Gold Standard for the Global Goals
Transition Annex
(To be used by all GS CDM/VER stand alone projects and PoAs, Micro Scale stand alone projects and Micro PoAs)

Version 1 – September 2017

Annex version: 1.6

Gold Standard

KEY PROJECT INFORMATION

Title of Project/PoA/Activity:	African Biogas Carbon Programme (ABC) and its 5 VPA's[1]: 1. VPA01: Kenya – KENAFF 2. VPA02: African Biogas Carbon Programme (ABC) – Tanzania – CAMARTEC – VPA002 3. African Biogas Carbon Programme (ABC) – Uganda -VPA003 4. African Biogas Carbon Programme (ABC) –Tanzania – CAMARTEC - VPA004 5. GS5801 African Biogas Carbon Programme (ABC) - Kenya - VPA006
GS ID of the project/PoA/activity:	PoA: GS2747 VPA-01 : GS2750 VPA-02: GS2751 VPA-03: GS4236 VPA-04: GS5123 VPA-06: GS5801
GS Version:	2.2
Brief description of Project:	VPAs under the ABC PoA will install biodigesters at households currently using non-renewable biomass and fossil fuels as their main source of cooking fuel. The biodigesters will be fed with manure mixed with water, which will undergo anaerobic digestion and produce biogas that is channelled directly to a cook stove. This biogas produced replaces the combustion of biomass and fossil fuels, thereby reducing carbon dioxide (CO_2) emissions. The biodigesters also reduce methane (CH_4) emissions by diverting manure that would otherwise decompose without the capture and use of the methane.
Project type: Energy/Land Use	Energy
For Renewable Energy Projects – intention to apply RECs Labels (y/n)	No
GS Stream (CDM/VER):	VER
Scale (large/scale/micro):	Small
GS Registration Date:	11/06/2015
GS Crediting period start date:	ABC-PoA: 13/06/2013

VPA	Crediting period start date
1	13/06/2013
2	07/01/2014
3	19/04/2015
4	04/03/2017
6	14/03/2016

[1] *GS5124 African Biogas Carbon Programme (ABC) – Tanzania – SimGas - VPA005 is discarded from the registry.*

CDM Registration Date:	N/A
CDM Crediting period start date:	N/A
Project Developer:	HIVOS is the CME
Project Representative:	Mr. Harry Clemens
Project Participants and any communities involved:	The CME is HIVOS and the implementers of the VPAs are: • VPA 01 and 06: Kenya Biogas Programme. • VPA-02 and 04: Centre for Agricultural Mechanisation and Rural Technology (CAMARTEC) • VPA-03: Biogas Solutions Uganda Ltd
Host Country/Location:	Kenya (VPA01 and 06) Tanzania (VPA02, 04 and 05) Uganda (VPA03)
Methodologies applied:	Technologies and Practices to Displace Decentralized Thermal Energy Consumption' (Version 1.0, 11/04/2011)
SDG Impacts:	SDG 2: Zero Hunger SDG 3: Good Health and Well-being SDG 5: Gender Equality SDG 7: Affordable and Clean Energy SDG 8: Decent work and Economic Growth SDG 13: Climate Action
Estimated amount of SDG Impact (GSVERs and others)	See table below SDG 2, 3, 5 and 8 targets are not quantified (see section A.2)

VPA	**SDG13**	**SDG7**
	Annual average tCO2 reduced	Biogas plants installed
1	52,197	11,578
2	114,709	9,928
3	7,975	11,368
4	10,136	4,200
5	16,736	5,030

INTRODUCTION

This transition annex presents information relating to the additional transition requirements under the Gold Standard for the Global Goals. At the time of this transition, the ABC PoA has six included VPAs. All VPAs cover the installation of fixed-dome type biodigesters, or design of equivalent performance, of up to 100 m3 in households that prior to the implementation of the project activity were using non-renewable biomass (NRB) and fossil fuels as their main source of cooking fuel.

