

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

KEY PROJECT INFORMATION

Title of Project/PoA/Activity:	Nairobi River Basin Biogas Project
GS ID of the project/PoA/activity:	939
GS Version:	2.2 (previous to transition to GS4GG)
Brief description of Project:	<p>The small-scale project activity aims to construct up to 10,000 domestic biogas units of mainly 2m³ and 3m³ gas storage capacities each for individual households with at least 2 zero-grazing cows in Nairobi River Basin. The geographical focus of the project activity is Kiambu County, northwest of Nairobi City. The biogas units are fed with cow dung and produce renewable biogas for cooking and water heating purpose. The digesting process will also generate fertile slurry as a by-product, which can be used as manure for local agriculture (e.g. vegetable farming) and as regular income earning activity.</p> <p>The project activity is saving greenhouse gas emissions by replacing non-renewable biomass (mainly fuel wood and charcoal) with renewable biogas.</p>
Project type: Energy/Land Use	Energy
For Renewable Energy Projects – intention to apply RECs Labels (y/n)	No
GS Stream (CDM/VER):	GS CDM
Scale (large/scale/micro):	small-scale
GS Registration Date:	19/12/2012
GS Crediting period start date:	31/12/2012
CDM Registration Date:	28/06/2012
CDM Crediting period start date:	31/12/2012
Project Developer:	atmosfair gGmbH
Project Representative:	atmosfair gGmbH
Project Participants and any communities involved:	Sustainable Energy Strategies Ltd. (SES), atmosfair gGmbH
Host Country/Location:	Kenya/Nairobi River Basin
Methodologies applied:	AMS I.E.: Project type: Type I. RENEWABLE ENERGY PROJECTS, Project Category: Category I.E. - Switch from non-renewable biomass for thermal applications by the user (ver. 4)
SDG Impacts:	<p>1- Goal 3, Target 3.9: Reduction of indoor air pollution</p> <p>2- Goal 7, Target 7.1: Availability of affordable and clean energy for dairy farmers due to an innovative and costeffective technology</p> <p>3- Goal 8, Target 8.5: Increased employment rates and income generation of masons, supervisors and unskilled labor</p> <p>4- Goal 13, Target 13.2: Reduction of GHG emissions through the project as contribution to a low greenhouse gas emission development path of Kenya.</p> <p>5- Goal 17, Target 17.7: Transfer of an innovative and clean energy technology</p>
Estimated amount of SDG Impact (GSVERs and others)	<p>Goal 3: Construction of 10,000 biogas units under the project until 2015</p> <p>Goal 7: 33.2 MW thermal capacity installed until 2015</p>

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	<p>Goal 8: Depending on implementation plan, > 60 masons trained and sub-contracted by SES</p> <p>Goal 13: 35,949 GS CERs per year</p> <p>Goal 17: Depending on implementation plan, > 60 masons trained and sub-contracted by SES; construction of 10,000 biogas units under the project until 2015</p>
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SECTION A Sustainable Development Goals (SDG) outcomes

A.1 Relevant target for each of the three SDGs

SDG	Positive/ Neutral / Negative	Chosen SDG Target	Indicator defined for the project	Justification information
Goal 3 – Good Health and Well-being	positive	3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.	Indoor air pollution is avoided through smokeless biogas improving the health situation of the users. Also, carbon dioxide emissions are reduced as fossil fuels and non-renewable biomass are displaced.	Status of respiratory problems
Goal 7 – Affordable and clean energy	positive	7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	Availability of affordable and clean energy for most dairy farmers due to an innovative and cost-effective technology.	Energy production of commissioned biogas units
Goal 8 – Decent work	positive	8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	Increased employment rates and income generation of masons, supervisors and unskilled labor (1 mason and 2 unskilled labour per unit).	List of masons working for SES in the specific monitoring period
Goal 13 – Climate action	positive	13.2: Integrate climate change measures into national policies, strategies and planning	Reduction of GHG emissions through the project as contribution to a low greenhouse gas emission development path of Kenya.	Reduction of GHG emissions through the project activities

<p>Goal 17 – Partnerships for the Goals</p>	<p>positive</p>	<p>17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed</p>	<p>Transfer of an innovative and clean energy technology. The technology transfer takes place on two levels: First for the project participants (masons working for SES), who are trained in building biogas units. Second for the general public and end users who are trained in the operation and maintenance of biogas units. With every unit installed more end users will be included into the technology transfer.</p>	<p>Number of masons working for SES in the specific Monitoring Period. Number of biogas units commissioned.</p>
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A.2 Explanation of methodological choices/approaches for estimating the SDG outcome

A.2.1 Methodological choices/approaches for SDG 7

Production of affordable and clean energy is expressed in terms of thermal capacity of the commissioned biogas units. Calculation of thermal capacity is described in section B.2 of the registered CDM-PDD, table 4, see below. For estimating the SDG outcome ex ante, N=10.000 was used for the number of units installed:

