Programme design document form for small-scale CDM programmes of activities

(Version 03.0)

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

PROGRAMME DESIGN DOCUMENT (PoA-DD)	
Title of the PoA	African Biogas Carbon Programme (ABC)
Version number of the PoA-DD	07
Completion date of the PoA-DD	29/10/2015
Coordinating/ managing entity	Hivos
Host Party(ies)	Kenya, Tanzania, Uganda
Sectoral scope(s) and selected methodology(ies), and where applicable, selected standardized baseline(s)	Scopes: 1: Energy industries (renewable - / non-renewable sources) and 15: Agriculture Methodology: Gold Standard's 'Technologies and practices to displace decentralized thermal energy' (11/04/2011)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

African Biogas Carbon Programme (ABC)

Version: 07
Date: 29/10/2015

A.2. Purpose and general description of the PoA

Policy/measure or stated goal that the PoA seeks to promote
The purpose of this small-scale Programme of Activities (PoA) is to stimulate the use of biogas systems in Africa (initially focusing on East Africa) to replace traditional thermal energy generation methods. The PoA will be able to encompass all types of biogas systems, depending on the supplier and the user of the biogas, serving both domestic and institutional users.

Biogas digesters produce biogas from human, animal or plant waste products that can be used in cooking and heating replacing the use of non-renewable biomass (NRB), either firewood or charcoal. NRB when used in the production of thermal energy produces greenhouse gas (GHG) emissions, particularly carbon dioxide. By switching from NRB to biogas, which is a renewable fuel, the PoA reduces GHG emissions.

The mission of this PoA is to make biogas systems affordable and available to households and institutions across Africa, especially for low and medium income households. This will be done by providing a carbon market access service to Voluntary Project Activity (VPA) implementers to help them overcome barriers to disseminating biogas systems in the host countries.

Confirmation that the PoA is a voluntary action by the CME
Each of the host countries under the PoA is actively promoting the development of biogas as an alternative modern energy source. There are no laws or mandatory requirements in Africa stipulating the adoption of biogas systems by households or institutions, nor their dissemination. This proposed PoA is a voluntary action by the CME, Hivos.

Contribution to sustainable development
According to the International Energy Agency (IEA)[1], over 1.3 billion people live without access to electricity (over 20% of the global population) and about 2.6 billion people live without clean cooking facilities (roughly 40% of global population). More than 95% of these people are either in sub-Saharan Africa or developing Asia and 84% are in rural areas. The PoA will meet the sustainable development criteria of each of the host countries by achieving the following sustainable development benefits:

Environmental:

- Reducing deforestation and forest degradation. This contributes to the overall stability of forest ecosystems, which support biodiversity and watersheds.
- Reducing greenhouse gas (GHG) emissions

[1] International Energy Agency (2014) *Energy Poverty* [online] Available at: http://www.iea.org/topics/energypoverty (accessed 15 February 2014).

- Reducing the need for artificial fertilisers and improving soil conditions where digester slurry is applied to agricultural land.[2]

Social

- Reducing respiratory illness caused by indoor-air-pollution[3]
- Reduction of injuries occurring in unsafe kitchen environments
- Reduction in time spent cleaning pots and the kitchen
- Improvement of hygiene through toilet attachments reducing bad odours from manure

Economic

- Reducing time/money spent obtaining biomass for cooking
- Increasing employment opportunities in the biogas industry
- Improving crop yields and diversity through use of bio-slurry produced by the digester

A.3. CMEs and participants of PoA

Hivos is the Coordinating/Managing Entity (CME) for this PoA. As such, it will coordinate the efforts from different Voluntary Project Activity (VPA) implementers to install biogas systems in Africa and comply with the requirements of this PoA. The VPA implementers will not be Project Participants to this PoA.

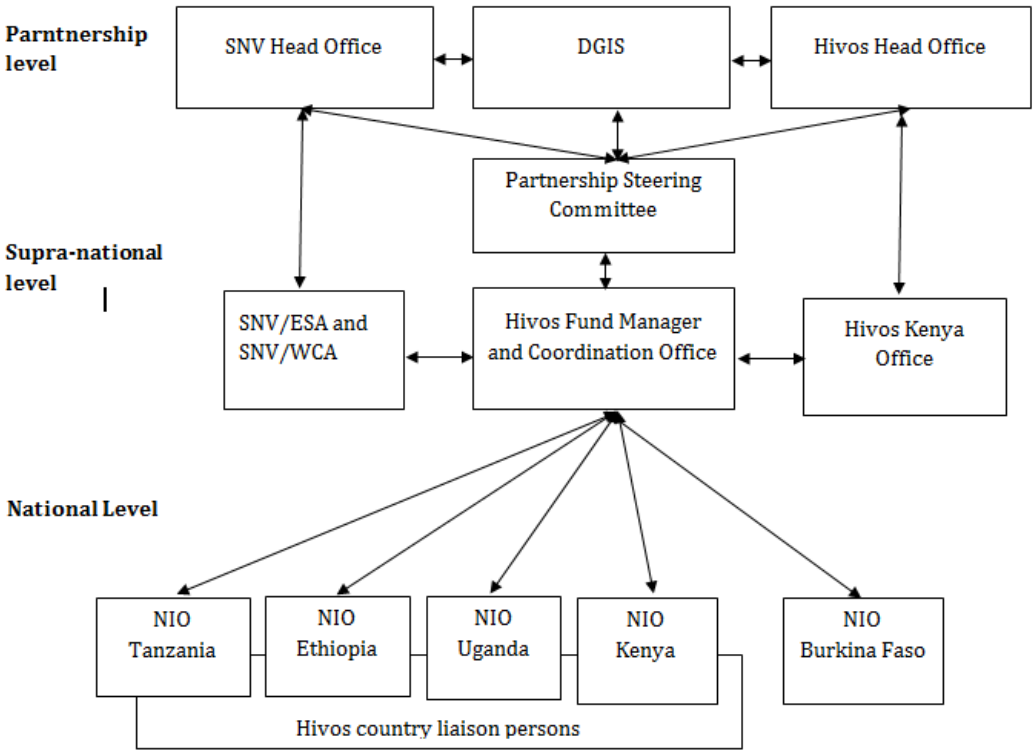

Figure 1: Organisational structure of the PoA for the Africa Biogas Partnership Programme. Includes relationship to the National Implementing Organisations (NIOs). DGIS = Directorate-General for International Cooperation; ESA = East and Southern Africa; WCA = West and Central Africa.

[2] Lukehurst, C.T., Frost, P. and Al Seadi, T (2010) 'Utilisation of digestate from biogas plants as biofertiliser'. IEA Bioenergy.

[3] World Health Organization (2007) 'Indoor Air Pollution - National burden of Disease Estimates'. Geneva.

During implementation, the CME for this PoA will be responsible for:

- Issuing and revoke the authorisation of included VPAs
- Providing technical and administrative support to VPAs to guarantee the compliance of their activities and their record keeping with the PoA's requirements
- Drafting VPA-DDs (if agreed with the VPA Implementer)
- Communicating with the Gold Standard Secretariat as required under the PoA
- Mediating VER agreements with VPAs Implementers
- May manage the execution of VER sales agreements and the distribution of the benefits if requested by individual VPAs
- Supervising the monitoring activities and data management practices of VPA Implementers during the lifetime of the PoA
- Being the focal point for VER issuance

Each VPA Implementer will act individually, requesting authorisation for its VPA(s) from the CME and running the project in accordance with the demands of the local market. VPA Implementers will be involved with the dissemination of biogas systems that are sold on a commercial or a non-commercial basis. Typical VPA Implementers will either be organisations that manufacture biogas systems and disseminate them, potentially through a supply chain. Alternatively VPA Implementers may be organisations that co-ordinate support for biogas systems to be installed. VPA Implementers will have the necessary technical and administrative resources to ensure technical compliance to the PoA requirements of the biogas systems sold, as well as accurate and complete record keeping.

During implementation, each VPA Implementer for this PoA will be responsible for:

- Ensuring compliance with PoA requirements to become an authorised VPA Implementer
- Overseeing the dissemination of biogas systems
- Ensuring all the participants in the distribution chain are aware that the sales are subscribed to the PoA and are trained to comply with the requirements
- Conducting annual monitoring within the VPA and producing annual Monitoring Reports in accordance with the requirements of the VPA
- Hiring a Designated Operational Entity (DOE) to verify the results of the annual monitoring effort and responding to any comments therein, unless otherwise agreed with the CME
- Keeping records of sales and users as per the monitoring plan and providing information to the CME regularly through the electronic database
- Keeping current with the Gold Standard requirements, as enforced by the CME
- Receiving audits and inspections to maintain authorisation status issued by the CME

VPA Implementers will be involved in the dissemination of biogas systems, and are encouraged by the CME to make biogas more affordable to users through the VER proceeds. Affordability will be stimulated as an increasing number of VPA Implementers become a part of this PoA and compete in the market for customer choice. The end users of the biogas will benefit from having a choice of high-quality biogas systems, added investment in marketing (awareness) and research and development of products that reduce deforestation and improve health by reducing indoor air pollution. The exact technology to be employed will vary depending on VPA Implementer and will be required to meet applicable national standards.

When purchasing the biogas system, the buyer will fill an agreement with the VPA Implementer that may contain, among others, information about the biogas system, model, price and payment, the name, location/address and phone number of the user (the Sales Agreement). This information will allow the identification and the monitoring of the system and its usage. VPA Implementers will be encouraged to undertake additional measures to keep in close contact with the buyer through for example, guarantee schemes on the biogas system, this will help to confirm that the biogas system is in use.

The VPA Implementer may use the VER proceeds to reduce the costs of biogas systems by providing a subsidy to customers, providing free or subsidised maintenance of the biogas systems

or to recoup the VPA Implementer's incurred associated costs, such as research and development, training and marketing. The exact usage of the revenues obtained from VERs will vary depending on the VPA Implementer.

A.4. Party(ies)

Name of Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Tanzania (host)	Hivos (private entity and CME)	No
Uganda (host)	Hivos (private entity and CME)	No
Kenya (host)	Hivos (private entity and CME)	No

Other host parties may be added in future.

A.5. Physical/ Geographical boundary of the PoA

The geographical region within which all VPAs included in this PoA will be implemented cover Tanzania, Kenya and Uganda. Other host countries may be added in future.

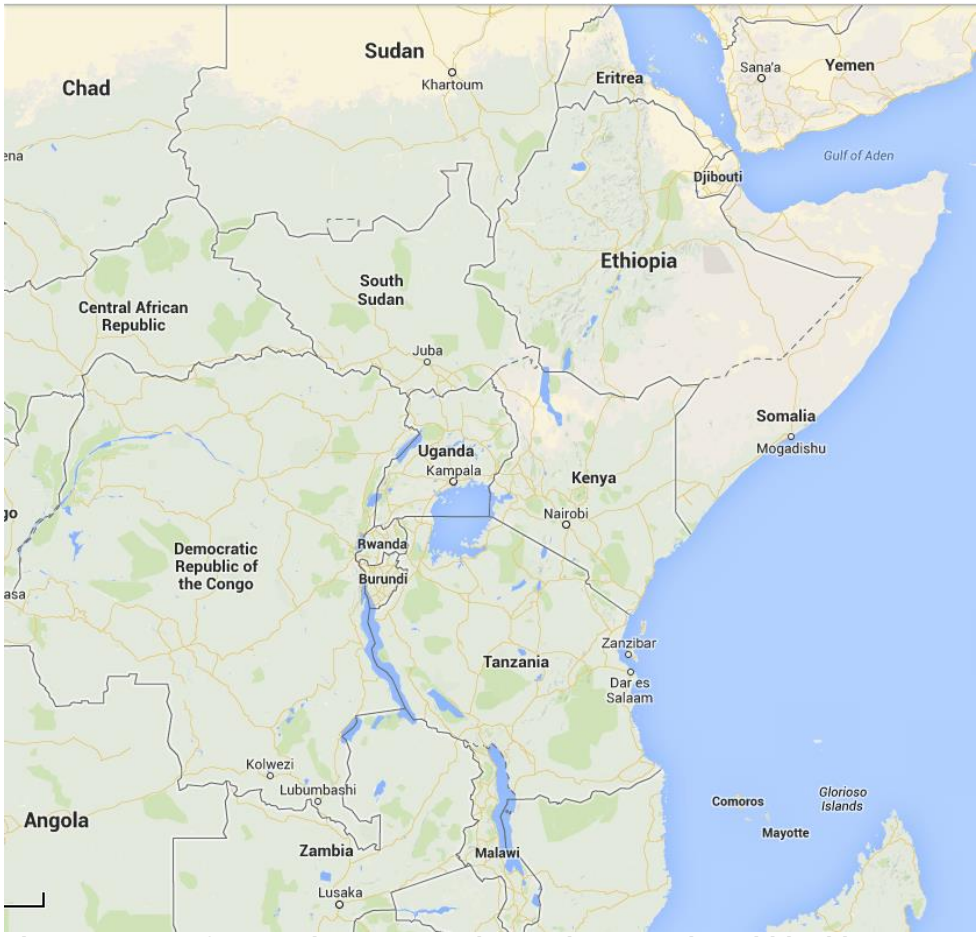

Figure 2: ***Map of Tanzania, Kenya and Uganda; countries within this PoA.***

A.6. Technologies/measures

Each VPA will encompass any of the different types of biogas systems covered by the PoA, depending on the VPA Implementer and the type of user of the system. The models of biogas systems covered by the PoA will vary depending on the VPA Implementer and the individual user's requirements. Details of the technology will be elaborated on VPA level. Each VPA Implementer will be required to ensure their technology meets any required standards in the respective host country. Currently there are no standards in the Host Countries. Biogas systems are constructed of materials that are readily available e.g. bricks, cement, plastic, piping and do not require any environmentally unsafe materials during either construction or operation.

The most common baseline for thermal energy use in households and institutions is firewood and charcoal, with more firewood being consumed in rural areas. These fuels are typically burned in inefficient processes such as the three stone fire or the traditional metal stove, such as the metal *sigiri* in Uganda or metal *jiko* in Kenya (**Figure 3**).

