CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

GHG capture and combustion from swine manure system, project BRA-01-2005, Paraná and São Paulo, Brazil
Vesion 01, 23 December, 2005

A.2. Description of the project activity:

The GHG capture and combustion from swine manure system, project BRA-01-2005 (hereafter, the "Project") developed by EcoSecurities Brasil Ltda. (hereafter referred to as the "Project Developer") is based on an improvement of the existing swine wastewater treatment facilities in swine farms located throughout Paraná and São Paulo, Brazil.

In manure treatment system the manure flows through a series of lagoons. The first one is an anaerobic lagoon. The second lagoon is a facultative lagoon that decomposes the organic matter though anaerobic or aerobic conditions. The third lagoon, if necessary, is an aerobic lagoon. The material, when degraded anaerobically, produces significant amounts of methane, which is released to atmosphere.

The Project Developer will implement an anaerobic digester that will cover the anaerobic lagoon, and utilize organic material to produce biogas. The anaerobic digester system will treat organically laden wastewater to reduce the amount of COD (Chemical Oxygen Demand) contained prior to the wastewater reaching the facultative lagoon. The biogas produced in the project's anaerobic digester will be captured and destroyed rather than released to the atmosphere.

The project will directly reduce greenhouse gas emissions produced by the release of methane and nitrous oxide from the anaerobic lagoons.

The Project is helping the Host Country fulfil its sustainable development goals, specifically:

- The project will act as a clean technology demonstration project within the waste water management sector, which could be replicated across the region;
- The project is an important capacity building activity, demonstrating the use of a new financial mechanism for funding of the renewable energy and waste management sector via the CDM;
- The multiplier effect of this investment is likely to bring additional benefits, such as employment opportunities, particularly in the agro-industrial sector;
- The project will improve environmental benefits such as local air and water quality, odour; and
- The project can implement, in the future, renewable energy with the biogas as Fuel to reduce the consumption of electricity from grid or fossil fuel for heat production.

A.3. Project participants:

Table: Project participant list.

Name of party involved (*) ((Host) indicate a host Party)	Private and/or public entity(ies) Project participants(*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (yes/no)
Brazil (Host party)	EcoSecurities Brasil Ltda.	No
UK	EcoSecurities ltd	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Host country Party(ies): Brazil

A.4.1.2. Region/State/Province etc.:

Region/State/Province etc.: Paraná and São Paulo

A.4.1.3. City/Town/Community etc:

City/Town/Community etc: Carambeí, Castro and Itararé

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

Table: Farms information, presenting detailed location and project activity data.

Farm / Site name	Address	City	State	Farm Type	Number of lagoons / Anaerobic digester
Cornelis Willem Kuipers Farm	Estrada Mangabeira	Carambei	Paraná	UT	1/1
Valéria Schittenhelm Farm	Estrada Castro Tibagi	Castro	Paraná	UPL	3/1
Fazenda Figueira	Embu	Carambei	Paraná	UPL e UT	1/1
Chacara Marujo	Chácara Marujo Caixa Postal 231	Castro	Paraná	UPL e UT	2/1
Granja Rio Taquara	Est Capão Alto	Castro	Paraná	UT	1/1
Chacara Cruzo	Estrada do Cerne	Castro	Paraná	UT	1/1
Janneke Morsink Greidanus farm	Santa Angela	Castro	Paraná	UPL	2/1
Fazenda Portão Vemelho	Estrada Do Cerne	Castro	Paraná	UPL e UT	2/1
Fazenda Frank"anna	Rodovia PR-151, km 315	Carambei	Paraná	UT	3/1
Fazenda Ponte Alta	Rodovia Aparecido Biglia Filhho, Km.1 - Caixa postal 123	Itararé	São Paulo	UT e UPL	1/2

A.4.2. Category(ies) of project activity:

It falls under category 13 (Waste handling and disposal) of sectoral scope list, referenced in UNFCCC´s website (sector scope list version 03, August of 2005).

A.4.3. Technology to be employed by the project activity:

The project activity includes the total replacement of the open primary anaerobic lagoon at the project sites by an anaerobic digestion technology, called "anaerobic digester”. The wastewater is stored in the reactor for a period between 25 days to 35 days. It is a Hydraulic Retention Time (HRT) enough to the process results in at least 80% reduction of COD. Suspended solids, colour and dissolved solids are all improved in the anaerobic digester.

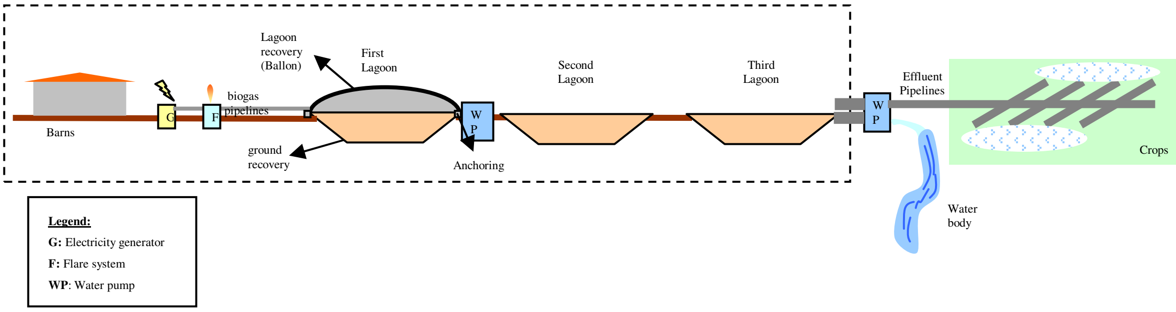

Figure: Manure treatment system scheme.

Anaerobic digester system will be comprised of one or more cells with sufficient capacity to create an adequate HRT for each farm. The anaerobic digester is designed to cover the first stage system (anaerobic lagoon) during 100% of the time. It uses a special 1.25mm UV-treated HDPE liners (High Density Polyethylene. It presents a long history of durability in sunlight and rainy weather), specifically designed for anaerobic digesters. HDPE liners and covers are used to provide a 'gas seal' to prevent leachate from escaping to the underground aquifer and to prevent methane from escaping to the atmosphere The junctions between liners are made through s double sealing, avoiding any gas or liquid to escape.