SECTION A Sustainable Development Goals (SDG) outcomes

A.1 Relevant target for each of the identified SDGs

>> (Specify the relevant SDG target for at least each of three SDGs addressed by the project. Refer most recent version of targets *here*. Contribution to SDG 13 is mandatory to be demonstrated for all projects and activities. Contribution to SDG 7 is recommended to be demonstrated for all community service projects and activities)

Each VPA contributes directly to 8 out of the 15 SDGs:

SDG	Explanation
1. End Poverty	Biodigester with a lifespan of over 10 years provide a free, renewable and clean energy source for cooking, which reduces fuel expenditure, addresses energy poverty and reduces health cost compared to cooking on wood and exposure to hazardous pollutants from wood stoves.
2. Zero hunger	The use of bio-slurry improve soil health and recycles nutrients which helps farmers to improve yields and makes soil more resilient against climate change
3. Good health and well-being	Significant reduction in household air pollution resulting in better health and lower medical costs.
5. Gender Equality	The workload of women to collect wood is reduced, cooking is faster, and less cleaning is required as pots are not blackened by soot. In addition, convenience is improved as biogas ignites directly and there is no need to tender the fire continuously.
7. Affordable and clean energy	Biodigester feedstock is animal manure which is available for free at the household farm. Biodigesters are generally paid back within 2-3 years and after that households have access to a free and clean source of energy for at least 10 years
8. Decent work and economic growth	The construction of biodigesters creates job opportunities for skilled workers in rural areas which improves the rural economy
13. Climate action	Biodigesters reduce GHG emissions significantly by reducing methane emissions from animal waste management systems and by displacing NRB and fossil fuels for cooking

15. Life on Land	The reduction in wood used for cooking reduces pressure on the forests for firewood and the use of bio-slurry as fertilizer reduces soil erosion and improve soil health (including soil microbial health)

Out of these 8 SDGs, 6 will be monitored. It was decided to retain the existing monitoring plan relevant and to identify matching GS V2.2 sustainable development indicators from the SD matrix[2]. The 6 SDGs to be monitored and matching GS indicators, including justification, are described in the table below:

Table 1: Identified SDGs matching SD indicators and justification

SDG	SDG Target	Specific SDG indicator	Corresponding GS v2.2 SD indicator	Justification
2: Zero Hunger	Target 2.4: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	Indicator 2.4.1 "Proportion of agricultural area under productive and sustainable agriculture	GS-03 Soil condition	A biodigester produces next to biogas bioslurry (the effluent). Bio-slurry is an organic and high quality fertilizer which helps farmers to increase crop yields while maintaining soil health[3]. The combination of improved soil quality, yield and reduced fertilization cost (i.e. farmers don't have to buy chemical fertilizers anymore) will improve farmer's income and their food security.
3: Good Health and Well-being	Target 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	GS-01: Air Quality	Biodigesters significantly reduce household air pollution, e.g. E.buysman in 2015[4]. The study showed that biogas reduces PM2.5 levels, with

[2] As per 3.11B https://globalgoals.goldstandard.org/100-gs4gg-transition-requirements/

[3] https://www.hivos.org/sites/default/files/publications/bioslurry_a_supreme_fertiliser_a_study_on_bioslurry_results_and_uses.pdf

[4] http://www.ccacoalition.org/en/news/report-biogas-and-household-air-quality-rural-cambodia

		3.9.1: Mortality rate attributed to household and ambient air pollution		a reduction of around 36% reduction in exposure and 88% reduction in kitchen concentrations. CO levels are also much lower, but in most cases, including the baseline households lower than the 24-hour WHO guidelines.
5: Gender equality	5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate	5.4.1 Proportion of time spent on unpaid domestic and care work, by sex, age and location	Not available in the previous Passports – new indicator	Empowering women by reducing workload and drudgery of fuel wood collection and creating opportunities for other activities enabled by the freed up time
7: Affordable and Clean Energy	Target 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services	7.1: By 2030, ensure universal access to affordable, reliable and modern energy services 7.1.2: Proportion of population with primary reliance on clean fuels and technology	GS-08 Access to affordable and clean energy services	Biogas generated from biodigesters enables households to have access to an affordable and clean source of energy. Biodigesters have an estimated lifespan of at least 10 years and the pay-back period is only around 2-3 years. Given that manure is produced at the households and available for free, the short pay-back period, households will have access to a free and clean