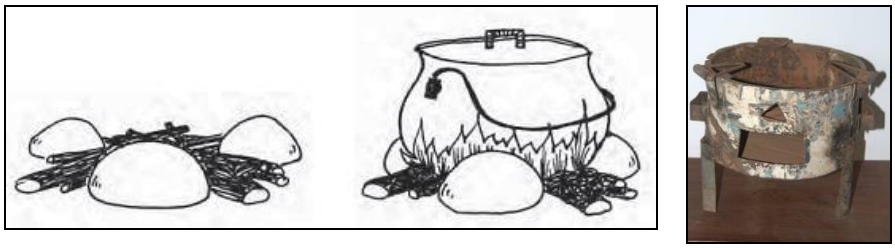

Figure 3: ***Three stone fire (left) and Sigiri, Ugandan charcoal traditional metal stove (right)***

Biogas systems in the host countries are a fuel switch from NRB. Biogas is a renewable fuel produced by waste products of humans, animals and/or plants by placing them in a digester under anaerobic conditions. Biogas is mostly made up of methane, which is combustible and enables biogas to be used as a fuel. The methane composition of biogas varies depending on the feedstock; typical values include 65% for cattle manure, 67% pig manure and 60% poultry manure.[4] The remainder of biogas is mostly carbon dioxide with other trace gases such as hydrogen sulphide. The biogas produced in a digester is then piped to be utilised in a variety of appliances depending on the needs of the users, e.g. biogas stoves. NRB, when used in the production of thermal energy, produces greenhouse gas emissions: particularly carbon dioxide. By switching from NRB to biogas the PoA will result in the reduction of GHG emissions.

The biogas digesters allowed in this PoA, include, but are not limited to, fixed dome, floating drums, flexible balloons and portable/fixed plastic biogas digesters. The preferred design for biogas digesters in East Africa is currently the fixed dome design. A general description of these technologies is given at PoA level below, but specific technological details will be given at VPA level.

Fixed Dome Digesters
Fixed dome digesters have been proven in several countries that the technology is robust, reliable and requires little maintenance. The size of these plants can range anywhere from 2 – 16 m^3.

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

[4] Page 36 -37, Nijaguna B.T., Biogas Technology, New Age International, 2002

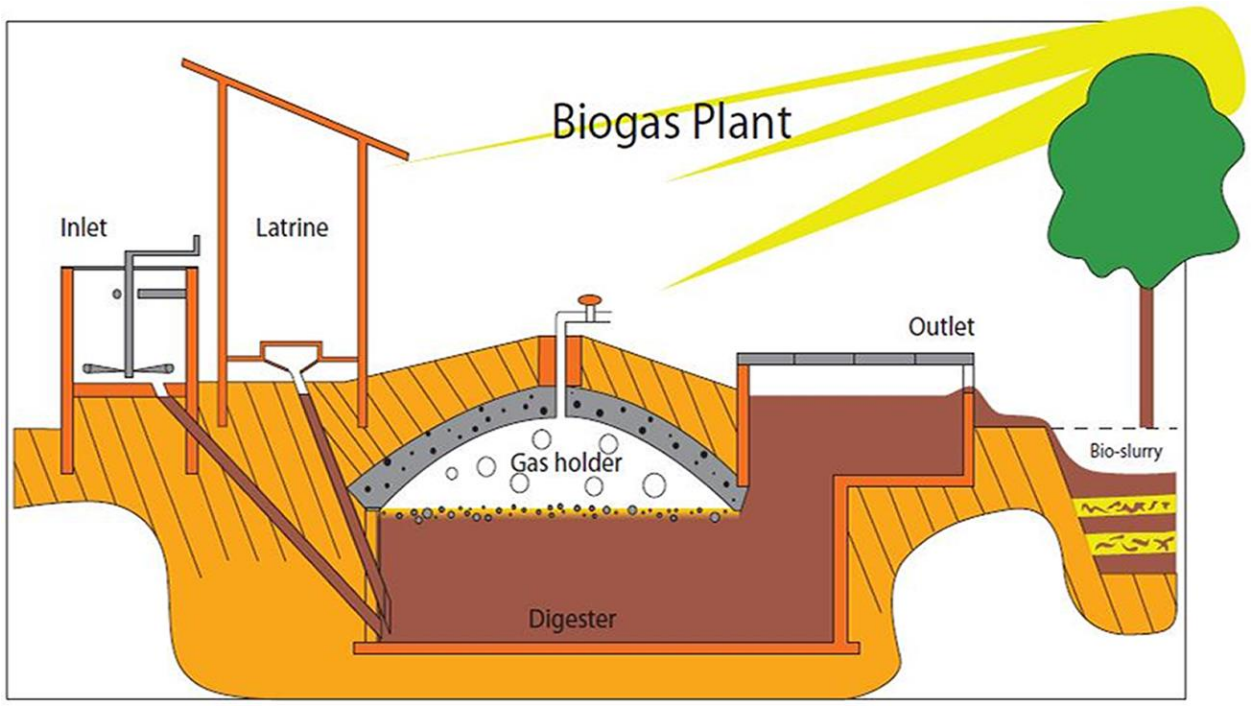

Figure 4: ***Schematic diagram of fixed dome digester***

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

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

Dome - The purpose of the dome is to collect the gas produced in the digester. This is typically plastered in several layers and painted with a special paint in order to minimise gas leakage. Gas accumulates under the dome creating pressure and pushing down the level of the slurry and consequently increasing the slurry level in the connected slurry tank. It is the difference in slurry levels between the slurry tank and the inside of the dome that maintains the pressure to push the gas into the outlet pipe. The outlet valve releases the collected gas under the dome to biogas appliances such as stoves or lamps.

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

Floating drum technology

The basic functioning of the floating drum digester is similar to the fixed dome. The key difference of this technology is a cylindrical or dome-shaped digester with a moving, floating gas-holder or drum that floats depending on the amount of gas in the digester. The gas-holder either floats directly in the digester slurry or in a separate water jacket. The drum in which the biogas collects will usually have an internal or external guide frame that provides stability and keeps the drum upright.

As biogas is produced and more gas is released, the drum is pushed up, indicating a rise in the amount of gas. When the gas is used up, the drum sinks. This provides a useful visual indicator of how much gas is available to users.

Costs of building/installing the floating drum type obviously depend upon the size, the materials used and the model of the digester. Floating drum digesters need some maintenance depending on how well they are managed. Maintenance involves cleaning, painting and fixing leaks.

The lifespan of these digesters vary widely, and is dependent upon the quality of materials used in construction, as well as management and maintenance. High quality, well-managed digesters can last for over 40 years, though there are some floating drums in disuse – largely because of poor management/maintenance. On the average, it is safe to say that floating drum digesters, if built with high quality materials and well managed, can give service of around 20-30 years, the same as fixed dome digesters providing cooking gas, lighting and fertiliser.[5]

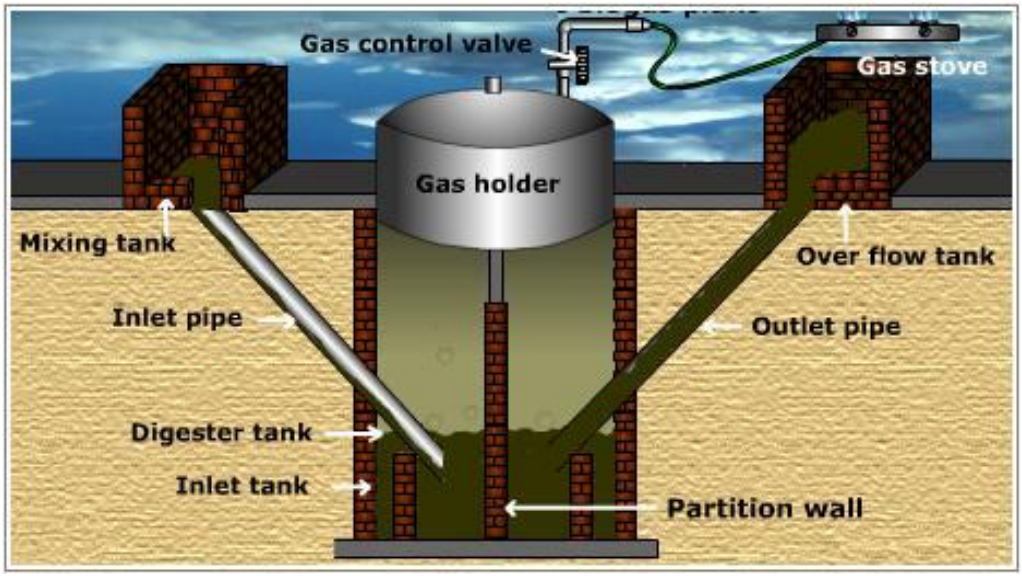

Figure 5: ***Floating drum biogas system***

Flexible Balloon Digesters

Flexible balloon digesters are constructed from a large plastic or rubber bag and are thus mobile, which is the main difference from the fixed dome and floating drum digesters that are constructed on site. The operation however follows largely the same principle as fixed-dome or floating drum digesters. The balloon material should be weather and UV resistant, specially stabilised reinforced plastic or rubber.

A balloon digester combines both the digester and gas-holder, with the biogas stored in the upper part of the balloon which expands as biogas is produced. The gas pressure can be increased by placing weights on the balloon, however a gas pump may be required if higher gas pressures are needed. Gas safety valves are required to control the pressure inside the balloon to avoid damaging the skin of the digester. The inlet and outlet for the digester are attached directly to the skin of the balloon.

The technology is flexible and allows for standard fabrication at low-cost and is suitable for use in areas with a high groundwater table. However, at low gas pressures a gas pump may be required; slurry cannot be removed during operation and the technology has a relatively short useful lifespan.

Rural/urban plastic biogas digesters

These biogas digesters have the same basic functioning as the above digester models, but are made of plastic, making them more portable and relatively quick and easy to install. Having a fixed plastic mould also allows for the quality of the biogas digesters to be more easily regulated. A

[5] www.tutorvista.com

number of different models currently exist on the market, including models from Kentainers[6] and SimGas[7].

Biogas Appliances

Appliances for the use of biogas can vary widely from stoves, lamps or generators. There will be no specific requirements under this PoA regarding appliances however it is expected that each VPA Implementer will ensure that all appliances, whether locally manufactured or imported, meet appropriate standards. This PoA will focus on the capacity and use of biogas overall to reduce NRB usage in cooking.

The above categorisation of biogas systems is only indicative, with further research and development expected to improve the system design, and completely new designs and models are likely to come onto the market. Details of technologies to be employed will be described at VPA level.

A.7 Public funding of PoA

Public funding is being provided by the Directorate General for International Cooperation (DGIS) of the Netherlands Ministry of Foreign Affairs through the Humanist Institute for Cooperation with Developing Countries (Hivos) as support for the process towards registration of the PoA e.g. validation cost, study support.

Official Development Assistance (ODA) is not being diverted to the implementation of the PoA as the Netherlands is not required to purchase any credits from this PoA as confirmed in the ODA Declaration Form provided to the DOE.

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

In accordance with the 'Gold Standard PoA Rules and Guidance – Annex F' (GS v2.2, Section 4), additionality must be demonstrated at both PoA and VPA level. Additionality of the PoA as a whole shall demonstrate that in the absence of carbon finance:

i. The proposed voluntary measure would not be implemented, or;
ii. The mandatory policy/regulation would systematically not be enforced and that non-compliance with those requirements is widespread in the country/region, or;
iii. That the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation or to a greater level of adoption of an existing voluntary scheme.

Additionality of the PoA as a whole will be demonstrated via option (i) above since there are no mandatory policies/regulations requiring the installation and use of biogas digesters in Africa. The 'Guidelines on the demonstration of additionality of small-scale project activities' (Version 09.0, EB 68, Annex 27), allows the demonstration of additionality via a barrier analysis, which is conducted below. The technical viability of small-scale biogas technology has been repeatedly proven in field tests and pilot projects, but until now mass dissemination of this technology has not been accomplished in Africa.[8] The following are seen as the main barriers:

[6] For more information see http://www.kentainers.com/

[7] For more information see http://www.simgas.nl/

[8] Page 25,Eshete, G et al., Report on the feasibility study of a national programme for domestic biogas in Ethiopia, 2006

Investment barrier

The baseline scenario in the host countries is the use of woodfuel to provide thermal energy requirements. Wood users tend to use the three stone fire method, meaning the technology is freely available and the fuel can be gathered or bought at relatively low cost. Charcoal users on a domestic level normally use unimproved cook stoves that can be bought for less than 5 USD.[9]

The cost of installing a fixed dome domestic biogas system ranges between 600 - 2,200 USD,[10] this initial cost is many times the cost of using the traditional appliances and presents a major barrier to households. Therefore, a financially more viable alternative (i.e. a three-stone fire or unimproved cookstove) to the project activity (a biogas digester) would have led to higher emissions.

Technological barriers

The technology that a biogas system will replace will typically be a three stone fire or metal charcoal stove. These baseline technologies are extremely simple and have a long history amongst the target market; and offer a less technologically advanced alternative to biogas. A biogas system, although relatively simple, is considerably more complicated than these baseline technologies and little prior knowledge exists in host countries on how to use and maintain a biogas digester over the long-term.

Many of the early-piloted biogas systems have fallen into disrepair due to lack of maintenance, this is normally due to a lack of local knowledge about how to properly maintain the systems.[11] The reputation of biogas systems has been damaged by these pilot plants as it is seen as a complicated, expensive technology that will not last. To overcome the challenges in the biogas market, VPA Implementers need to train local people to manufacture biogas digesters and be able to supply biogas appliances from either local manufacturers or importers. Being a new technology, training is a vital component for the smooth implementation. Masons, their supervisors, other staff and the biogas users will all receive appropriate training courses.

Conclusion

It has been demonstrated that in the absence of the programme, biogas technologies would not be implemented at scale. The baseline technology of a three stone fire or unimproved charcoal stove would lead to more GHG emissions than the project situation. These technologies are many times cheaper and simpler than a biogas system, which produces far lower GHG emissions.

Additionality of each VPA is demonstrated by the following:

1) Positive List[12]

Page 48, Winrock International, Report on the Feasibility for a National Household Biogas Commercialization Program in Uganda, 2007

Page 19-20, Gichohi, P., Analysis of the Market Potential for Domestic Biogas in Rural Kenya Supported by GTZ-PSDA, 2009

[9] Page 48, The World Bank, Household Cookstoves, Environment, Health, and Climate Change, A new look at an old problem, 2011

[10] The price varies according to the size and location..