The minimum configuration is the construction of an anaerobic digesters (as described above) and flaring system. The flaring system is composed by safety valves which connect the reactor to pipelines, pipelines, monitoring equipments and a flare. These safety valves avoid the fast and dangerous increase in the anaerobic digester pressure, diminishing the risks of accidents. The pipelines conduct the biogas from anaerobic digester to flare. The monitoring equipments are connected to pipelines and flare measuring the project activity data requested for emission reduction calculation (for more details see section D. and Annex 4).

There is also an optional upgrade which includes a renewable energy system to produce electricity and/or heat, using methane produced by the covered cells as fuel. The energy system will be specifically designed to attend the farmer demand. It will be used the state of art on renewable energy system fueled by biogas.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The open lagoon treatment system is the most common practice scenario in the host country. The wastewater flows into a series of lagoons which only use a geo membrane to avoid ground and water ground contamination. The animal manure waste material degrades anaerobically in the first and second lagoons, releasing anthropogenic GHG (methane and nitrous oxide) into the atmosphere. It is defined as the baseline scenario, where large amounts of methane contained in the biogas are not collected nor destroyed, been release directly to atmosphere.

It is the most common practice due to the fact that it is the cheapest way to treat the swine manure and attend wastewater environmental parameters. The methane capture and destruction is not required by the host country legislation. Moreover, the producers do not have access to capital to make large investments on biogas capture and renewable energy systems. (See section B. for more details).

Considering the revenues from carbon credits, the proposed project activity intends to improve current waste management system practices, replacing the open primary anaerobic lagoon by an anaerobic digester. These improvements will result in the mitigation of anthropogenic GHG emissions by controlling the decomposition processes and collecting and combusting the methane in biogas. If project activity also include installation of a renewable energy system (electricity and/or heat), it will also displace fossil fuel consumption. The emission reduction related to fossil fuel displacement will not be considered on this PDD, as a conservative approach. Estimation of emission reductions related to methane destruction is presented on section below. Detailed calculation of these estimations are presented in section E.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Table: Estimated amount of emission reductions over the chosen crediting period

Years	Annual estimation of emission reductions in tonnes of CO_2 e
1 - 2003	33935
2 - 2004	33935
3 - 2005	33935
4 - 2006	33935
5 - 2007	33935
6 - 2008	33935
7 - 2009	33935
Total estimated reductions (tonnes of CO_2 e)	**237547**
Total number of crediting years	21 years (three periods of seven years)
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**33935**

A.4.5. Public funding of the project activity:

The project has not received and is not seeking public funding.

SECTION B. Application of a baseline methodology

B.1. Title and reference of the approved baseline methodology applied to the project activity:

Approved baseline methodology AM0006, "GHG emission reductions from manure management systems". Version 01, 14 June 2004

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The AM0006 Methodology suits this project activity due the aplicabilities listed below:

-The project activity is not a monopoly neither receives subsides from government thus; the farms are operating under a competitive market.
-The manure management system is in accordance with the regulatory framework in Brazil;
-Livestock populations comprise only swine, and are managed under confined conditions;
-The baseline as anaerobic lagoon, and the project activity as anaerobic digester are included in the step 1 of additionality. It does not include barn systems and barn flushing systems as baseline scenario neither as project activity.
-The project activity does not lead to a significant increase of electricity consumptions. The equipment that consume electricity are the water pumps used for wastewater circulation inside the anaerobic digester. It will be turned on abut five hours (conservative value, probably a shorter period) at day consuming61 MWh per year, considering all farms. It represents 32 CO2e emission per year, less than 0.1% of emission reduction.

B.2. Description of how the methodology is applied in the context of the project activity:

In the methodology AM 0006 the baseline scenario and additionality demonstration are determined in a step-wise process. It is divided in four steps:

1) List of plausible scenarios
2) Identify possible scenarios
3) Economic comparison
4) Assessment of barriers

A financial analysis of several possible scenarios is conducted and barriers for their implementation are assessed. The economically most attractive course of action, taking into account barriers and local practices, is assumed as the baseline scenario. The project activity is additional, if this analysis shows that the project is economically less attractive than the identified baseline scenario.

To better illustrate the project activity in the several farms, and how the approved methodology should be applied to it, the baseline definition and additionality demonstration will be made based on a "model farm", being a farm representative to all cases. In case of very specific situation among farms listed on section A.4.1.4, comments on these specifications will be presented during baseline definition and additionality demonstration. If it leads to different baselines, it will be considered on emission reduction calculation.

For this Project Activity the model farms characteristics are:

Table: Main characteristics of model farm used in the baseline definition process.

Model Farm Main Characteristics	
Heads	4500
Local average temperature	Harm
Local average humidity	Wet
Number Lagoons	3 (anaerobic, facultative and polishing lagoons)
Number of ANAEROBIC DIGESTER	1
Renewable energy system installed capacity	50 Kw
Total energy generated per year	40000 KWh

An economic comparison is made between each waste management system scenario. Given the fact that most of scenarios do not bring positive cash flow to project developer, the NPV will be used to compare scenarios. All benefits related to plausible scenarios (e.g. electricity or heat) will be considered on financial analysis. The values used are calculated in a conservative manner. The highest NPV will be defined as the baseline scenario. If the project activity presents a NPV significant lower than baseline scenario, or other barriers (assessed on step 4), the project activity is additional.

The emission reduction calculations include the following GHG emission: CH_4 and N_2O from manure treatment system. The GHG emission reduction calculation approach used for CERs estimations (presented on PDD) and credits generation (based n monitored data) will be option B, which is based on referenced data for different treatment types and swine population data. The CO2 emission from wastewater aerobic treatment and methane combustion will not be included as being renewable. Leakage effects under this methodology comprise only methane emissions from disposal of treated manure under anaerobic conditions (e.g. sludge deposited in landfills). It is not the project activity situation, hence the project activity do not lead to leakage emissions.

The following sources are used to calculate baseline emissions:

- 1996 Revised IPCC Guidelines, Chapter 4 of the Reference Manual
- IPCC Good Practice Guidance and Uncertainty management in National GHG Inventories, Chapter 4
- US-EPA 2001: Development Document for the Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations, Chapter 8.2 (http://epa.gov/ost/guide/cafo/devdoc.html)
- Site-specific data, such as the average animal weight and number of animals.

