifiable evidence: – Calculation in Excel supported by published literature, official reports and/or statistics
	Only if AMS-I.I applies:	Each biogas digester shall have a rated capacity equal to or less than 150 kW_{th}	☑ [tick when met] See section A.12 of the CPA-DD _____ Verifiable evidence: – Sales Contract – CPA database
	Only if AMS-III.R applies:	The CPA comprises the recovery and destruction of methane from manure and organic wastes that would be decaying anaerobically in the absence of the project activity.	☑ [tick when met] See section D.4 of the CPA-DD _____ Verifiable evidence: – Commissioning protocol;
	Only if AMS-III.R applies:	The CPA is limited to biogas digesters installed at individual households or small farms with methane recovery systems that achieve an annual emission reduction of less than or equal to 5 tCO_2 / year per system.	☑ [tick when met] See section A.12 of the CPA-DD _____ Verifiable evidence: – Sales Contract – CPA Database – Emissions reduction spreadsheet
	Only if AMS-III.R applies:	The CPA specifies that methane emissions are prevented by changing the management practice of a biogenic waste or raw material in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system.	☑ [tick when met] See section D.4 of the CPA-DD _____ Verifiable evidence: – Commissioning protocol;
	Only if AMS-III.R applies:	The CPA uses the methodology AMS-III.R in combination with: – AMS-I.I "Biogas/biomass thermal applications for households/small users" or – AMS-I.E "Switch from non-renewable biomass for thermal applications by the user"	☑ [tick when met] See section D.1 and D.6.3 of the CPA-DD _____ Verifiable evidence: – CPA database – Emissions reductions calculation spreadsheet
	Only if	The CPA satisfies the following	☑ [tick when met]

	AMS-III.R applies:	conditions: – The sludge is handled aerobically. In case of soil application of the final sludge the proper conditions and procedures that ensure that there are no methane emissions is ensured; – Measures are used (e.g. combusted or burnt in a biogas burner for cooking needs) to ensure that all the methane collected by the recovery system is destroyed.	See section A.5 of the CPA-DD _____ Verifiable evidence: – Commissioning protocol; – CME Manual
10. Where applicable, target group (e.g. domestic/commercial /industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation)		The target group within the CPA are households, communities and /or SMEs, as recorded in the Sales Contract. All biogas digesters will be directly installed at the user's by qualified personnel. All entities involved in the distribution of biogas digesters will have a contractual agreement with the CME detailing their role in the CPA and the transfer of emissions rights to the CME.	☑ [tick when met] _____ Verifiable evidence: – Sales Contract – CME Manual
11. Where applicable, the conditions related to sampling requirements for the PoA in accordance with the "Standard for sampling and surveys for CDM project activities and programme of activities		The sampling method applied in the CPA (e.g. in the monitoring plan) follows the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4). A 90% confidence interval and a 10% margin of error requirement is achieved for the sampled parameters.	☑ [tick when met] See section D.7.2 of the CPA-DD _____ Verifiable evidence – CME Manual
12. Where applicable, the conditions that ensure that every CPA (in aggregate if it comprises of independent sub units) meets the small-scale or microscale threshold6 and remains within those thresholds throughout the crediting period of the CPA		Where AMS-I.E or AMS I.I apply: The CPA's power capacity in aggregate remains below 15 MW_{th} throughout the crediting period; Where AMS III.R applies: The CPA's annual emission reductions in aggregate remains below 20 $ktCO_2e$ per year throughout the crediting period;	☑ [tick when met] _____ Verifiable evidence: – Technical unit design specifications – CPA Database – Emissions reductions calculation spreadsheet

As all of the above criteria are met, the CPA is eligible to be included in the SimGas Biogas Programme of Activities.

The additionality of the CPA is demonstrated per the conditions outlined in Part I. section B.5.. of the PoA-DD and in accordance with the *Guidelines for demonstrating additionality of microscale project activities* (EB 68, Annex 26). This section states that three conditions need to be met for the CPA to pass the additionality test:

Additionality Criteria	Means of verification	Verifiable evidence:
1. Where AMS-I.E or AMS-I.I apply, the size of the SSC-CPA is less than or equal to 15MW_{th} Where AMS-III.R applies, the size of the SSC- CPA is less than or equal to 20 ktCO_2e/yr Whichever CPA capacity is reached first will define the limits of the CPA.	The size of individual biogas systems in a SSC-CPA are registered through the Sales Contract, and entered into the CPA database. The emissions reductions and thermal capacity of each installation are automatically calculated from the data entered into the database under each methodology applied. The CPA implementer must take care that one SSC-CPA does not exceed the limit of 15 MW_{th} and/or 20 ktCO_2e/yr, whichever CPA capacity is reached earlier.	☑ [tick when met] _____ Verifiable evidence: – Sales Contract (capacity of units installed) – Emissions reduction spreadsheet (calculating size/capacity of stoves and the biodigester)
2. Where AMS-I.E or AMS-I.I apply, an individual household biogas system in the SSC-CPA has a maximum thermal capacity of 4500 $kW_{th;}$	Size of individual biogas systems is registered through the Sales Contract. Biogas systems larger than 4500 kW_{th} will not be included in the SSC-CPA.	☑ [tick when met] _____ Verifiable evidence: – Sales Contract (capacity of units installed)
3. Where AMS-III.R applies, each of the independent biogas systems in the project activity achieves an estimated annual emission reduction equal to or less than 600 tCO_2e per year;	Size of individual biogas systems are registered through the Sales Contract. Household biogas systems achieving an estimated annual emission reduction larger than 600 tCO_2e per year will not be included in the SSC-CPA.	☑ [tick when met] _____ Verifiable evidence: – Sales Contract (capacity of units installed)
4. End users of the subsystems or measures are households/ communities/SMEs.	Registration through the sales contract. Users other than households/ communities/SMEs will not be included in the SSC-CPA.	☑ [tick when met] _____ Verifiable evidence: – Sales Contract (type of user)

The CPA meets all requirements and is therefore eligible to be included in the SimGas Biogas Programme of Activities

D.6. Estimation of emission reductions

D.6.1. Explanation of methodological choices

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The programme outlined will apply the following methodologies:

- AMS-I.I. Version 4: Biogas/biomass thermal applications for households/small users
- AMS-I.E. Version 4: Switch from non-renewable biomass for thermal applications by the user
- AMS-III.R. Version 2: Methane recovery in agricultural activities at household/small farm level

All baseline and monitoring procedures applied will follow the guidelines laid out in these methodologies.

AMS-I.E assumes that in the absence of the project activity, the baseline scenario would be the use of fossil fuel for meeting similar thermal energy needs.

- Equation (1) is referred to for the calculation of emission reductions. B_y, the quantity of woody biomass that is substituted or displaced, is determined using historical data, in line with option (a) of paragraph (6).
  Leakage is to be determined in accordance with the guidance provided by AMS-I.E version 4, paragraph 10.a: "*B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.*"

AMS-I.I covers activities for the generation of renewable thermal energy using renewable biogas.

- The emission reduction calculation under AMS-I.I will be estimated in line with option (2), paragraph (14): based on thermal energy generated. This implies that $BS_{k,y}$, the net quantity of renewable biogas consumed by the thermal application, will be defined either as per the requirements stipulated in Table 1 of the applied methodology, or via a default value of 0.13 $Nm^3.m^{-3}.day^{-1}$.
- Parameters η_{BL} and η_{PJ} will be defined *ex ante* through a laboratory test.
- Leakage will be accounted for applying the default 0.05m^3 biogas leaked per 1 m^3 biogas produced, in accordance with the guidance provided by AMS-III.D, in case where the biodigesters are not part applying AMS-III.R to account for methane avoidance.

AMS-III.R covers the recovery of the methane from manure and organic waste that would otherwise decay anaerobically.

- The emission reductions are calculated in accordance with paragraph (9), which relates to the IPCC TIER 2 methodology.
- Default value for parameters VS_T and B_0 are applied as no country-specific values are available.
- Parameters MCF_j, $MS\%_{Bl,j}$ and N_T will be gathered from a survey. Respondents will be asked to comment on their manure handling practice upon commissioning of the biogas system through the Manure Management survey. After gathering data in the initial CPAs, the parameters can be fixed for following CPAs.
- Project emissions will be accounted for applying the default 0.05m^3 biogas leaked per 1 m^3 biogas produced, in accordance with the guidance provided by AMS-III.D.

The methods used to apply the final sludge to soil will be verified by sampling.