[11] Pages 29-31, 58-59 and 71, Eshete, G et al., Report on the feasibility study of a national programme for domestic biogas in Ethiopia, 2006

Page 94, Winrock International, Report on the Feasibility for a National Household Biogas Commercialization Program in Uganda, 2007

Page 22-23, Gichohi, P., Analysis of the Market Potential for Domestic Biogas in Rural Kenya Supported by GTZ-PSDA, 2009

[12] As per the “Guidelines on the Demonstration of Additionality of Small-Scale Project Activities” Version 09, EB68 Annex 27 clause 2 (c)

Paragraph 2 (c) of the 'Guidelines on the Demonstration of Additionality of Small-Scale Project Activities', version 09 states that "*Project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the size of each unit is no larger than 5% of the small-scale CDM thresholds"* are part of the positive list of technologies that are defined as additional with no further need for demonstration. Biogas systems for thermal energy generation are isolated systems and will be below the 5% small-scale threshold (2.25MW thermal). The users of the systems are households, communities or SMEs.

All VPAs, and biogas units therein, are required to demonstrate that they meet the above criteria as part of the eligibility criteria outlined in B.2 below.

B.2. Eligibility criteria for inclusion of a VPA in the PoA

VPAs to be included under this PoA must meet the following requirements:

Nr.	Requirement[13]	Eligibility criteria	Evidence required
1.	The geographical boundary of the VPA including any time-induced boundary consistent with the geographical boundary set in the PoA	All biogas systems included in the VPA will demonstrate they fall within the geographical boundary of the PoA through: – Recording the address/location of the system in the Sales Agreement – Recording the GPS coordinates of the systems (not relevant for retroactive digesters) – Physically attaching a Programme or VPA logo to the digester which identifies it as being part of the African Biogas Partnership Programme on a national scale.	One of the following documents shall be provided: – Business plan – Implementation document – Contractual agreement between CME and VPA Implementer – Declaration from VPA implementer and confirmation check by CME – Sales Agreement
2.	Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations	The VPA shall demonstrate that it does not double-count any of its appliances for the ERs estimation by confirming that: – the complete address of each biogas system will be recorded – the biogas systems will have unique serial numbers attached (not relevant for the retroactive digesters) – the VPA implementer has	– Contractual agreement between CME and VPA Implementer. – Declaration from VPA implementer – Sales Agreement

[13] Requirements 1-12 are taken from EB65 Annex 3 paragraph 14. Requirement 13 is taken from EB47, Annex 29, paragraph 3. Requirement 14 is a CME requirement to ensure successful implementation of the VPA.

Nr.	Requirement[13]	Eligibility criteria	Evidence required
		not included these biogas systems in another VPA or carbon project.	
3.	The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications	The biogas systems disseminated are renewable energy generation units to provide thermal energy and will be required to conform to any applicable national standards.	The following documents shall be provided: – Technical documentation describing the operation of the biogas system. – Evidence of compliance with national standard (if applicable).
4.	Conditions to check the start date of the VPA through documentary evidence	The VPA implementer will demonstrate the start date of the VPA is on or after the start date of the PoA. The start date of the VPA will be defined as the date on which the first Sales Agreement is signed under the VPA.	– Sales Agreements and Project Database for the first digester included under the VPA.
5.	Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by VPAs	The VPA complies with the baseline and monitoring methodology requirements of the 'Technologies and Practices to Displace Decentralised Thermal Energy Consumption' (version 1.0). and should meet its eligibility criteria as discussed in Section B.3 of the PoA-DD.	The following documents shall be provided as evidence: – Electronic database – KPT reports – Sales Agreement
6.	The conditions that ensure that VPAs meet the requirements pertaining to the demonstration of additionality	The VPA will prove additionality as per the CDM´s approved ***Positive List***[14] 1. Biogas system rated capacity is less than 2.25MW_{th} each 2. Biogas systems are disseminated to households or communities or Small and Medium Enterprises (SMEs).	The following evidences shall be provided: 1. Calculation showing the capacity of the biogas system(s) in MW 2. Business plan / Implementation document
7.	The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis	1. The VPA, or a group of VPAs, organised a local stakeholder consultation (LSC) 2. The VPA, or a group of VPAs, got environmental clearance for the project related activities, if applicable.	The following documents shall be provided: 1. Local Stakeholder Report including comments of stakeholders and how the comments were taken into account by the VPA implementer 2. Environmental clearance letter and/or EIA if required

[14] As per the "Guidelines on the Demonstration of Additionality of Small-Scale Project Activities" Version 09, EB68 Annex 27 clause 2 (c)

Nr.	Requirement[13]	Eligibility criteria	Evidence required
			by national regulations
8.	Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance	VPAs will demonstrate that any Official Development Assistance received for the VPA has not occurred on the condition that the resulting credits are transferred to the donor country[15].	Verifiable evidence: – ODA Declaration
9.	Where applicable, target group (e.g. domestic / commercial / industrial, rural / urban, grid connected / off-grid) and distribution mechanisms (e.g. direct installation)	The VPA will demonstrate which target group(s) is/are to be targeted by the VPA and the distribution mechanism. Target groups shall include: – Households – Small/Medium Enterprises – Communities	Any of the following documents shall be provided: – Sales forecast – Marketing plan – description of technology (e.g. domestic or institutional biogas system) – Implementation document
10.	Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys	The VPA Implementer will agree to support the sampling and survey activities of CME in accordance with B.7.2 of the PoA-DD.	Contractual agreement between CME and VPA Implementer
11.	Where applicable, the conditions that ensure that every VPA in aggregate meets the small-scale threshold criteria and remains within those thresholds throughout the crediting period of the VPA	The VPA Implementer will ensure that each VPA remains below the small scale limits. For activities falling under Type I[16], each VPA in aggregate will remain below 15 MW ($45MW_{th}$) per year. For activities falling under Type III [17], each VPA will achieve below 60,000 tCO_2e in emission reductions annually.	Any of the following documents shall be provided: – Contractual agreement between CME and VPA Implementer – Sales forecast – Calculation showing the capacity of the biogas system(s) – Project Database
12.	Where applicable, the requirements for the debundling check, in case VPAs belong to small-scale (SSC) or microscale project categories.	The VPA implementer will demonstrate that the VPA is not a de-bundled component via the following approach: 1. The biogas systems are less than 1% of the SSC threshold (as per	The following evidence shall be provided: 1. Calculation showing the capacity of the biogas system(s) 2. Project Database showing size of systems

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

[16] Type I activities are “renewable energy project activities with a maximum output capacity of 15 MW (or an appropriate equivalent)”, CDM Project Standard (version 07.0), paragrapgh 89 (a)

[17] Type III activities are “other project activities not included in Type I or Type II that result in GHG emission reductions not exceeding 60 kt CO_2e per year in any year of the crediting period”, CDM Project Standard, (version 07.0), paragraph 89 (b)

Nr.	Requirement[13]	Eligibility criteria	Evidence required
		paragraph 10 EB54 Annex 13)	
13.	The proposed VPA must ensure that sufficient training has been carried out to ensure the construction / installation of the biogas system is done by competent persons	The VPA implementer will provide sufficient evidence of training or qualification to implement the proposed VPA.	Any of the following documents shall be provided: – Training certificates – Training records – Qualification certificates – Planned training schedules
14.	Transfer of rights to carbon credits.	The end user of each biogas digester has been properly informed during the stake holders consultation on the transfer of credit ownership and agreed to transfer all rights to any carbon credits to the VPA Implementer or CME of the PoA.	The following documents are provided: – Sales Agreement – Contractual agreement between CME and the VPA Implementer – Local Stakeholder report and/or Passport
15.	Prior consideration of carbon revenues	For retroactive VPAs, prior consideration of carbon revenues shall be checked at the time of inclusion by checking that carbon revenues are considered in early project documentation before the date of VPA inclusion (e.g. in a feasibility report, a programme implementation document or similar documentation).	The following documents are provided: – Feasibility study – Business plan – Implementation document – Any other such documents demonstrating compliance

B.3. Application of technologies/measures and methodologies

The programme applies all baseline and monitoring procedures according to the guidelines laid out in the methodology entitled 'Technologies and practices to displace decentralized thermal energy' (11/04/2011).

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

Applicability conditions applied:

Applicability criteria	Justification
1. *Clearly identifiable project boundary:* The project boundary can be clearly identified, and the biodigesters counted in the project are not included in another voluntary market or CDM project activity (i.e. no double counting takes place). Project proponents must have a survey mechanism in place together with appropriate mitigation	The project boundary is the physical, geographical site of the methane recovery and combustion systems. The mitigation measures to prevent double-counting are presented in Section C.

Applicability criteria	Justification
measures so as to prevent double-counting in case of another similar activity with some of the target area in common.	
2. *Limited level of energy output per biodigester:* The biodigesters each have continuous useful energy outputs of less than 450 kW_{th} per unit (defined as total energy delivered usefully from start to end of operation of a unit divided by time of operation).	The maximum energy output of the biodigesters implemented in the project activities is 44.77 kW_{th}, below the indicated 450 kW_{th} limit per unit.
3. *Continued use of baseline technology:* The use of the baseline cook stoves as a backup in parallel with the new, biogas fuelled cook stoves introduced by the project activity is permitted as long as a mechanism is put into place to encourage the removal of the old technology and the definitive discontinuity of its use. The project documentation must provide a clear description of the approach chosen and the monitoring plan must allow for a good understanding of the extent to which the baseline cook stove is still in use after the introduction of the improved technology. The success of the mechanism put into place must therefore be monitored, and the approach must be adjusted if proven unsuccessful.	Monitoring will include an assessment of the continued use of the baseline stove through survey methods and biennial Kitchen Performance Tests.
4. *Settling of ownership rights over generated emission reductions:* The project proponent must clearly communicate to all project participants to whom the ownership rights of the emission reductions resulting from the project activity belong. This must be communicated to the technology producers and the retailers of the systems by contract or clear written assertions in the transaction paperwork.	As set out in the operational and management plan explained in Section C, each end user of a biodigester will be asked to confirm that they transfer the right and title to VERs to the VPA Implementer as part of the Sales Agreement. Copies of these signed contracts will be kept by the VPA Implementer and made available to the CME/a DOE on request.
5. *Use of new biomass feedstock* Project activities making use of a new biomass feedstock in the project situation (e.g. shift from non-renewable to green charcoal, plant oil or renewable biomass briquettes) must comply with relevant Gold Standard specific requirements for biomass related project activities, as defined in the latest version of the Gold Standard rules.	This applicability criterion is not applicable as no new biomass feedstock is used in the project scenario.
6. Climate zones If more than one climate zone is included in the project activity, a distinction per climate zone must be considered. The distinct geographical boundary of each project area must be clearly documented in the project documentation, using representative GPS data.	The distinct geographical boundary of each VPA will be clearly documented in the VPA-DD, and the GPS coordinates of the VPA as a whole identified.

The largest biodigester type implemented in this PoA, the 100 m^3 unit, is estimated to produce up to 30 m^3 of biogas per day. This amounts to a maximum output of 44.77 kW_{th}, which is below the established threshold of 450 kW_{th}. The calculation is presented below:

$Th_{cap} = \frac{E}{t}$ *where* $E = \eta * H_b * V_b$		
Where:	Value:	Comments:
t = hours/day usage	2.15	
η = efficiency of stove	55%	
H_b = heat of combustion per unit volume of biogas	21.0 MJ/m^3 [18]	Derived from IPCC defaults
V_b = volume of biogas	30 m^3/day [19]	Data provided by Hivos
E = Energy available from the biogas system	346.5 MJ/day	Calculated[20]
E_{th} =	96.26 kWh/day	1 MJ = 0.2778 kWh
Th_{cap} =	44.77 kW_{th}	Given a 2.15 hour/day usage

B.4. Date of completion of application of methodology and standardized baseline and contact information of responsible person(s)/ entity(ies)

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Application of the methodologies was completed on 24 June 2014. A standardized baseline is not applied.

Harry Clemens (Hivos International) is the contact person for this PoA. See Appendix 1 for further details.

SECTION C. Management system

Each authorised VPA Implementer under this PoA will sign a standard contractual agreement with the CME to participate in the PoA as a VPA Implementer, who is committed to the following requirements:

- Those operating the VPA are aware of and have agreed that their activity is being subscribed to this PoA.
- The VPA Implementer shall not assign a new VPA that has been already registered either as a CDM project activity or as a VPA of another PoA.

It is the responsibility of the CME to register the PoA. The CME prepares all the necessary documentation for validation to be passed to the DOE. The CME may also be responsible for organising the inclusion of VPAs and the finalisation of the respective VPA-DDs, although this will depend on the agreed arrangement with each VPA Implementer.

The VPA Implementers will organise the monitoring of their VPAs under the PoA through field monitoring surveys, with the CME maintaining a guidance role to ensure this is carried out in accordance with the PoA.

[18] Methane has an energy value of 37.78 MJ/m^3; thus, biogas at 55% CH_4 has an energy value of 21 MJ/m^3

[19] Cow dung produces approximately 40 litres biogas per kg. Each m^3 capacity of the biodigester needs 7.5 kg dung per day. Given a 100 m^3 biodigester, 750 kg of cow dung per day is required. This translates into 30 m^3 of gas produced per day.

[20] Calculated as: 55% * 21 * 30

Finally, the CME will be the focal point with the Gold Standard Secretariat and will receive the VERs generated. Whilst the end-users transfer the rights to the VERs to the VPA Implementer, a separate agreement is in place between the VPA Implementers and the CME transferring the rights to VERs to the CME. The VERs will be assigned among their corresponding VPAs, and the respective VPA implementers will each decide on their sale. The VPA implementers may or may not handle the selling of their VERs themselves. In cases where the capacity of the VPA implementers to sell the VERs is limited or they have decided otherwise, the CME may offer a sales service resulting in the transfer of VERs to the respective VER buyers, and the resulting revenues to the VPA implementers.

The CME operational management system will ensure that the following requirements are met:

(i) A record keeping system for each VPA under the PoA.

The procedure for registering a new customer into the Programme is as follows:

1. Complete a Sales Agreement: this contains basic household details and a general agreement for the work to be carried out.
2. Quality Control Form 1: completed one a digester starts to be built. Completion of this form requires a check that the quality of materials used to construct a digester is sufficient.
3. Quality Control Form 2: completed once a digester has been completed (i.e. built) to check it has been constructed correctly.
4. Plant Completion Form: once the digester starts to produce biogas, the user calls a technician to check that the gas is produced correctly and that no leaks are present. The date recorded in this form is the date from which biogas is considered to be produced.

During the sales of biogas systems, vendors shall complete Sales Agreements (step 1 above) with the customers containing at least the information contained in Table 1.