The volatile solid (VS) and nitrogen excretion (NEx) are adjusted for the animal weight at the project site following the equations (2) and (9). The NEx is adjusted with the factors in Table 4.14 of the IPCC GPG for young animals.

All aspects above are better described in the following section B.3 and section E.

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

The next steps are followed to determine the baseline scenario. As described above, the baseline definition and additionality demonstration analysis will be made based on a model farm. Following the baseline methodology procedures, both are made on a step wise procedures. The first step is described below.

General Context – Business as usual situation

All farms in the project activity have been producing for at least one year before project activity starts. In all the cases, the swine population were under confined system. The flushing system is a water sheet ventilated system, producing liquid manure. The manure treatment system is based on an anaerobic lagoon.

Step1: ***List of possible Baseline Scenarios***

1) Solid Storage
2) Dry lot
3) Liquid/Slurry
4) Anaerobic lagoon
5) Pit storage below animal confinements
6) Anaerobic Digester (ANAEROBIC DIGESTER)
7) Deep litter
8) Composting
9) Aerobic treatment

Step2: ***Identify Plausible Scenarios***

Listed below are the plausible scenarios for the project farm operations and conditions. Justification for including or excluding a scenario from consideration is provided.

Included Scenarios:

-Liquid Slurry: Most of the barriers to this technology relate to the cost required to store the volumes of liquid necessary from confined animal operations. It is a plausible technology alternative and has been considered.

-Anaerobic Lagoon: This is the business as usual scenario.

- Anaerobic digester: This scenario represents the project activity and must be included.

Excluded scenarios:

-Solid Storage: Depending on the storage design, this system will not be efficient enough for odour and vector control, plus the storage system is not appropriate to the water sheet system that is in use; so the exclusion of this potential baseline scenario can be justified.

-Dry lot: This animal waste manure system has been excluded because is not applicable to the conditions of the barns which incorporate the use of slats and paved pens. The project activity must not change the barn system or the flushing system, hence, this scenario was excluded.

-Pit Storage below animal confinements: installing pit storage would require digging underneath each of the existing barns and replacement of flushing system, making this scenario excluded from the plausible list.

-Deep litter: this scenario is based on use of wood sawdust as bedding system. As result, it would require some improvements on barn system, resulting in solid manure. The deep litter practice is not used in host country for swine farms with more than 250 heads, thus it has been excluded from plausible scenario list.

-Composting: Composting systems are not adapted to large volumes of water, or moisture contents. This dry aerobic system can only be applied after solid separation stages of activated sludge. The business as usual is a liquid manure system. For this reason, it is excluded from the list of plausible scenarios.

-Aerobic treatment: is typically suited for separated slurry or dilutes effluents. Solids in manure increase the amount of oxygen needed and also increase the energy needed for mixing and the cost of energy to run the aerators. This scenario is not often used in swine culture in host country, thus it has been excluded from consideration has been excluded from the list of plausible scenarios.

Therefore, the list of plausible scenarios has been reduced to proposed project activity scenario and two alternative scenarios:

Table: Plausible scenarios list.

Proposed project activity scenario:	Plausible alternative scenarios:
ANAEROBIC DIGESTER	Liquid/Slurry Anaerobic Lagoon

Step 3: ***Economic Comparison***

In step 3, the plausible scenarios previously identified in step 2 are economically compared. All the plausible scenarios are based on liquid manure. Components of treatment manure system are similar between plausible scenarios. There are 8 components of treatment manure system in total, allowing different combinations of components to construct the costs and benefits of each scenario.

Tables ahead, illustrate the benefits and costs of each component, and an economic comparison between plausible baseline scenarios and the proposed project activity scenarios.

Table: Costs and revenues f each component that constitutes the plausible scenarios.

	First lagoon					Second lagoon	Third Lagoon / reservoir	
Components	A	B	C	D	E	F	G	H
	Ground recovery	Lagoon recovery (Balloon)	water pump (WP)	flare (F)	Electricity Generator (G)	ground recovery	ground recovery	Land Application
	US$	US$	US$	US$	US$	US$	US$	US$
Costs	-	24000	4000	12000	100000	20000	45000	100000
Investments	250	1250	638	750	10000	250	250	1638
Maintenance/Operational								
Others								
Revenues	-	-	-	-	16000	-	-	-
Electricity	-	24000	4000	12000	100000	20000	45000	100000

Table: Financial analysis for "Liquid Slurry" plausible scenario.

Waste Treatment type:	**Lquid/Slurry**									
Costs Formula:	**(G+H)**									
COSTS AND BENEFITS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Costs										
Equipment Costs	145000									
Installations Costs										
Maintenance Costs	1889	1889	1889	1889	1889	1889	1889	1889	1889	1889
Other Costs										
Revenues										
Electricity, fuel swtch or any other applicable revenue	0	0	0	0	0	0	0	0	0	0
TOTAL	**(146889)**	**(1889)**	**(1889)**	**(1889)**	**(1889)**	**(1889)**	**(1889)**	**(1889)**	**(1889)**	**(1889)**
NPV (US$)	**(129072)**									
Discount rate (%)	**20%**									

Table: Financial analysis for "Anaerobic Lagoon" plausible scenario.

Waste Treatment type:	**Anaerobic Lagoon**									
Costs Formula:	**(A+F+G)**									
COSTS AND BENEFITS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Costs										
Equipment Costs	65000									
Installations Costs										
Maintenance Costs	750	750	750	750	750	750	750	750	750	750
Other Costs										
Revenues										
Electricity, fuel swtch or any other applicable revenue	0	0	0	0	0	0	0	0	0	0
TOTAL	**(65750)**	**(750)**	**(750)**	**(750)**	**(750)**	**(750)**	**(750)**	**(750)**	**(750)**	**(750)**
NPV (US$)	**(57451)**									
Discount rate (%)	**20%**									

Table: Financial analysis for "anaerobic digester + electricity generation" plausible scenario.