D.6.2. Data and parameters fixed ex-ante

Data / Parameter:	**$B_{y\ rural}$**
Data unit:	Tonnes/year
Description:	Biomass substituted in rural areas
Source of data:	Kituyi et al.: Biofuel consumption rates and patterns in Kenya, Biomass and Bioenergy 20, 83-99 (2001)
Value applied:	7.42
Choice of data or Measurement methods and procedures	National data are used as the CPA is implemented nationwide.
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-I.E

Data / Parameter:	**$B_{y\ urban}$**
Data unit:	Tonnes/year
Description:	Biomass substituted in urban areas
Source of data:	Kituyi et al.: Biofuel consumption rates and patterns in Kenya, Biomass and Bioenergy 20, 83-99 (2001)
Value applied:	4.72

Choice of data or Measurement methods and procedures	National data are used as the CPA is implemented nationwide.
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-I.E

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:	FAO: Global Forest Resources Assessment 2010: Kenya (2010); and Kituyi et al.: Biofuel consumption rates and patterns in Kenya, Biomass and Bioenergy 20, 83-99 (2001)
Value applied:	95.1
Choice of data or Measurement methods and procedures	National data are used as the CPA is implemented nationwide. The FAO Assessment provides insight into Kenya's forestry sectors, indicating total forest cover and growing stock figures. NRB can be calculated by subtracting the DRB of 4,040,000 m^3 from B_y of 82,618,338 m^3. The fraction of NRB equals to 78,578,338 / 82,618,338, which is 95.1% (see section D.6.3)
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-I.E

Data / Parameter:	**NRB**
Data unit:	m^3
Description:	Non-renewable woody biomass
Source of data:	FAO: Global Forest Resources Assessment 2010: Kenya (2010); and Kituyi et al.: Biofuel consumption rates and patterns in Kenya, Biomass and Bioenergy 20, 83-99 (2001)
Value applied:	78,578,338
Choice of data or Measurement methods and procedures	NRB can be calculated by subtracting the DRB of 4,040,000 m^3 from B_y of 78,578,338 m^3.
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-I.E

Data / Parameter:	**DRB**
Data unit:	m^3
Description:	Demonstrably renewable woody biomass
Source of data:	FAO: Global Forest Resources Assessment 2010: Kenya (2010); and Montagnini, F. and Jordan, C. F. Tropical forest ecology: the basis for conservation and management p.167 (2005)
Value applied:	4,040,000
Choice of data or Measurement methods and procedures	Literature indicates that sustainable yields in managed plantations is 20 m^3 per ha. Given the total plantation cover referred to by FAO of 202,000 ha, the annual sustainable yield from the plantations is determined to be 4,040,000 m^3. This is the demonstrably renewable biomass (DRB).
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-I.E

Data / Parameter:	$SNU_{NRB\ switch}$
Data unit:	%
Description:	Share of non-users that started using non-renewable biomass that was replaced by biogas from a digester user
Source of data :	AMS-I.E. (version 4) paragraph 10.a
Value(s) applied:	5 (adjustment factor of 0.95 applicable to B_y)
Choice of data or Measurement methods and procedures	B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.
Purpose of data	Calculation of leakage emissions
Any comment:	Applied in AMS-I.E

Data / Parameter:	**Capacity**
Data unit:	kW_{th}
Description:	Capacity of a biodigester system
Source of data:	Calculated as shown in Section A.12.
Value applied:	1.44
Choice of data or Measurement methods and procedures actually applied:	Calculated using the formula presented in Section A.12. The $16m^3$ capacity biodigester produces $6m^3$ of biogas per day. If the $6m^3$ capacity is used, 2,25 m^3 applies. This gives a maximum output of 1.44 kW_{th}.
Purpose of data	Calculation of project emissions
Any comment:	Qualifies as a micro-scale project. Applied in AMS-III.R

Data / Parameter:	$EF_{projected\_fossilfuel}$
Data unit:	tCO_2/TJ
Description:	Emission factor for the substitution of non-renewable woody biomass
Source of data:	AMS-I.E. version 4
Value applied:	81.6
Choice of data or Measurement methods and procedures	As per requirement of the methodology
Purpose of data	Calculation of baseline emissions and project emissions
Any comment:	Applied in AMS-I.I

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/tonne
Description:	Net calorific value of the non-renewable biomass that is substituted
Source of data:	IPCC default
Value applied:	0.015
Choice of data or Measurement methods and procedures	As per requirement of the methodology
Purpose of data	Calculation of baseline emissions and project emissions
Any comment:	Applied in AMS-I.E

Data / Parameter:	NCV_{biogas}
Data unit:	TJ/tonne
Description:	Net calorific value of the biogas
Source of data:	AMS-I.I. version 4, Werner U., Stohr U., and Hees, N. Biogas plants in

	animal husbandry. GTZ, Germany (1989)
Value applied:	0.0182
Choice of data or Measurement methods and procedures	AMS-I.I. states that the NCV of biogas to be applied is 0.0215 GJ/m^3. To convert this figure to TJ/tonne, a density factor of 1.18 kg/m^3 is applied (Werner et al, 1989 – p.66). This results in a NCV of biogas of 0.0182 TJ/tonne.
Purpose of data	Calculation of baseline emissions and project emissions
Any comment:	Applied in AMS-I.I

Data / Parameter:	**$EF_{fossil\ fuel}$**
Data unit:	tCO_2/TJ
Description:	Emission factor of kerosene consumed in the baseline scenario
Source of data:	IPCC default
Value applied:	71.9
Choice of data or Measurement methods and procedures	Literature indicates that kerosene is used for cooking purposes, and is prevalent in urban regions. As per Table 2.3, Chapter 2, Volume 2 of the 2006 IPCC Guidelines.
Purpose of data	Calculation of baseline emissions and project emissions
Any comment:	Applied in AMS-I.I

Data / Parameter:	**$EF_{fossil\ fuel}$**
Data unit:	tCO_2/TJ
Description:	Emission factor of LPG consumed in the baseline scenario
Source of data:	IPCC default
Value applied:	63.1
Choice of data or Measurement methods and procedures	Literature indicates that LPG is used for cooking purposes, and is prevalent in urban regions. As per Table 2.3, Chapter 2, Volume 2 of the 2006 IPCC Guidelines.
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-I.I

Data / Parameter:	**η_{BL}**
Data unit:	%
Description:	Efficiency of the baseline equipment being replaced
Source of data:	Laboratory test
Value applied:	15
Choice of data or Measurement methods and procedures	
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-I.I

Data / Parameter:	**η_{PJ}**
Data unit:	%
Description:	Efficiency of the new equipment being implemented
Source of data:	Stove Report SimGas –average efficiency value from nine tested cook stoves
Value applied:	55
Choice of data or Measurement methods and procedures	

Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-I.I

Data / Parameter:	**$VS_{dairy\ cow}$**
Data unit:	kg/hd/day
Description:	Daily volatile solid excreted for dairy cows
Source of data:	IPCC default
Value applied:	1.9
Choice of data or Measurement methods and procedures	As per Table 10.A. 4, Chapter 10, Volume 4 of the 2006 IPCC Guidelines
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**$VS_{market\ swine}$**
Data unit:	kg/hd/day
Description:	Daily volatile solid excreted for market swine
Source of data:	IPCC default
Value applied:	0.3
Choice of data or Measurement methods and procedures	As per Table 10.A. 7, Chapter 10, Volume 4 of the 2006 IPCC Guidelines
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**VS_{goat}**
Data unit:	kg/hd/day
Description:	Daily volatile solid excreted for goat
Source of data:	IPCC default
Value applied:	0.35
Choice of data or Measurement methods and procedures	As per Table 10.A. 9, Chapter 10, Volume 4 of the 2006 IPCC Guidelines
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**VS_{sheep}**
Data unit:	kg/hd/day
Description:	Daily volatile solid excreted for sheep
Source of data:	IPCC default
Value applied:	0.32
Choice of data or Measurement methods and procedures	As per Table 10.A. 9, Chapter 10, Volume 4 of the 2006 IPCC Guidelines
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**$B_{0dairy\ cow}$**
Data unit:	$m^3\ CH_4/kg$
Description:	Maximum methane producing capacity for manure produced by dairy cows

Source of data:	IPCC default
Value applied:	0.13
Choice of data or Measurement methods and procedures	As per Table 10.A. 4, Chapter 10, Volume 4 of the 2006 IPCC Guidelines
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**$B_{0market\ swine}$**
Data unit:	$m^3\ CH_4/kg$
Description:	Maximum methane producing capacity for manure produced by market swine
Source of data:	IPCC default
Value applied:	0.29
Choice of data or Measurement methods and procedures	As per Table 10.A. 7, Chapter 10, Volume 4 of the 2006 IPCC Guidelines
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**B_{0goat}**
Data unit:	$m^3\ CH_4/kg$
Description:	Maximum methane producing capacity for manure produced by goats
Source of data:	IPCC default
Value applied:	0.13
Choice of data or Measurement methods and procedures	As per Table 10.A. 9, Chapter 10, Volume 4 of the 2006 IPCC Guidelines
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**B_{0sheep}**
Data unit:	$m^3\ CH_4/kg$
Description:	Maximum methane producing capacity for manure produced by sheep
Source of data:	IPCC default
Value applied:	0.13
Choice of data or Measurement methods and procedures	As per Table 10.A. 9, Chapter 10, Volume 4 of the 2006 IPCC Guidelines
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**UF_b**
Data unit:	[unit]
Description:	Model correction factor
Source of data:	AMS-III.R, version 2
Value applied	0.94
Choice of data or Measurement methods and procedures	-

Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**$PE_{leakage}$**
Data unit:	tCO_2e/year
Description:	Project emissions due to physical leakage of biogas from the animal manure management system
Source of data:	AMS-III.D. version 18
Value applied:	0.08
Choice of data or Measurement methods and procedures	A default value of 0.05 m³ biogas leaked/m³ biogas produced may be used in accordance with paragraph 13.b of AMS-III.D. version 18
Purpose of data	Calculation of project emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**N_s**
Data unit:	#
Description:	Number of biogas systems in each size category (m^3) installed under the CPA
Source of data:	SimGas Business Plan (2010)
Value applied:	For the *ex-ante* estimation of the emission reductions achieved, the following implementation schedule is assumed:
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions; project emission and leakage
Any comment:	As the CPA will collect baseline data from each participating household/community/SME *ex-ante*, the presented estimate is only illustrative and the actual emission reductions claimed will be based on the collected data.

