CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1. Title of the small-scale project activity:

BRASCARBON Methane Recovery Project BCA-BRA-08, Brazil.

Version 2, 25th June 2009

A.2. Description of the small-scale project activity:

Purpose: The purpose of this project is to mitigate and recover animal effluent related Greenhouse Gas (GHG) by improving the Animal Waste Management System practices in the confined animal feed operations in the cities located at the São Paulo state, southwest Brazil, developed by BRASCARBON.
In Brazil the agricultural operations related to the confined animals procedures are very wide and grows progressively and intensive to attend the worldwide food demand.

There are three types of Confined Animal Operation for this project: finishing, breeding and nursery.

The confined animal wastewater operation consists in transporting wastewater, a compound of fresh water mixed with manure and urine that accumulates in pits under or beside the barns, to an open lagoon for evaporation, fed by gravity pipeline systems. The organic material, degraded in the primary treatment lagoon, is then digested, thereby producing significant amounts of methane.

These systems emit methane (CH4) resulting from anaerobic decomposition process.
The swine livestock operations create profound environmental consequences, such as greenhouse gas emissions, odour and water/land contamination, as a result of storing animal waste, in places where this operation is not sustainable due to its sever environmental pollution.

The Project Activity consists in the construction of a new covered in-ground anaerobic reactor (digester) that will utilize the organic material currently treated in the wastewater opened lagoon, of the confined animal operations, to produce biogas.

This project proposes to apply the Methane Recovery methodology identified in Section III.D, of the Indicative Simplified Baseline and Monitoring Methodologies for Small-Scale CDM Project Activity Categories, in swine confined feed operations located on the states mentioned above in Brazil. The expected result of this project is a significant reduction of GHG emissions compared to those emissions that would have occurred in the absence of the project, and also the promotion of sustainable swine production farms, bringing environmental and social benefits, moving from a high-GHG animal waste management system practice to an anaerobic digester, with capture and combustion of resulting biogas.

Contribution to sustainable development:
According to Brazil's Inter-Ministerial Commission on Global Climatic Change[1], manure management is an important issue that needs to be solved.

The swine waste storage and treatment systems in Brazil consists in open tanks, open digesting process and ponds (anaerobic, variable and aerobic), due to the most economic and viable system approved to manage the manure in confined animal feed operations. Economic barriers are very common because producers can invest only in the confined feed operations and with no need to invest in waste management systems. Financial resources are always used to maintain the confined feed operation working.

Also, waste treatment involves low technology, as open lagoons need less employees and technicians for operation and maintenance.

For those reasons, the project is additional and more details can be found in the section B.5. Just few producers invest in bio-digesters to have a modern waste management system. The material cumulated in the open lagoons is normally distributed by pumps or gravity and applied to crops and pastures. EMBRAPA[2] stimulated by the Expansion and Waste Treatment Program of the State of Santa Catarina by giving instructions and providing publications to help the producers and agro-industries to implement projects or systems to control the animal waste management protecting the eco-system.

Failure to do so will spread existing disease continually (i.e. increased (insect) pest populations, problems with allergies and livestock disease). With the purpose of avoiding this problem, Brazil has in recent years, required all confined animals feed operations to change from single to multi-lagoon systems, introducing a Good Practices in confined animal feed operations and even more recently has required them to line the bottom of their primary sedimentation lagoon to prevent effluent infiltration.[3]

In 2005, the swine population in São Paulo state was 1.707.000.[4] [5]
Considering that a typical hog produces 4.9 kilograms of effluent daily (Table A1)[2], annually some 8.4 million metric tons of hog waste produced in this state alone.
Introduce a progressive animal waste management practices throughout this region of Brazil could result in an annual reduction of approximately 2.9 million tonnes[6] of carbon dioxide equivalent (CO2e/year).

[1] http://www.ambientebrasil.com.br
[2] PNMA-II – Programa Nacional do Meio Ambiente, coordenado pelo Sr. Paulo Armando Vitoria de Oliveira, Concordia – SC, EMBRAPA Suinos e Aves, 2004;
http://www.cnpsa.embrapa.br/pnma/pdf_doc/doc_pnma.pdf
[3] http://www.agricultura.gov.br/pls/portal/url/ITEM/C90C773459FBB52AE0300801FD0AF827;
[4] IBGE – Pesquisa Pecuária Municipal (www.ibge.gov.br).
[5] www.agricultura.gov.br
[6] Approximate calculation using IPCC model and emission factors

Table A1. Daily production of effluent by type of swine production

Stage	Manure kg/day	Manure and Urine kg/day	Volume litres/day
25-100 kg	2.3	4.9	7.0
Gestating sows	3.6	11.0	16.0
Nursing sows	6.4	18.0	27.0
Boar pig	3.0	6.0	9.0
Piglet	0.35	0.95	1.4

Source: PNMA-II – Programa Nacional do Meio Ambiente, coordenado pelo Sr. Paulo Armando Vitoria de Oliveira, Concordia – SC, EMBRAPA Suinos e Aves, 2004; http://www.cnpsa.embrapa.br/pnma/pdf_doc/doc_pnma.pdf

Socio-Economic Sustainability

- Improvement in air quality (e.g. – reduction of Volatile Organic Compounds [VOCs]) and worker safety;
- Elimination of odors in surrounding areas, improving the living standards of neighbors communities;
- Proper handling of animal waste ensuring an adequate level of protection of human health and the environment;
- By improving the waste management system at the farm, the project will support the continued production of pork, in order to meet the consumption needs of the growing global population.