Table 1: Mandatory information in the Sales Agreement

– Name of customer
– Address/location
– Date of purchase
– Serial number of the digester
– Name of VPA Implementer
– Biogas model and size (m^3)
– Phone number of the user
– Confirmation that the user assigns the right and title to the VERs to the VPA Implementer

The name of the customer and the address will be needed to track back the system during monitoring, and the serial number of the biogas systems will identify the biogas digester unit (for non-retroactive digesters). The Quality Control Forms ensure that the customer receives a digester of good quality, and records the date of completion of the digester. The Plant Completion Form records the date from which biogas is produced. Since it is not possible to visit all plants on the exact day that biogas is produced, the date in the Quality Control Form 2 is used to estimate the date that biogas is produced after a conservative 45 – 50 days from the date of construction completion. This date will correspond to the date from which VERs can be earned in the respective monitoring period.

The Sales Agreements from vendors will be gathered by the VPA Implementer and transferred to an electronic record kept by the VPA Implementer and precisely assigned to its corresponding VPA. The database allows for the verification of the actual number of systems sold, and the avoidance of double-counting emission reductions in the PoA by automatically checking each biogas system sold and any duplication of serial numbers. The contact point for the end user of the biogas system will be the staff of the VPA Implementer and its network of installers/sellers. A record of the original Sales Agreements will be kept by the VPA Implementer. The serial numbers will be used to monitor the system and determine the emission reductions for each VPA.

The CME will keep an electronic database of the data contained in all the Sales Agreements. Verification will be done using a statistically sound sample of each VPA Implementer population. Verification of the Sales Agreements can be done by phone, post, email or physical visits to households as required, thus ensuring that the status of the verification can be determined anytime for each VPA.

Monitoring of biogas system usage and continued use of biomass will be carried out annually or biennially by the VPA Implementer and/or by organisations authorised by the VPA Implementer. The detailed monitoring plan and the parameters to be verified are included in Section B of the Generic VPA-DD.

(ii) A system/procedure to avoid double counting.

Double counting will be avoided through a number of strategies:

- Checks will be performed on the electronic database via searching for repeated serial numbers, addresses and phone numbers that might indicate a double-entry. For any possible double entries identified, the hard-copy of the Sales Agreement will be first cross-checked to ensure there was no error in data entry to the electronic database. If the issue is still not resolved, the users will be contacted and requested to confirm the possible error (e.g. confirm the serial number of their digester). If the issue is still not resolved, a site visit to confirm details will be arranged.
- The unique serial number of each digester will avoid the same system being counted twice in different VPAs in the PoA. The database will not allow two biogas systems to have the same serial number, and each serial number will belong to only one VPA. The VPA Implementers will be aware by their contractual agreement with the CME that they must not count the same biogas system under another PoA or project activity. For the retroactive digesters, the unique user address will be used to avoid double counting.
- In the field, each digester is identified as uniquely belonging to the PoA through a metal plate, or other permanent fixture, physically attached to the digester which includes the details of the VPA Implementer
- The VPA Implementer must certify that the proposed VPA is not registered under another CDM or voluntary project activity. Should such a case occur the CME will not include the VPA under the PoA. If the contractual agreement between the CME and the VPA Implementer has been signed, the agreement will automatically terminate and the emission reduction crediting operations of the VPA Implementer will be suspended.
- End-users are required to confirm that they assign the rights and titles to VERs to the named VPA Implementer in the Sales Agreement.

If the address is found to no longer comply with the database and the user is found to be different to that listed in the Sales Agreement, the new user will be asked to sign and complete the Sales Agreement, if willing to do so. All new details will be recorded in the database. Where the new user does not wish to sign such a contract or does not fit the criteria outlined, the system will be listed as no longer operational in the database and no emission reductions from that system will be accounted for.

There are two situations in which the address or serial number of the biodigester may change:

- A biodigester is replaced. The user will contact the supplier, as indicated during signing of the original Sales Agreement, who will record the case of a biodigester that needs replacing, and will enter the new serial number into the database, or inform the CME that this needs to be done;
- A biodigester is moved to a different location. During installation, the user will have been directed to contact the supplier should a biodigester be moved. If the user is found to differ from that registered in the database the new address will be recorded in the database and a new Sales Agreement will be completed.

A record of old data will be kept alongside a description of the circumstances under which changes were made.

(iii) The VPA included in the PoA is not a de-bundled component of another VPA or CDM project activity.

The PoA is a voluntary project activity and is therefore exempt from the debundling rules, as per the Gold Standard's PoA Rules and Guidance: Annex F (GSV2.2), Section 9, which states that "De-bundling provisions in EB 54 Report Annex 13 do not apply to Voluntary PoAs".

(iv) The provisions to ensure that those operating the VPA are aware of and have agreed that their activity is being subscribed to the PoA.

The contractual agreement between the CME and the VPA Implementer will ensure that those operating the VPA are aware of their involvement in the PoA. Each of the levels of biogas system distribution will be informed of its involvement in the PoA and its registration as a Gold Standard project.

(v) A clear definition of roles and responsibilities of personnel involved in the process of inclusion of VPAs, including a review of their competencies.

The CME has the competencies to review and include VPAs in the PoA. The following CME entities, and their responsibilities, are outlined below:

Table 2: Roles and responsibilities of the CME

CME Role	Responsibility
Carbon Programme Manager	The Carbon Programme Manager is responsible for - the strategic management of the CME role, preparation of annual plans and reports, and communication with Hivos Board of Directors and Senior Staff of African Biogas Partnership Progarmme. - Overseeing compliance of the PoA with Gold Standard procedures, and ensuring that all VPAs follow the guidelines set out in the PoA-DD. - Managing the process of adding future VPAs under the programme, including negotiating any contractual agreements with the VPA Implementer and hiring a Designated Operational Entity (DOE) to validate the inclusion, unless otherwise agreed with the VPA Implementer - Disseminating information about the PoA to VPA Implementers, including training VPA staff, supervising collection of monitoring data, the preparation of Monitoring Reports (if applicable) and any other routine CME operations.
Monitoring Specialist	The Monitoring Specialist is responsible for providing guidance to the VPA Implementers on the parameters that need to be monitored under the VPA, the frequency of monitoring and how to monitor the necessary parameters. However, each VPA Implementer is responsible for performing monitoring of the biogas digesters included under their VPA on an annual basis. The Monitoring Specialist may provide services to draft the Monitoring Report following collection of data, depending on the agreement in place with the VPA Implementer.
Carbon Marketing Manager	The Carbon Marketing Manager is responsible for marketing VERs to potential buyers, transferring any VERs to buyers and ensuring that any income from the sale of VERS is transparently tracked and transferred to the respective VPA Implementers (if agreed).

New VPAs are included under the programme as follows:

1. Hivos initially signs a Non-Disclosure Agreement (NDA) with each applicant VPA Implementer, followed by a mutual exchange of information about the PoA and the activities of the applicant VPA Implementer. An initial review of the applicant's information is carried out to determine eligibility for inclusion under the PoA. For those proposed VPA Implementers that fall under the ABPP, a NDA will not be necessary.

2. Once the CME team has positively reviewed the initial information provided by the applicant VPA, a Memorandum of Understanding is signed between the parties whereby the CME management team undertakes a full due diligence assessment of the applicant. Shortcomings in the applicant's information and its proposed activities are communicated, and remedial actions are proposed, which the CME may mobilise support to rectify. For those proposed VPA Implementers that under the ABPP, a due diligence assessment will not be necessary.

3. Once the due diligence assessment is positive, an agreement is signed between the parties which sets out the mutual obligations of the CME and the applicant. The agreement documents the way in which the CME will work with VPAs, sets out Gold Standard and PoA requirements and agrees on rights to VERs and contracting entities for the validation/verification of the VPA.

(vi) Records of arrangements for training and capacity development for personnel.

It is the VPA Implementer's responsibility to ensure that their staff has received the necessary training in order to comply with the requirements of the PoA (e.g. how to complete the Sales Agreement, who to instruct users to contact if their digester requires maintenance etc.). If agreed with the VPA Implementer, the CME may also provide training to the VPA Implementer's staff to ensure their ability to comply with all aspects of the PoA's requirements. Records of all training conducted, including a complete list of attendees, will be kept by the VPA Implementer.

(vii) Procedures for technical review of inclusion of VPAs.

In accordance with the sequence of events described in *(v)* above, the CME will conduct a technical review of each VPA prior to inclusion as part of the due diligence assessment. This will involve ensuring that each VPA meets the required eligibility criteria for compliance with the approved methodology, the baseline, additionality, double counting and de-bundling. It will also ensure that the VPA complies with all the regulatory requirements of the host country(s).

For retroactive VPAs, prior consideration of carbon revenues shall be checked at the time of inclusion by checking that carbon revenues are considered in early project documentation before the date of VPA inclusion (e.g. in a feasibility report, a programme implementation document or similar documentation).

(viii) Measures for continuous improvements of the PoA management system.

The management of the CME is committed to identifying opportunities for improvement and supporting their implementation. Corrective measures will be taken depending on issues raised (e.g. software issues will be corrected by the software developer, operational procedures for the field staff will be modified ad hoc, etc.). In order to identify areas for improvement, besides regular feedback from staff, the following issues will be discussed during Programme Meetings which will be held on a regular basis:

- Any inefficiencies in operation and management (e.g. in recording data or transferring data to database);
- Opportunities to employ better methods;

- Control of planned and unplanned changes.

- Any improvements in the management system shall be checked against the PoA-DD and VPA-DDs to ensure there is no conflict.

SECTION D. Duration of PoA

D.1. Start date of PoA

The start date of the PoA is retroactive, and is 06/11/2009, the earliest date at which either the implementation or construction or real action of a project began.

D.2. Duration of the PoA

28 years

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at VPA level ✓

It has been decided to undertake the environmental analysis at the VPA level due to the differing circumstances of the VPA Implementers in relation to the manufacturing and the supplying of biogas systems. Furthermore, due to the multiple host country locations of the PoA, each VPA will need to comply with the respective host country environmental documentation requirements depending on which of them the VPA is operating in.

For a typical VPA the requirements of the host country regarding Environmental Impact Assessment (EIA) are as follows:

Tanzania
There is no legislation in place regulating the domestic biogas sector in Tanzania.[21] The Environment Management Act, 2004[22], states that only projects which are under the Third Schedule of the act are required to undertake an EIA. As biogas is not contained in this Schedule (pages 127 -128) no EIA is required by a VPA installing small biogas systems.

Kenya
According to the Energy Regulatory Commission (ERC) of Kenya, there is no legislation in place currently regulating the domestic biogas sector[23][24]. Legislation relevant to carrying out an Environmental Impact Assessment (EIA): the Environmental Management and Coordination Act, 1999 [revised 2012][25] states that only projects that fall under the Second Schedule are required to

[21] Lexadin (no date) *Legislation in Tanzania* , available from http://www.lexadin.nl/wlg/legis/nofr/oeur/lxwetan.htm

[22] Page 56 paragraph 81, available from http://faolex.fao.org/docs/pdf/tan61491.pdf

[23] ERC (no date) *Renewable Energy Sources: Biogas*, available from http://www.renewableenergy.go.ke/index.php/content/30

[24] Lexadin (no date) *Legislation in Kenya,* available from http://www.lexadin.nl/wlg/legis/nofr/oeur/lxweken.htm

[25] Environmental Management and Co-ordination Act, Laws of Kenya, page 73, chapter 387. Available from: http://faolex.fao.org/docs/pdf/ken41653.pdf

submit a Project Report and then potentially an Environmental Impact Assessment (EIA). Since small biogas digesters (2 – 16 m^3) are not included in the Second Schedule, a VPA will not be required to submit a Project Report or EIA.

Uganda
There is no legislation in place regulating the domestic biogas sector in Uganda.[26] Legislation relevant to carrying out an EIA: in terms of the National Environment Act of 19 May, 1995, an EIA is required by law where, after the submission of a Project Brief, the Executive Director of the National Environment Management Authority finds that the project will have significant impacts on the environment and that the Project Brief discloses no sufficient mitigation measures to cope with the anticipated impacts.[27] A VPA will not be required to submit a Project Brief if they are installing small biogas systems (2 – 16 m^3), as these activities do not fall under the Third Schedule of the National Environment Act (pages 55-58).

Other host countries may be added in the future, in which case the EIA requirements of the new host country shall be considered.

E.2. Analysis of the environmental impacts

Not applicable – analysis is done at VPA level.

SECTION F. Local stakeholder comments

F.1. Solicitation of comments from local stakeholders

1. Local stakeholder consultation is done at PoA level	☐
2. Local stakeholder consultation is done at VPA level	✓

It has been decided to do the stakeholder consultation at the VPA level due to the different nature of the VPA Implementers in relation to the manufacturing and the supplying of biogas systems. Furthermore, due to the multiple host country locations of the PoA stakeholders may vary in their comments. One stakeholder consultation can be applied to a group of VPAs so long as it can be demonstrated that these VPAs are similar (e.g. target group).

F.2. Summary of comments received

Not applicable – consultations are done at VPA level.

F.3. Report on consideration of comments received

Not applicable – consultations are done at VPA level.

[26] Lexadin (no date) *Legislation in Uganda,* available from http://www.lexadin.nl/wlg/legis/nofr/oeur/lxweuga.htm

[27] The National Environmental Act, Cap 153, page 15, paragraph 19, 1995. Available from: http://nemaug.org/regulations/national_environment_act.pdf

SECTION G. Approval and authorization

Obtaining a Letter of Approval is not applicable to voluntary Gold Standard projects.

PART II. Generic component project activity (VPA)

SECTION A. General description of a generic VPA

A.1. Purpose and general description of generic VPAs

The purpose of each VPA is to stimulate the use of biogas digester systems in their host country. The VPA Implementer of each VPA will act individually, requesting authorisation for its VPA(s) to the CME and running the project in accordance with the demands of the local market. VPA Implementers will be involved with the dissemination of biogas systems that are sold on a commercial or a non-commercial basis. Typical VPA Implementers will either be organisations that manufacture biogas systems and disseminate them, potentially through a supply chain. Alternatively VPA Implementers may be organisations that co-ordinate support for biogas systems to be installed. VPA Implementers will have the necessary technical and administrative resources to ensure technical compliance to the PoA requirements of the biogas systems sold, as well as accurate and complete record keeping.