Type **Date**	*Manure-fed*	*Organic waste-fed*
Jan. – March 2013	1,000	1,500
Apr. – June 2013	1,000	1,500
Jul. – September 2013	1,000	1,500
Oct. – December 2013	1,000	1,500
Total	**4,000**	**6,000**

Data / Parameter:	**D_{CH4}**
Data unit:	t/m^3
Description:	Methane density
Source of data used:	IPCC: http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref7.pdf
Value applied :	0.00067
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Any comment:	Applied in AMS-III.R

Data / Parameter:	**$B_{sk,y}$**

Data unit:	$Nm^3.m^{-3}.day^{-1}$
Description:	The net quantity of renewable biogas consumed by the thermal application *k* in year *y*
Source of data:	AMS-I.I (versión 4)
Value applied:	0.13
Choice of data or Measurement methods and procedures	As per the applied methodology, paragraph 14. This is permitted to be applied for countries where annual average ambient temperature is higher than 20C. The annual average ambient temperature in Kenya is 25.10C.[6]
Any comment:	-

All other parameters that need to be monitored are outlined in Part II. section B.7. of the PoA-DD.

D.6.3. Ex-ante calculation of emission reductions

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The applicability of the methodologies will depend on the baseline scenario determined on the user level. Users with the manure-fed biodigesters will apply a combination of AMS-I.E or AMS-I.I and AMS-III.R. Users with the organic waste-fed biodigesters will apply either AMS-I.E or AMS-I.I only.

Accounting for emission reductions due to the displacement of non-renewable biomass (AMS-I.E, version 4)

Emission reductions

Methodology AMS-I.E. version 4 is applied to calculate the emission reductions resulting from the displacement of non-renewable biomass (NRB). This methodology will apply to households that indicate most of their fuel for cooking purposes comes from biomass. The emission reductions are calculated using the following formula[7]:

$$\mathbf{ER_y} = B_y * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel} \quad (1)$$

Where:

ER_y Emission reductions from non-renewable biomass use during the year *y* in tCO_2e

B_y Quantity of woody biomass that is substituted or displaced in tonnes

$f_{NRB,y}$ Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non-renewable biomass using survey methods (percentage)

$NCV_{biomass}$ Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for firewood, 0.015 TJ/tonne)

$EF_{projected\_fossilfuel}$ Emission factor for the substation of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO_2/TJ

[6] As evidenced by World Bank, *Climate Change Knowledge Portal*, Average Monthly Temperature for Kenya from 1990 – 2012 [online] Available from: http://sdwebx.worldbank.org/climateportal/index.cfm?page=country_historical_climate&ThisCCode=KEN . See also temperature analysis file 'World Bank Temp Data 10 year', cell A220

[7] AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user (Version 04)

Determining B_y

B_y has been determined using available historical data, in accordance with paragraph 6 (a) of AMS-I.E. version 4.

According to UNEP[8], biomass energy (predominantly firewood and charcoal) constitutes 70% of national energy supply, 90% of which is consumed by households. This is in line with values reported in academic literature[9] and Kenya's National Communication[10]. A baseline survey conducted by Kituyi et al.[11] provides insight into the actual consumption figures of Kenyan households. The survey was carried out in 1997 and targeted 1,538 rural households and 664 urban households nationwide. Results indicate that firewood is the main source of energy used for cooking purposes in rural areas, while charcoal dominated the energy mix in urban areas. Rural households reported using on average 4,296 kg of firewood per year and 522 kg of charcoal per year. For urban households the consumption rates are 281 kg of firewood per year and 742 kg of charcoal per year. To convert charcoal use into firewood consumption, the average charcoal consumption was multiplied by a factor of 6, in accordance with IPCC guidance[12].

Table 3: Quantity of woody biomass that is displaced by the project activity

Description (*tonnes/hh/yr*)	**B_y rural**	**B_y urban**
Firewood consumption	4.30 tonnes	0.28 tonnes
Charcoal converted to wood	3.12 tonnes	4.44 tonnes
Total biomass consumption (*charcoal converted by factor 6*)	**7.42 tonnes**	**4.72 tonnes**

Determining $f_{NRB,y}$

As per methodology AMS-I.E., project participants need to determine the shares of renewable and non-renewable woody biomass in By (the quantity of woody biomass used in the absence of the project activity) using nationally approved methods (e.g. surveys or government data if available) and then determine $f_{NRB,y}$, as described below.

Demonstrably renewable biomass (DRB)

As per AMS-I.E., the woody biomass is originating from land areas that are forests where:

a) The land area remains a forest;
b) Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
c) Any national or regional forestry and nature conservation regulations are complied with.

Data from the Food and Agriculture Organization (FAO) is used to indicate the DRB. FAO[13] (2005 data) reports that Kenya's total natural forest cover equates to 3,522,000 ha, of which 1,245,000 ha consists of indigenous closed forest while 2,075,000 ha is represented by open woodland. Only 202,000 ha is reported to be designated as plantations, either under public or private ownership. The DRB is the amount of biomass that can be sustainably harvested from this managed territory.

[8] UNEP: Kenya: Integrated assessment of the Energy Policy (2006)
[9] Mahiri, I. and Howorth, C.: Twenty years of resolving the irresolvable: approaches to the fuel wood problem in Kenya (2001)
[10] Ministry of Environment and Natural Resources: First National Communication of Kenya to the COP to the UNFCCC (2002)
[11] Kituyi et al.: Biofuel consumption rates and patterns in Kenya. Biomass and Bioenergy 20, 83-99 (2001)
[12] IPCC: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual, Chapter Energy (1996)
[13] FAO: Global Forest Resources Assessment 2010: Kenya (2010)

The entire growing stock amounts to 280,960,000 m^3, of which 30,300,000 m^3 is covered by sustainably managed plantations. [14]

Literature[15] indicates that sustainable yields in managed plantations is 20 m^3 per ha. Given the total plantation cover referred to by FAO, the annual sustainable yield from the plantations is determined to be 4,040,000 m^3. This is the demonstrably renewable biomass (DRB).

Non-renewable woody biomass (NRB) is the quantity of woody biomass used in the absence of the project activity (By) minus the DRB component. To determine the fraction of NRB, the following formula is applied[16]:

$$f_{NRB,y} = \frac{NRB}{NRB + DRB} \quad (2)$$

B_y is determined by multiplying Kenya's population of 38,610,097[17] by the average consumption per capita derived from Table 3. With an average household size of 5.5[18], a total of 7,020,017 households are accounted for, 22%[19] of which live in urban areas. Applying the fraction of urban and rural households and the respective consumption values, the B_y amounts to 47,918,636 tonnes, equivalent to 82,618,338 m^3 [20]. NRB can be calculated by subtracting the DRB of 4,040,000 m^3 from B_y of 82,618,338 m^3.

Therefore, the fraction of NRB is as follows:

$$f_{NRB,y} = \frac{78,578338}{82,618,338} = \mathbf{95.1}\ \%$$

Further to paragraph 7 of AMS-I.E., version 4, the existence of NRB is supported by two indicators:

1. Survey results, national or local statistics, studies, maps or other sources of information, such as remote-sensing data, that show that carbon stocks are depleting in the project area.

Kenya's forests are rapidly declining. Growing population and increasing demand for land and biofuel are straining local biodiversity and resulting in high deforestation rates. UNESCO[21] reports that since Kenya's independence in 1963, the country's forest cover has declined from 10 % of its total territory to a mere 1.7 % in 2006. According to FAO[22], Kenya has been losing on average 13,000 ha per year between 1990 and 2010, equivalent to about 0.34% of total forested land annually. This is an indication that carbon stocks are depleting in the project area at a rapid pace.