Economic Sustainability

- An increase in local employment of skilled labor for the manufacturing, installation, Operation and maintenance of equipment;
- Additional employment opportunities in the agro-industrial sector, specifically from the use of recycled water from the waste management system on the farms for agricultural activities in surrounding land;
- Infrastructure improvement is in direct alignment with the national goals and objectives for agriculture, livestock, rural development, fishing and nutrition.

Environmental Sustainability

- An overall decrease in the amount of Greenhouse Gases (GHGs) emitted into the atmosphere;
- Improvement in the quality of the water used in the waste management system and its potential use as water for irrigation;
- Avoiding potential dumping of waste into clean sources of water.

Technological Sustainability

- This project will promote a model for the reduction of GHG's produced by Confined Animal Operation and a transfer of technology for methane production and capture through anaerobic digestion and combustion.

A.3. Project participants:

Name of Party involved (*) ((host) indicates 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)	• Brascarbon Consultoria, Projetos e Representação Ltda. (private entity)	No
Portugal	Luso Carbon Fund	No

A.4. Technical description of the small-scale project activity:

Anaerobic digestion

The technology used is an anaerobic digestion process in which microorganisms break down biodegradable material in the absence of oxygen. The process is widely used to treat wastewater sludge and organic wastes because it provides the reduction of both volume and mass of the input material.

As part of an integrated waste management system, anaerobic digestion reduces the emission of the greenhouse gas into the atmosphere. Anaerobic digestion is a renewable energy source because the process produces a methane and carbon dioxide, rich biogas, suitable for energy production helping the replacement of fossil fuels. The nutrient-rich solids left after digestion can be used as fertilizer also.

The digestion process begins with bacterial hydrolysis of the input materials in order to break down insoluble organic polymers such as carbohydrates and make them available for other bacteria. Acidogenic bacteria then convert the sugars and amino acids into carbon dioxide, hydrogen, ammonia, and organic acids. Acetogenic bacteria then convert these resulting organic acids into acetic acid, along with additional ammonia, hydrogen, and carbon dioxide. Methanogenic bacteria finally are able to convert these products to methane and carbon dioxide.

The equipment is based at an ambient temperature storage covered cells (lagoon) with sufficient capacity to create an adequate Hydraulic Retention Time (HRT). The cell will use a single-piece liner affixed to a reinforced outer concrete frame. The outer cover consists of a synthetic vinyl membrane or High Density Polyethylene (HDPE)-, which is also fastened to the frame. The liner and cover will be sealed together with bolts and iron plate frame.
The system also includes a piping biogas collector, from the digester to the flare system.

The flare is enclosed and controlled by a data logger CLP –Controller Logic Programmable – in which the combustion temperature is stored every one minute in the system. This system will record every each minute the combustion temperature to determinate the flare efficiency according to the specification of the flare. A thermocouple installed in the flare is connected to the PLC to control the combustion temperature.

The sparkling system in the flare is automatic. Every one second the system sparks.

The biogas flow rate will be also controlled by a CLP in which every each minute the system records the flow rate.

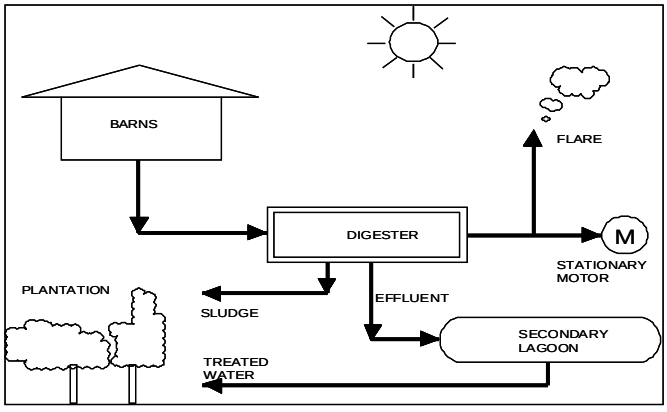
The sparkling system, the PLC and the control panel are powered by a 12 volts battery charged by solar cells.

A secondary pipe will be installed before the flare and after the flow meter, for future purposes, willing to supply biogas to the power generators, for in site electricity supply where **no claims for emissions reductions by the electricity generation will be requested** during the entire project activity. Brascarbon will not claim the emissions reductions of the renewable energy in the future installations of biogas generators units but it will be requested the emissions reduction by the methane destruction in the combustion system of energy generation unit and the efficiency parameter to be used will be the same adopted in the flare.