Waste Treatment type:	**BIODIGESTER + Electricity Generator**									
Costs Formula:	**(A+B+C+D+E+F+G+H)**									
COSTS AND BENEFITS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Costs										
Equipment Costs	305000									
Installations Costs										
Maintenance Costs	15028	15028	15028	15028	15028	15028	15028	15028	15028	15028
Other Costs										
Revenues										
Electricity, fuel swtch or any other applicable revenue	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000
TOTAL	**(304028)**	**973**	**973**	**973**	**973**	**973**	**973**	**973**	**973**	**973**
NPV (US$)	**(250585)**									
Discount rate (%)	**20%**									

Table: Financial analysis for "anaerobic digester only" plausible scenario.

Waste Treatment type:	**BIODIGESTER only**									
Costs Formula:	**(A+B+C+D+F+G)**									
COSTS AND BENEFITS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Costs										
Equipment Costs	205000									
Installations Costs										
Maintenance Costs	5028	5028	5028	5028	5028	5028	5028	5028	5028	5028
Other Costs										
Revenues										
Electricity, fuel swtch or any other applicable revenue	0	0	0	0	0	0	0	0	0	0
TOTAL	**(210028)**	**(5028)**	**(5028)**	**(5028)**	**(5028)**	**(5028)**	**(5028)**	**(5028)**	**(5028)**	**(5028)**
NPV (US$)	**(192448)**									
Discount rate (%)	**20%**									

It can be seen that the anaerobic lagoon is the most attractive course of action, for this reason the baseline scenario. The project initiative have ranges of NPV far more negative than the other scenarios presented, so it can be assured that the project scenario is additional comparing to the chosen baseline. The cost of implementing ANAEROBIC DIGESTER is much higher than the baseline thus presents an economic barrier.

Table: Financial analysis comparison.

Scenarios	Lquid/Slurry	Anaerobic Lagoon	Anaerobic digester + Electricity Generator	Anaerobic digester only
NPV (US$)	(129072)	(57451)	(250585)	(192448)
Increase in costs when compared with the most attractive course of action	125%	*	336%	235%

Conclusion: The baseline scenario is defined as an open anaerobic lagoon system, emitting CH4 and N2O to atmosphere.

Step 4: Assessments Barriers

Prevailing practice: During the eighties, the Brazilian government presented a program to stimulate the installation of anaerobic digesters on farms, for electricity generation. The program would finance the first anaerobic digesters implemented to swine producers, utilizing a Indian type of anaerobic digesters. It was an inappropriate system to Brazilian producers, presenting high maintenance costs, and demanding technical labour. The farmers did not have the technical training or support for a satisfactory. For these reasons it never worked properly, and with time passing by, the Indian anaerobic digesters were abandoned. After that, the farmers presented some kind of aversion to high investment and difficult operation treatment systems. Now a day, the most common manure treatment system is anaerobic lagoon. It is economically attractive, reliable, simple to operate, effective and satisfy regulatory, thus, there is no reason to expect that these conditions will change in a foreseeable future.

Investment barriers: This anaerobic digester manure treatment system is one of the most advanced technologies in manure treatment system in the world. Only a few countries have widely implemented this technology due to the high cost of investment compared to other available systems (see tables above). Even the banks have been unwilling to finance such activities absents government guarantees or other incentives (also result of Indian model failure). Another important issue is the fact that Brazil presents one of the highest interest rates of the world, thus the capital cost is too high. High capital costs associated to the fact that banks require a lot of guarantees to finance manure treatment systems inhibits the implementation of advanced technologies that requires large amount of capital for installation and operation.

Technology barriers: In the baseline, the farmer is the person responsible for operation and maintenance of anaerobic lagoon system. To implement and operate an anaerobic digester it is required skilled labour. Maintenance requirements involved in this technology includes a detailed monitoring program of performance level, and special procedures do avoid risks of accident and continued training program for the operators. Due to this fact, specialized and outsourced labour will be required to operate and maintain the anaerobic digester working properly.

Summarizing, besides the financial barrier, the installation, operation and maintenance of anaerobic digester presents other barriers. The table below summarize these barriers.

Table: Summary of barriers related to project activity.

	Baseline Scenario	**Project Activity**
	Anaerobic Lagoon	**ANAEROBIC DIGESTER**
Financial Barrier	NO	YES
Investment Barrier	NO	YES
Technology Barrier	NO	YES.
Prevailing practices Barrier	NO	YES.

At last, considering all investments related for implementation of project activity in all farms listed in section A.4.1.4, a financial analysis was made to check the impact of CDM on project activity cash flow. The CDM revenues are enough to make the project activity as a viable and attractive course of action.

Table: Summary of impact of CDM on project activity.

	With C	**Without C**
Present Value	**258.117**	**(825.476)**
Discount rate	20%	

Conclusion: The project activity is additional to the baseline scenario, due to the fact that it presents many barriers for implementation, and the CDM revenues are enough to make the project viable.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The project boundary is defined according to figure below.