2. Increasing trends in fuel wood prices indicating a scarcity of fuel-wood;

The price of charcoal in Kenya has been increasing steadily, even more than the price of other fuels. [23]

[14] Based on the stem volume figures presented in: FAO Forestry department, Global Forest Resources Assessment country report for Kenya, 2005
[15] FAO: Simple technologies for charcoal making (1987)
[16] AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user (Version 04)
[17] Kenya National Census (2009)
[18] Kituyi et al.: Biofuel consumption rates and patterns in Kenya. Biomass and Bioenergy 20, 83-99 (2001)
[19] CIA: The World Fact Book: Kenya (2010)
[20] Density factor of 0.58 tonnes/m^3 (FAO Forestry department, Global Forest Resources Assessment country report for Kenya, 2005)
[21] UNESCO: Fighting desertification in Kenya, one tree at a time. Courier, 3 (2006)
[22] FAO: Global Forest Resources Assessment 2010 – Main Report (2010)
[23] Kenyan National Bureau for Statistics

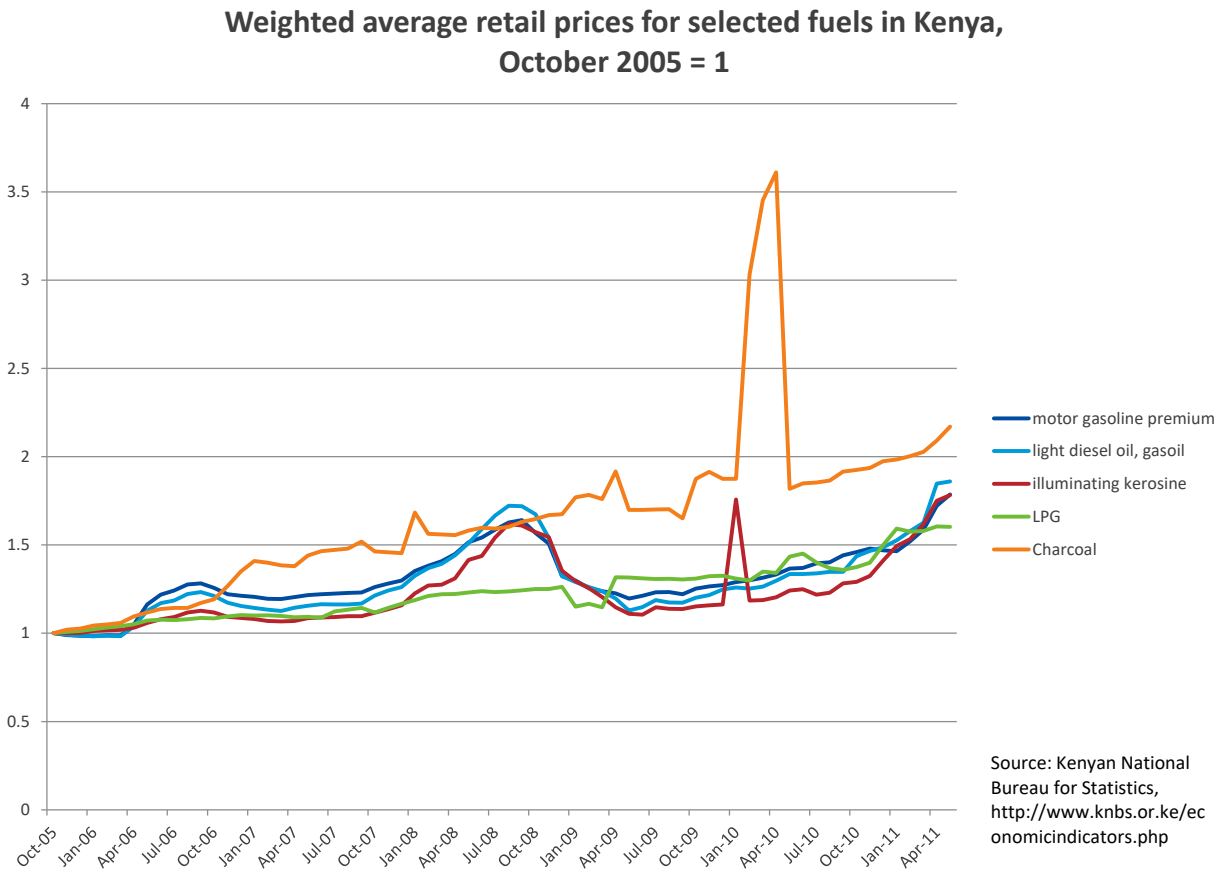

Figure 4: Price development of fuels (2005 = 1) (Kenyan National Bureau for Statistics)

Project emissions

No project emissions are accounted for under the methodology.

Leakage

In accordance with the methodology, leakage is accounted for through an adjustment factor as suggested by AMS-I.E. paragraph 10, by multiplying by a net to gross adjustment factor of 0.95 to account for leakages.

Emission reductions

The emission reductions of households operating manure-fed systems are:

$$\mathbf{ER_y} = (7.42\ tonnes/year * 95.1\% * 0.015\ TJ/tonne * 81.6\ tCO_2/TJ) * 0.95 = \mathbf{8.21}\ tCO_2e$$

The emission reductions of households operating organic waste-fed systems are:

$$\mathbf{ER_y} = (4.72\ tonnes/year * 95.1\% * 0.015\ TJ/tonne * 81.6\ tCO_2/TJ) * 0.95 = \mathbf{5.22}\ tCO_2e$$

Accounting for emission reductions due to the displacement of fossil fuels (AMS-I.I, version 4)

Baseline emissions

Methodology AMS-I.I. version 4 is applied to calculate the emission reductions resulting from the displacement of fossil fuels. This methodology will apply to households that indicate most of their fuel for cooking purposes comes from fossil fuels. The emission reductions are calculated following 'Option 2' of the methodology.

The emission reductions are calculated using the following formula[24]:

$$\mathbf{ER_y} = \sum_k N_{k,0} * n_{k,y} * BS_{k,y} * EF * \eta_{PJ/BL} * NCV_{biogas} - LE_y \quad (\mathbf{3})$$

Where:

ER_y	Emission reductions from fossil fuel use during the year *y* in tCO_2e
$N_{k,0}$	Number of thermal applications k commissioned
$n_{k,y}$	Proportion of k ,0 N that remain operating in year y (fraction)
$BS_{k,y}$	The net quantity of renewable biogas consumed by the thermal application k in year y. A default biogas generation rate of 0.13 $Nm^3.m^{-3}.day^{-1}$ is applied.
EF	Mean CO_2 emission factor, in tonnes/TJ (calculated as the mean of $EF_{fossil\ fuel}$)
$\eta_{PJ/BL}$	Ratio of efficiencies of project equipment and baseline equipment
NCV_{biogas}	Net calorific value of the biogas, use default value: 0.0215 GJ/m^3 biogas, to be reported in TJ/tonne

To calculate the thermal energy supplied in the baseline scenario, the NCV (TJ/day) of the fossil fuel used before the implementation of the biogas system is defined. A baseline survey conducted by Kituyi et al.[25] provides insight into the actual fossil fuel consumption figures of Kenyan households. Results indicate that rural households use minimal amounts of fossil fuel, and firewood and charcoal are the main sources of energy for cooking. Urban households reportedly use 120 litres of kerosene[26] and 14 kg of LPG per household per year. Given the respective NCVs and a baseline cook stove efficiency of 15%[27], the equivalent annual output equals to 270 kg of biogas per year.[28]

Project emissions

As option 2 is chosen to calculate the baseline emissions, no project emissions need to be accounted for.

[24] AMS-I.I.: "Biogas/biomass thermal applications for households/small users" (Version 4)

[25] Kituyi et al.: Biofuel consumption rates and patterns in Kenya. Biomass and Bioenergy 20, 83-99 (2001)

[26] Conversion of 817.15 kg/m^3 is applied, resulting in 0.098 tonnes of Kerosene. For reference to the applied conversion rate see: http://www.snvworld.org/sites/www.snvworld.org/files/publications/monitoring_report_period_ii_september_2010_december_2011_nbp_cambodia_2012.pdf (p.27)

[27] University of Utrecht: Towards a sustainable biomass energy supply for rural households in semi-arid Shinyanga, Tanzania (2008)

[28] Calculated as follows: ((0.014 tonnes LPG * 0.0473 TJ/tonne) + (0.098 tonnes Kerosene * 0.0441 TJ/tonne) *15%) = (x * 0.0182 TJ/tonne * 15%). Therefore, x ≈ 0.27 tonnes of biogas.

Leakage
The implemented biogas system is not transferred from outside the boundary to the project activity as all installed systems are new. A default value of 0.05 m³ biogas leaked/m³ biogas produced applies where a Type III project activity (AMS-III.R) is not combined.