				source of energy for the majority of the technology lifespan.
			GS-12 Technology transfer and technological self-reliance	Refers to changes compared to the baseline in activities that build usable and sustainable know-how in a region/country for a technology, where know-how was previously lacking.
8: Decent Work and Economic Growth	8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services	8.3.1 Proportion of informal employment in non-agriculture employment, by sex	GS-10 Quantitative employment and income generation	The original indicator measured the number of employees in the project in VPA 1,2,3,4 and 5. This indicator did not capture the actual situation as many masons are working part-time and was therefore modified in VPA06. The number of actual days worked on biodigester construction will be measured and this will be expressed in number of person-years employment created
13: Climate action	Target 13.2: Integrate climate change measures into national policies, strategies and planning	Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan	All monitoring parameters covered in Technologies and Practices to Displace Decentralized Thermal	The installation of biodigester reduces GHG emissions by displacing NRB and LPG by the provision of a clean and renewable fuel: biogas and by

		which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".	Energy Consumption Version 1.1 methodology	reducing methane emissions from animal waste management systems by capturing methane gas in a biodigester and using it for cooking

A.2 Explanation of methodological choices/approaches for estimating the SDG outcome

>> (Explain how the methodological steps in the selected methodology(ies) or proposed approach for calculating baseline and project outcomes are applied. Clearly state which equations will be used in calculating net benefit.)

As per the Gold Standard Transition Requirements, existing programmes that transition to GS4GG may retain their existing sustainable development monitoring plan, including the original indicators chosen. Refer to Section C of this Transition document for further details on how the impacts of these parameters are to be measured.

A.2.1: Methodological approach to calculating the contribution to SDG2

SDG 2.4.1: Proportion of agricultural area under productive and sustainable agriculture

The contribution will be reported as the: Percentage of biogas users who use slurry as a fertilizer

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. The outcome of the survey is the share of households that use bio-slurry.

A.2.2: Methodological approach to calculating the contribution to SDG3

3.9.1: Mortality rate attributed to household and ambient air pollution

The contribution will be reported as the number of users with a reduced, increased or no change in the incidence of eye problems and respiratory illness.

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. The incidence will be monitored through sampling as part of the annual monitoring effort.

A.2.3: Methodological approach to calculating the contribution to SDG5

SDG 5: Achieve gender equality and empower all women and girls

The contribution will be reported as: (1) Percentage of women that report time-savings attributed to the installation of a biodigester and (2) usage of saved time.

1. Time savings will be determined as follows:

   The female member of the household in charge of cooking and/or cooking fuel collection, will be asked:

   - *Did you save time compared to before you have installed a biodigester? (yes/no/same time investment)*

2. The same female member will be asked
   - *What did you do with your saved time? or if no time savings were reported, the reason why will be asked*

The contribution will be monitored through sampling as part of the annual monitoring effort.

A.2.4: Methodological approach to calculating the contribution to SDG7

7.1.2: Proportion of population with primary reliance on clean fuels and technology

The contribution to this target will be determined by:

- Number of biogas units installed (captured in parameter $N_{op1,y}$(Cumulative number of project technologies included in the project database for project scenario p1 in year y). This data originates from the project database
- Number of masons and biogas enterprise staff attending training programmes. The source of data will be training records such as participants lists.