Thermal Capacity Calculations				
$E = \eta * Hb * Q * N$				
Activity Data	Value	Unit	Parameter	Source
Combustion efficiency of burners	60	Percent	η	Manufacturer Specification (Rupak)
Heat of combustion per unit volume of biogas	22.1	MJ/m ³	Hb	B.T. Nijajuna 20024
Burner rating	0.90	m ³ /h	Q	Manufacturer Specification (Rupak)
Unit Conversion rate MJ -> kWh	0.278	-	-	-
Thermal Capacity per unit per day	3.32	kW	E	Calculated
Total number of units installed	10,000	-	N	Project Objective
Total Thermal Capacity	33.20	MW	E	Calculated

Copy of table 4 “Thermal capacity calculations” from the registered CDM-PDD

A.2.2 Methodological choices/approaches for SDG 13

Emission reductions are calculated according to methodology **AMS I.E. (Version 04) : Switch from Non-Renewable Biomass for Thermal Applications by the User** by multiplying the number of biogas units operating with the emission reductions per unit.

For conservativeness reasons, only emission reductions from the substitution of fuelwood and charcoal are taken into account. Households in the project area also use Kerosene and LPG. The use of the fossil fuels is part of the baseline, but not for calculation of emission reductions. Furthermore, emission reductions from anaerobic storage of dung are not considered.

Calculation of emission reductions per unit

The following description refers to a single 2 m³ (gas storage) biogas unit. The same emission reductions per unit will also apply to larger units.

According to methodology AMS I.E. (Version 04) : Switch from Non-Renewable Biomass for Thermal Applications by the User, the calculation of emission reductions per unit is done in the following steps:

Step	Description	Derived Parameter(s)	Data source(s)
I.E. -1	Determination of quantity of woody biomass substituted or displaced (per unit)	B_y (gross per unit)	Ministry of Energy: STUDY ON KENYA'S ENERGY DEMAND, SUPPLY AND POLICY

	(including potential leakage)		STRATEGY FOR HOUSEHOLDS, SMALL SCALE INDUSTRIES AND SERVICE ESTABLISHMENTS (Final Report, 2002, prepared by Kamfor Ltd.)
I.E.-2	Determination of the share of Non-Renewable woody biomass	$f_{NRB,y}$	Own assessment based on FAO data (FRA 2010)
I.E.-3	Determination of the fossil fuel likely to be used by similar consumers	$EF_{projected_fossilfuel}$	AMS I.E. Default value
I.E.-4	Determination of Leakage	LE_{NRB}	AMS I.E. Default value
I.E.-5	Calculation of Emission Reductions	ER_y	

Step I.E.-1: Determination of quantity of woody biomass that is substituted or displaced

According to AMS I.E., v. 4, par. 6, B_y can be calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year); This can be derived from historical data or estimated using survey methods. Official historical data is available on national level and is used for the determination of B_y .¹

Household firewood consumption in rural areas among firewood users is reported as 3,394 kg/a and 89 % of rural households use firewood (Kamfor report 2002, p. 10). Therefore, the average fuelwood consumption which is substituted by a biogas unit is $3,394 \text{ kg/a} * 0.89 = 3,020 \text{ kg/a}$.

Household charcoal consumption in rural areas among charcoal users is reported as 717 kg/a. (Kamfor report 2002, p. 12). The average charcoal consumption was multiplied with IPCC Factor of 6² to convert it into woodfuel consumption. The average amount of woodfuel consumption for charcoal of those households using charcoal was calculated to be 4,302 kg per household and year. According to the official Kamfor report, 34% of rural households use charcoal. Therefore, the average woodfuel consumption for charcoal which is substituted by a biogas unit is $4,302 \text{ kg/a} * 0.34 = 1,462 \text{ kg/a}$.

The average annual quantity of woody biomass substituted by a biogas unit is hence $3,020 \text{ kg/a} + 1,462 \text{ kg/a}$.

$$B_y (\text{gross per unit}) = 4.482 \text{ t/a}$$

Note: This is the gross quantity without consideration of net-to-gross adjustment factor for leakage (see Step I.E.-4 below). The value used for calculation of emission reductions is hence further reduced by 5%.

¹ In the registered CDM-PDD, section B.6.1, historical data is compared to results from a baseline survey from atmosfair/ BTA Consultants showing that the chosen historical data is more conservative.

² IPCC (1996): „Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual“, Chapter Energy, p. 1.45, <http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref3.pdf>, last accessed 17.02.2011. Though local data is available (Ministry of Energy “STUDY ON KENYA’S ENERGY DEMAND, SUPPLY AND POLICY STRATEGY FOR HOUSEHOLDS, SMALL SCALE INDUSTRIES AND SERVICE ESTABLISHMENTS (Kamfor 2002) states “More than 90% of charcoal in Kenya is produced in earth kilns, which are characterized by very low conversion efficiencies in the ranges of 10–15% by weight.”) the IPCC factor was used in order to be conservative.