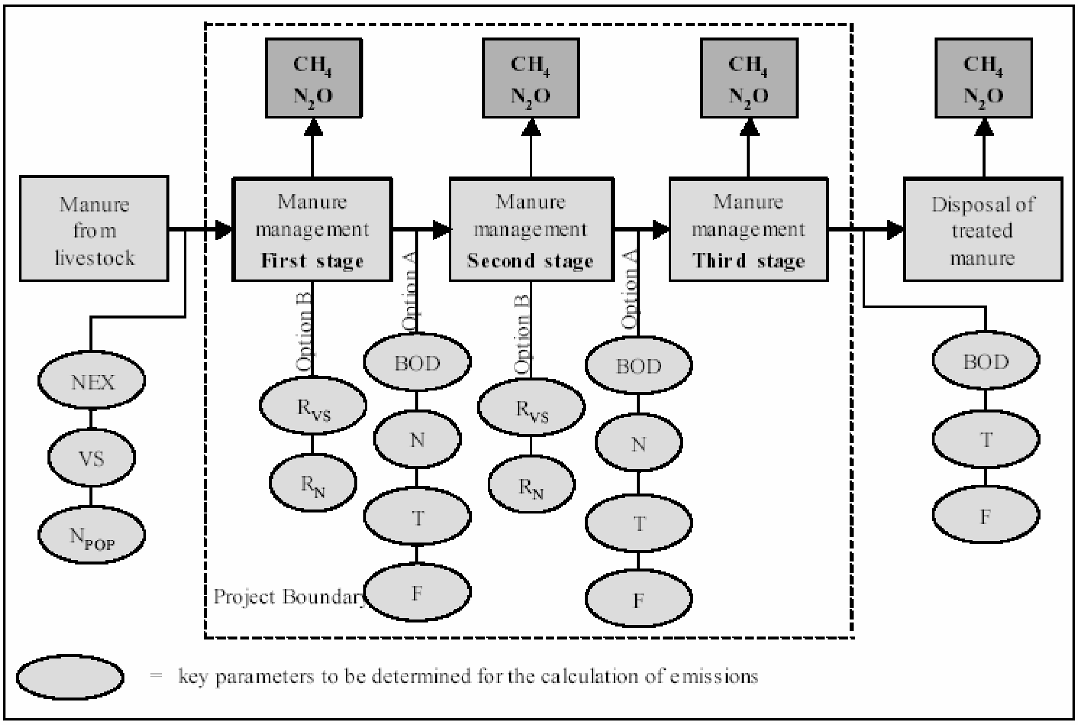

Figure: Project Boundary

The methodology does not give additional guidance on baseline definition. The list of GHG emission source included or excluded from calculation is presented in table below.

Table: List of GHG emission sources inside and outside boundary.

Boundary	Source	GHG	Consider or not	justification
Outside	Disposal of treated manure under anaerobic conditions	CH4	Excluded	Project activity do not present this kind of practice, thus does not present leakage emissions.
Outside	Grid electricity generation	CO2	Excluded	Insignificant. According to methodology it may be excluded.
Inside	Emissions from combustion(on flare or renewable energy system)	CO2	Excluded	CO2 considered to be from biogenic origins, that do not change carbon stocks
Inside	Emissions from manure management system	CH4	Included	Attending methodology requests
Inside	Emissions from manure management system	N2O	Included	Attending methodology requests

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

Date of conclusion: 23 December, 2005
Person/entity determining the baseline: Thiago Linde, Pablo Fernandez and Federico Moyano
Ecosecurities Brasil Ltda.
Rua Lauro Muller n°116 sala 3107, Botafogo.
Rio de Janeiro – RJ, Brasil
CEP: 22290-160
Phone: +55 (21) 2279-9570
e-mail:
br@ecosecurities.com

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
january 2003

C.1.2. Expected operational lifetime of the project activity:

>>
More than 25 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>
July 2003

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>
Not applicable

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

>> AM0006 "GHG emission reductions from manure management systems"
Version 01, 14 June 2004

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

>> As with the Baseline Methodology, the AM0006 Monitoring Methodology suits this project activity due the aplicabilities already listed in section B.1.1.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. Npopulation (Project)	Animal Population	Project participant	Heads	measured	weekly	100%	electronic	To be collected for each livestock population from 1996 Revised IPCC Guidelines and IPCC GPG 2000.
2. Wsite (Project)	Average weight of animals	Project participant	kg	measured	Records of entrance and exit of animals to the barn	100%	electronic	To be collected for each livestock population from 1996 Revised IPCC Guidelines
3. VSpopulation (Project)	Volatile solid excretion per animal and per day	Project participant	Kg dry matter/ animal/ day	calculated	monthly	100%	electronic	Monitoring of this data is only required if measured site-specific data is used. To be collected for each livestock population from 1996 Revised IPCC Guidelines
4.NEXpopulation (Project)	Nitrogen excretion per animal per year	Project participant	Kg dry matter/ animal/ year	calculated	monthly	100%	electronic	Monitoring of this data is only required if measured site-specific data is used. To be collected for each livestock population from 1996 Revised IPCC Guidelines
5. Biogas extracted	biogas flow extracted by	Project participant	M3/day	measured	Every working day	100%	electronic	This parameter guarantees the correct performance of digester and gas recovery. This parameter will verify the correct anaerobic fermentation process in the baseline scenario (considering the effect of inhibitors)

	digester							
6. CO2 conc. In gas flow	CO2 conentration in gas flow	Project participant	%	measured	daily	100%	electronic	This parameter guarantees the correct performance of digester and gas recovery.
7. Flare Effic.	Flare Efficiency	Project participant	%	measured and calculated	Semi-annual, monthly if unstable	n.a.	electronic	Methane content of flare exhaust gas.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

Methane and Nitrous Oxide emissions from manure management

For the first treatment stage of the manure management system, Methane and Nitrous Oxide emissions are calculated as follows:

$$E_{CH4,mm,1,y} = GWP_{CH4} * MCF_1 * D_{CH4} * 365/1000 * (\Sigma VS_{population} * B_{0,population})$$

where:

$E_{CH4,mm,1,y}$ Are the CH_4 emissions from manure management in the first treatment stage of a manure management system during the year y in tons of CO_2 equivalent.

GWP_{CH4} Is the approved Global Warming Potential (GWP) of CH_4.

MCF_1 Is the methane conversion factor (MCF) for treatment of manure in the first treatment stage in per cent.

D_{CH4} Is the CH_4 density (0.67 kg/m^3 at room temperature (20 ºC) and 1 atm pressure).

$VS_{population}$ Is the volatile solid excretion per day on a dry-matter basis for a defined livestock population in kg-dm/animal/day.

$B_{0,population}$ Is the maximum CH_4 production capacity from manure per animal for a defined livestock population m^3 CH_4/kg-dm.

$N_{population}$ Is the livestock of a defined population.

$$E_{N2O,mm,1,y} = EF_{N2O,mm,1} * CF_{N2O-N,N} * GWP_{N2O} * (\Sigma\ NEX_{population} * N_{population})$$

where:

$E_{N2O,mm,1,y}$ Are the nitrous oxide emissions from the first stage of the manure management systems in tonnes of CO_2 equivalents per year.

GWP_{N2O} Is the approved Global Warming Potential (GWP) for N_2O.

$EF_{N2O,mm,1}$ Is the N_2O emission factor for the first treatment stage of the manure management system in kg N_2O-N/kg N (EF_3 in 1996 Revised IPCC Guidelines and IPCC GPG).

$CF_{N2O-N,N}$ Is the conversion factor N_2O-N to N (44/28).

$NEX_{population}$ Is annual average nitrogen excretion per animal of the defined livestock population in kg N/animal/year.

$N_{population}$ Is the livestock of a defined population.