Emission reductions
With an efficiency of 55%[29] of the new cook stove, and a mean EF of 70.78 tonnes/TJ, the emission reductions of households operating organic waste-fed systems using fossil fuel are:

$$\mathbf{ER_y} = 0.27\ tonnes/year * 70.78\ tonnes/TJ * 3.67 * 0.0182\ TJ/tonne * 0.95 = \mathbf{1.21}\ tCO_2e$$

Accounting for emission reductions due to the avoidance of methane emissions from manure handling (AMS-III.R, version 2)

Baseline emissions
Methodology AMS-III.R. version 2 is applied to calculate the emission reductions due to the avoidance of methane emissions from manure handling. Formula (**4**) applies to households operating manure-fed systems[30]:

$$\mathbf{BE_y} = GWP_{CH4} * D_{CH4} * UF_b * \sum_{j,LT} MCF_j * B_{O,LT} * N_{LT,y} * VS_{LT,y} * 365 * MS\%_{Bl,j} \quad (\mathbf{4})$$

Where:

BE,y	Baseline emissions from manure handling during the year y in tCO2e
GWP_{CH4}	Global Warming Potential of methane
D_{CH4}	CH^4 density (0.00067 t/m^3)
UF_b	Model correction factor to account for model uncertainties (0.94)
LT	Index for all types of livestock
j	Index for animal manure management system
MCF_j	Annual methane conversion factor (MCF) for the baseline manure management system *j*
$B_{0,LT}$	Maximum methane producing capacity for manure produced by livestock category LT in m^3 CH_4/kg dm
$N_{LT,y}$	Annual average number of animals of type LT in year *y* (numbers)
VS_{LT}	Daily volatile solid excreted for livestock category LT in kg/day
$MS\%_{Bl,j}$	Fraction of manure handled in the baseline animal manure management system *j*

No emission reductions from households operating organic waste-fed systems are claimed, as baseline methane emissions from organic waste disposal are minimal.

[29] SimGas Stove Report –average efficiency value from nine tested cook stoves
[30] AMS-III.R.: Methane recovery in agricultural activities at household/small farm level (Version 2)

Emission factor for methane emissions from manure management
The MCF_j reflects the methane conversion factor for each manure management system applied in the baseline scenario. A survey of applied manure management systems will be conducted to determine the portion of the manure that is handled with each manure management technique. To reflect realised emission reductions as accurately as possible, the actual baseline situation will be determined for a sample of the biogas system users. This implies that parameters MCF_j, $MS\%_{BL,j}$ and $N_{LT,y}$ will be determined upon commissioning of the biogas system and will therefore be specified *ex-post.*

For the presented emission reduction calculation, survey data sourced from literature is used.

The system-specific methane conversion factors applicable to the baseline are provided in the IPCC Guidelines for National Greenhouse Gas Inventories[31]. A survey conducted by the Kenya Agricultural Research Institute[32] amongst 300 rural households in Central Kenya indicates that the average rural household possess 3 dairy cows. 67% of the farmers store their manure in uncovered pits, and 33% through solid storage. The reported age of the manure at sampling time ranged from 1 to 8 months, with 5 months being the most common. The applicable MCF will be chosen from the default values presented in Table 10.17, Chapter 10, Volume 4 of the 2006 IPCC Guidelines. Average temperatures are defined on the national level.

Table 4: Average temperature per province and the applicable MCF [33] (list is not exhaustive)

	Kenya[34]
Average temperature	25.10^{O}C

MCF	
Pasture/Range/Paddock	1.5%
Daily spread	0.5%
Dry lot	1.5%
Solid storage	4%
Liquid/slurry (covered)	41%
Liquid/slurry (uncovered)	65%
Uncovered anaerobic lagoon	79%
Pit storage < 1 month	3%
Pit storage > 1 month	65%

Manure characteristics of targeted animal population
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 LT and the maximum amount of methane able to be produced from that manure (B_{OT}).

[31] IPCC Guidelines for National Greenhouse Gas Inventories: Chapter 10: Emissions from Livestock and Manure Management (2006)
[32] Cattle manure quality in Maragua District, Central Kenya: Effect of management practices and development of simple methods of assessment (2002)
[33] IPCC Guidelines for National Greenhouse Gas Inventories: Chapter 10: Emissions from Livestock and Manure Management, Table 10.17 (2006)
[34] As evidenced by World Bank, *Climate Change Knowledge Portal*, Average Monthly Temperature for Kenya from 1990 – 2012 [online] Available from: http://sdwebx.worldbank.org/climateportal/index.cfm?page=country_historical_climate&ThisCCode=KEN . See also 'Temperature' tab of the ER calculations, cell A219

Table 5: Manure characteristics of different livestock categories [35] (list is not exhaustive)

	VS (kg/hd/day)	$\mathbf{B_O}$ (m^3 CH_4/kg VS)
Dairy cow	1.9	0.13
Market swine	0.3	0.29
Goat	0.35	0.13
Sheep	0.32	0.13

The baseline emissions of households operating manure-fed systems are (assuming 3 dairy cows[36])[37]:

$$\mathbf{BE_y} = 21 * 0.00067 * 0.94 * 0.449 * 0.13 * 3 * 1.9 * 365 * 1 = \mathbf{1.61}\ tCO_2$$

Project emissions

Project emissions due to physical leakage of biogas from the animal manure management are accounted for in accordance with option (b) listed in paragraph 13 from AMS-III.D. version 18.

$$\mathbf{PE_y} = x * GWP_{CH4} * D_{CH4} * UF_b * \sum_{j,LT} MCF_j * B_{O,LT} * N_{LT,y} * VS_{LT,y} * 365 * MS\%_{Bl,j} \quad \textbf{(5)}$$

Where:

PE_y	Emissions due to physical leakage of biogas in year y (tCO_2e)
x	Physical leakage of biogas, where a default factor of $0.05m^3$ per $1m^3$ of produced biogas.
GWP_{CH4}	Global Warming Potential of methane
D_{CH4}	CH_4 density (0.00067 t/m^3)
UF_b	Model correction factor to account for model uncertainties (0.94)
LT	Index for all types of livestock
j	Index for animal manure management system
MCF_j	Annual methane conversion factor (MCF) for the baseline manure management system *j*
$B_{0,LT}$	Maximum methane producing capacity for manure produced by livestock category LT in m^3 CH_4/kg dm
$N_{LT,y}$	Annual average number of animals of type LT in year *y* (numbers)
VS_{LT}	Daily volatile solid excreted for livestock category LT in kg/day
$MS\%_{Bl,j}$	Fraction of manure handled in the baseline animal manure management system *j*

[35] IPCC Guidelines for National Greenhouse Gas Inventories: Chapter 10: Emissions from Livestock and Manure Management, Table 10.A 4, 7 & 9 (2006)

[36] Cattle manure quality in Maragua District, Central Kenya: Effect of management practices and development of simple methods of assessment (2002)

[37] The MCF of 44.9% (0.4492) is the result of the multiplication of baseline manure handling methods and respective MCFs: ((0.33*0.04)+(0.67*0.65))

The project emissions of households operating manure-fed systems are (assuming 3 dairy cows):

PE_y = 0.08 tCO_2e

Leakage
No leakage is considered as the implemented biogas systems are not transferred from another activity.

Emission reductions

$$\mathbf{ER_y} = BE_y - PE_y - LE_y$$

Therefore, emission reductions of households operating manure-fed systems are:

ER_y = (1.61 – 0.08) – 0 = **1.52 tCO_2e**

Table 6: Summary of emission reductions per digester type and baseline scenario (tCO_2/yr)

Methodology	Manure-fed system	Organic waste-fed system
AMS-I.E		
BE_y	8.64	5.49
PE_y	0	0
LE_y	0.43	0.27
ER_y	8.21	5.22
AMS-I.I		
BE_y	0	1.28
PE_y	0	0
LE_y	0	0.06
ER_y	0	1.21[38]
AMS-III.R		
BE_y	1.61	0
PE_y	0.08	0
LE_y	0	0
ER_y	1.52	0
Total ER_y	**9.73** tCO_2/yr	**5.22 or 1.21** tCO_2/yr

D.6.4. Summary of the ex-ante estimates of emission reductions

This table provides a summary of the ex-ante estimation of emission reductions.

Total estimated emission reductions for the manure-fed systems are 9.73 tCO_2e per biodigester, per year. Given a total of 4,000 manure-fed systems foreseen in this CPA, this amounts to total emission reductions of 25,501 tCO_2e in the first crediting year. This is because it is assumed that implementation of all 4,000 biodigesters occurs within the first year and that the implementation is evenly spread out over the year. This means that the emission reductions generated under the first

[38] Due to rounding.

year are only half of the emission reductions that are generated in the following years.[39] Each following year, the estimated emission reductions are 51,003tCO_2e per year, as all 4,000 manure-fed biodigesters are assumed to be operational.

For the organic waste-fed biodigesters, while the total estimated emission reduction for NRB substitution by the organic waste-fed system is 5.22 tCO_2 as calculated above, this ex-ante estimate assumes that only 20% of the urban users included in this CPA indicate biomass to be their primary fuel for cooking purposes. Similarly, while the total estimated emission reduction for fossil fuel substitution by the organic waste-fed system is 1.21 tCO_2, it is assumed that 80% of the urban users use fossil fuel as their primary fuel for cooking purposes. This means that an emission reduction of 2.01 tCO_2[40] is assumed for the organic waste-fed systems. Given a total of 6,000 organic waste-fed systems foreseen in this CPA, and given the same assumption and reasoning as described above, this amounts to total emission reductions of 6,030 tCO_2e per year in the first crediting year and 12,060 tCO_2e per year each following year.