Step I.E.-2: Determination of the share of Non-Renewable biomass

According to AMS I.E., v. 4, par. 7, Project participants shall determine the shares of renewable and non-renewable woody biomass in By (the quantity of woody biomass used in the absence of the project activity) using nationally approved methods (e.g. surveys or government data if available) and then determine $f_{NRB,y}$. To calculate NRB, the following equation shall be used (par.8):

$$f_{NRB,y} = \frac{NRB}{NRB + DRB}$$

Where:

$f_{NRB,y}$ = Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass (calculated)

NRB = Quantity of Non Renewable Biomass

DRB = Quantity of Demonstrably Renewable Biomass

A) Assessment of Non-renewable woody biomass in the project area

According to AMS I.E., v. 4, par.7, Non-renewable woody biomass (NRB) is the quantity of woody biomass used in the absence of the project activity (By) minus the DRB component, as long as at least two supporting indicators are shown to exist:

- Trend showing increase in time spent or distance travelled by users (or fuel-wood suppliers) for gathering fuel wood or alternatively trend showing an increase in the distances the fuel wood is transported to the project area.
- Increasing trends in fuel wood price indicating scarcity

The baseline survey showed increasing trends both in time taken to collect fuel wood and fuel wood prices.³ Therefore, By minus the DRB component can be used to determine NRB.

B) Assessment of Demonstrably Renewable woody biomass in the project area

According to AMS I.E., v. 4, par.7, woody biomass is "renewable" if one of the following two conditions are satisfied:

I. The woody biomass is originating from land areas that are forests where:

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

II. The biomass is woody biomass and originates from non-forest areas (e.g., croplands, grasslands) where:

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

³ See the registered CDM-PDD, pp. 20-21.

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In the registered CDM-PDD, data on the national level from the FAO (Food and Agriculture Organization) Forest Resource Assessment (FRA) of 2010⁴ as a standardized global data collection on forest resources has been used for the assessment.

In line with the definition of AMS I.E., ver. 4, par. 7, only areas where all three criteria as mentioned in par. 7 are fulfilled qualify as renewable. This is true only for private plantation forests (27,180,000 m³ in 2010) and indigenous mangrove areas (13,920,000 m³ in 2010). For the detailed assessment of criteria, see pp. 22 to 24 of the registered CDM-PDD.

C) Determination of the share of Non-Renewable biomass

Using the data from FRA, the parameter $f_{NRB,y}$ was calculated as follows in the registered CDM-PDD, p. 24:

$$f_{NRB,y} = \frac{NRB}{NRB + DRB} = \frac{1,045,774,000 \text{ m}^3}{1,045,774,000 \text{ m}^3 + (27,180,000 \text{ m}^3 + 13,920,000 \text{ m}^3)} = 0.962$$

Step I.E.-3: Determination of fossil fuel likely to be used by similar consumers

According to AMS I.E., v. 4, par. 5, the emission factor for substitution of non renewable woody biomass by similar consumers must be taken to determine emission reductions from non-renewable biomass. The default value to be used and as provided by the methodology is 81.6 t CO₂/TJ.

Step I.E.-4: Determination of Leakage

According to AMS I.E., v. 4, par. 10 and 11, the following leakage sources have to be considered:

Leakage Source	Included?	Justification/ Explanation
Use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources.	Yes	In line with the methodology, B_y is multiplied by a net to gross adjustment factor LE_{NRB} of 0.95 to account for leakages. $B_y(\text{netperunit}) = B_y(\text{grossperunit}) * LE_{NRB}$
If the equipment currently being utilised is transferred from outside the boundary to the project boundary, leakage is to be considered	No	The biogas units will be newly built units, therefore it is not necessary to consider this leakage source.

Step I.E.-5: Calculation of emission reductions from substitution of non-renewable biomass (per unit)

For substitution of non-renewable woody biomass with biogas, emission reductions are calculated as follows:

Emission reductions from the use of non-renewable biomass (per unit)				
$ER_{y, \text{unit}} = B_y(\text{net per unit}) * f_{NRB,y} * NCV_{\text{biomass}} * EF_{\text{projected_fossilfuel}}$				
Activity Data	Value	Unit	Parameter	Source
Quantity of Biomass that is substituted or displaced (incl. NTG Leakage)	4.257	tonnes/yr/household	B_y (net per unit)	Kamfor report

⁴ Food and Agriculture Organization (2010): Global Forest Resources Assessment 2010. Country Report Kenya. <http://www.fao.org/docrep/013/al543E/al543E.pdf>, last accessed 14.06.2019.