The treated effluent is discharged in the open lagoons, at this moment it is aerated as per the design of the original lagoon system.
The treated water can be then recycled and sent back to the farm purposes, or used for irrigation, in a system that uses biogas pumps or electrical stationary pumps supplied by the biogas co-generators.
No electricity will be consumed from the grid. The technical parts that will be powered by energy, this energy will come from a solar cell system. The energy will be stored in 12 volts batteries.

The sludge from the digesters will be spread aerobically in the surface of the pasture or plantation as fertiliser in a depth less than 0, 30 meters. The sludge will be pumped by a portable biogas pump.

Figure A2. Flowchart of the treatment system



A.4.1. Location of the small-scale project activity:

The project is located in southwest Brazil at the province of São Paulo state, Brazil.

A.4.1.1. Host Party (ies):

The host party for this project activity is Brazil.

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

Southwest Region / State of São Paulo.

A.4.1.3. City/Town/Community etc:

Cities of Jarinu, Itapetininga, Descalvado, Santo Antonio de Posse, Pilar do Sul, Águas da Prata, Porto Feliz, Limeira, Fartura, Bauru and Monte Alegre do Sul, in São Paulo state.

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity:

The project sites are shown in Figures A3 and A4 with specifics detailed in Table A2.

Table A2. Detailed physical location and identification of project site

Farm/Site Name	Brascarbon ID	Address	Town/State	Contact	Phone	GPS Coord
Agropecuária Sitio Herlu	BCA-074SP1-08	Bairro Chapadão, s/n	Pilar do Sul, SP	Hermano de Moura	+55 11 3645 2950	S 23° 54' 54,4" W 047° 51' 39,4"
Fazenda São Carlos	BCA-055SP1-08	Estrada Municipal Guilerme Scatena, km 6	Descalvado, SP	José Antonio G. Benvenga	+55 19 3583 1009	S 21° 51' 16,40 " W 47° 38' 33,00 "
Fazenda Sta Elisa - Site 1	BCA-056SP1-08	Rod. Aguas da Prata-Poços de Caldas. Bairro Cascata	Aguas da Prata, SP	José Carlos G. Carneiro	+55 35 3721 2900	S 21° 52' 34,2 " W 46° 40' 28,29 "
Fazenda Sta Elisa - Site 2	BCA-056SP2-08	Rod. Aguas da Prata-Poços de Caldas. Bairro Cascata	Aguas da Prata, SP	José Carlos G. Carneiro	+55 35 3721 2900	S 21° 52' 19,44 " W 46° 40' 34,09 "
Faz. Esmeralda	BCA-054SP1-08	Rod. SP 340 - Km 129	Santo Antonio de Posse, SP	Guilherme Van de Geesst	+55 19 3802 4042	S 22° 33' 38,80" W 46°58' 06,49"
Sitio Cotovia	BCA-007SP1-08	Estrada Soamim, s/n	Porto Feliz, SP	Antonio Ianni	+55 11 4022 5118	S 23° 12' 32,50 " W 47° 28' 45,70 "
Sitio Santo Antonio - Site 1	BCA-076SP1-08	Rod. SP 147, km 91	Limeira, SP	Pedro Antonio Tosello	+55 19 3864 1211	S 22° 31' 07,0" W 047° 14' 30,6"
Sitio Santo Antonio Site 2	BCA-079SP1-08	Rod. SP 147, km 91	Limeira, SP	Diana Tosello Laloni	+55 19 3864 1211	S 22° 31' 19,3" W 047° 14' 48,5"

Farm/Site Name	Brascarbon ID	Address	Town/State	Contact	Phone	GPS Coord
Granja Lajeado	BCA-077SP1-08	Bairro Lajeado s/n	Fartura, SP	José Carlos Ribeiro	+55 14 3386 1106	S 23° 23' 31,8" W 049° 26' 40,44"
Faz. São José Nápoles	BCA-078SP1-08	Bairro Vargem Grande – CEP 13910-000	Monte Alegre do Sul	Érica Nápoles	+55 11 7310 3442	S 22° 45' 32,09" W 046° 37' 38,61"
Sitio Santa Cruz	BCA-053SP1-08	Estrada do Rio Abaixo, s/n - Bairro Ponte Alta	Jarinu, SP	Antonio Capobianco	+55 11 4535 1647	S 23° 02' 52,0" W 046° 41' 11,4"
Faz. Analia Franco	BCA-075SP1-08	Rodovia SP 127, km 166	Itapetininga, SP	Fernando Galvão	+55 15 3275 9333	S 22° 26' 12,7" W 047° 23' 46,9"
Sitio São João – site 1	BCA-107SP1-08	Rod Bauru-Iacanga (SP321) km 360	Bauru, SP	Antonio Carlos da Silva	+55 14 3234 7531	S 22° 9,783' W 049° 2,396'
Sitio São João – site 2	BCA-107SP2-08	Rod Bauru-Iacanga (SP321) km 360	Bauru, SP	Antonio Carlos da Silva	+55 14 3234 7531	S 22° 8,381' W 049° 3,148'
Sitio São Thiago	BCA-109SP1-08	Rod Bauru-Iacanga (SP321) km 360	Bauru, SP	Antonio Carlos da Silva	+55 14 3234 7531	S 22° 9,329' W 049° 2,940'

Hermano de Moura has one site in Pilar do Sul city:

- Agropecuaria Sitio Herlu is a finishing swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

José Antonio Garcia Benvenga has one site in Descalvado city:

- Fazenda São Carlos is a farrow-to-finish operation. The site uses two primary open lagoons for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation. Water from this lagoon will be used for irrigation.