A.2.5: Methodological approach to calculating the contribution to SDG8

8.5 By 2030, achieve full and productive employment and decent work for all women and men

The contribution to this target will be determined by calculating the number of man-days involved in the construction of biodigesters.

$$\boldsymbol{MD_y = \sum_{DT,S}^{1} N_{DT,S} \times MD_{DT,S}}$$

Where

MD_y	=	Man-days of employment generated through the construction of biodigesters (days)
$N_{DT,S}$	=	Number of biodigester constructed by type and size
$MD_{DT,S}$	=	Number of man-days required for the construction of a particular type and size of biodigester

The number of days required by digester type will be determined based on the bill of quantities (BoQ) of each digester type and size. In the case of pre-fabricated digesters this is will be defaulted at 0.25 days per digester irrespective of the size unless otherwise indicated by the supplier.

A.2.6 Methodological approach to calculating the contribution to SDG13

Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".

With regards to the monitoring of the climate impacts as represented through the GS VERs, the PoA will apply the Technologies and Practices to Displace Decentralized Thermal Energy Consumption Version 1 methodology.

i. Accounting for emission reductions due to the displacement of fossil fuels and non-renewable biomass[5].

[5] 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.

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)
$ER_{b,p,y,CO2}$	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
$ER_{b,p,y,non-CO2}$	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:

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

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[6]
$N_{p,y}$	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.

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

Where:

$BE_{b,CO2,y}$	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[7]. Prior to submission for verification, these values shall be fixed *ex-post* and will be deduced from the statistical analysis conducted on the data

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

[7] 'Technologies and practices to displace decentralized thermal energy – 11/04/2011' p.10

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[8]. 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[9]:

- 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.

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

Where:

$PE_{p,CO2,y}$	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

[8] 'Technologies and practices to displace decentralized thermal energy – 11/04/2011' p.12 - 14

[9] This is of baseline scenarios is not exhaustive

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[10].

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 1of the methodology. Default rates of f_{NRB} published by the UNFCCC can also be referred to.

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.

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.

[10] 'Technologies and practices to displace decentralized thermal energy – 11/04/2011' p.12 - 14

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:

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

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[11]. $U_{p,y}$, 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:

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

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*
$EF_{awms,T}$	Emission factor for the defined livestock population category T
PL_y	Physical leakage of the biodigester (through measurement or application of 10% default)

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

$\eta_{new\ stove}$ 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

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

$MCF_{x,k}$	Methane conversion factors for the animal waste handling system in the baseline situation by climate zone *k*, (%)
$MS_{T,x,k}$	Fraction of livestock category T's manure handled using manure management system *x* in climate region *k* (determined through survey method ex-post)
GWP_{CH4}	Global Warming Potential of methane
$N_{T,h}$	Number of livestock category T in premise *h*

$MCF_{x,k}$, $MS_{T,x,k}$ and $N_{T,h}$ 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:

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

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)
$\eta_{new\ stove}$	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:

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

Where

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

VS(T)	Daily volatile solid excreted for livestock category *T*, (kg dry matter per animal per day)
365	Basis for calculating annual VS production, (days per year)
Bo(T) category	Maximum methane production capacity for manure produced by livestock *T*, (m3CH4 per kg of VS excreted)
D_{CH4}	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)

A.3 Data and parameters fixed ex ante for monitoring contribution to each of the sixSDGs

(Include a compilation of information on the data and parameters that are not monitored during the crediting period but are determined before the design certification and remain fixed throughout the crediting period like IPCC defaults and other methodology defaults. Copy this table for each piece of data and parameter.)

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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.

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
Data / Parameter:	**$EF_{p, bio}$**
Data unit:	tCO_2/TJ
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.

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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.

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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:	-

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

SECTION B Safeguarding Principles Assessment

B.1 Analysis of social, economic and environmental impacts

>> (Refer the GS4GG Safeguarding Principles and Requirements document for detailed guidance on carrying out this assessment. The assessment of following Safeguarding Principles Assessment is required to be carried out by GS Version 2.0, 2.1 and 2.2 projects. GS v1.0 projects will carry out assessment of all the safeguarding principles discussed in the GS4GG Safeguarding Principles and Requirements document.)

The PoA is registered under GS version 2.2. Therefore only an assessment of the Safeguarding Principles Assessment is done.