The actual ratio of urban users using NRB and fossil fuels respectively for cooking will be determined ex-post through surveying. It will be ensured that the total amount of biodigester implemented under the CPA meets the limits defined by the methodology and micro-scale additionality guidelines.

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2013	26,844	161	1,182	25,501
2014	53,687	321	2,363	51,003
2015	53,687	321	2,363	51,003
2016	53,687	321	2,363	51,003
2017	53,687	321	2,363	51,003
2018	53,687	321	2,363	51,003
2019	53,687	321	2,363	51,003
Total	348,967	2,087	15,362	**331,519**
Total number of crediting years	7			
Annual average over the crediting period	49,852	298	2,195	47,360

D.7. Application of the monitoring methodology and description of the monitoring plan

D.7.1. Data and parameters to be monitored

The following tables provide an overview of the parameters that will be monitored:

Data / Parameter	**N**
Unit	[units]
Description	Number of biogas systems commissioned
Source of data	CME database

[39] The reasoning is that the first biodigester commissioned on day 1 of the first crediting year will generate the full emission reduction of 9.73 tCO_2e, while the biodigester commissioned on day 365 of the first crediting year will generate no emission reductions.

[40] Calculated as follows: ((5.22*0.2)+(1.21*0.8)). Due to rounding, the result is 2.01 tCO_2e.

Value(s) applied	*Ex-ante* estimate of the number of biogas digesters to be installed based on the CPA implementer's projections.

Type / **Date**	*Manure-fed*	*Organic waste-fed*
Jan. – March 2013	1,000	1,500
Apr. – June 2013	1,000	1,500
Jul. – September 2013	1,000	1,500
Oct. – December 2013	1,000	1,500
Total	**4,000**	**6,000**

Measurement methods and procedures	The unique GPS coordinates of each installation will be recorded upon commissioning and entered into the electronic database, with clear divisions between CPAs.
Monitoring frequency	Annual
QA/QC procedures	On commissioning of the biogas system the unique GPS coordinates of each digester will be recorded, and entered into an electronic database, with clear divisions between CPAs.
Purpose of data	Calculation of baseline emissions, project emissions and leakage
Additional comment	Completed as part of the Commissioning Protocol on a continual basis as and when new biogas digesters are added to the programme. Annual record checks will be carried out.

Data / Parameter	$\mathbf{n_{k,y}}$
Unit	%
Description	Operational rate of the thermal applications installed
Source of data	CME database
Value(s) applied	100
Measurement methods and procedures	The CME's database collects a number of key data concerning each implemented biogas system. This includes annual checks of whether the installed biogas system is operational, based on sampling.
Monitoring frequency	Annual
QA/QC procedures	The operational rate of thermal applications will be monitored annually using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4).
Purpose of data	Calculation of project emissions
Additional comment	Completed as part of the Monitoring Survey

Data / Parameter	$\mathbf{Displacement_{NRB}}$
Unit	Not applicable
Description	Confirmation of the displacement or substitution of the non-renewable woody biomass at each location.
Source of data	Annual survey based on sample
Value(s) applied	
Measurement methods and procedures	Through an annual Monitoring Survey, the CPA implementer will ask users if their consumption of firewood has changed since the installation of a biodigester, and if so, by how much.
Monitoring frequency	Annual
QA/QC procedures	This will be monitored annually using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4).
Purpose of data	Not applicable
Additional comment	Completed as part of the Monitoring Survey

Data / Parameter:	**$HG_{p,y}$**
Data unit:	Number
Description:	Quantity of thermal energy generated by the new renewable energy technology in the project in year *y* (TJ)
Source of data:	Annual monitoring survey based on sample
Value(s) applied	Not applicable
Measurement methods and procedures:	As per AMS-I.E., monitoring shall include the amount of thermal energy generated by the new renewable energy technology in the project in year y. This parameter only needs to be monitored in CPAs where B_y is determined from the thermal energy generated in the project activity.
Monitoring frequency:	Annual
QA/QC procedures:	This will be monitored annually using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4).
Purpose of data	Calculation of baseline emissions
Additional comment:	This monitored parameter is not applicable since this parameter only needs to be monitored in CPAs where B_y is determined from the thermal energy generated in the project activity.

Data / Parameter:	**$BS_{k,y}$**
Data unit:	Tonne
Description:	The net quantity of renewable biogas consumed by the thermal application *k* in year *y*
Source of data :	Measurement campaign
Value(s) applied	Not applicable
Measurement methods and procedures:	In accordance with the monitoring requirements of AMS-I.I, at least five campaigns per digester type shall be carried out in each year of the crediting period. Continuous measurement made for at least one month at a single digester is considered as a campaign.
Monitoring frequency	Annual
QA/QC procedures to be applied:	Shall be monitored in accordance with AMS-I.I (version 4.0)
Purpose of data	Calculation of baseline emissions
Any comment:	Only applicable if the CPA chooses **not** to apply a default value for **$BS_{k,y}$** following paragraph 14 of AMS-I.I (version 4.0). If **$BS_{k,y}$** shall be monitored the requirements stipulated in Table 1 of paragraph 14 of AMS-I.I (version 4.0) shall be applied.

Data / Parameter	**MCF_j**
Unit	%
Description	Methane conversion factor for each manure management system j
Source of data	Baseline survey completed on commissioning of installations
Value(s) applied	44.9 (MCF of 44.9% is the result of the multiplication of baseline manure handling methods and respective MCFs: ((0.33*0.04)+(0.67*0.65))
Measurement methods and procedures	Upon commissioning of the biogas system, users will be asked to take part in a Manure Management Survey, as part of the baseline survey. Questions regarding the exact manure management practice applied prior to the biogas system usage will be included, based on IPCC terminology. A randomly selected sample of these will serve to establish MCF_j *ex-post*.
Monitoring frequency	Ongoing
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions

Additional comment	Will not be monitored continually, but only assessed once on commissioning of the biogas system through the Baseline Survey.

Data / Parameter	**$MS\%_{BL,j}$**
Unit	Number
Description	Fraction of manure handled in the baseline animal manure management system *j*
Source of data	Baseline survey completed on commissioning of installations
Value(s) applied	1, dairy cows
Measurement methods and procedures	Upon commissioning of the biogas system, users will be asked to take part in a Manure Management Survey, as part of the baseline survey. Questions regarding the type of livestock handled will be included. A randomly selected sample of these will serve to establish $MS\%_{BL,j}$ *ex-post.*
Monitoring frequency	Annual
QA/QC procedures	This parameter will be established using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4).
Purpose of data	Calculation of baseline emissions
Additional comment	Will not be monitored continually, but only assessed once on commissioning of the biogas system through the Baseline Survey

Data / Parameter	**OP_{hours}**
Unit	Hours
Description	The average annual hours of operation of a system using survey methods.
Source of data	Annual monitoring survey
Value(s) applied	
Measurement methods and procedures	As part of the monitoring survey, households/communities/SMEs will be asked the average annual hours of operation of the installed biogas stoves.
Monitoring frequency	Annual
QA/QC procedures	All data will be recorded alongside the unique GPS coordinates of the digester installations. This will be monitored annually using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4).
Purpose of data	Not applicable
Additional comment	Completed as part of Monitoring Survey

Data / Parameter	**$N_{da,y}$**
Unit	Number
Description	Number of days animal is alive in farm in year *y*
Source of data	Annual Monitoring Survey
Value(s) applied	365 (this value will be used for ex-ante calculation purposes, the real data will be determined through annual surveys and be verified in the ERs verification process of the CPA)
Measurement methods and procedures	Will be monitored on a sampling basis.
Monitoring frequency	Annual
QA/QC procedures	The number of days animals are alive will be monitored annually using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4).

Purpose of data	Calculation of baseline emissions
Additional comment	This survey will be carried out annually.

Data / Parameter	$\mathbf{N_{p,y}}$
Unit	Number
Description	Number of animals produced annually of type LT for the year *y*
Source of data	Annual Monitoring Survey
Value(s) applied	Different values have been applied from the baseline survey.
Measurement methods and procedures	Will be monitored on a sampling basis.
Monitoring frequency	Annual
QA/QC procedures	The number will be monitored annually using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4)
Purpose of data	Calculation of baseline emissions
Additional comment	This survey will be carried out annually.

Data / Parameter	$\mathbf{N_{LT,y}}$
Unit	Number
Description	Annual average number of animals of type LT in year *y* (population)
Source of data	Annual Monitoring Survey
Value(s) applied	3 (this value will be used for ex-ante calculation purposes, the real data will be determined through annual surveys and be verified in the ERs verification process of the CPA)
Measurement methods and procedures	For annual monitoring purposes, a count of the number of animals in category LT in year *y* will be performed.
Monitoring frequency	Annual
QA/QC procedures	This will be monitored annually using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4).
Purpose of data	Calculation of baseline emissions
Additional comment	This survey will be carried out annually.