VPA Implementers will be involved with the dissemination of biogas systems, and are encouraged by the CME to make biogas more affordable to users through the VER proceeds. Affordability will be stimulated as an increasing number of VPA Implementers become a part of this PoA and compete in the market for customer choice. The end users of the biogas will benefit from having a choice of high-quality biogas systems, added investment in marketing (awareness) and research and development of products that reduce deforestation and improve health by reducing indoor air pollution. The exact technology to be employed will vary depending on VPA Implementer and will be required to meet applicable national standards.

When purchasing the biogas system, the buyer will fill an agreement with the VPA Implementer that contains, among other details, information about the biogas system, model, price and payment, the name, location/address and phone number of the user (the Sales Agreement). This information will allow the identification and the monitoring of the system and its usage. VPA Implementers will be encouraged to undertake additional measures to keep in close contact with the buyer through for example, guarantee schemes on the biogas system, this will help to confirm that the biogas system is in use.

The VPA Implementer may use the VER proceeds to reduce the costs of biogas systems by providing a subsidy to customers, providing free or subsidised maintenance of the biogas systems or to recoup the VPA Implementer's incurred associated costs, such as research and development, training and marketing. The exact usage of the revenues obtained from VER sales will vary depending on the VPA.

SECTION B. Application of a baseline and monitoring methodology and standardized baseline

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

The programme applies the methodology 'Technologies and practices to displace decentralized thermal energy' (Version 1.0) (11/04/2011).

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

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

Applicability conditions applied:

Applicability criteria	Justification
1. *Clearly identifiable project boundary:* The project boundary can be clearly identified, and the biodigesters counted in the project are not included in another voluntary market or CDM project activity (i.e. no double counting takes place). Project proponents must have a survey mechanism in place together with appropriate mitigation measures so as to prevent double-counting in case of another similar activity with some of the target area in common.	The project boundary is the physical, geographical site of the methane recovery and combustion systems. The mitigation measures to prevent double-counting are presented in Section C.
2. *Limited level of energy output per biodigester:* The biodigesters each have continuous useful energy outputs of less than 450 kW_{th} per unit (defined as total energy delivered usefully from start to end of operation of a unit divided by time of operation).	The maximum energy output of the biodigesters implemented in the project activities is 44.77 kW_{th}, below the indicated 450 kW_{th} limit per unit.
3. *Continued use of baseline technology:* The use of the baseline cook stoves as a backup in parallel with the new, biogas fuelled cook stoves introduced by the project activity is permitted as long as a mechanism is put into place to encourage the removal of the old technology and the definitive discontinuity of its use. The project documentation must provide a clear description of the approach chosen and the monitoring plan must allow for a good understanding of the extent to which the baseline cook stove is still in use after the introduction of the improved technology. The success of the mechanism put into place must therefore be monitored, and the approach must be adjusted if proven unsuccessful.	Monitoring will include an assessment of the continued use of the baseline stove through survey methods and biennial Kitchen Performance Tests.
4. *Settling of ownership rights over generated emission reductions:* The project proponent must clearly communicate to all project participants to whom the ownership rights of the emission reductions resulting from the project activity belong. This must be communicated to the technology producers and the retailers of the by contract or clear written assertions in the transaction paperwork.	As set out in the operational and management plan explained in Section C, each end user of a biodigester will be asked to confirm that they transfer the right and title to VERs to the VPA Implementer as part of the Sales Agreement. Copies of these signed contracts will be kept by the VPA Implementer and made available to the CME/a DOE on request.
5. *Use of new biomass feedstock*	This applicability criterion is not applicable as

Applicability criteria	Justification
Project activities making use of a new biomass feedstock in the project situation (e.g. shift from non-renewable to green charcoal, plant oil or renewable biomass briquettes) must comply with relevant Gold Standard specific requirements for biomass related project activities, as defined in the latest version of the Gold Standard rules.	no new biomass feedstock is used in the project scenario.
6. Climate zones If more than one climate zone is included in the project activity, a distinction per climate zone must be considered. The distinct geographical boundary of each project area must be clearly documented in the project documentation, using representative GPS data.	The distinct geographical boundary of each VPA will be clearly documented in the VPA-DD, and the GPS coordinates of the VPA as a whole identified.

B.3. Sources and GHGs

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

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

The project boundary is the physical, geographical site of the use of biomass or the renewable energy as demonstrated in Figure 6.

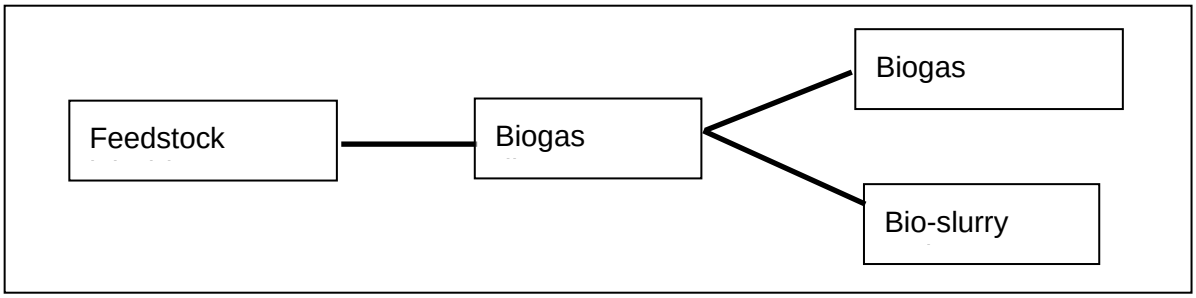

Figure 6: ***Schematic diagram of biogas system project boundary***

B.4. Description of baseline scenario

More than 81% of East African households rely on traditional biomass cooking methods[28], typically charcoal or firewood for urban dwellers, and firewood for rural households. This biomass also accounts for more than 70% of all primary energy needs in East Africa[29]. The wood collected/harvested and used in meeting energy needs or converted into charcoal for the same purpose, consists of a high percentage of non-renewable biomass in East African countries. The

[28] Page 4, Strategy on scaling up access to modern energy services. East African Community. http://www.eac.int/energy/index.php?option=com_docman&task=doc_download&gid=14&Itemid=70

[29] Page 19, Strategy on scaling up access to modern energy services. East African Community. http://energy.eac.int/index.php?option=com_docman&task=doc_download&gid=15&Itemid=70

primary use of NRB for most households is cooking. The technology for charcoal users is the traditional metal charcoal stove, while the "three-stone" fire is the most frequently used technology by wood users. Institutions in East Africa also primarily use wood fuel for cooking purposes and in some cases for industrial processes. The substitution of traditional technologies with biogas systems is a switch from a non-renewable fuel to a renewable one. By switching from wood fuel consumption, the PoA is reducing anthropogenic GHG emissions.

B.5. Demonstration of eligibility for a generic VPA

Nr.	Requirement[30]	Eligibility criteria	Evidence required
1.	The geographical boundary of the VPA including any time-induced boundary consistent with the geographical boundary set in the PoA	All biogas systems included in the VPA will demonstrate they fall within the geographical boundary of the PoA through: – Recording the address/location of the system in the Sales Agreement – Recording the GPS coordinates of the systems (not relevant for retroactive digesters) – Physically attaching a Programme or VPA logo to the digester which identifies it as being part of the African Biogas Partnership Programme on a national scale.	One of the following documents shall be provided: – Business plan – Implementation document – Contractual agreement between CME and VPA Implementer – Declaration from VPA implementer and confirmation check by CME – Sales Agreement
2.	Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations	The VPA shall demonstrate that it does not double-count any of its appliances for the ERs estimation by confirming that: – the complete address of each biogas system will be recorded – the biogas systems will have a unique serial numbers attached (not relevant for retroactive digesters) – the VPA implementer has not included these biogas systems in another VPA or carbon project.	– Contractual agreement between CME and VPA Implementer. – Declaration from VPA implementer – Sales Agreement
3.	The specifications of technology/measure including the level and type	The biogas systems disseminated are renewable energy generation units to	The following documents shall be provided: – Technical documentation

[30] Requirements 1-12 are taken from EB65 Annex 3 paragraph 14. Requirement 13 is taken from EB47, Annex 29, paragraph 3. Requirement 14 is a CME requirement to ensure successful implementation of the VPA.

Nr.	Requirement[30]	Eligibility criteria	Evidence required
	of service, performance specifications including compliance with testing/certifications	provide thermal energy and will be required to conform to any applicable national standards.	describing the operation of the biogas system. – Evidence of compliance with national standard (if applicable).
4.	Conditions to check the start date of the VPA through documentary evidence	The VPA implementer will demonstrate the start date of the VPA is on or after the start date of the PoA. The start date of the VPA will be defined as the date on which the first Sales Agreement is signed under the VPA.	– Sales Agreements for the first digester included under the VPA.
5.	Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by VPAs	The VPA complies with the baseline and monitoring methodology requirements of the 'Technologies and Practices to Displace Decentralised Thermal Energy Consumption' (version 1.0). and should meet its eligibility criteria as discussed in Section B.2 of the PoA-DD.	The following documents shall be provided as evidence: – Electronic database – KPT reports – Sales Agreement
6.	The conditions that ensure that VPAs meet the requirements pertaining to the demonstration of additionality	The VPA will prove additionality as per the CDM´s approved ***Positive List***[31] 1. Biogas system rated capacity is less than 2.25MW_{th} each 2. Biogas systems are disseminated to households or communities or Small and Medium Enterprises (SMEs).	The following evidences shall be provided: 1. Calculation showing the capacity of the biogas system(s) in MW 2. Business plan / Implementation document
7.	The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis	1. The VPA, or a group of VPAs, organised a local stakeholder consultation (LSC) in accordance with Gold Standard requirements 2. The VPA, or a group of VPAs, got environmental clearance for the project related activities, if applicable	The following documents shall be provided: 1. Local Stakeholder Report including comments of stakeholders and how the comments were taken into account by the VPA implementer 2. Environmental clearance letter and/or EIA if required by national regulations
8.	Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development	VPAs will demonstrate that any Official Development Assistance received for the VPA has not occurred on the condition that the resulting	Verifiable evidence: – ODA Declaration

[31] As per the "Guidelines on the Demonstration of Additionality of Small-Scale Project Activities" Version 09, EB68 Annex 27 clause 2 (c)

Nr.	Requirement[30]	Eligibility criteria	Evidence required
	assistance	credits are transferred to the donor country[32].	
9.	Where applicable, target group (e.g. domestic / commercial / industrial, rural / urban, grid connected / off-grid) and distribution mechanisms (e.g. direct installation)	The VPA will demonstrate which target group(s) is/are to be targeted by the VPA and the distribution mechanism. Target groups shall include: – Households – Small/Medium Enterprises – Communities	Any of the following documents shall be provided: – Sales forecast – Marketing plan – description of technology (e.g. domestic or institutional biogas system) – Implementation document
10.	Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys	The VPA Implementer will agree to support the sampling and survey activities of CME in accordance with B.7.2 of the PoA-DD.	Contractual agreement between CME and VPA Implementer
11.	Where applicable, the conditions that ensure that every VPA in aggregate meets the small-scale threshold criteria and remains within those thresholds throughout the crediting period of the VPA	The VPA Implementer will ensure that each VPA remains below the small scale limits. For activities falling under Type I[33], each VPA in aggregate will remain below 15 MW ($45MW_{th}$) per year. For activities falling under Type III [34], each VPA will achieve below 60,000 tCO_2e in emission reductions annually.	Any of the following documents shall be provided: – Contractual agreement between CME and VPA Implementer – Sales forecast – Calculation showing the capacity of the biogas system(s) – Project database
12.	Where applicable, the requirements for the debundling check, in case VPAs belong to small-scale (SSC) or microscale project categories.	The VPA implementer will demonstrate that the VPA is not a de-bundled component via the following approach: 1. The biogas systems are less than 1% of the SSC threshold (as per paragraph 10 EB54 Annex 13)	The following evidence shall be provided: 1. Calculation showing the capacity of the biogas system(s) 2. Project Database showing size of systems.
13.	The proposed VPA must ensure that sufficient training has been carried out	The VPA implementer will provide sufficient evidence of training or qualification to	Any of the following documents shall be provided:

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

[33] Type I activities are “renewable energy project activities with a maximum output capacity of 15 MW (or an appropriate equivalent)”, CDM Project Standard (version 07.0), paragrapgh 89 (a)

[34] Type III activities are “other project activities not included in Type I or Type II that result in GHG emission reductions not exceeding 60 kt CO_2e per year in any year of the crediting period”, CDM Project Standard, (version 07.0), paragraph 89 (b)

Nr.	Requirement[30]	Eligibility criteria	Evidence required
	to ensure the construction / installation of the biogas system is done by competent persons	implement the proposed VPA.	– Training certificates – Training records – Qualification certificates – Planned training schedules
14.	Transfer of rights to carbon credits.	The end user of each biogas digester has been properly informed during the stake holders consultation on the transfer of credit ownership and agreed to transfer all rights to any carbon credits to the VPA Implementer or CME of the PoA.	The following documents are provided: – Sales Agreement – Contractual agreement between CME and the VPA Implementer – Local Stakeholder report and/or Passport
15.	Prior consideration of carbon revenues	For retroactive VPAs, prior consideration of carbon revenues shall be checked at the time of inclusion by checking that carbon revenues are considered in early project documentation before the date of VPA inclusion (e.g. in a feasibility report, a programme implementation document or similar documentation).	The following documents are provided: – Feasibility study – Business plan – Implementation document – Any other such documents demonstrating compliance

B.6. Estimation of emission reductions of a generic VPA

B.6.1. Explanation of methodological choices

The programme applies the baseline and monitoring procedures according to the guidelines laid out in the methodology entitled 'Technologies and practices to displace decentralized thermal energy' (11/04/2011).

- The methodology is applicable to the selected biodigester technology as it covers technologies that reduce or displace GHG emissions from the thermal energy consumption of households, communities and SMEs, which is the scope of this programme.
- The methodology accounts for the displacement of NRB and fossil fuels, both which are applicable to the baseline scenario.
- The methodology assumes that in the absence of the project activity, the baseline scenario would be the use of these fuels for meeting similar thermal energy needs. Equation (2) of the methodology is referred to for the calculation of emission reductions.
- The differentiation between non-renewable and renewable woody biomass is determined following the approach outlined in Annex 1[35] of the methodology. Where a default fNRB value has been approved by a host country DNA and listed on the UNFCCC website, this will be applied[36].
- The methodology also covers the recovery of the methane from manure and organic waste that would otherwise decay anaerobically. The emission reductions are calculated in

[35] Annex 1: Non-Renewable Biomass Assessment

[36] Available from http://cdm.unfccc.int/DNA/fNRB/index.html

accordance with Annex 6[37] of the methodology, which refers to the IPCC Tier 1 or 2 methodologies.