Safeguarding principles	Assessment questions	Assessment of relevance to the project (Yes/potentially/no)	Justification	Mitigation measure (if required)
3.2 Gender Equality and Women's Rights	The Project shall not directly or indirectly lead to/contribute to adverse impacts on gender equality and/or the situation of women. Specifically, this shall include (not exhaustive): sexual harassment and/or violence against	No	The project does not involve in gender based discrimination, or result in an adverse impact on gender equality or the situation of women. In contrast, the installation results in an overall improvement in the situation of women due to time savings	Not Applicable

	women . Slavery, imprisonment, physical and mental drudgery, punishment or coercion of women Restriction of women's rights or access to resources (natural or economic)		(faster cooking, less wood collection) and significantly reduced exposure to hazardous pollutants from biomass stoves by switching to biogas.	
3.4.3 Land Tenure and Other Rights	1. Does the Project require any change to land tenure arrangements and/or other rights? 2. For Projects involving land-use tenure, are there any uncertainties with regards land tenure, access rights, usage rights or land ownership?	No	Biodigesters are installed in the backyard of the farms of small holders, no change in land tenure arrangements or other rights is required for this.	Not Applicable
3.6.2 Negative Economic Consequences	The Project Proponent must demonstrate the financial sustainability of the Projects implemented, also including those that will occur beyond the Project Certification period The Projects shall consider economic impacts and demonstrate a consideration of potential risks to the local economy and how these have been taken in to account in project design, implementation,	No	1. the operating and maintenance cost of biodigesters are minimal. After a mandatory warrantee period, the digesters run virtually maintenance free and given the cost savings attributed to wood displacement and reduce usage of chemical fertilizers, the net running cost of a biodigester are negative, or in words, financially sustainable. 2. The project does not possess any threat to the local economy, instead it	Not Applicable

	operation and after the Project. Particular focus shall be given to vulnerable and marginalized social groups in targeted communities and that benefits are socially inclusive and sustainable.		catalyses several aspects relating to its growth, such as monetary savings, job creating, protection of biomass stocks etc.	
4.1.1 Emissions	Will the Project increase the greenhouse gas over the baseline scenario	No	The intention of this project is to monetize the savings in carbon emissions. Previous carbon issuances are evidence of the GHG emission reduction component.	Not Applicable
4.1.2 Energy Supply	Will the Project use energy from a local grid or power supply (i.e. not connected to a national or regional grid) or fuel resource (such as wood, biomass) that provides for other local users?	No	The project does not require grid access.	Not Applicable
4.2.1 Impact on natural water patterns and flow	Will the Project affect the natural or pre-existing pattern of watercourses and/or he watershed(s) such as high seasonal flow variability, flooding potential, lack of aquatic connectivity or water scarcity?	No	No, the construction of biodigesters does not affect natural or pre-existing pattern of watercourses, ground-water and/or the watershed	Not Applicable
4.2.1 Erosion and/or water body stability	Could the Project directly or indirectly cause additional erosion	No	No, the construction occurs in backyards and does not cause	Not Applicable

	and/or water body instability or disrupt the natural pattern of erosion?		erosion. The use of bio-slurry on the other hand, improves soil health and prevents erosion. In addition, The substitution of fuel wood with biogas will indirectly contribute to a reduction in soil erosion by reducing deforestation.	
4.2.3 Landscape modification and soil	Does the Project involve activities that physically modifies the current landscape use that alter the surface or sub-surface within the Project boundary?	Potentially	The construction of biodigester alters the sub-surface (digesters are constructed sub-surface). The impact of the landscape however is minimal.	Not Applicable
4.3.2 Vulnerability to Natural Disaster	Will the Project be susceptible to or lead to increased vulnerability to wind, earthquakes, subsidence, landslides, erosion, flooding, drought or other extreme climatic conditions?	No	Not applicable, the construction of biodigesters is not related to these risks.	Not Applicable
4.3.3 Genetic Resources	Projects involving the use of GMOs are not eligible for Gold Standard registration. An assessment for the risk of GMO contamination from outside the Project area and appropriate counter measures should be taken.	1. No 2. No	This is not applicable to the project as it does not produce crops	Not Applicable
4.3.4 Release of pollutants	Could the Project potentially result in	Potentially	Digester effluent can cause local	Not Applicable