Following Option B of AM0006, Methane and Nitrous Oxide emissions of second or subsequent treatment stages are calculated on the basis of total volatile solids applied to the manure management system adjusted for volatile solid reductions in previous treatment stages:

$$E_{CH4,mm,i,y} = GWP_{CH4} \cdot MCF_i \cdot D_{CH4} \cdot \left[\prod_{n=1}^{i-1}(1-R_{VS,n})\right] \cdot \frac{365}{1000} \cdot \sum_{population} VS_{population} \cdot B_{0,population} \cdot N_{population}$$

where:

$E_{CH4,mm,i,y}$ Are the CH_4 emissions from manure management in the first treatment stage of a manure management system during the year y in tons of CO_2 equivalent.

GWP_{CH4} Is the approved Global Warming Potential (GWP) of CH_4.

MCF_i Is the methane conversion factor (MCF) for the treatment of manure in stage i in per cent.

D_{CH4} Is the CH_4 density (0.67 kg/m^3 at room temperature (20 ºC) and 1 atm pressure).

$R_{VS,n}$ Is the relative reduction of volatile solids in the treatment stage n in per cent.

$VS_{population}$ Is the volatile solid excretion per day on a dry-matter basis for a defined livestock population in kg-dm/animal/day.

$B_{0,population}$ Is the maximum CH_4 production capacity from manure per animal for a defined livestock population m^3 CH_4/kg-dm.

$N_{population}$ Is the livestock of a defined population.

$$E_{N2O,mm,1,y} = GWP_{N2O} \cdot EF_{N2O,mm,i} \cdot CF_{N2O-N,N} \cdot \left[\prod_{n=1}^{i-1}(1-R_{N,n})\right] \cdot \frac{1}{1000} \cdot \sum_{populations} NEX_{population} \cdot N_{population}$$

where:

$E_{N20,mm,1,y}$ Are the nitrous oxide emissions from the first stage of the manure management systems in tonnes of CO_2 equivalents per year.

GWP_{N20} Is the approved Global Warming Potential (GWP) for N_2O.

$EF_{N20,mm,i}$ Is the N_2O emission factor for the treatment stage i of the manure management system in kg N_2O-N/kg N (EF_3 in 1996 Revised IPCC Guidelines and IPCC GPG).

$CF_{N20-N,N}$ Is the conversion factor N_2O-N to N (44/28).

$R_{VS,n}$ Is the relative reduction of nitrogen in the treatment stage n in per cent.

$NEX_{population}$ Is annual average nitrogen excretion per animal of the defined livestock population in kg N/animal/year.

$N_{population}$ Is the livestock of a defined population.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. $N_{population}$ (baseline)	Animal Population	Project proponent	Heads	measured	weekly	100%	electronic	To be collected for each livestock population from 1996 Revised IPCC Guidelines and IPCC GPG 2000.

2. Wsite (baseline)	Average weight of animals	Project proponent	kg	measured	Records of entrance and exit of animals to the barn	100%	electronic	To be collected for each livestock population from 1996 Revised IPCC Guidelines
3. VSpopulation (baseline)	Volatile solid excretion per animal and per day	Project proponent	Kg dry matter/animal/day	calculated	monthly	100%	electronic	Monitoring of this data is only required if measured site-specific data is used. To be collected for each livestock population from 1996 Revised IPCC Guidelines
4.NEXpopulation (baseline)	Nitrogen excretion per animal per year	Project proponent	Kg dry matter/animal/ year	calculated	monthly	100%	electronic	Monitoring of this data is only required if measured site-specific data is used. To be collected for each livestock population from 1996 Revised IPCC Guidelines

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

Methane and Nitrous Oxide emissions from manure management

For the first treatment stage of the manure management system, Methane and Nitrous Oxide emissions are calculated as follows:

$$E_{CH4,mm,1,y} = GWP_{CH4} \cdot MCF_1 \cdot D_{CH4} \cdot \frac{365}{1000} \cdot \sum_{population} VS_{population} \cdot B_{0,population} \cdot N_{population}$$

where:

$E_{CH4,mm,1,y}$ Are the CH_4 emissions from manure management in the first treatment stage of a manure management system during the year y in tons of CO_2 equivalent.

GWP_{CH4} Is the approved Global Warming Potential (GWP) of CH_4.

MCF_1 Is the methane conversion factor (MCF) for treatment of manure in the first treatment stage in per cent.
D_{CH4} Is the CH_4 density (0.67 kg/m^3 at room temperature (20 ºC) and 1 atm pressure).
$VS_{population}$ Is the volatile solid excretion per day on a dry-matter basis for a defined livestock population in kg-dm/animal/day.
$B_{0,population}$ Is the maximum CH_4 production capacity from manure per animal for a defined livestock population m^3 CH_4/kg-dm.
$N_{population}$ Is the livestock of a defined population.

$$E_{N2O,mm,1,y} = GWP_{N2O} \cdot EF_{N2O,mm,1} \cdot CF_{N2O-N,N} \cdot \frac{1}{1000} \cdot \sum_{populations} NEX_{population} \cdot N_{population}$$

where:
$E_{N2O,mm,1,y}$ Are the nitrous oxide emissions from the first stage of the manure management systems in tonnes of CO_2 equivalents per year.
GWP_{N2O} Is the approved Global Warming Potential (GWP) for N_2O.
$EF_{N2O,mm,1}$ Is the N_2O emission factor for the first treatment stage of the manure management system in kg N_2O-N/kg N (EF_3 in 1996 Revised IPCC Guidelines and IPCC GPG).
$CF_{N2O-N,N}$ Is the conversion factor N_2O-N to N (44/28).
$NEX_{population}$ Is annual average nitrogen excretion per animal of the defined livestock population in kg N/animal/year.
$N_{population}$ Is the livestock of a defined population.