José Carlos Gonçalves Carneiro has two sites in Aguas da Prata city:

- Fazenda Santa Elisa site 1 is a farrow-to-finish swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.
- Fazenda Santa Elisa Site 2 is a farrow-to-finish swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Guilherme Van der Geest has one site in Santo Antonio de Posse city:

- Fazenda Esperança is a farrow-to-finish swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Vanderlei Bressiani has one site in Porto Feliz city:

- Sitio Ana Paula is a farrow-to-finish swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Antonio Ianni has one site in Porto Feliz city:

- Sitio Cotovia is a breeding and nursering swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Pedro Antonio Tosello has one site in Limeira city:

- Fazenda Santo Antonio site 1 is a farrow-to-finish swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Diana Tosello Lalonio has one site in Limeira city:

- Fazenda Santo Antonio Site 2 is a finishing swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Jose Carlos Ribeiro has one site in Fartura city:

- Granja Lajeado is a farrow-to-finish swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Érica Nápoles has one site in Monte Alegre do Sul city:

- Fazenda São José Nápoles is a farrow-to-finish swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Antonio Capobianco has one site in Jarinu city:

- Sitio Santa Cruz is a farrow-to-finish swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Fernando Galvão has one site in Itapetininga city:

- Fazenda Anália Franco is a finishing swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Antonio Carlos da Silva has three sites in Bauru city:

- Sitio São João, site 1, is a breeding and nursery swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

- Sitio São João, site 2, is a finishing swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

- Sitio São Thiago is a finishing swine operation. The site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

Figure A3 State of São Paulo, Brazil – cities location of the project sites

A.4.2. Type and category (ies) and technology/measure of the small-scale project activity:

The project activity is a Type III.
The project is small scale due the emissions reductions are less than 60 tons of CO2 eq.

• Type III.D (reference AMS-III.D) / Version 14 – "***Methane recovery in animal manure management systems*** ".

The simplified methodology is appropriate due the project activity site is considered an agro-industry and the emissions reductions are less than 60 tons of CO2 eq. The GHG emissions calculations can be estimated using internationally accepted IPCC 2006 guidance.

The project activity will capture and combust methane gas produced in the decomposing manure at swine confined animal feed operation located in São Paulo state, Brazil. This simplified baseline methodology is applicable to this project activity, since without the proposed project activity, methane from the existing animal waste management system would continue to be emitted into the atmosphere.

A.4.3. Estimated amount of emission reductions over the chosen crediting period:

THE TOTAL ESTIMATE OF EMISSIONS REDUCTIONS OVER THE 7 YEARS PROJECT PERIOD

Table A3. Detailed / total - annual estimated reductions per year

Years	Annual estimation of emission reductions in tonnes of CO2e
2010 – from 1st Feb to 31st Dec	42.713
2011	46.678
2012	46.678
2013	46.678
2014	46.678
2015	46.678
2016	46.678
2017 – from 1st.Jan to 31st Jan	3.965
Total estimated reductions (tones of CO2e) **Total number of crediting years**	326.746 7
Annual average over the crediting period of estimated reductions **(tonnes of CO2e)**	46.678

A.4.4. Public funding of the small-scale project activity:

There is no official development assistance being provided for this project.

A.4.5. Confirmation that the small-scale project activity is not a de-bundled component of a large scale project activity:

Based on paragraph 2 of Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities[7], this project is not de-bundled. There are no other registered small-scale CDM project activities with the same project participants, in the same project category and technology/measure whose project boundary is within 1 km of another proposed small-scale activity.

SECTION B. Application of a baseline and monitoring methodology

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

The approved baseline and monitoring methodology is:
• Type III.D (reference AMS-III.D) / Version 14 – "***Methane recovery in animal manure management systems***".

B.2. Justification of the choice of the project category:

The simplified methodologies are appropriate because the project activity site is considered an agro-industry and GHG emissions calculations can be estimated using internationally accepted IPCC guidance. The project activity will capture and combust methane gas produced from the decomposing manure at swine Confined Animals Feed Operations located in São Paulo state, Brazil. This simplified baseline methodology is applicable to this project activity because without the proposed project activity, methane from the existing animal waste management system would continue to be emitted into the atmosphere. Also, the project is a small scale project because it comprises methane recovery from agro-industries, and project emissions are less than 60 kt CO2eq.
The starting date for this activity is 20/05/2008, when the first construction with the owner of a pig farm/project site was started (Agropecuária Sitio Herlu), in Pilar do Sul city, São Paulo state. This date can be considered as the starting date where the project participant has committed to expenditures related to the implementation of the project activity.
Proof of an early consideration of CDM is available, as the contract between the project developer (Brascarbon) and the carbon credit buyer (Luso Carbon Fund) was signed before than the starting date, on June 2007 (document is also available for review).