	release of pollutants to the environment?		eutrophication if not used and dumped. However, most farmers use bio-slurry which is a superior fertilizer compared to farm yard manure. Farmers are also trained to use bio-slurry and the overall effect is positive compared to farm yard manure that is not always used and not properly stored.	
4.3.5 Hazardous and Non-hazardous Waste	Will the Project potentially involve the manufacture, trade, release, and/or use of hazardous and non-hazardous chemicals and/or materials?	No	No hazardous and non-hazardous chemical are involved in biodigester use and construction	Not Applicable
4.3.6 Pesticides and fertilizers	Will the project involve the application of pesticides?	Yes	Farmers are trained to use bio-slurry as effective organic fertilizer which can improve yields and soil quality. However, the project does not encourage using chemical fertilizers	Not Applicable
4.3.7 Harvesting of forests	Will the project involve the harvesting of natural forests?	No	On the contrary, the project will result in a lower demand for firewood	Not Applicable
4.3.8 Food	Does the Project modify the quantity or nutritional quality of food available such as through crop regime alteration, export or economic incentives?	No	On the contrary, bio-slurry is a very good fertilizer which improves crop quality	Not Applicable

4.3.9 Animal Husbandry	Will this Project involve animal husbandry?	No	The project deals with animal's waste and does not involved growing, producing or using animals in any means whatsoever	Not applicable

No additional critical issues were identified.

SECTION C Monitoring plan

C.1 Data and parameters to be monitored

(Include specific information on how the data and parameters that need to be monitored in the selected methodology(ies) or proposed approaches or as per mitigation measures from safeguarding principles assessment or as per feedback from stakeholder consultations would actually be collected during monitoring. Copy this table for each piece of data and parameter.)

Relevant SDG Indicator	**Indicator 2.4.1 "Proportion of agricultural area under productive and sustainable agriculture**
Data/parameter	GS-3 Soil condition
Unit	%
Description	Percentage of biogas users who use slurry as a fertilizer
Source of data	Annual monitoring surveys
Value(s) applied	Not applicable, no effect on emission reductions
Choice of data or Measurement methods and procedures	Application of slurry as fertilizer on 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.
Purpose of data	SDG impact monitoring
Additional comment	N/A

Relevant SDG Indicator	**3.9.1: Mortality rate attributed to household and ambient air pollution**
Data/parameter	GS-1 Air Quality
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	E.g. in Tanzania: Current biogas users report an improvement in health since receiving a biogas digester. 71 % of respondents report a reduction in the occurrence of respiratory diseases[12]. Similar improvements are expected in the other VPAs.
Choice of data or 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.
Purpose of data	SDG impact monitoring
Additional comment	N/A

Relevant SDG Indicator	**SDG 5: Achieve gender equality and empower all women and girls**
Data/parameter	Time savings
Unit	Percentage
Description	Percentage of women that report time-savings attributed to the installation of a biodigester
Source of data	Annual monitoring surveys
Value(s) applied	N/A
Choice of data or Measurement methods and procedures	The female member of the household in charge of cooking and/or cooking fuel collection, will be asked: Did you save time compared to before you have installed a biodigester? (yes/no/same time investment)
Purpose of data	SDG impact monitoring
Additional comment	N/A

Relevant SDG Indicator	**SDG 5: Achieve gender equality and empower all women and girls**
Data/parameter	Usage of saved time
Unit	[-]
Description	Usage of saved time
Source of data	Annual monitoring surveys
Value(s) applied	N/A
Choice of data or Measurement methods and procedures	The same female member will be asked – What did you do with your saved time? or if no time savings were reported, the reason why will be asked
Purpose of data	SDG impact monitoring
Additional comment	N/A