Following Option B of AM0006, methane emissions of second or subsequent treatment stages are calculated on the basis of total volatile solids applied to the manure management system adjusted for volatile solid reductions in previous treatment stages. Formulae are the same as in section **D.2.1.2.**

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

Not applicable since this will not be done

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not applicable

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Not applicable since this will not be done

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not applicable since leakage is not considered (detail in section B.2)

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Not applicable since leakage is not considered (detail in section B.2)

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Total emission reductions

Total emission reductions of the project are the sum of CH_4 and N_2O emission reductions:

$$ER_y = ER_{CH4,mm,y} + ER_{N2O,mm,y}$$

where:

ER_y Are the net emission reductions due to the project activity during the year y in tons of CO_2 equivalents.
$ER_{CH4,mm,y}$ Are the CH_4 emission reductions due to the project activity during the year y in tons of CO_2 equivalents.
$ER_{N2O,mm,y}$ Are the N_2O emission reductions due to the project activity during the year y in tons of CO_2 equivalents.

$$ER_{CH4,mm,y} = E_{CH4,mm,1,y,baseline} - E_{CH4,mm,1,y,project} - \sum_i E_{CH4,mm,i,y}$$

where:
$ER_{CH4,mm,y}$ Are the CH_4 emission reductions due to the project activity during the year y in tons of CO_2 equivalents.
$E_{CH4,mm,1,ybaseline}$ Are the CH_4 emissions from manure management in the baseline scenario during the year y, calculated with equation 1, in tons of CO_2 equivalents.
$E_{CH4,mm,1,yproject}$ Are the CH_4 emissions from manure management in first stage of the project manure management system during the year y, calculated with equation 1, in tons of CO_2 equivalents.
$E_{CH4,mm,i,y}$ Are the CH_4 emissions from manure management in the second or subsequent treatment stage i of the project activity during the year y in tons of CO_2 equivalents.

$$ER_{N2O,mm,y} = E_{N2O,mm,baseline} - E_{N2O,mm,project} - \sum_i E_{N2O,mm,i,y}$$

where:

$ER_{N2O,mm,y}$	Are the N_2O emission reductions due to the project activity during the year y in tons of CO_2 equivalents.
$E_{N2O,mm,baseline}$	Are the N_2O emissions from manure management in the baseline scenario during the year y, calculated with equation 1, in tons of CO_2 equivalents.
$E_{N2O,mm,project}$	Are the N_2O emissions from manure management in first stage of the project activity during the year y, calculated with equation 1, in tons of CO_2 equivalents.
$E_{N2O,mm,i,y}$	Are the N_2O emissions from manure management in the second or subsequent treatment stage i of the project activity during the year y in tons of CO_2 equivalents.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1. $N_{population}$	*Low*	*Stock changes are controlled through purchase and sell invoices..*
2. W_{site})	*Low*	*Animals are weighted when bought and sold. Can be double checked by purchase and sell invoices.*
3. $VS_{population}$	*Medium*	*IPCC data used for calculation*
4.$NEX_{population}$	*Meduim*	*IPCC data used for calculation*
5. Biogas extracted	*Low*	*Data is recorded on a daily by a designated person. Measuring equipment will be calibrated according to manufacturer's requirements.*
6. CO2 conc. In gas flow	*Low*	*Data is recorded on a daily by a designated person. Measuring equipment will be calibrated according to manufacturer's requirements.*
7. Flare Effic.	*Low*	*Measuring equipment will be calibrated according to manufacturer's requirements.*

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

>>

D.5 Name of person/entity determining the monitoring methodology:

>>

Date of conclusion: 23, December, 2005

Person/entity determining the baseline: Thiago Linde, Pablo Fernandez and Federico Moyano
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SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>The formula used for calculating the project emissions is presented in section D.2.1.2.

The total amount of emissions by source of greenhouse gases of the project activity are presented in table below.

Table: Project emissions by source.

GHG source	unit	GHG emission
CH_4	t CO_2e	7958
N_2O	t CO_2e	812
TOTAL	t CO_2e	8770

E.2. Estimated leakage:

>> Not applicable since leakage is not considered (detail in section B.2)

E.3. The sum of E.1 and E.2 representing the project activity emissions:

>>Since no leakage is considered then the total amount of emissions by source of greenhouse gases of the project activity is same as table presented in section E.1.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

>> The formula used for calculating the project emissions is presented in section D.2.1.4.

The total amount of emissions by source of greenhouse gases of the baseline scenario is presented in table below.

Table: Project emissions by source.

GHG source	unit	GHG emission
CH_4	t CO_2e	41893
N_2O	t CO_2e	812
TOTAL	t CO_2e	42705

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

>>
33,935 tones CO_2 e per year

E.6. Table providing values obtained when applying formulae above:

>>

Table: Detailed emission reduction calculation during the whole crediting period.

Year	Estimation of project activity emissions reductions (tones of CO2)	Estimation of Baseline emissions (tones of CO2)	Estimation of leakage (tones of CO2 e)	Estimation of emissions reductions (tones of CO2)
1- 2003	8770	42705	0	33935
2- 2004	8770	42705	0	33935
3- 2005	8770	42705	0	33935
4- 2006	8770	42705	0	33935
5- 2017	8770	42705	0	33935
6- 2008	8770	42705	0	33935
7- 2009	8770	42705	0	33935
Total (tones of CO2 e)	**61387**	**298934**	**0**	**237547**

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The project activity do not result in significant negatives impacts. Instead of it the project activity results in positive environmental impacts. The main ones are:

- Elimination of odour;
- Control of vectors and flies;
- Improvement of landscaping;
- Disposability of a renewable energy resource;
- and reducing emissions of GHG.

All Farms including in this project are in accordance to the local environment regulations.

Table: List of environmental licenses related to project activity.

Farm / Site name	Environmental license type
Cornelis Willem Kuipers Farm	Protocol
Valéria Schittenhelm Farm	Protocol
Fazenda Figueira	Protocol
Chacara Marujo	LO
Granja Rio Taquara	LO
Chacara Cruzo	LO
Janneke Morsink Greidanus farm	Protocol
Fazenda Portão Vemelho	Protocol
Fazenda Frank"anna	LO
Fazenda Ponte Alta	Protocol

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Given that the project activity will not induce to significant impacts, no impact assessment was undertaken.

SECTION G. Stakeholders' comments

>>

G.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

According to the Resolution #1 dated on December 2nd, 2003, from the Brazilian Inter-Ministerial Commission of Climate Change (Comissão Interministerial de Mudança Global do Clima -CIMGC), decreed on July 7th, 1999[1], any CDM projects must send a letter with description of the project and an invitation for comments by local stakeholders. In this case, letters were sent to the following local stakeholders:

- City Hall of cities were project is located;
- Chamber of cities were project is located;
- Environment agencies from the state and Local Authority;
- Brazilian Forum of NGOs;
- District Attorney (known in Portuguese as Ministério Público, i.e. the permanent institution essential for legal functions responsible for defending the legal order, democracy and social/individual interests) and;
- Local communities associations.