Adjustment Factor)				
Fraction of non-renewable Biomass	0.962	percent	$f_{NRB,y}$	Own assessment based on FAO Data
Net calorific value of the non-renewable biomass	0.015	TJ/tonne	$NCV_{biomass}$	AMS I.E.
Emission factor projected fossil fuel (AMS I.E.)	81.6	tCO ₂ /TJ	$EF_{projected_fossilfuel}$	AMS I.E.
Emission reductions from the use of n-r biomass	5.012	tCO ₂ /yr/unit	$ER_y (unit)$	Calculated

Calculation of total emission reductions

Total emission reductions are calculated by multiplying the emission reductions per unit with the number of units operating:

$$ER_y = B_y * NRB_y * NCV_{biomass} EF_{projected_fossilfuel}$$

$$B_y = N_y * B_y(\text{netperunit}) * (1 - DO_y)$$

Therefore:

$$ER_y = N_y * B_y(\text{netperunit}) * (1 - DO_y) * NRB_y * NCV_{biomass} EF_{projected_fossilfuel}$$

Where:

- ER_y = Emission reductions during the year y in tCO₂e
- N_y = Adjusted total number of biogas units deployed until year y of end users who confirmed that non-renewable biomass was displaced/substituted
- DO_y = Statistically adjusted drop out from total population of units in period y
- B_y (net per unit) = Quantity of fuelwood and woodfuel consumption for charcoal that is substituted or displaced in tonnes (tonnes/year/household)
- $f_{NRB,y}$ = Fraction of non renewable woody biomass used in the absence of the project activity in year y (dimensionless)
- $NCV_{biomass}$ = Net calorific value of the non-renewable woody biomass that is substituted (TJ/tonne)
- $EF_{projected_fossilfuel}$ = Emission factor for substitution of non renewable woody biomass by similar consumers (tCO₂/TJ)

Notes:

1. AMS I.E., ver. 4 offers two options for determining B_y . PPs choose option a) of para 6: (a) Calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year); this being expressed in the term:

$$N_y * B_y(\text{netperunit})$$
2. Furthermore, AMS I.E., ver.4, para 12 requires checking all or a representative sample of appliances to ensure that they are still operating. This is expressed in parameter DO_y and considered in the calculation of B_y .

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

Relevant SDG Indicator	SDG 13, Target 13.2, Indicator 13.2.1
Data/parameter	Quantity of fuelwood and woodfuel consumption displaced (B_y , net per unit)
Unit	tonnes/yr/household
Description	Quantity of fuelwood and woodfuel consumption for charcoal that is substituted or displaced in tonnes
Source of data	Ministry of Energy: STUDY ON KENYA'S ENERGY DEMAND, SUPPLY AND POLICY STRATEGY FOR HOUSEHOLDS, SMALL SCALE INDUSTRIES AND SERVICE ESTABLISHMENTS (Final Report, 2002, prepared by Kamfor Ltd.)
Value(s) applied	4.257
Choice of data or Measurement methods and procedures	Quantity of fuelwood and charcoal was determined using official, historical data and cross checked with results from a baseline survey carried out by atmosfair and SES and reviewed by independent third party. See Section A.2, Step I.E.-1 for details. By (gross per unit) is multiplied with a net to gross adjustment factor LE_{NRB} of 0.95 to account for leakages as per AMS I.E., v.4 (see Section A.2, Step I.E.-4): $B_y(\text{netperunit}) = B_y(\text{grossperunit}) * LE_{NRB}$
Purpose of data	Calculation of emission reductions
Additional comment	This is a fixed value throughout the crediting period.

Relevant SDG Indicator	SDG 13, Target 13.2, Indicator 13.2.1
Data/parameter	Fraction of non renewable biomass ($f_{NRB,y}$)
Unit	percent
Description	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non renewable biomass using survey methods
Source of data	FAO (Forest Resource Assessment 2010)
Value(s) applied	0.962
Choice of data or Measurement methods and procedures	In the NRB assessment using FAO data for each type of forest or non-forest area, it was found that in most areas the DRB conditions as per the methodology are not fulfilled. Areas where the growing stock has increased were counted as renewable sourcing areas. See Section A.2, Step I.E.-2 and the registered CDM-PDD, Section B.6.1 for details.
Purpose of data	Calculation of emission reductions
Additional comment	This is a fixed value throughout the crediting period.

Relevant SDG Indicator	SDG 13, Target 13.2, Indicator 13.2.1
Data/parameter	Net calorific value (NCV_{biomass})
Unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass that is substituted
Source of data	AMS I.E., ver. 4
Value(s) applied	0.015

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Choice of data or Measurement methods and procedures	This is a default value as per AMS I.E., ver. 4, par. 5.
Purpose of data	Calculation of emission reductions
Additional comment	This is a fixed value throughout the crediting period.