Relevant SDG Indicator	**7.1.2: Proportion of population with primary reliance on clean fuels and technology**
Data/parameter	GS-08 Access to affordable and clean energy services
Unit	Number

[12] Tanzania Biogas User Survey 2014, Section 3.1.9.5 (page 46)

Description	Number of biogas units installed
Source of data	Electronic database
Value(s) applied	Value will be made available ex-post on an annual interval
Choice of data or Measurement methods and procedures	The total number of biogas digesters will be determined via the electronic Project Database
Purpose of data	SDG impact monitoring
Additional comment	N/A

Relevant SDG Indicator	**7.1.2: Proportion of population with primary reliance on clean fuels and technology**
Data / Parameter	GS-12 Technology transfer and technological self-reliance
Unit	Number of masons and biogas enterprise staff attending training programmes
Description	Refers to changes compared to the baseline in activities that build usable and sustainable know-how in a region/country for a technology, where know-how was previously lacking. The number of constructors trained will be monitored.
Source of data	Training records and through the VPA Database; Biogas User Survey.
Value(s) applied	Value will be made available ex-post on an annual interval
Measurement methods and procedures	Records will be kept of attendance at the vocational training programmes, including general training extended to entities outside of the programme.
Monitoring frequency	Annually
QA/QC procedures	N/A
Purpose of data	SDG impact monitoring.
Additional comment	in some VPAs the number of employees of the programme were monitored. This however does not reflect the impact that the program has on building local know-how. Measuring the number of masons and biogas enterprise staff trained is a better indicator as they are involved in the implementation of the program at local level.

Relevant SDG Indicator	**8.5 By 2030, achieve full and productive employment and decent work for all women and men,**
Data / Parameter	GS-10 Technology transfer and technological self-reliance
Unit	Number of employees attending training programmes
Description	Man-days
Source of data	Project database
Value(s) applied	Not applicable, no effect on emission reduction calculations
Measurement methods and procedures	This will be calculated by multiplying the number of digesters constructed times the default number of days required for the construction
Monitoring frequency	Annual

QA/QC procedures	N/A
Purpose of data	Monitoring of sustainable development benefits
Additional comment	In the other VPAs this is monitored as the number of employees. In VPA06 however this was modified to the number of days actually worked which is more informative. Many employees for example, are technology not employees as they are freelance masons and secondly, many employees are just working part-time and the number of employees therefore does not have a direct relationship with employment created.

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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.

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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 ($N_{op1,y}$ * ($O_{p1,y}$ / 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.
Monitoring frequency	Continuous
QA/QC procedures	$N_{p,y}$ shall be calculated from (a) the number of installed system (parameter $N_{op,y}$); and (b) the average operational days of the system ($O_{p,y}$). The equation is therefore ($N_{p,y}$ = $N_{op,y}$ * ($O_{p,y}$ / 365)). The average operational days will be confirmed upon verification.
Purpose of data	Calculation of project emissions
Additional comment	N/A

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".** **7.1.2: Proportion of population with primary reliance on clean fuels and technology**
Data / Parameter:	**$N_{op,y}$**
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. **N0p,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

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
Data / Parameter:	**Op,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)

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
Data / Parameter:	**LEp,y**
Data unit:	tCO2e/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

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
Data / Parameter:	**$N_{T,h}$**
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

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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.

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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.

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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.

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated**

	policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".
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.

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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.

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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

Relevant SDG Indicator	**Indicator 13.2.1 "Number of countries that have communicated the establishment or operationalisation of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production".**
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 CH4 emissions from the anaerobic decay of the residual organic content of digestate subjected to anaerobic storage.

C.1.1 Other elements of monitoring plan (if applicable)

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)"[13]. The guidelines 'Sampling and surveys for CDM project activities and programmes of activities' (Version 03) has been used to structure the monitoring plan.