Local stakeholders were invited to raise their concerns and provide comments on the project activity for a period of 30 days after receiving the letter of invitation. EcoSecurities and the project developer addressed questions raised by stakeholders during this period.

G.2. Summary of the comments received:

>>

Up to date no comments were received.

G.3. Report on how due account was taken of any comments received:

>>

Up to date no comments were received.

[1] Source: http://www.mct.gov.br/clima/comunic/pdf/Resolução01p.pdf

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not applicable

Annex 3

BASELINE INFORMATION

Summary Table - CH4 Emission Factor

Emission reductions from methane capture and destruction	Per year	Total (crediting period)
Total Daily VS (kg)	27452	576488
Anaerobic Lagoon		
MCF (%)	90%	n/a
Bo (m3 CH4 / Kg VS)	0.29	n/a
treatment efficiency (%)	86%	n/a
Biodigestor		
MCF (%)	100%	n/a
Bo (m3 CH4 / Kg VS)	0.29	n/a
treatment efficiency (%)	84%	n/a
Capture efficiency (%)	100%	n/a
Flare effciency (%)	95%	n/a
Methane		
methane density (kg/m3)	0.67	n/a
CH4 GWP	21	n/a

Summary Table - N2O Emission Factor

Emission reductions from methane capture and destruction	Per year	Total (crediting period)
Total NEX (kg N/year)	1464097	30746031
Anaerobic Lagoon		
EF (N2O)	0.001	n/a
CF (N2O-N, N)	1.57	n/a
treatment efficiency (%)	86%	n/a
Biodigestor		
EF (N2O)	0.001	n/a
CF (N2O-N, N)	1.57	n/a
treatment efficiency (%)	86%	n/a
Nitrous Oxide		
N2O GWP	310	n/a

General Informations	value	unit
Swine population	46992	#
Average weight	54,52	kg
Number of Farms	10	#
Average population per farm	4699	#

	FINANCIAL ANALYSIS PARAMETERS		
	Parameter	**value**	**Unit**
investments	Ground Recovery	313.600,00	US$
	Lagoon recovery	86.800,00	US$
	Flare	43.200,00	US$
	water pump	15.200,00	US$
	electricity generator	199.000,00	US$
	Land Application	225.000,00	US$
operation costs	ANAEROBIC DIGESTER costs	25.000,00	US$ / year
	electricity operating costs	-	US$/MWh
carbon costs	PDD Elaboration	30.000,00	US$
	Validation	25.000,00	US$
	Registration	20.000,00	US$
	Other services	-	US$
	Monitoring plan	10.000,00	US$
	Verification	10.000,00	US$
carbon revenues	Price of carbon	5,00	US$ / t CO2e
	taxes on carbon credits	0%	%
electricity revenues	Electricity Tariff (U$/MWh)	40,00	US$ / MWh
others	Exchange rate	2,50	R$ / US$
	Discount rate	20%	%

Annex 4

MONITORING PLAN

This section details the steps taken to monitor on a regular basis the GHG emissions reductions from the project activity. The main components covered within the monitoring plan are:

1) Parameters to be monitored, and how the data will be collected
2) The equipment to be used in order to carry out monitoring
3) Operational procedures and quality assurance responsibilities.

Monitoring for the project activity will start with the start operation. The monitoring plant details the actions necessary to record all the variables and factors required by methodology AM0006, as detailed in section D of the PDD. All data will be achieved electronically, and data will be kept for the full crediting period, plus two years.

Table: Data to be collected or used to monitor emission reduction from project activity.

ID Number	Data Variable	Data unit	Measured (m), calculated (c) or estimated (e)	Monitoring method	Responsible parties/ individuals for monitoring	Monitoring equipment	Comments
1. *Npopulation (Project)*	Animal Population	Heads	measured	Population control	Farm manager	-	Based on purchase and sell invoices, and death control.
2. *Wsite (Project)*	Average weight of animals	kg	measured	Population control	Farm manager	-	All pigs are weighted before come in or come out of farm. All data are crosschecked with purchase and sell invoices.
3. *VSpopulation (Project)*	Volatile solid excretion per animal and per day	Kg dry matter/animal/day	calculated	-	-	-	
4.*NEXpopulation (Project)*	Nitrogen excretion per animal per year	Kg dry matter/animal/year	calculated	-	-	-	
5. Biogas extracted	biogas flow extracted by digester	m3/day	measured	Flow meter	Farm manager	Flow meter	
6. CO2 conc. In gas flow	CO2 conentration in gas flow	%	Standard diffusion method	ORSAT method	Farm manager	CO_2 probe	
7. Flare Effic.	Flare Efficiency	%	measured and calculated	Methane content in exhaust gas	Operational Technician	-	

Table: Equipment used to monitor emission reduction from project activity.

Equipment	Variables monitored	Operational Range	Calibration procedures	Parties responsible for operating equipment	Procedure in case of failure	Default value in case of failure	Comments
Flow meter	biogas flow extracted by digester	Pressure: Flow:	Annual calibration by specialized companies.	Farm manager	Failure reported to equipment supplier and repairs carried out. If repair is not possible, equipment will be replaced by equivalent item. Failure events will be recorded in the site events log book.	Previous reading +/- 5% (minus 5% for baseline and + 5% for project activity emission)	
CO_2 probe	CO2 concentration in gas flow	0-5,000 PPM	Auto calibration using sample gases as "blank".	Farm manager	Failure reported to equipment supplier and repairs carried out. If repair is not possible, equipment will be replaced by equivalent item. Failure events will be recorded in the site events log book.	Previous reading +/- 5% (minus 5% for baseline and + 5% for project activity emission)	

Table: Operational procedures and responsibilities for monitoring and quality assurance f emission reduction from the project activity (E=responsible for execution, R=responsible for overseeing and assuring quality, I=to be informed)

Task	Farm manager	Operational Technician	Regional Manager	Equipment supplier	Ecosecurities Ltd.
Collect data	E	R			
Enter into spreadsheet		E	R		
Make monthly and annual reports	I	E	R		I
Achieve data and reports		E	R		I
Calibration Maintenance		R	I	E	I

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