Furthermore, the contract between the project developer and the owner of the pig farms specifically mentions the project implementation under the context of CDM.

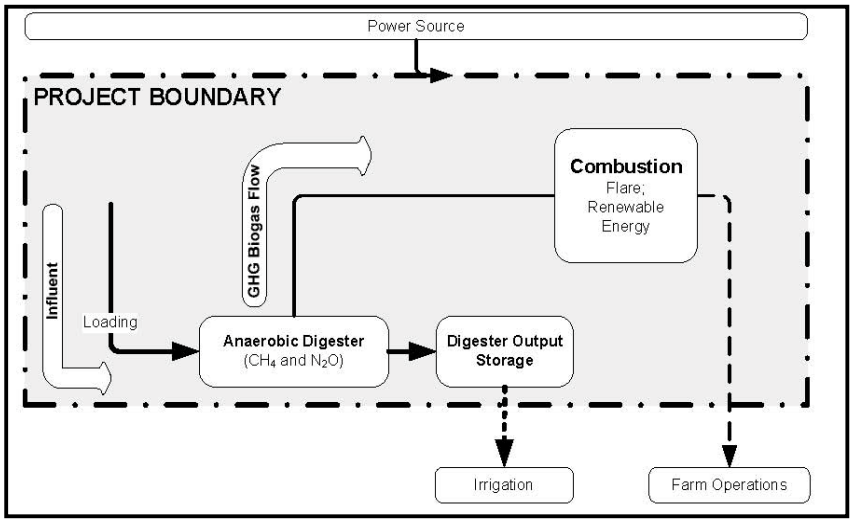
[7] http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf

After the starting date of the project activity and until the PDD started validation (August 2008), the project developer finalized and signed the contracts with the other owners of pig farms/project sites, elaborated the PDD and contracted the DOE for validation.

B.3. Description of the project boundary:

The project boundary is illustrated in Figure B1. It describes the basic layout of the project farm in a schematic format. The proposed project boundary considers the GHG emissions that come from the animal waste practices, including the GHG resulting from the capture and combustion of biogas. The project activity site uses a system of one or more lagoons. The proposed animal waste management system practice changes include the construction of a digester comprised of cells that capture the resulting biogas which is then combusted. Based on the methodology, the anaerobic digester is the physical boundary of the methane recovery facility.

Figure B1 - Project Boundary



B.4. Description of baseline and its development:

This section is based on the equations used on the approved methodology AMS.III.D version 14 and data from 2006 IPCC Guidelines for National GHG Inventories, volume 4, chapter 10.
The amount of methane that would be emitted to the atmosphere in the absence of the project activity can be estimated by referring to the equation B1 – Baseline emissions from manure management, according to the methodology AMS.III.D – version 14.

The final draft of this baseline section was completed on 04 July 2008. The name of entity determining the baseline is BrasCarbon, which is a project participant, as well as the project developer.

The baseline for this project activity is defined as the amount of methane that would be emitted to the atmosphere during the crediting period in the absence of the project activity. In this case an open anaerobic lagoon is considered the baseline and estimated emissions are determined as follows:

Step 1 – Animal Population

Animal populations for the project activity sites are described in this section Table B2.

Step 2: Baseline Emissions.

Equation B1

$$BE_y = GWP_{CH4} * D_{CH4} * UFB * \sum MCF_J * B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{Bl,j}$$

Where:

BE_y	Baseline emissions in year "y" (tCO_2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (21)
D_{CH4}	CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure).
LT	Index for all types of livestock
j	Index for animal waste management system
MCF_j	Annual methane conversion factor (MCF) for the baseline animal waste management system "j"
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m^3 CH_4/kg dm)
$N_{LT,y}$	Annual average number of animals of type "LT" in year "y" (numbers)
$VS_{LT,y}$	Volatile solids for livestock "LT" entering the animal manure management system in year "y" (on a dry matter weight basis, kg dm/animal/year)
$MS\%_{Bl,j}$	Fraction of manure handled in baseline animal manure management system "j"
UF_b	Model correction factor to account for model uncertainties (0.94)[1]

Where:

(A) $VS_{LT,y}$ can be determinate by scaling default IPCC values to adjust for a site-specific average animal weight.

Equation B2

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}} \right) * VS_{default} * nd_y$$

Where:

W_{site}	Average animal weight of a defined livestock population at the project site (kg)
$W_{default}$	Default average animal weight of a defined population, this data is sourced from IPCC 2006 (kg)
$VS_{default}$	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day)
nd_y	Number of days in year "y" where the treatment plant was operational.