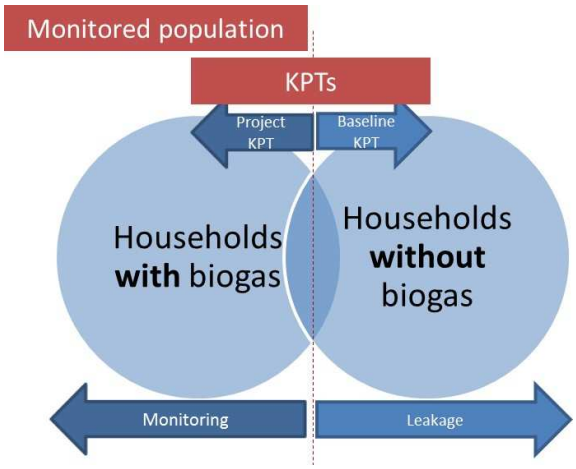
(i)Sampling Design

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'*. 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)

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

[13] 48 EB74, Annex 4

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)[14]:

- 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.

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

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

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.

(ii)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 [15].

[15] 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.

(iii)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.

SECTION D Duration and crediting period

D.1 Duration of project

D.1.1 Start date of project

>> (Specify start date of the project, in the format of DD/MM/YYYY)

06/11/2009

D.1.2 Expected operational lifetime of project

>> (Specify in years)

28 years (PoA), VPA lifetime 21 years

D.2 GS Crediting period of the project/activity

D.2.1 Start date of the ongoing GS crediting period

>> (Specify in dd/mm/yyyy)

VPA	Crediting period start date
1	13/06/2013
2	07/01/2014
3	19/04/2015
4	04/03/2017
5	04/02/2016
6	14/03/2016

D.2.3 End date of the ongoing GS crediting period

>> (Specify in dd/mm/yyyy)

VPA	End of on-going GS crediting period
1	12/06/2020
2	06/01/2021
3	18/04/2022
4	03/03/2024
5	03/02/2023
6	14/03/2023

D.2.3 Total length of the GS crediting periods

>> (Specify the total length of crediting period in years in line with GS4GG Principles & Requirements or relevant activity requirements)

21 years for VPA

SECTION E Stacking of new assets

(If project is looking to stack new assets over GSVERs the required information to demonstrate compliance to the relevant methodology, product specification and additionality shall be presented in the new PDD template launched with GS4GG)

N/A

Appendix 1. Contact information of project participants

CME and/or responsible person/ entity	HIVOS
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.org; hclemens@hivos.org
Website	www.hivos.org
Contact person	Harry Clemens
Title	Programme Officer Carbon Finance and Green Society
Salutation	Mr.
Last name	Clemens
First name	Harry

VPA implementer and/or responsible person/ entity	VPA03
Organization	Biogas Solutions Uganda Ltd
Street/P.O. Box	P.O. Box 8339
Building	Plot 36 Luthuli Rise, Bugolobi
City	Kampala
State/Region	Kampala
Postcode	P.O. Box 8339
Country	Uganda
Telephone	0750 899 238/ 0750 899 236
Fax	Not applicable
E-mail	info@biogassolutions.co.ug
Website	www.biogassolutions.co.ug
Contact person	Michel Muvule Pinto
Title	Programme Coordinator
Salutation	
Last name	Pinto
Middle name	Muvule
First name	Michel
Department	
Mobile	+256 752496128
Direct fax	NA

Direct tel.	+256 750899156
Personal e-mail	muvulex@gmail.com

VPA implementer and/or responsible person/ entity	VPA01 and VPA06
Organization name	Kenya Biogas Program (KBP)
Country	Kenya
Address	P.O. Box 79875-00202 Nairobi
Telephone	0791496964
Fax	Not applicable
E-mail	info@kbp.co.ke
Website	https://kenyabiogas.com
Contact person	Kevin Kinusu
Title	Programme Coordinator
Salutation	Mr.
Last name	Kinusu
Middle name	
First name	Kevin
Department	
Mobile	+254 725 685 864
Direct fax	NA
Direct tel.	+254 789 451 729
Personal e-mail	kkinusu@kbp.co.ke

VPA implementer and/or responsible person/ entity	VPA-02 and VPA-04
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