- Country-specific values can be applied if these become available. Otherwise, defaults values for parameters VS_T and B_0 can be used.
- Project emissions and leakage will be accounted for in line with the methodology requirements.

B.6.2. Data and parameters fixed ex-ante

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Data / Parameter:	**$f_{NRB,y}$**
Data unit:	%
Description:	Fraction of biomass used in the absence of the project activity in year y that can be established as non-renewable biomass using nationally approved methods
Source of data:	Default **$f_{NRB,y}$** factors from the CDM, available from http://cdm.unfccc.int/DNA/fNRB/index.html
Value(s) applied:	Kenya: 92% Uganda: 82% Tanzania: 96%
Choice of data or Measurement methods and procedures:	N/A
Purpose of data	Calculation of baseline and project emissions
Additional comment:	N/A

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

Data / Parameter:	**$EF_{p, bio}$**
Data unit:	tCO_2/TJ

[37] Annex 6: Application of the methodology to biodigesters, including animal waste management

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

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

Data / Parameter:	**NCV_{bio}**
Data unit:	TJ/tonne
Description:	Net calorific value of the non-renewable biomass used in the baseline scenario
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied:	0.015
Choice of data or Measurement methods and procedures:	As per requirement of the methodology and Table 2.3, Chapter 2, Volume 2 of the 2006 IPCC Guidelines. The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of baseline emissions
Additional comment:	N/A

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

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

Data / Parameter:	VS_T
Data unit:	kg/head/day
Description:	Daily volatile solid excreted for livestock category T
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied:	Dairy cows = 1.9 Other cattle = 1.5 Market swine = 0.3 Goats = 0.3 Sheep = 0.32 Poultry = 0.02
Choice of data or Measurement methods and procedures:	As per requirement of the methodology and sourced from Tables 10. A-4 through A-9, Chapter 10, Volume 4 of the 2006 IPCC Guidelines The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of baseline emissions
Additional comment:	IPCC (2006); May be updated according to any future changes by the IPCC. National data can replace the IPCC value, if available

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

Data / Parameter:	$\eta_{biogas\ stove}$
Data unit:	%
Description:	Combustion efficiency of the new biogas stove introduced by the programme
Source of data:	Determined on VPA level through reference to studies, reports, or laboratory tests.
Value(s) applied:	Determined on VPA level
Choice of data or Measurement methods and procedures:	As above
Purpose of data	Calculation of project emissions
Additional comment:	-

Data / Parameter:	$MCF_{x,k}$
Data unit:	%
Description:	The methane conversion factor for the baseline manure management systems (x) in all the regions (k).
Source of data:	Determined on VPA level referencing reports, studies or baseline surveys
Value(s) applied:	Determined on VPA level
Choice of data or Measurement methods and procedures:	As per Tables 10.A., Chapter 10, Volume 4 of the 2006 IPCC Guidelines
Purpose of data	Calculation of baseline emissions
Additional comment:	National data can replace the IPCC value, if available

Data / Parameter:	$EF_{awms,T}$
Data unit:	kg CH_4
Description:	Emission factor for the defined livestock population category T by average temperature
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories; Indonesian Meteorological Climatological and Geophysical Agency
Value(s) applied:	<u>Kenya and Tanzania</u> Dairy cows = 1 Other cattle = 1 Market swine = 1 Breeding swine = 1 Goats = 0.17 Sheep = 0.15 Poultry = 0.02 <u>Uganda</u> Dairy cows = 1 Other cattle = 0 Market swine = 0 Breeding swine = 0 Goats = 0.11 Sheep = 0.10 Poultry = 0.02

Choice of data or Measurement methods and procedures:	As per requirement of the methodology and sourced from Tables 10.A-4 through A-9., Chapter 10, Volume 4 of the 2006 IPCC Guidelines The IPCC is a standard, credible source of emissions factors.
Purpose of data	Calculation of baseline emissions
Additional comment:	IPCC (2006); May be updated according to any future changes by the IPCC

Data / Parameter:	**PL**
Data unit:	%
Description:	Physical leakage of the biodigester
Source of data:	IPCC
Value(s) applied:	Estimated using a 10% default rate of total methane production.
Choice of data or Measurement methods and procedures:	10 %
Purpose of data	Calculation of project emissions
Additional comment:	As per Annex 6 of the applied methodology

B.6.3. Ex-ante calculations of emission reductions

i. Accounting for emission reductions due to the displacement of fossil fuels and non-renewable biomass[38].

Emission reductions:
Emission reductions are credited by comparing fuel consumption in a project scenario to the applicable baseline scenario. When the baseline fuel and the project fuel are different and the emission factors are different, the overall GHG reductions achieved by the project activity in year *y* are calculated as follows:

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

Where:

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

$\sum_{b,p}$ Sum over all relevant (baseline *b*/project *p*) couples

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

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

[38] CO_2 and non-CO_2 emissions factors for charcoal may be estimated from project specific monitoring or alternatively by researching a conservative wood to charcoal production ratio (from IPCC, credible published literature, project-relevant measurement reports, or project-specific monitoring) and multiplying this value by the pertinent EF for wood.

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

$ER_{b,p,y,non\text{-}CO2}$ Specific non-CO_2 emission savings for an individual technology of project p against an individual technology of baseline b in year y, converted in tCO_2/year, and as derived from the statistical analysis of the data collected from the field tests

$f_{NRB,b,y}$ Fraction of biomass used in year y for baseline scenario b that can be established as non-renewable biomass

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

As specific non-CO_2 emission savings are treated in a separate equation (equation **5** onwards), the VPAs included under this programme can apply the following formula for calculating emission reductions for the VPA:

$$\sum ER_{CO2,y} = (\sum BE_{b,CO2,y} - \sum PE_{p,CO2,y} - \sum LE_{p,CO2,y}) * N_{p,y} * U_{p,y} \quad \textbf{(2)}$$

Where:

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

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

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

$\sum LE_{p,CO2,y}$ Cumulative leakage as per methodology guidance[39]

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

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

Baseline emissions:

Applicable baseline scenarios are defined by the typical baseline fuel consumption patterns in a population that is targeted for adoption of the biodigester technology. The amount of baseline scenarios per project activity will be defined on the VPA level, whereby the different applicable baseline scenarios will be defined ex-ante through a baseline survey. The baseline survey will also serve to determine the ex-ante ratio of users that fall into each identified baseline scenario. This ratio will be monitored annually on a sampling basis as part of the monitoring survey, with the annual ratio applied during each verification. In addition to the defined pre-project situation, the methodology allows for a baseline scenario to be assessed in terms of suppressed demand if adequate evidence is provided that in the baseline scenario the target population consumes less fuel than would satisfy their human development needs.

$$\mathbf{BE_{b,CO2,y}} = \sum_b BB_{b,fuel} * NCV_{fuel} * EF_{b,fuel}) + (BB_{b,bio} * NCV_{bio} * EF_{b,bio} * f_{NRB}) \quad (\mathbf{3})$$

Where:

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

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

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

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

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

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

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

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

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

VPAs included under this PoA have two ways to determine the *ex-ante* baseline fuel usage amounts. Under Option 1, $BB_{b,fuel}$ and $BB_{b,bio}$ shall be defined *ex-ante* on the VPA level referencing a baseline survey applicable to the target user[40]. Prior to submission for verification, these values shall be fixed *ex-post* and will be deduced from the statistical analysis conducted on the data collected during the Baseline Performance Field Test (BFT). The BFTs will target end users representative of the baseline scenario and shall be arranged in accordance with the guidance provided by the methodology[41]. Under Option 2, $BB_{b,fuel}$ and $BB_{b,bio}$ shall be defined *ex-ante* on the VPA level through a Baseline Performance Field Test (BFT) directly.

Under either option, a separate BFT shall be conducted per baseline scenario identified in the original baseline survey. Each BFT shall comply with the 90/30 confidence/precision interval defined by the applied methodology, and the resulting fuel amounts for each identified baseline scenario will be weighted as per the ratio determined in the baseline (for ex-ante calculations) and monitoring (for ex-post calculations) surveys. Any combination of baseline fuels can constitute a separate baseline scenario. Examples of baseline scenarios allowed under the applied methodologies include[42]:

- Baseline scenario 1 ($BB_{b1,bio}$): Households using firewood only
- Baseline scenario 2 ($BB_{b2,bio}$): Households using charcoal only
- Baseline scenario 3 ($BB_{b3,bio}$): Households using firewood + charcoal only

VPAs that chose not to implement separate BFTs per baseline scenario will, for the sake of conservativeness, apply the baseline emission values from the most conservative baseline scenario that is applicable to the VPA.

Unless updated IPCC guidance is published, reference shall be made to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for the default EF_{fuel}, EF_{bio}, NCV_{fuel}, NCV_{bio} values.

Project emissions:
The project scenario is defined by the fuel consumption of end users within the targeted population that adopts the biodigester technology.

$$\mathbf{PE_{p,CO2,y}} = \sum(BB_{p,fuel} * NCV_{fuel} * EF_{p,fuel}) + (BB_{p,bio} * NCV_{bio} * EF_{p,bio} * f_{NRB}) \quad \textbf{(4)}$$

Where:

[40] 'Technologies and practices to displace decentralized thermal energy – 11/04/2011' p.10
[41] 'Technologies and practices to displace decentralized thermal energy – 11/04/2011' p.12 - 14
[42] This is of baseline scenarios is not exhaustive

$PE_{p,CO2,y}$ Cumulative project CO_2 emissions from the use non-renewable biomass and fossil fuels during year y

$BB_{p,fuel}$ The quantity of fossil fuel consumed in the project scenario *p*, in tonnes/year

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

$EF_{p,fuel}$ CO_2 emission factor of fossil fuel in project scenario *p*, in tonnes/TJ

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

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

$EF_{p,bio}$ CO_2 emission factor of biomass in project scenario *p*, in tonnes/TJ

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

In the project scenario, *ex-ante* $BB_{p,fuel}$ and $BB_{p,bio}$ - the quantities of fossil fuel and biomass consumed during year *y* - shall be estimated from literature, lab testing, application of appropriate discount factors, manufacturer specifications or other viable sources. Conducted Project Performance Field Test (PFT) data can also be applied, if available. These values will be presented prior to validation. Prior to submission for verification, these values shall be fixed *ex-post* and will be deduced from the statistical analysis conducted on the data collected during the Project Performance Field Test (PFT), which will be updated once every two years. The PFTs will target end users representative of the project scenario target population using the biodigester technology and shall be arranged in accordance with the guidance provided by the methodology[43].

As there is only one project scenario applicable to the project activities included under this PoA, only one PFT needs to be conducted on the VPA level to determine project emissions.

Unless updated IPCC guidance is published, reference shall be made to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for the default $EF_{p,fuel}$, $EF_{p,bio}$, NCV_{fuel}, NCV_{bio} parameters.

To estimate the f_{NRB}, reference shall be made to one of the methodologies outlined in Annex 1[44] of the methodology. Default rates of f_{NRB} published by the UNFCCC can also be referred to.[45]

Leakage:
The methodology states that the following potential sources of leakage are to be considered:

- The displaced baseline cook stoves- are reused outside the project boundary in place of lower emitting technology or in a manner suggesting more usage than would have occurred in the absence of the project;
- The non-renewable biomass or fossil fuels saved under the project activity are used by non-project users who previously used lower emitting energy sources;
- The project significantly impacts the NRB fraction within an area where other CDM or VER project activities account for NRB fraction in their baseline scenario;
- The project population compensates for loss of the space heating effect of inefficient technology by adopting some other form of heating or by retaining some use of inefficient technology;
- By virtue of promotion and marketing of a new technology with high efficiency, the project stimulates substitution within users who commonly used a technology with relatively lower emissions, in cases where such a trend is not eligible as an evolving baseline.

[43] 'Technologies and practices to displace decentralized thermal energy – 11/04/2011' p.12 - 14
[44] Annex 1: Non-Renewable Biomass Assessment
[45] Available on: http://cdm.unfccc.int/DNA/fNRB/index.html

A leakage investigation shall be conducted every two years using relevant survey methods that can be combined with monitoring surveys as is applicable. Leakage risks deemed very low will be ignored where the case for their insignificance can be substantiated.

Leakage shall be calculated as a quantitative emissions volume (tCO_2e) or as a percentage of total emissions.

ii. Accounting for emission reductions due to the avoidance of methane emissions from manure handling.

The baseline emissions from the handling of animal waste shall be determined by using one of the two approaches; IPCC Tier 1 or IPCC Tier 2. The choice of the appropriate approach shall be contingent upon the availability of baseline data for the estimation of the methane emission factor per category of livestock.

Baseline emissions following Tier 1:

The Tier 1 approach is applicable to situations where baseline data required for the estimation of the methane emission factor per category of livestock is *not* available, or where it is difficult to define a distinct practice of manure handling within the programme boundary. The following equation is applicable to calculate the baseline emissions per household:

$$\mathbf{BE_{b,CH4,y}} = GWP_{CH4} * \sum_T (EF_{awms,T} * N_{T,h}) \quad \textbf{(5)}$$

Where:

$BE_{b,CH4,y}$	Baseline emissions from manure handling during the year y in tCO_2e
GWP_{CH4}	Global Warming Potential of methane
$EF_{awms,T}$	Emission factor for the defined livestock population category T
$N_{T,h}$	Number of livestock category T in premise *h*

The relevant default methane emission factor for livestock by temperature and region shall be sourced from Tables 10.14 – 10.16 of the IPCC Guidelines for National Greenhouse Gas Inventories[46]. $U_{p,y}$, which in accordance to the PoA-DD is assumed to be 1 *ex-ante,* will be confirmed *ex-post* through the annual Biogas User Survey.

Project emissions following Tier 1:

Project emissions include both the physical leakage of biogas from the biodigester and the incomplete combustion of biogas. These shall be accounted for in accordance with equation (17) of the applicable methodology:

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

Where:

$PE_{p,CH4,y}$	Project emissions from manure handling during the year y in tCO_2e
GWP_{CH4}	Global Warming Potential of methane
$N_{T,h}$	Number of livestock category T in premise *h*

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

$EF_{awms, T}$ Emission factor for the defined livestock population category T

PL_y Physical leakage of the biodigester (through measurement or application of 10% default)

$\eta_{new\ stove}$ Combustion efficiency of the used type of biogas stove

$PE_{awms,NT}$ Project emission from the animal waste not treated in the biodigester

Project emissions from the animal waste not treated in the biodigester in the project scenario will be zero since the non-treated animal waste in the project scenario will have the same situation as they would have had in the baseline. Tier 1 approach is applied for the calculation of the baseline emissions where baseline data required for an estimation of the methane emission factor per category of livestock were not available, thus the project scenario for untreated animal waste will be similar to baseline.