Relevant SDG Indicator	SDG 13, Target 13.2, Indicator 13.2.1
Data/parameter	Emission factor ($EF_{\text{projected_fossilfuel}}$)
Unit	tCO ₂ /TJ
Description	Emission factor for substitution of non renewable woody biomass by similar consumers.
Source of data	AMS I.E., ver. 4
Value(s) applied	81.6
Choice of data or Measurement methods and procedures	This is a default value as per AMS I.E., ver. 4, par. 5.
Purpose of data	Calculation of emission reductions
Additional comment	This is a fixed value throughout the crediting period.

SECTION B Safeguarding Principles Assessment

B.1 Analysis of social, economic and environmental impacts

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	a. Is there a possibility that the Project might reduce or put at risk women's access to or control of resources, entitlements and benefits?	no	The project doesn't put at risk women's access to or control of resources, entitlements and benefits. Switching to biogas saves time and/or money for the procurement of fuelwood (see Section A.2, Step I.E.-2) and thereby benefits women in particular, as fuelwood procurement is traditionally one of their duties.	
3.2 Gender Equality and Women's Rights	b. Is there a possibility that the Project can adversely affect men and women in marginalised or vulnerable communities (e.g., potential increased burden on women or social isolation of men)?	no	The project does not negatively affect marginalised or vulnerable people. Women in particular benefit from the project activity (see principle 3.2, assessment question a.).	
3.2 Gender Equality and Women's Rights	c. Is there a possibility that the Project might not take into account gender roles and the abilities of women	no	The project takes into account gender roles. Both genders have the possibility to participate in the	

	or men to participate in the decisions/designs of the project's activities (such as lack of time, child care duties, low literacy or educational levels, or societal discrimination)?		decision about and design of the project's activity.	
3.2 Gender Equality and Women's Rights	d. Does the Project take into account gender roles and the abilities of women or men to benefit from the Project's activities (e.g., Does the project criteria ensure that it includes minority groups or landless peoples)?	no	The project takes into account gender roles and women in particular benefit from the project activity (see principle 3.2, assessment question a.).	
3.2 Gender Equality and Women's Rights	e. Does the Project design contribute to an increase in women's workload that adds to their care responsibilities or that prevents them from engaging in other activities?	no	The project is not designed to increase women's workload nor add care responsibilities. On the contrary, the project reduces women's workload (see principle 3.2, assessment question a.).	
2.3 - Gender Equality and Women's Rights	f. Would the Project potentially reproduce or further deepen discrimination	no	The project does not reproduce or further deepen discrimination against women. No discrimination	

	against women based on gender, for instance, regarding their full participation in design and implementation or access to opportunities and benefits?		takes place in the project. Discrimination of any kind, including gender-based discrimination, is not tolerated.	
3.2 Gender Equality and Women's Rights	g. Would the Project potentially limit women's ability to use, develop and protect natural resources, taking into account different roles and priorities of women and men in accessing and managing environmental goods and services?	No	The project does not limit women's ability to use, develop and protect natural resources.	
3.2 Gender Equality and Women's Rights	h. Is there a likelihood that the proposed Project would expose women and girls to further risks or hazards?	No	The project does not expose women and girls to any further risks or hazards. On the contrary, the risk of burn accidents is reduced by switching from open fires to biogas.	
3.4.3 Land tenure and other rights	a. Does the project require any change to land tenure arrangements	No	Household biogas digesters are constructed under the project. The units are built on the premises of	

	and/or other rights?		the households and on their demand. No land tenure arrangements and/or other rights are affected.	
3.4.3 Land tenure and other rights	b. For projects involving land-use tenure, are there any uncertainties with regards land tenure, access rights, usage rights or land ownership?	No	See answer to assessment question a.	
3.6.2 Negative Economic Consequences	1. The Project Developer shall demonstrate the financial sustainability of the Projects implemented, also including those that will occur beyond the Project Certification period.	No	The project has created new jobs in the construction of biogas digesters. In the third monitoring period, 54 masons, one plumber and one marketer/project assistant were working for SES. Biogas units are subsidized for the end-user and access to microfinance is provided to make building biogas digesters affordable. Biogas users save money for fuelwood expenditures and/or save time for fuelwood	

			procurement which can be used for income generation. The dung required for operation of the biogas units is available without additional costs in households with at least 2 cows.	
3.6.2 Negative Economic Consequences	2. The Projects shall consider economic impacts and demonstrate a consideration of potential risks to the local economy and how these have been taken into account in Project design, implementation, operation and after the Project. Particular focus shall be given to vulnerable and marginalised social groups in targeted communities and that benefits are socially-inclusive and sustainable.	No	The project does not imply risks for the local economy, nor affect vulnerable and marginalized social groups, see also answer to request 3.6.2 – 1. above for an assessment of the economic impacts of the project.	
4.1.1 Emissions	Will the Project increase greenhouse gas emissions over the Baseline Scenario?	No	The project reduces greenhouse gas emissions by replacing non-renewable biomass by renewable biogas.	