And,

(B) $N_{LT,y}$, the annual average number of animals can be determinate as follows:

Equation B3

$$N_{LT,y} = N_{da,y} * (N_{p,y}/365)$$

Where:

$N_{da,y}$	Number of days animal is alive in the farm in the year "y" (numbers)
$N_{p,y}$	Number of animals produced annually of type "LT" for the year "y" (numbers)

Table B1 - Parameters and factors for the applying baseline equations

Parameter/Factor	Value	Source/Comment
Baseline		
$VS_{default}$	Annex 3	Obtained from IPCC2006, vol 4, chapter 10, Tables 10A-7 and 10A-8.
GWP_{CH4}	21	Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996)
$B_{0,LT}$	0.45	Obtained from 2006 IPCC, Table 10A-7, p.10.80 and Table 10A-8, p.10.81.
D_{CH4}	0.00067	CH4 density at room temperature 20°C and 1 atm pressure.
MCF_J	78%	Obtained from 2006 IPCC, Chp.10 vol 4 - Table 10.17, p.10.45
$N_{LT,y}$	Table B2	Annual average number of animals of type "LT " in year "y"(numbers)
$MS\%_{Bl,j}$	100%	Fraction of manure handled in system "j".
W default	198 kg breeding and 50 kg market	Obtained from IPCC2006, vol 4, chapter 10, Tables 10A-7 and 10A-8.
UF_B	0.94	Model correction factor to account for model uncertainties.

Table B2 - Parameters and factors for the specific animal category

ID	Farm/Site	Anual Average Number of Animals of Type LT in year y - $N_{LT,y}$					Total
		Sows	Finishers	Nursery/ Weaners	Boars	Gilts	
1	Agropec, Sitio Herlu	-	2.219	-	-	-	**2,219**
2	Fazenda São Carlos	1.200	8.208	4.729	12	460	**14,609**
3	Fazenda Sta Elisa - Site 1	250	1.710	985	3	75	**3,023**
4	Fazenda Sta Elisa - Site 2	540	3.694	2.128	5	162	**6,529**
5	Faz, Esmeralda	400	2.441	1.381	5	200	**4,427**
6	Sitio Cotovia	500	3.662	-	8	216	**4,386**
7	Sitio Sto Antonio - Site 1	600	2.497	2.365	14	37	**5,513**
8	Sitio Sto Antonio Site 2	-	2.497	-	-	-	**2,497**
9	Granja Lajeado	480	3.283	1.892	6	50	**5,711**
10	Faz, São José Nápoles	1.000	6.840	3.941	10	300	**12,091**
11	Sitio Santa Cruz	550	5.548	2.186	8	200	**8,492**
12	Faz, Analia Franco	-	2.219	-	-	-	**2,219**
13	Sitio São João - site 1	-	3.329	-	-	-	**3,329**
14	Sitio São João - site 2	1.000	-	4.220	12	300	**5,532**
15	Sitio São Thiago	-	3.329	-	-	-	**3,329**
TOTAL		**6,520**	**51.476**	**23.827**	**83**	**2.000**	**83.906**

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

In absence of this project activity, the swine producers would not change their animal waste management system practices. They have no motivations or financial resources to implement a different waste treatment as open anaerobic lagoons.

The swine waste storage and treatment systems in Brazil consists in open tanks, open digesting process and ponds (anaerobic, variable and aerobic), due to the most economic and viable system approved to manage the manure in confined animal feed operations. Economic barriers are very common because producers can invest only in the confined feed operations and with no need to invest in waste management systems. Financial resources are always used to maintain the confined feed operation working.

Also, waste treatment involves low technology, as open lagoons need less employees and technicians for operation and maintenance. For these reasons the project is additional.

In accordance with paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in Appendix B may be used if project participants can demonstrate that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in attachment A of Appendix B. Similarly, for the identified CDM project, following barriers have been overcome during project planning and execution:

Investment Barrier:
In the economic point of view, Brazilian pork producers face the same challenges as farmers in other nations due to the growth worldwide pork production and low operating margins. Farm owners focus on the bottom line, and odour benefits, alleged water quality enhancements, and the potential increment savings associated with electricity cost avoidance, are rarely enough to compel an upgrade to an (expensive) advanced animal waste management system.
Also, from the producer´s point of view the animal waste is outside of the production process and has difficulty financing changes that should be undertaken. Even banks have been unwilling to finance such activities, absent government guarantees or other incentives.
The anaerobic digester requires a much higher investment, it can be assumed that the anaerobic lagoon, usually requires less investment, is the most likely alternative and therefore can be considered the baseline scenario.

To demonstrate the existence of an investment barrier, that foresee the implementation of the project without the revenue of the carbon credits, the project proponent has undertaken an economic sensitive analysis of the project activity (without the revenue of the carbon credits), considering three different scenarios: first, only the installation of the anaerobic digester plus flare is being considered; second, the installation of both an anaerobic digester plus flare and a generator are being considered and assuming that all farms will start to produce electricity in 2010 (36KWh that will be used on site for the farm activities only, without connection to the grid for further energy commercialization); and third, the installation of the anaerobic lagoon, as usual in the baseline scenario.

In all scenarios the Internal Return Rate (IRR) cannot be calculated hence the analysis is based on the NPV, using the discount rate of 12,13% - Brazilian bonds (taxa SELIC - http://www.bcb.gov.br/ (average last 12 months from July/2008 to July/2009), in 21 years.
At the first scenario, table B 2.1, there is only negatives cash flows, as no revenue will be expected from the implementation of the project activity.