Total emissions reductions following Tier 1:
Emission reductions for the VPA will be calculated as:

$$\mathbf{ER_{CH4,y}} = \left(BE_{b,CH4,y} - PE_{p,CH4,y}\right) * N_{p,y} * U_{p,y} \quad \textbf{(7)}$$

Where:

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

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

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

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

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

Baseline emissions following Tier 2:
The Tier 2 approach is applicable to situations where baseline data for an estimation of the methane emission factor per category of livestock are available. The baseline emissions per household shall be calculated as follows:

$$BE_{b,CH4,h,y} = \frac{(VS_T * 365) * (B_{0,T} * 0.67 kg/m^3 * MCF_{x,k} * MS_{T,x,k} * GWP_{CH_4} * N_{T,h})}{1000} \quad \textbf{(8)}$$

Where:

$BE_{b,CH4,h,y}$ Baseline emissions from manure handling during the year *y* in tCO_2e for manure handling method h

VS_T Daily volatile solid excreted for livestock category T in kg dry matter per animal per day

$B_{0,T}$ in Maximum methane producing capacity for manure produced by livestock category T m^3 CH_4

$MCF_{x,k}$ Methane conversion factors for the animal waste handling system in the baseline situation by climate zone *k*, (%)

$MS_{T,x,k}$ Fraction of livestock category T's manure handled using manure management system *x* in climate region *k* (determined through survey method ex-post)

GWP_{CH4} Global Warming Potential of methane

$N_{T,h}$ Number of livestock category T in premise *h*

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

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

Project emissions following Tier 2:

Project emissions include both the physical leakage of biogas from the biodigester and the incomplete combustion of biogas. These shall be accounted for in accordance with equation (17) of the applicable methodology:

$$\mathbf{PE_{p,CH4,y}} = \mathrm{GWP_{CH4}} * \sum (\mathrm{N_{T,h,y}} * \mathrm{EF_{awms,T}}) * \mathrm{PL_y} + \sum (\mathrm{N_{T,h,y}} * \mathrm{EF_{awms,T}}) * (1 - \eta_{\mathrm{new\ stove}})(1 - \mathrm{PL_y}) \quad \textbf{(9)}$$

Where:

$PE_{p,CH4,y}$ Project emissions from manure handling during the year y in tCO_2e

GWP_{CH4} Global Warming Potential of methane (25)

$N_{T,h}$ Number of livestock category T in premise h

$EF_{awms,\ T}$ Emission factor for the defined livestock population category T

PL_y Physical leakage of the biodigester (through measurement or application of 10% default)

$\eta_{\text{new stove}}$ Combustion efficiency of the used type of biogas stove

$PE_{awms,NT}$ Project emission from the animal waste not treated in the biodigester. In the above equation, $EF_{awms,\ T}$ is further defined as:

$$\mathrm{EF_{awms,h}} = \frac{(\mathrm{VS_T} * 365) * (\mathrm{B_{0,T}} * 0.67\mathrm{kg/m^3} * \mathrm{MCF_{x,k}} * \mathrm{MS_{T,x,k}})}{1000} \quad (\textbf{10})$$

EFawms(T) CH_4 emission factor for livestock category *T*, (tCH4per animal per year)

VS(T) day) Daily volatile solid excreted for livestock category *T*, (kg dry matter per animal per

365 Basis for calculating annual VS production, (days per year)

Bo(T) Maximum methane production capacity for manure produced by livestock category *T*, (m3CH4 per kg of VS excreted)

DCH4 CH_4 density (0.00067 t per m^3 at room temperature)

MCF(BL,k) Methane conversion factors for the animal waste handling system in the baseline situation by climate zone *k*, (%)

MS(T,S,k) Fraction of livestock category *T*'s manure treated in the animal waste management system, in climate region *k* (dimensionless)

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

Total emissions reductions following Tier 2:
Emission reductions per VPA will be calculated as:

$$\mathbf{ER_{CH4,y}} = \left(BE_{b,CH4,y} - PE_{p,CH4,y}\right) * N_{p,y} * U_{p,y} \quad (\mathbf{9})$$

Where:

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

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

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

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

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

iii. Accounting for total emission reductions

The total emission reductions per VPA per year from both the displacement of fossil fuels and non-renewable biomass and avoidance of methane emissions from manure handling will be calculated as:

$$\mathbf{ER_{Total}} = ER_{CO2,y} + ER_{CH4,y} \quad (\mathbf{10})$$

Where:

$ER_{CO2,y}$ CO_2 emissions reductions in year *y* (tCO_2)

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

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

B.7.1. Data and parameters to be monitored by each generic VPA

Data / Parameter:	**$U_{p,y}$**
Data unit:	Fraction
Description:	Cumulative usage rate for technologies in project scenario p in year y, based on cumulative adoption rate and drop-off rate (fraction)

Source of data:	Determined on VPA level; Collected through the annual Biogas User Survey (which integrates a usage survey) or collected separately via an exclusive Usage Survey aiming to determine only $U_{p,y}$.
Value(s) applied	
Measurement methods and procedures:	An assessment of the drop-off rate of usage requires that digesters of different age groups are assessed. Monitoring shall be carried out on a random sample of digesters of different ages. The minimum total sample size is 100, with at least 30 samples for biogas digesters of each age bracket (measured in annual increments) being surveyed. The usage rate of thermal applications will be monitored annually using survey methods to satisfy the requirements put forth by the methodology 'Technologies and practices to displace decentralized thermal energy consumption' (11/04/2011).
Monitoring frequency:	Annual
QA/QC procedures:	To account for void responses and lack of availability of some households on the day of the survey, additional households within each age group should be questioned. To ensure conservativeness, participants in a usage survey with technologies in the first year of use (age 0-1) must have technologies that have been in use on average longer than 0.5 years. For technologies in the second year of use (age 1-2), the usage survey must be conducted with technologies that have been in use on average at least 1.5 years, and so on.
Purpose of data	Calculation of project emissions
Additional comment:	A single usage parameter is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario.

Data / Parameter	**$N_{p,y}$**
Unit	Number
Description	Cumulative number of project technology-days included in the project database for project scenario p against baseline scenario b in year y
Source of data	Total sales record from the Project Database.
Value(s) applied	Reported as a result of ($No_{p1,y}$ * ($O_{p1,y}$ / 365))
Measurement methods and procedures	New biogas digesters included under the PoA will be entered into the Project Database as and when they come online. This will enable a running cumulative total of biogas digesters installed to be kept. The operational rate is determined on a sampling basis through annual monitoring surveys. In addition, households are required to notify provincial office staff in a situation when a biodigester stops working. This information is recorded in the Project database, allowing the identification per included biodigester the amount of operational days per year. In a scenario where the biodigester stops operating, the number of non-operational days is recorded in the database.
Monitoring frequency	Continuous
QA/QC procedures	$N_{p,y}$ shall be calculated from (a) the number of installed system (parameter $No_{p,y}$); and (b) the average operational days of the system ($O_{p,y}$). The equation is therefore ($N_{p,y}$ = $No_{p,y}$ * ($O_{p,y}$ / 365)). The average operational days will be confirmed upon verification.
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data / Parameter:	**$No_{p,y}$**
Data unit:	Number
Description:	Cumulative number of project technologies included in the project database for project scenario p in year y

Source of data:	Determined on VPA level; Total sales record from the Project Database.
Value(s) applied	
Measurement methods and procedures:	The date presented in the Sales Agreement for each biogas digester is recorded in the Project Database. The average length of time between when a digester is completed and when biogas begins to be used will be established on VPA level. $\mathbf{N_{0p,y}}$ will be calculated from this date.
Monitoring frequency:	Continuous
QA/QC procedures:	As per procedures of the Project Database.
Purpose of data	Calculation of project emissions
Additional comment:	N/A

Data / Parameter:	$\mathbf{O_{p,y}}$
Data unit:	Number
Description:	The average technology-days during which the biodigesters are operational for project scenario p1 against baseline scenario b in year y
Source of data:	Determined on VPA level; Project Database
Value(s) applied	Determined on VPA level
Measurement methods and procedures:	The operational rate is determined on a sampling basis through annual monitoring surveys. In addition, households are required to notify provincial office staff in a situation when a biodigester stops working. This information is recorded in the Project database, allowing the identification per included biodigester the amount of operational days per year. In a scenario where the biodigester stops operating, the number of non-operational days is recorded in the database.
Monitoring frequency:	Continuous
QA/QC procedures:	The average operational days will be confirmed upon verification.
Purpose of data	As per procedures of the Project Database.
Additional comment:	The actual cumulative number of biodigester non-operational days will be confirmed upon verification. The equation to calculate this is ($O_{p,y}$ = 365 – non-operational days)

Data / Parameter:	$\mathbf{LE_{p,y}}$
Data unit:	tCO_2e/year
Description:	Leakage in project scenario *p* during year *y*
Source of data:	Determined on VPA level; Collected through the annual Biogas User Survey.
Value(s) applied	0.00
Measurement methods and procedures:	Non-biogas digester users will be surveyed through a questionnaire to determine whether leakage has occurred.
Monitoring frequency:	Every two years
QA/QC procedures:	The leakage will be monitored annually using survey methods to satisfy the requirements put forth by the methodology 'Technologies and practices to displace decentralized thermal energy consumption' (11/04/2011).
Purpose of data	Calculation of leakage
Additional comment:	N/A

Data / Parameter:	$\mathbf{N_{T,h}}$
Data unit:	Number
Description:	Number of animals of livestock category T in premise *h*
Source of data:	Determined on VPA level; Baseline surveys

Value(s) applied	Determined on VPA level
Measurement methods and procedures:	Households/communities/SMEs will be asked how many animals of different categories they own, and the conditions under which they are kept (i.e. freely or in a confined space).
Monitoring frequency:	Annually
QA/QC procedures:	N/A
Purpose of data	Calculation of project emissions
Additional comment:	N/A

Data / Parameter:	**$BB_{b\ ratio}$**
Data unit:	%
Description:	Baseline scenario ratios
Source of data:	Baseline survey (ex-ante figures) Monitoring survey (ex-post figures)
Value(s) applied	Determined on VPA level, with 'b' being sub-categorised into: b1: households using firewood only b2: household using charcoal only b3: households using firewood + charcoal only This list of baseline scenarios is not exhaustive and may contain other baseline scenarios as long as permitted under the applied methodologies. Separate baseline scenarios will need to be defined for households, communities and SMEs, alike.
Measurement methods and procedures:	Households/communities/SMEs will be asked which baseline scenario they fell into before receiving a biogas digester.
Monitoring frequency:	Annually
QA/QC procedures:	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, additional households should be questioned.
Purpose of data	Calculation of baseline emissions
Additional comment:	The ratio to apply for each baseline scenario in the project population will be determined as part of the monitoring survey on a sampling basis. The survey results will be applied to the project population to calculate the emission reductions.

Data / Parameter:	**$BB_{b,bio}$**
Data unit:	Tonnes/year
Description:	Amount of woody biomass used in the baseline scenario *b*
Source of data:	Option 1: Initially estimated on VPA level referencing reports, studies or baseline surveys. Subsequently confirmed through a Baseline Performance Field Test. Option 2: Baseline Performance Field Test directly
Value(s) applied	Determined on VPA level, with 'b' being sub-categorised into: b1: households using firewood only b2: household using charcoal only b3: households using firewood + charcoal only This list of baseline scenarios is not exhaustive and may contain other baseline scenarios as long as permitted under the applied methodologies. Separate baseline scenarios will need to be defined for households, communities and SMEs, alike.

Measurement methods and procedures:	Households/communities/SMEs will be asked how much woody biomass they use per week, and undergo a Kitchen Performance Test as per the requirements of the TPDDTEC methodology.
Monitoring frequency:	Option A: Baseline Performance Field Test will be updated once every two years. Option B: Baseline Performance Field Test only conducted once upfront and parameter fixed throughout crediting period.
QA/QC procedures:	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	Calculation of baseline emissions
Additional comment:	Separate BFTs per identified baseline scenario will need to be conducted.

Data / Parameter:	**$BB_{b,fuel}$**
Data unit:	Tonnes/year
Description:	Amount of fossil fuels used in baseline scenario *b*
Source of data:	Option 1: Initially estimated on VPA level referencing reports, studies or baseline surveys. Subsequently confirmed through a Baseline Performance Field Test. Option 2: Baseline Performance Field Test directly
Value(s) applied	Determined on VPA level, with '*b'* being sub-categorised into: b1: households using firewood only b2: household using charcoal only b3: households using firewood + charcoal only This list of baseline scenarios is not exhaustive and may contain other baseline scenarios as long as permitted under the applied methodologies. Separate baseline scenarios will need to be defined for households, communities and SMEs, alike.
Measurement methods and procedures:	Households/communities/SMEs will be asked how much fossil fuels they use per week for cooking.
Monitoring frequency:	Option A: Baseline Performance Field Test will be updated once every two years. Option B: Baseline Performance Field Test only conducted once upfront and parameter fixed throughout crediting period.
QA/QC procedures:	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	Calculation of baseline emissions
Additional comment:	Separate BFTs per identified baseline scenario will need to be conducted.

Data / Parameter:	**$BB_{p,bio}$**
Data unit:	Tonnes/year
Description:	Amount of woody biomass used in the project scenario p
Source of data:	Estimated on VPA level referencing reports, studies or baseline surveys. Confirmed through a Project Performance Test.
Value(s) applied	Determined on VPA level. As there is only one applicable project scenario (biogas usage), only one project scenario is applicable per user group. Separate project scenarios will need to be defined for each user group (households, communities and SMEs).

Measurement methods and procedures:	Households/communities/SMEs will both be asked how much woody biomass they use per week, and undergo a Kitchen Performance Test as per the requirements of the TPDDTEC methodology.
Monitoring frequency:	Once every two years
QA/QC procedures:	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	To calculate project emissions
Additional comment:	Project Performance Field Test (PFT) will be updated once every two years.