Data / Parameter	$\mathbf{WST_{generation,\ y}}$
Unit	Tonne
Description	Amount of waste/animal manure generated on the farm in year *y*
Source of data	Manure Management Survey, performed as part of the annual Monitoring Survey
Value(s) applied	
Measurement methods and procedures	The amount of animal waste generated by livestock shall be calculated as the product of the number of animals in the household/community/SME and the default VS values as per 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Monitoring frequency	Annual
QA/QC procedures	The number of livestock will be monitored annually using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4).
Purpose of data	Not applicable
Additional comment	This survey will be carried out annually.

Data / Parameter	$WST_{fed, y}$
Unit	Tonne
Description	Amount of waste/animal manure fed into the system
Source of data	Manure Management Survey, performed as part of the annual Monitoring Survey
Value(s) applied	
Measurement methods and procedures	The parameter will be established during an annual Monitoring Survey, where customers will be asked what percentage of their animals manure they feed into the biogas digester. On commissioning users will be shown how to record the quantity of manure deposited into the system. Users will be provided with a bucket and required to tally the number of buckets of manure loaded into the system on a check sheet as a record. The total manure fed to the digester will be limited by the capacity of the digester.
Monitoring frequency	Annual
QA/QC procedures	This will be monitored annually using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4).
Purpose of data	Not applicable
Additional comment	This survey will be carried out annually.

Data / Parameter	**Soil application**
Unit	-
Description	The proper soil application of the final sludge. Sludge should be handled aerobically to ensure no methane emissions result.
Source of data	Manure Management Survey, performed as part of the annual Monitoring Survey
Value(s) applied	
Measurement methods and procedures	Will be monitored on a sampling basis.
Monitoring frequency	Annual
QA/QC procedures	On commissioning of biodigester systems, users will be provided with training as to the proper application of sludge to soil to avoid methane emissions. The application of soil will be surveyed annually using sampling methods to satisfy a 90/10 precision/confidence, following the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4). in accordance with CDM requirements.
Purpose of data	Not applicable
Additional comment	This survey will be carried out annually.

Data / Parameter	GWP_{CH4}
Unit	Number
Description	Global Warming Potential of methane
Source of data	IPCC
Value(s) applied	25
Measurement methods and procedures	Not applicable
Monitoring frequency	Annual
QA/QC procedures	Not applicable
Purpose of data	Calculation of baseline emissions, project emissions and leakage
Additional comment	All future emission reductions and removals shall be calculated using the global warming potentials (GWPs) adopted by the Conference of the Parties serving as the meeting of the Parties at its seventh session, in

	accordance with decision 4/CMP.7 and EB 69, Annex 3. This decision references the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) as the source to be used for GWPs during the second commitment period of the Kyoto Protocol.

D.7.2 Description of the monitoring plan

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The monitoring procedures and sampling plan for the PoA is in-line with the procedures outlined in paragraph 18 of the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4), which refers to the *Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 5):

- *a) Sampling design*
  - *(i) Objectives and Reliability Requirements*
  - *(ii) Target population*
  - *(iii) Sampling method*
  - *(iv) Sample size*
  - *(v) Sampling frame*
- *b) Data to be collected*
  - *(i) Field measurements*
  - *(ii) Quality Assurance/Quality control*
  - *(iii) Analysis*
- *c) Implementation plan*
- *d) Data Storage*

The above criteria are elaborated in the forthcoming paragraphs.

a) Sampling Design

(i) Objectives and Reliability Requirements

The objective of the sampling effort will be to meet the monitoring requirements set forth in the methodologies AMS-III.R (version 2), AMS-I.I (version 4). and AMS-I.E (version 4). In accordance with the requirements set forth in the respective methodologies, the sample size will be selected following a 90% confidence interval and a 10% margin of error (90/10) where applicable. Monitoring will be carried out on an annual basis. As the PoA progresses and the number of CPAs increases, the sampling plan can apply to a group of CPAs as referred to in paragraph 20 of EB 69, Annex 4. This will be applicable to CPAs that have installed similar types of biogas digesters and there is no wide disparity between the income levels of users

All monitoring shall be coordinated by the CME, SimGas IP BV.

(ii) Target Population

The target population for the application of monitoring procedure will be the households/SMEs/communities in which biogas systems have been installed, as identified through the centralised record-keeping database managed by the CME.

(iii) Sampling method

The sampling method and the desired precision/expected variance are outlined in Part II. section B.7.2. of the PoA-DD.

(iv) Sample size

The formula and method for calculating the sample size is outlined in Part II. section B.7.2. of the PoA-DD.

(v) Sampling frame

The sampling frame is outlined in Part II. section B.7.2. of the PoA-DD.

b) Data to be collected

(i) Field measurements

Field measurement objectives and data to be collected are listed Part II. section B.7.1. of the PoA-DD. The parameters to be monitored within each CPA will depend on the methodologies applied, as outlined below. A weighted-average approach will be applied based on the population sizes of the sampled clusters.

AMS-I.E (version 4):

1. Yearly check by sampling (90/10) if the biogas systems are still operating.
2. Yearly check through a survey that non-renewable biomass previously used by those that start using a digester, is not now used by other households/SMEs/communities that previously used renewable biomass.
3. Confirmation that non-renewable biomass is displaced or substituted at the users included under 1 above.

Where AMS-I.E applies, operational data that installed systems are still in use will be. These data will be collected through a biogas data logger which checks if the gas is flowing in a set time interval, or through a survey to check that the systems are operational, conducted via sampling. Through a Monitoring Survey users will be asked how much biomass is used for cooking after the installation of the biodigesters. Leakage under AMS-I.E is to be calculated in accordance with the guidance provided by AMS-I.E version 4, paragraph 10.a: " *B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required."*

AMS-I.I (version 4)

4. Yearly check by sampling (90/10) if the biogas systems are still operating.

Where AMS-I.I applies, , an annual check that the biogas system is still operating will be conducted.

AMS-III.R (version 2)

5. Estimating the average annual hours of operation of a system using survey methods
6. Annual recording of operating systems using survey methods
7. Survey methods are used to determine the annual average animal population (NLT), the amount of waste/animal manure generated on the farm and the amount of waste/animal manure fed into the biogas system.
8. The proper soil application (not resulting in methane emissions) of the final sludge verified on a sampling basis.
9. The baseline manure handling practice at a sample of biodigester users. These exact data will substitute MCF_j and $MS\%_{Bl,j}$ currently estimated in the SCC-CPA-DD.

Where AMS-III.R applies, operational data that installed systems are still in use will be collected. These data will be collected through a biogas datalogger which checks if the gas is flowing in a set time interval, or through a survey to check that the systems are operational, conducted via sampling. Average annual hours of operation will be determined through asking users how many days a year they use the biodigesters, and for how many hours per day, on average, they cook using biogas. Through a Manure Management Survey, part of the Monitoring Survey, the CME will also ask users to estimate their annual average animal population, as well as to estimate the quantity of manure generated on the farm and the quantity fed into the system. Users will also be asked to detail the methods used to apply the final sludge to soil.

Upon sale of the biodigester installations, and associated accessories, the user will sign a Sales Contract, and upon commissioning, a Commissioning Protocol, as detailed in Part I. section Cof the PoA-DD. The sales and commissioning persons shall be responsible for ensuring that all data are complete and accurate within respective documents. Hard copies of both documents will be kept at the office of the CME, and all data entered into a central record keeping database.

The record keeping database will be used to record the results of all monitoring, thereby avoiding double counting, with all data stored to be kept for at least two years after the crediting period or the last issuance of CERs for the project activity.

(ii) Quality Assurance/Quality control

Training will be given to staff responsible for the data collection system on the management system to be put in place as part of the overall PoA. This will include:

- Data to be recorded in the database (as per Part I. section Cof the PoA-DD) and how to complete the sales contract and installation record correctly;
- How to identify the GPS coordinates of a biogas system;
- How to fill out and where to submit copies of the sales contract, installation records and invoice and any associated documentation;
- Procedure for dealing with a change in address or capacity of a biogas system;
- Monitoring procedures, in accordancePart I. section C. of the PoA-DD.

In order to ensure that no methane emissions result from the application of slurry to soils under AMS-III.R staff will also receive training to be passed to biogas digester users during commissioning. This includes specifications that the slurry, once removed from the biogas digester, must be stored in a reservoir of less than 1 m in depth[41].

On completion of training, trained staff will receive a letter confirming their attendance. The name, company and contact details of all attendees will be recorded as part of the CME's PoA database. This will be used to confirm that the training has been completed and that staff is qualified to carry out the data collection as required under the PoA.

In order to minimise errors, a quality control and assurance strategy plan will be established. This strategy includes a planning phase in which there is a clear definition of the target population, of the issues and variables to be investigated, of the sampling frame and sample size, a distribution and random sample selection in the different strata of the population, and the design of a questionnaire that reflects the objectives of the survey and facilitates field operations and information processing. The team who will carry out the sampling survey will be appropriately selected to have previous field experience in performing similar surveys.