In the following table illustrates that there is no positive cash flow scenario involved in the project activity. Therefore, there is an investment barrier that prevents the implementation of the project activity.

Considering the analysis undertaken, it is determined that the project is “additional” from an economic perspective, as it is only viable with the revenues of the carbon credits.

Brascarbon decided to make the NPV calculation considering 21 years as the period of the project, that is the maximum period of the Small Scale project life cycle, instead of what is mentioned in the Annex 45 of the EB 41 (max period 20 years).

Table B 2.1 – NPV and IRR calculation (digester + flare, operation lifetime of the project: 21 years)

ID	FARM/SITE	Equipment costs (digester and flare)	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from the sale of electricity or other project related products, when applicable			TOTAL	NPV (US$) (12.13% discount rate)	IRR (%)
					2010	year n	year n+1	2010	year n	year n+1			
1	Aropec Sitio Herlu	-23.100	-15.400	0.00	-15.600	-15.600	-15.600	0	0	0	-54.100	-137.412	undefined
2	Fazenda São Carlos	-59.600	-39.700	0.00	-15.600	-15.600	-15.600	0	0	0	-114.900	-191.635	undefined
3	Fazenda Sta Elisa - Site 1	-23.600	-15.800	0.00	-15.600	-15.600	-15.600	0	0	0	-55.000	-138.215	undefined
4	Fazenda Sta Elisa - Site 2	-43.000	-28.400	0.00	-15.600	-15.600	-15.600	0	0	0	-87.000	-166.753	undefined
5	Faz. Esmeralda	-29.500	-19.700	0.00	-15.600	-15.600	-15.600	0	0	0	-64.800	-146.955	undefined
6	Sitio Cotovia	-18.700	-12.500	0.00	-15.600	-15.600	-15.600	0	0	0	-46.800	-130.902	undefined
7	Sitio Sto Antonio - Site 1	-46.000	-30.700	0.00	-15.600	-15.600	-15.600	0	0	0	-92.300	-171.480	undefined
8	Sitio Sto Antonio Site 2	-38.800	-25.800	0.00	-15.600	-15.600	-15.600	0	0	0	-80.200	-160.689	undefined
9	Granja Lajeado	-26.000	-17.400	0.00	-15.600	-15.600	-15.600	0	0	0	-59.000	-141.782	undefined
10	Faz. São José Nápoles	-44.500	-29.600	0.00	-15.600	-15.600	-15.600	0	0	0	-89.700	-169.161	undefined
11	Sitio Santa Cruz	-78.900	-52.600	0.00	-15.600	-15.600	-15.600	0	0	0	-147.100	-220.352	undefined
12	Faz. Analia Franco	-71.200	-47.500	0.00	-15.600	-15.600	-15.600	0	0	0	-134.300	-208.936	undefined
13	Sitio São João - site 1	-23.100	-15.400	0.00	-15.600	-15.600	-15.600	0	0	0	-54.100	-137.412	undefined
14	Sitio São João - site 2	-18.600	-12.400	0.00	-15.600	-15.600	-15.600	0	0	0	-46.600	-130.724	undefined
15	Sitio São Thiago	-73.600	-49.100	0.00	-15.600	-15.600	-15.600	0	0	0	-138.300	-212.504	undefined

In the second scenario, table B 2.2, considered electricity cogeneration and anaerobic digester plus flare installation, although the project activity generates positive returns from the avoided costs of the electricity purchase, the yearly cash-flows are always negative, as the electricity avoided cost is not enough to offset the maintenance costs of the anaerobic digester and the generator.

The NPV of the project activity is negative. It is assumed that the farms would implement a 36 KWh generator, which would produce electricity 12 hours per day (to guarantee farm needs).

The revenue adopted in this model was considered the energy cost savings by the use of the biogas generator. The energy generation is directly to the user. Selling energy was not considered due the internal difficulties for grid connection for such amount of energy produced.
Once again, there is an investment barrier that prevents the implementation of the project activity.

Considering the analysis undertaken, it is determined that the project is “additional” from an economic perspective, as it is only viable with the revenues of the carbon credits.

Table B 2.2. NPV and IRR calculation (Digester+ Flare+ Co-generation , operation lifetime of the project: 21 years)