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<p>4.1.2 Energy Supply</p>	<p>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?</p>	<p>No</p>	<p>The project supports the construction of biogas digesters which supply renewable biogas from cow dung to individual households. No energy from a grid or resources that provide for other local users are used. On the contrary, the project activity reduces consumption of woody biomass.</p>	
<p>4.2.1 Impact on natural water patterns and flow</p>	<p>Will the Project affect the natural or pre-existing pattern of watercourses, ground-water and/or the watershed(s) such as high seasonal flow variability, flooding potential, lack of aquatic connectivity or water scarcity?</p>	<p>No</p>	<p>The project protects water resources by reducing deforestation. A biogas unit uses approximately 50 litres of water per day and unit. A baseline survey showed that most households have access to sufficient water supply to operate the biogas unit. Most households have a water source (borehole) in their compound. Also piped water or rain water is used.</p>	
<p>4.2.2 Erosion and/or water body Instability</p>	<p>a. Could the Project directly or indirectly cause additional erosion and/or water body instability or</p>	<p>No</p>	<p>The project will not cause additional erosion or water body instability or</p>	

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	disrupt the natural pattern of erosion? If 'Yes' or 'Potentially' proceed to question b		disrupt the natural pattern of erosion.	
4.3.1 Landscape modification and soil	Does the Project involve the use of land and soil for production of crops or other products?	No	Biogas units are small in size and the largest part of the biogas unit (the gas storage with 2-3 m ³) is built underground. A biogas unit thus uses a negligible amount of land.	
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	Earthquake hazard is low in the Nairobi region ⁵ and the constructed biogas units are very robust. The project does not lead to increased vulnerability to wind, earthquakes, subsidence, landslides, erosion, flooding, drought or other extreme climatic conditions. On the contrary, by improving soil condition through bio-slurry and protecting forest areas through reduced fuelwood consumption, the project contributes to mitigating the vulnerability to natural disasters like landslides,	

⁵ Rao, S. (2013). Assessing seismic risk in Kenya. GSDRC Helpdesk Research Report 964. Birmingham, UK:GSDRC, University of Birmingham. <http://www.gsdr.org/go/display&type=Helpdesk&id=964>

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			erosion, drought or flooding.	
4.3.3 Genetic Resources	Could the Project be negatively impacted by the use of genetically modified organisms or GMOs (e.g., contamination, collection and/or harvesting, commercial development)?	No	The project does not use GMOs.	
4.3.4 Release of pollutants	Could the Project potentially result in the release of pollutants to the environment?	No	The project reduces CO ₂ -emissions from burning non-renewable woody biomass. Emissions from using renewable biogas are net zero.	
4.3.5 Hazardous and Non-hazardous Waste	Will the Project involve the manufacture, trade, release, and/ or use of hazardous and non-hazardous chemicals and/or materials?	No	Biogas digesters only use cow dung and water and produce fertile slurry as a by-product of digestion which can be used as organic fertilizer.	
4.3.6 Pesticides and fertilizers	Will the Project involve the application of pesticides and/or fertilisers?	No	The project does not involve the application of pesticides and fertilisers. On the contrary, biogas digesters produce fertile slurry as by-product which can be used to replace fertilizers.	
4.3.7 Harvesting of forests	Will the Project involve the harvesting of forests?	No	The project does not involve the harvesting of forests. On the	

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			contrary, it reduces deforestation by replacing fuelwood by biogas.	
4.3.8 Food	Does the Project modify the quantity or nutritional quality of food available such as through crop regime alteration or export or economic incentives?	No	The project does not modify food production patterns such as crop regime. Bioslurry produced by the biogas digesters as by-product may be used as organic fertilizer and increase crop yields and food security for the biogas users.	
4.3.9 Animal Husbandry	Will the Project involve animal husbandry?	No	The project activity itself does not involve animal husbandry.	

SECTION C Monitoring plan

C.1 Data and parameters to be monitored

Relevant Indicator/Safeguarding Principle	SDG SDG 13, Target 13.2, Indicator 13.2.1 SDG 17, Target 17.7, Indicator 17.7.1
Data / Parameter	Number of biogas units commissioned (N_y)
Unit	Number
Description	Adjusted total number of biogas units deployed until monitoring period y of end users who confirmed that non-renewable biomass was displaced/substituted
Source of data	End user agreements. In the end user agreement, end users also confirm to substitute/displace non-renewable biomass. This will also be checked during monitoring for parameter DO_y (see below).
Value(s) applied	To be monitored
Measurement methods and procedures	The total number of units commissioned until period y is calculated from the end user agreements where owner and location of the biogas unit are stated according to the equation provided in the registered PDD, Section B.7.1.
Monitoring frequency	Data is collected continuously
QA/QC procedures	Data will be collected using the standard procedures as described in an internal Monitoring Manual and will be stored for the crediting period and an additional two years.
Purpose of data	Calculation of emission reductions
Additional comment	