Data / Parameter:	**$BB_{p,fuel}$**
Data unit:	Tonnes/year
Description:	Projected amount of fossil fuels used in the project scenario *p*
Source of data:	Estimated on VPA level referencing reports, studies or baseline surveys. Confirmed through a Project Performance Test.
Value(s) applied	Determined on VPA level, with '*p'* being sub-categorised into: As there is only one applicable project scenario (biogas usage), only one project scenario is applicable per user group. Separate project scenarios will need to be defined for each user group (households, communities and SMEs)
Measurement methods and procedures:	Households/communities/SMEs will be asked how much fossil fuels they use per week for cooking.
Monitoring frequency:	Once every two years
QA/QC procedures:	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	Calculation of project emissions
Additional comment:	Project Performance Field Test (PFT) will be updated once every two years.

Data / Parameter:	**$MS_{P,S,K}$**
Data unit:	%
Description:	Fraction of livestock category T's manure not treated in bio-digester, in climate region *k*
Source of data:	Collected through the annual Biogas User Survey.
Value(s) applied	Determined on VPA level
Measurement methods and procedures:	Households/communities/SMEs will be asked to estimate the fraction of their animal's manure that is fed into the biogas digester for the different relevant livestock categories.
Monitoring frequency:	Annual
QA/QC procedures:	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	Calculation of project emissions
Additional comment:	N/A

Data / Parameter:	$MS_{T,S,k}$
Data unit:	%
Description:	Fraction of livestock category T's manure fed into the bio-digester, *S* in climate region *k*
Source of data:	Biogas User Survey
Value(s) applied	Determined on VPA level
Measurement methods and procedures:	Households/communities/SMEs will be asked to estimate the fraction of their animal's manure that is fed into the biogas digester for the different relevant livestock categories.
Monitoring frequency:	Annual
QA/QC procedures:	To account for void responses and lack of availability of some households/communities/SMEs on the day of the survey, at least 10 additional households should be questioned.
Purpose of data	Calculation of project emissions
Additional comment:	Applicable to VPAs applying Tier 2 only

Data / Parameter:	GWP_{CH4}
Data unit:	Unit
Description:	Global Warming Potential of methane
Source of data:	IPCC (2006); May be updated according to any future changes by the IPCC
Value(s) applied	As per the Gold Standard's rule update 'The application of Global Warming Potentials for Gold Standard project activities': 21 for VPAs seeking issuance for emission reductions incurred before 1 January 2013 25 for VPAs seeking issuance for emission reductions incurred after 1 January 2013
Measurement methods and procedures:	The IPCC guidelines will be checked on an annual basis during verification to determine if the GWP of methane has changed from the above.
Monitoring frequency:	Annual
QA/QC procedures:	As per the Gold Standard's rule update 'The application of Global Warming Potentials for Gold Standard project activities'
Purpose of data	Calculation of project emissions
Additional comment:	N/A

Data / Parameter:	Bio
Data unit:	-
Description:	Use of bio-slurry
Source of data:	Determined on VPA level; Biogas User Survey
Value(s) applied	Not applicable (no effect on ER calculations)
Measurement methods and procedures:	Households will be asked how they use the bio-slurry produced as a bio-product of the anaerobic digestion process.
Monitoring frequency:	Annual
QA/QC procedures:	Sampling in accordance with the procedures in the methodology applied shall be carried out.
Purpose of data	Calculation of project emissions
Additional comment:	To be used for the calculation of project emissions associated with bio-slurry usage – the CH_4 emissions from the anaerobic decay of the residual organic content of digestate subjected to anaerobic storage.

The PoA will also monitor the following social and environmental parameters, as defined under the Gold Standard[47]:

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

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

Data / Parameter:	**GS-06 Quality of employment**
Data unit:	Number
Description:	Number of employees attending training programmes
Source of data:	Electronic Project Database
Value(s) applied	Not applicable, no effect on emission reduction calculations.
Measurement methods and procedures:	All vocational training attendees will be issued with a certificate proving their attendance, and a record of their names, contact details and gender, will be kept as part of the CME's consolidated monitoring database. This will be updated as and when trainings are conducted.
Monitoring frequency:	Annual
QA/QC procedures:	N/A
Purpose of data	Monitoring of sustainable development benefits
Additional comment:	N/A

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

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

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

Data / Parameter:	GS-10 Quantitative employment and income generation
Data unit:	Number
Description:	Number of employees in the project
Source of data:	Employment records
Value(s) applied	Not applicable, no effect on emission reduction calculations
Measurement methods and procedures:	Records will be kept of all employees and jobs created as part of the programme. Hard copies of employment contracts will be kept by VPA Implementers as evidence. Will include part-time work.
Monitoring frequency:	Annual
QA/QC procedures:	N/A
Purpose of data	Monitoring of sustainable development benefits
Additional comment:	N/A

Data / Parameter:	GS-12 Technology transfer and technological self-reliance
Data unit:	Number
Description:	Number of employees attending training programmes
Source of data:	Electronic Project Database
Value(s) applied	Not applicable, no effect on emission reduction calculations

Measurement methods and procedures:	All vocational training attendees will be issued with a certificate proving their attendance, and a record of their names, contact details and gender, will be kept as part of the CME's consolidated monitoring database. This will be updated as and when trainings are conducted.
Monitoring frequency:	Annual
QA/QC procedures:	N/A
Purpose of data	Monitoring of sustainable development benefits
Additional comment:	N/A

B.7.2. Description of the monitoring plan for a generic VPA

The monitoring plan describes how to collect, assess and archive all relevant data to be monitored according to the methodology. Data from the monitoring procedures will be recorded in the electronic project database and summarised in an annual Monitoring Report. The data collection will follow the standard "Sampling and surveys for CDM project activities and programme of activities (Version 04)"[48]. The guidelines 'Sampling and surveys for CDM project activities and programmes of activities' (Version 03) has been used to structure the monitoring plan.

Sampling Design

Objectives and reliability requirements

The objective of the sampling effort is to meet the monitoring requirements set forth in the methodology '*Technologies and Practices to Displace Decentralized Thermal Energy Consumption',* as detailed in D.7.1 above. Monitoring will be carried out on an annual basis, with those parameters that can be monitored on a biennial basis monitored once every two years.

As the PoA progresses and the number of VPAs increases, a single monitoring plan can be applied, covering several VPAs.

Target population

The target population for the application of monitoring procedure is the households, local communities and SMEs with installed biodigesters, as identified through the Project Database managed by the CME. Those parameters required to assess the extent of leakage for non-biogas users every two years will be asked to similar households in the same region.

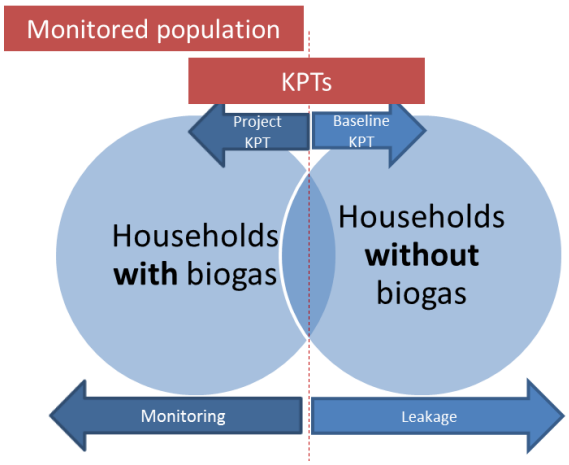

Figure 7: Target population of sampling efforts. (KPTs = Kitchen Performance Test)

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Sampling method

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

Sample size

In order to combine monitoring with an assessment of the drop-off rate of usage (which requires that digesters of different age groups are assessed), monitoring should be carried out on a random sample of digesters of different ages. The minimum total sample size is 100, with at least 30 samples for biogas digesters of each age bracket (measured in annual increments) being surveyed. Table 1 illustrates how the sample size can be determined. To account for void responses and lack of availability of some households on the day of the survey, additional households within each age group should be questioned.

Table 3: Example of minimum sample sizes for the usage rate survey.

Age of digesters (years)	Number digesters installed in age group	Minimum number sampled
0 - 1	200	30
1 - 2	1,500	30
2 - 3	1,000	30
3 - 4	2,000	30
	Total sampled in year 4	**120**

To ensure conservativeness, participants in an usage survey with technologies in the first year of use (age 0-1) must have technologies that have been in use on average longer than 0.5 years. For technologies in the second year of use (age 1-2), the usage survey must be conducted with technologies that have been in use on average at least 1.5 years, and so on.

Alternatively, if the VPA implementer wishes to conduct the usage survey separately from monitoring the other parameters, the following minimum sample sizes will apply to the monitoring of all other parameters (apart from the average fuel saving derived from the Kitchen Performance Test)[49]:

- Group size <300: minimum sample size 30 or population size, whichever is smaller
- Group size 300 to 1000: minimum sample size 10% of group size
- Group size > 1000: minimum sample size 100.

[49] 'Technologies and practices to displace decentralized thermal energy consumption' (11/04/2011), p.10

The sample size for the usage survey will remain as above. As per the methodology, the majority of interviews in a usage survey must be conducted in person and include observations by the interviewer within the kitchen in question. The remainder may be conducted via telephone by the same interviewers on the condition that in-kitchen observational interviews are concluded and analysed first, so that typical circumstances are well understood by telephone interviewers.

To determine the average fuel savings as per the Kitchen Performance Test, the sample size shall be determined through ensuring that the results comply with a 90/30 level of confidence/precision, as per Annex 4 of the applied methodology. A BFT will be conducted for each identified baseline scenario. VPAs that chose not to implement separate BFTs per baseline scenario will, for the sake of conservativeness, apply the baseline emission values from the most conservative baseline scenario that is applicable to the VPA. Only one PFT per target group (household/communities/SMEs) is required on the VPA level as there is only one project scenario.

Sampling frame

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

Data to be collected

Field measurements

The VPA Implementer, with support from the CME if agreed, will collect the data necessary for the monitoring and for the emission reductions calculation. Field measurements and data to be collected are listed in section B.7.1. above.

To account for seasonal fluctuations, monitoring of fuel wood consumption (KPT) should by preference be carried out during the dry season. This ensures conservativeness since during this season less wood is needed for cooking purposes as the wood fuel, the primary fuel for cooking purposes of most households, contains less moisture. Seasonality does not impact usage rate of other fuels such as LPG and kerosene. Measurements conducted during the dry season can therefore be assumed to be conservative. In case monitoring of fuel wood consumption is not taking place during the dry season moisture meters should be used.

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

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

- Quantity of biomass and fossil fuel that is used for cooking in a given baseline scenario in a given year (y) – once every two years under Option A; or once upfront under Option B, whereby under Option B the baseline scenario fuel usage is fixed for the crediting period and therefore not monitored;
- Quantity of biomass and fossil fuel that is used for cooking in a given project scenario in a given year (y) – once every two years;
- Leakage in the given project scenario in the given year (y) – once every two years.

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

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

Quality assurance/Quality control

The CME will provide the necessary training to the VPA implementers and the parties involved in the monitoring to ensure that the data recorded is complete and accurate. Training will include going through all the data that needs to be collected and how to do this, including how to carry out the Kitchen Performance Test (KPT) and to adequately fill out the questionnaire. The VPA Implementer will prepare data collection protocols to be given to the research assistants to guide them during the data collection exercise. The qualifications and experience of personnel involved in monitoring should be as follows:

- Knowledge of local language(s)
- Prior experience in household surveys, with experience in KPTs an advantage
- At least one team member with a good understanding of statistics and statistical software
- Knowledge of technical aspects of operating a biogas digester
- Ability to identify different manure management techniques
- Prior involvement in surveys (baseline or monitoring) for other carbon projects is advantageous,

Response rates will be maximized by contacting all randomly-selected biogas digester users beforehand to arrange a practical site visit date and sampling over the minimum required number to compensate for any non-responses. In special cases where participants refuse to participate in the monitoring, the reason shall be documented in the CME's Project Database. The surveyor will explain that monitoring is part of the requirements of the programme and try to arrange an alternative date for a site visit, or carryout monitoring with another member of the households, community or SME.

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

Analysis

All the sales data and the survey data will be captured in a computerised database. The analysis will include a calculation of the proportion of biogas system in use and of the emission reductions according to the methodology applied. Outliers will be excluded using the Grubb's Test.[50]

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

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

Implementation plan

The VPA Implementer will be responsible for the collection of all Sales Agreement data and the creation of the Monitoring Report at the end of each Monitoring Period. The VPA implementer will also be responsible for entering user data into the Project Database, and for ensuring that the information in the Sales Agreements is complete and correct. The total number of Sales Agreements will reveal the quantity of biogas systems sold at the end of a Monitoring Period. The Project Database will record the start and end dates of each selling year *y* for each biogas system ($t_{fraction}$), and calculate the emission reductions attributable to each Monitoring Period. Appropriate record keeping procedures will be implemented to ensure that each Monitoring Period dataset can be transparently attributed to its corresponding VPA, preventing any occurrences of double counting.

Monitoring Responsibilities

The VPA Implementer is responsible for all the monitoring activities carried out within their respective VPA, including data collection, data analysis and writing the Monitoring Report.

Appendix 1. Contact information of coordinating/managing entity and responsible person(s)/ entity(ies)

CME and/or responsible person/ entity	☒ CME ☐ Responsible person/ entity for application of the selected methodology(ies) and, where applicable, the selected standardized baseline(s) to the PoA
Organization	Hivos
Street/P.O. Box	Raamweg
Building	16
City	The Hague
State/Region	South Holland
Postcode	2596 HL
Country	The Netherlands
Telephone	+31 (0)70 376 55 00
Fax	+31 (0)70 362 46 00
E-mail	info@hivos.nl; hclemens@hivos.org
Website	www.hivos.org
Contact person	Harry Clemens
Title	Programme Officer Carbon Finance and Renewable Energy
Salutation	Mr.
Last name	Clemens
First name	Harry

Appendix 2. Affirmation regarding public funding

Please see Official Development Assistance (ODA) Declaration dated 08/09/2014

Appendix 3. Applicability of methodology(ies) and standardized baseline(s)

Please see section B.2. of this PoA-DD for details.

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

No further background information necessary.

Appendix 5. Further background information on the monitoring plan

No further background information necessary.

Appendix 6. Summary of post registration changes

No further background information necessary.

History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the programme design document form for small-scale CDM programmes of activities" (EB 66, Annex 13).
01	EB33, Annex43 27 July 2007	Initial adoption.
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