In order to minimise errors, all personnel conducting field measurements, both for the collection of baseline data and annual monitoring of CPAs, on behalf of the programme will receive training on the procedures to be used for data collection, including the format in which data should be collected, project background, basic functioning of the biogas systems, the application of slurry to soil and any other relevant project background. Response rates will be maximised by contacting all randomly-selected biogas system users beforehand to arrange a practical site visit date and sampling over the minimum required number to compensate for any non-responses. In cases where participants refuse to participate in the monitoring, the reason shall be documented in the CME's programme database. The CME 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 household/SME/community. The programme database will have a provision for recording any monitoring carried out in reference to the GPS coordinates of the installed system.

Calibration of the data logger

Prior to field dispatch of the data logger, the equipment will be checked for minimum flow sensitivity. This check ensures that the data logger functions properly and has sensitivity suitable for use in conjunction with low-flow biogas appliances. When the data logger is commissioned and each time the batteries are replaced, the software is initialised. Initialisation is carried out using the custom application developed for data collection, which runs on a mobile phone and communicates with the data logger by means of near field communication. During initialisation, the application recalibrates the data logger's internal real-time clock (RTC) to match that of the mobile phone. The

[41] Exceeding these parameters is assumed to result in methane emissions as specified in AMS-III.R.

data logger will continue to keep track of time and correlate biogas usage data to specific dates using the RTC. The RTC has its own power source to keep track of time even if the batteries in the data logger die, but the initialisation process provides an extra calibration process to ensure that the RTC is accurate.

(iii) Analysis

Data will be used for the preparation of monitoring reports for each CPA or a group of similar CPAs. The results of all monitoring will be entered into the CME's management database. Where it is found that an installed biogas digester is no longer in use, the installation will be removed from inclusion in the CPA.

c) Implementation plan

SimGas IP BV is responsible for the production of annual monitoring reports, following the criteria outlined in Part II. section B.7 and B.7.1. Sampling will be carried out following *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* (EB 69, Annex 4) in accordance with CDM requirements. A precision/confidence of 90/10 will be applied, in accordance with the requirements of the methodologies above.

All sampling efforts will be conducted by qualified personnel who have undergone training as part of the programme. They will be issued with a certificate confirming their attendance at any training and their qualification to complete the monitoring. A paper copy of the certificate will also be kept by the CME. Any samplers will be required to speak the native language(s) in which biogas systems have been implemented, allowing for full understanding of any responses given by users, and any questions therein.

The first sampling effort for each CPA shall be carried out one year after inclusion in the PoA, and each subsequent year thereafter. If sampling is to be carried out for a group of CPAs, monitoring may be carried out any time before the annual deadline for each CPA to be included in the sampling effort, and should be conducted annually thereafter. The date of all monitoring shall be recorded in the CPA database.

d) Data Storage

The baseline data collection for the three applicable methodologies is as follows:

- Baseline data for AMS-I.E will be established for each household/SME/community *ex-ante* on the CPA level. This will be gathered through data collected from official baseline surveys, reports or statistical databases.
- Baseline data for AMS-I.I. presented in the respective CPA-DDs will be estimated *ex-ante* through data collected from official baseline surveys, reports or statistical databases.
- Baseline data for AMS-III.R presented in the respective CPA-DDs will be estimated *ex-ante* through data collected from official baseline surveys, reports or statistical databases, but will be confirmed *ex-post* through a Manure Management Survey, which will be performed upon commissioning at the users. A randomly selected sample of these will serve to establish MCF_j *ex-post.*

Quality control procedures and sampling efforts conducted by the qualified personnel are outlined in Part II. section B.7.2. of the PoA-DD.

In accordance with the requirements set forth in the respective methodologies, where applicable the sample size will be selected following a 90% confidence interval and a 10% margin of error (90/10).

SECTION E. Approval and authorization

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The National Environment Management Authority of Kenya issued a Letter of Approval for the SimGas Biogas Programme of Activities and this CPA on the 25th of June 2012.

The Federal Environmental Agency of Germany issued a Letter of Approval for SimGas Biogas Programme of Activities and this CPA on the 22nd June 2015.

The Ministry of Infrastructure and the Environment of the Netherlands issued a Letter of Approval for the SimGas Biogas Programme of Activities and this CPA on the 3rd of August 2012.

Appendix 1. Contact information of CPA implementer(s) and responsible person(s)/ entity(ies) for completing the CDM-SSC-CPA-DD-FORM

CPA implementer and/or responsible person/ entity	☒ CPA implementer(s) ☐ Responsible person/ entity for completing the CDM-SSC-CPA-DD-FORM
Organization	SimGas Tanzania Ltd
Street/P.O. Box	368 Msasani Road, P.O. Box 3016
Building	Oyster Bay Office Complex Block B, 3rd Floor,
City	Dar es Salaam
State/Region	-
Postcode	-
Country	Tanzania
Telephone	+255 684 800 125
Fax	-
E-mail	mirik@simgas.com
Website	http://www.simgas.com/
Contact person	Mirik Castro
Title	CEO
Salutation	Mr.
Last name	Castro
Middle name	-
First name	Mirik
Department	-
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	mirik@simgas.com

CPA implementer and/or responsible person/ entity	☐ CPA implementer(s) ☒ Responsible person/ entity for completing the CDM-SSC-CPA-DD-FORM
Organization	Climate Focus BV
Street/P.O. Box	Sarphatikade
Building	13
City	Amsterdam
State/Region	Noord Holland
Postcode	1017 WV
Country	The Netherlands
Telephone	+31202611030
Fax	N/A
E-mail	a.korthuis@climatefocus.com
Website	climatefocus.com
Contact person	Adriaan Korthuis

Title	Director
Salutation	Mr.
Last name	Korthuis
Middle name	-
First name	Adriaan
Department	-
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	-

Appendix 2. Affirmation regarding public funding

Hivos
people unlimited

The Hague, 2 May 2012

Dear Sir/Madam,

Hivos is considering to support the SimGas Biogas Programme of Activities in East Africa, and SimGas Programme of Activities, Kenya (CPA KE1), through African Biogas Partnership Programme (ABPP).

Hivos herewith affirms that the funding of this project does not result in a diversion of Official Development Assistance and that this funding is separate from and is not counted towards the financial obligation of concerned parties included in Annex I of UNFCCC.

Yours faithfully,

Ben Witjes
Director Programmes and Projects

Humanistisch Instituut voor Ontwikkelingssamenwerking
Humanist Institute for Co-operation with Developing Countries
Instituto Humanista para la Cooperación con los Países en Desarrollo
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Appendix 3. Applicability of methodology(ies) and standardized baseline(s)

Appendix 4. Further background information on ex ante calculation of emission reductions

No further background information provided

Appendix 5. Further background information on monitoring plan

No additional information. See Part I. section B.3. of the PoA-DD and Part II. section B.7.2. .

Appendix 6. Summary of post registration changes

Version	*Date*	*Description*
7.0	*13/10/2016*	Post-registration design changes made as follows: **Corrections:** Removal of requirement for serial numbers to be physically attached to digesters. This requirement had been included at registration of the PoA to avoid double counting. However, double counting is still avoided through: - Recording the unique GPS coordinates of each biogas digester - A programme logo physically attached to the biogas digester - The CME has an agreement in place with the owner of each individual biogas digester in which the owner transfers the rights to the emission reductions to SimGas IP BV. Removal of tracking quantity of manure fed into digester: corrected to remove the requirement for customers to record the quantity of manure fed into the biodigester everytime they feed it to establish parameter WST_{fed}. Given farmer's circumstances, it is practically unreasonable to expect them to tally this information every time they feed their digester. The parameter can therefore equally be established through a monitoring survey in which customers are asked what percentage of their animal's manure is fed into the biogas digester. Removal of capacity limit: Section A.3 of the CPA-DD has a statement that the CPA would "include biodigesters with capacities ranging from 0.5 m^3 to 16 m^3". However, there is no need for such a size boundary as long as each individual system remains below the micro-scale limit. This statement have therefore been removed. Removal of time induced limit: Section A.3 of the CPA-DD has been corrected to remove the requirement for only digesters implemented between 20/01/2013 to 20/01/2014 being eligible for inclusion in the CPA. The geographical boundary of the CPA is met through recording the address of all customers' at which the digester is installed, as well as the GPS coordinates. An additional time-induced boundary is not necessary MCF and temperature: The registered CPA-DD listed the temperatures per regions. For simplicity, this has been modified to use the MCF based on the national average temperature of 25.10C[42]. Debundling capacities mentioned in Section C (page 18) of the PoA-DD were not consistent, and have been corrected. **Permanent changes to monitoring plan***:* Update version of AMS-I.I from version 3.0 to version 4.0. Version 4.0 of the methodology allows the application of a default biogas generation rate of 0.13 Nm3.m3.day1 to be applied for BSk,y in regions where the annual average ambient temperature is higher than 20C.

[42] As evidenced by World Bank, *Climate Change Knowledge Portal*, Average Monthly Temperature for Kenya from 1990 – 2012 [online] Available from: http://sdwebx.worldbank.org/climateportal/index.cfm?page=country_historical_climate&ThisCCode=KEN . See also temperature analysis file 'World Bank Temp Data 10 year', cell A220