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Relevant Indicator/Safeguarding Principle	SDG SDG 13, Target 13.2, Indicator 13.2.1
Data / Parameter	Drop out rate (DO _y)
Unit	%
Description	Statistically adjusted drop out from total population of units in period y
Source of data	Primary data collection: dedicated monitoring team
Value(s) applied	To be monitored
Measurement methods and procedures	<p>Monitoring of the statistically adjusted drop out involves two steps:</p> <p>Step 1: Sample survey amongst units deployed as specified in section B.7.2 of the registered PDD.</p> <p>Step 2: Calculation of the adjusted drop out rate at confidence level and precision as required by the methodology (AMS I.E. v.4) for the inspection frequency chosen.</p> <p>The Drop outs will be determined through spot checks and interviews where it will be checked if the units have been operational during the monitoring period, performed by a dedicated monitoring team according to the sampling procedure described in section B.7.2 of the registered PDD. Substitution of non-renewable biomass will also be checked. Interviews will be reported in a questionnaire.</p> <p>Checks are conducted until the required precision for this parameter is achieved. All questionnaires and information gathered during the sampling by the monitoring team are handed over to the head of the monitoring team that takes care of entering the information to an electronic database.</p> <p>All formulas applied to determine the statistical precision used are standard formula. Furthermore, according to AMS I.E., v. 4, par.17 the sampling error has to be deducted (“...the lower bound of a [...] confidence interval of the parameter value may be chosen”) in the event that the required precision could not be achieved because of a small sample size. No deductions have to be made if the precision is achieved by sampling a proper number of units.</p>
Monitoring frequency	Once per monitoring period
QA/QC procedures	<p>Data will be collected using the standard procedures as described in an internal Monitoring Manual and will be stored for the crediting period and an additional two years.</p> <p>A traceable “identity check” of the units visited during sampling shall be performed and recorded (e.g. a picture of the biogas unit).</p>
Purpose of data	Calculation of emission reductions
Additional comment	

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Relevant Indicator/Safeguarding Principle	SDG SDG 3, Target 3.9, Indicator 3.9.1 GS Monitoring Parameter 01: Air quality
Data / Parameter	Status of respiratory problems
Unit	N.A.
Description	Use of biogas avoids indoor air pollution through smoke from open fires and thereby reduces negative health impacts like respiratory problems.
Source of data	Question on questionnaire for sample households during monitoring campaign
Value(s) applied	To be monitored
Measurement methods and procedures	Data on the parameter air quality are collected through surveys with the sample households during the monitoring campaign. Biogas owners are asked how air quality in the kitchen has changed since using biogas, whether they experienced respiratory problems before using the biogas unit and, if yes, whether they have perceived an improvement as a result of cooking with biogas.
Monitoring frequency	Once per monitoring period
QA/QC procedures	Questionnaires are stored electronically and as hard copy. Answers are copied into an excel-database.
Purpose of data	Monitoring of GS parameter/SDG
Additional comment	

Relevant Indicator/Safeguarding Principle	SDG SDG 17, Target 17.7, Indicator 17.7.1; GS Monitoring Parameter 02: Quality of employment
Data / Parameter	Report on trainings for masons carried out up to the specific monitoring period
Unit	Number of people trained
Description	Masons and supervisors receive training in safe construction of a biogas unit.
Source of data	Training report and number of masons trained
Value(s) applied	To be monitored
Measurement methods and procedures	All masons working for the project have been trained. Staff figures are collected from working contracts.
Monitoring frequency	Once per monitoring period
QA/QC procedures	Working contracts are stored by SES. Also, a manual with special safety instructions for masons was created.
Purpose of data	Monitoring of GS parameter/SDG
Additional comment	

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Relevant Indicator/Safeguarding Principle	SDG	SDG 7; Target 7.1, Indicator 7.1.2; GS Monitoring Parameter 03: Access to affordable and clean energy services
Data / Parameter		Thermal capacity of commissioned biogas units
Unit		MWth
Description		Targeted households do not use clean energy before switching to biogas; they use firewood, kerosene and LPG for cooking. Biogas is a clean energy source and cow dung needed for production available without extra costs for households with at least 2 cows.
Source of data		Commissioning Database and calculation of thermal capacity according to equation provided in the CDM-PDD, Section B.2
Value(s) applied		To be monitored. Thermal capacity of one 2 m ³ biogas unit is 3.35 kW (rating of the burner).
Measurement methods and procedures		Calculation of thermal capacity according to equation provided in the registered PDD, Section B.2
Monitoring frequency		Data is collected continuously, computation of thermal capacity once per monitoring period
QA/QC procedures		Data will be collected using the standard procedures as described in an internal Monitoring Manual and will be stored for the crediting period and an additional two years.
Purpose of data		Monitoring of GS parameter/SDG
Additional comment		

Relevant Indicator/Safeguarding Principle	SDG	SDG 8; Target 8.5., Indicator 8.5.2 SDG 17, Target 17.7, Indicator 17.7.1; GS Monitoring Parameter 04: Quantitative employment and income generation
Data / Parameter		Number of masons working for SES in the specific monitoring period
Unit		Employment number
Description		The project creates jobs for masons and unskilled labor.
Source of data		Staff figures reported by SES
Value(s) applied		To be monitored
Measurement methods and procedures		Staff figures are collected from working contracts
Monitoring frequency		Once per monitoring period
QA/QC procedures		Working contracts are stored by SES.
Purpose of data		Monitoring of GS parameter/SDG
Additional comment		

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

The general set-up of the monitoring is as follows (see the registered CDM-PDD, section B.7.2):

Roles and responsibilities for monitoring by SES

Person	Role
Monitoring Head	The Monitoring Head will be responsible for administering the electronic data storage, and data review
Monitoring team	The monitoring team will conduct the surveys.

Training

SES will provide training or second trainers to persons involved in the monitoring to ensure accuracy and completeness of data recorded. This training procedures will be described in an internal Monitoring Manual.

Monitoring report to be provided to Verification Entity:

SES Monitoring head and atmosfair will be responsible for preparing the Monitoring Report with the support of the monitoring team.

Data archiving

Data will be stored for the crediting period and an additional two years.

Monitoring Requirements

The monitoring requirements of the applicable methodology are as follows:

Monitoring Requirements AMS I.E., ver. 4	Applicable to project activity?	Justification/ Explanation
Para 12: Monitoring shall consist of checking of all appliances or a representative sample thereof, at least once every two years (biennial) to ensure that they are still operating or are replaced by an equivalent in service appliance.	Yes	This requirement is applicable to all project activities using the methodology.
Para 13: In order to assess the leakages specified under paragraph 10, monitoring shall include data on the amount of woody biomass saved under the project activity that is used by non-project households/users (who previously used renewable energy sources). Other data on non-renewable woody biomass use required for leakage assessment shall also be collected.	No	By is multiplied with a Net to Gross Adjustment Factor of 0.95 as per para 10 of AMS I.E., ver. 4, in which case surveys are not required.
Para 14, Phrase 1: Monitoring should confirm the displacement or substitution of the non-renewable woody biomass at each location.	Yes	This requirement is applicable to all project activities using the methodology.
Para 14, Phrase 2: In the case of appliances switching to renewable biomass the quantity of renewable biomass used shall be monitored.	No	Project activity is not switching to renewable biomass, but to biogas.
Para 15: In case option (b) in paragraph 6 is chosen for baseline calculations, monitoring shall include the amount of thermal energy	No	Option (b) of para 6 is not chosen for baseline calculations

generated by the new renewable energy technology in the project in year y, where applicable.		
Para 16: In the case of renewable energy based water treatment technologies, water quality shall be monitored to ensure that it conforms to drinking water quality specified in relevant national microbiological water quality guidelines/standards of the host country. In case a national standard/guideline is not available, the standards/guidelines by the World Health Organization (WHO) or United States Environmental Protection Agency (US-EPA) shall be applied.	No	Project activity does not involve water treatment technologies

Monitoring will be carried out according to the methods and procedures (incl. QA/QC procedures where applicable) specified in the monitoring tables under Section B.7.1. of the registered CDM-PDD, in each Monitoring period.

Sampling

Where a parameter is determined via survey, sampling will be in accordance with the Standard for sampling and surveys for CDM project activities and programme of activities (EB65, Annex 2).

Random sampling will be applied. Documentation of the sampling will be provided i.a. in the Monitoring Report. All data will be stored for the crediting period and an additional two years, providing traceability of the selection.

The Sampling Plan is using the outline as proposed in Appendix 3 of the standard for sampling and surveys for CDM project activities and programme of activities (EB65 Annex 2). For the detailed Sampling Plan and information on data collection and implementation of sampling, please refer to the registered CDM-PDD, pp. 31-37.

SECTION D Duration and crediting period

D.1 Duration of project

D.1.1 Start date of project

01/06/2010 (Date of first expenditures related to construction of biogas units)

D.1.2 Expected operational lifetime of project

15 years: This is a conservative estimate. The technology designer from AFPRO state in their manual: "By building the biogas plant with qualitative materials a lifetime from 25 to 30 years can be expected"⁶

⁶ Manual on Deenbandhu Biogas Plant – 1987; p.6

D.2 GS Crediting period of the project/activity

D.2.1 Start date of the ongoing GS crediting period

31/12/2012

D.2.3 End date of the ongoing GS crediting period

30/12/2022

D.2.3 Total length of the GS crediting periods

10 years

SECTION E Stacking of new assets

N.A.

Appendix 1. Contact information of project participants

Organization name	atmosfair gGmbH
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