ID	FARM/SITE	Equipment costs (digester, flare, cogeneration)	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from electricity savings due the on site energy production (36KWh during 12 hours/day in year)			TOTAL	NPV (US$) (12.13% discount rate)	IRR (%)
					2010	year n	year n+1	2010	year n	year n+1			
1	Aropec Sitio Herlu	-73.100	-25.400	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-101.463	-107.419	undefined
2	Fazenda São Carlos	-109.600	-49.700	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-162.263	-161.642	undefined
3	Fazenda Sta Elisa - Site 1	-73.600	-25.800	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-102.363	-108.222	undefined
4	Fazenda Sta Elisa - Site 2	-93.000	-38.400	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-134.363	-136.760	undefined
5	Faz. Esmeralda	-79.500	-29.700	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-112.163	-116.962	undefined
6	Sitio Cotovia	-68.700	-22.500	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-94.163	-100.909	undefined
7	Sitio Sto Antonio - Site 1	-96.000	-40.700	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-139.663	-141.487	undefined
8	Sitio Sto Antonio Site 2	-88.800	-35.800	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-127.563	-130.696	undefined
9	Granja Lajeado	-76.000	-27.400	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-106.363	-111.789	undefined
10	Faz. São José Nápoles	-94.500	-39.600	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-137.063	-139.168	undefined
11	Sitio Santa Cruz	-128.900	-62.600	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-194.463	-190.359	undefined
12	Faz. Analia Franco	-121.200	-57.500	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-181.663	-178.943	undefined
13	Sitio São João - site 1	-73.100	-25.400	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-101.463	-107.419	undefined
14	Sitio São João - site 2	-68.600	-22.400	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-93.963	-100.731	undefined
15	Sitio São Thiago	-123.600	-59.100	0	-20.600	-20.600	-20.600	17.637	17.637	17.637	-185.663	-182.511	undefined

The third scenario, which considers the installation of the open anaerobic lagoons (baseline scenario), is usually installed due the most economic option to the swine producers. The table B 2.3, considered the installation of the open anaerobic lagoon and a less cost for maintenance, comparing with the 1st and 2nd options, because there is less technology involved. Although the third option is the favorable economic option, the yearly cash-flows are always negative. The NPV of this scenario is also negative.

Table B 2.3. NPV and IRR calculation (Open Lagoon , operation lifetime of the project: 21 years)

ID	FARM/SITE	Equipment costs (anaerobic open lagoon)	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from the sale of electricity or other project related products, when applicable			TOTAL	NPV (US$) (12.13% discount rate)	IRR (%)
					2010	year n	year n+1	2010	year n	year n+1			
1	Aropec Sitio Herlu	-9.861	-5.221	0	-1.000	-1.000	-1.000	0	0	0	-16.082	-20.058	undefined
2	Fazenda São Carlos	-20.166	-9.833	0	-1.000	-1.000	-1.000	0	0	0	-30.999	-33.361	undefined
3	Fazenda Sta Elisa - Site 1	-8.849	-3.999	0	-1.000	-1.000	-1.000	0	0	0	-13.848	-18.066	undefined
4	Fazenda Sta Elisa - Site 2	-12.051	-6.273	0	-1.000	-1.000	-1.000	0	0	0	-19.324	-22.949	undefined
5	Faz. Esmeralda	-10.676	-4.940	0	-1.000	-1.000	-1.000	0	0	0	-16.616	-20.534	undefined
6	Sitio Cotovia	-11.489	-5.795	0	-1.000	-1.000	-1.000	0	0	0	-18.284	-22.022	undefined
7	Sitio Sto Antonio - Site 1	-11.183	-5.447	0	-1.000	-1.000	-1.000	0	0	0	-17.630	-21.439	undefined
8	Sitio Sto Antonio Site 2	-6.404	-3.747	0	-1.000	-1.000	-1.000	0	0	0	-11.151	-15.660	undefined
9	Granja Lajeado	-12.851	-5.681	0	-1.000	-1.000	-1.000	0	0	0	-19.532	-23.135	undefined
10	Faz. São José Nápoles	-16.134	-7.698	0	-1.000	-1.000	-1.000	0	0	0	-24.832	-27.861	undefined
11	Sitio Santa Cruz	-19.173	-5.150	0	-1.000	-1.000	-1.000	0	0	0	-25.323	-28.299	undefined
12	Faz. Analia Franco	-7.894	-4.968	0	-1.000	-1.000	-1.000	0	0	0	-13.862	-18.078	undefined
13	Sitio São João - site 1	-11.809	-5.483	0	-1.000	-1.000	-1.000	0	0	0	-18.292	-22.029	undefined
14	Sitio São João - site 2	-11.809	-5.483	0	-1.000	-1.000	-1.000	0	0	0	-18.292	-22.029	undefined
15	Sitio São Thiago	-11.809	-5.483	0	-1.000	-1.000	-1.000	0	0	0	-18.292	-22.029	undefined

Once again, there is also an investment barrier that prevents the implementation of the installation of the anaerobic open lagoon, but it is the option approved by the environment department for waste management system to the confined feed animal operation.
The negative cash flow and the present value demonstrated in the 3 scenarios, indicates that the farm producers would not engage in any implementation due the negative cash-flow and no investment returns.
Continuation of current practices, as the anaerobic lagoon, would be the most attractive course of action because requires fewer investment (since all the producers already have an anaerobic lagoon under place) and this practice is approved by the environmental department to the confined feed animals operation, but with high emissions.

The table B2.4 shows the summary of the sensitive investment analysis for each farm, in which the 3rd scenario (continuation with the baseline scenario) is the most attractive option due the less investment involved comparing with the 1st and 2nd scenarios but with high emissions practice.
The 1st and 2nd scenarios without emissions and considering the analysis undertaken, it is determined that the project is "additional" from an economic perspective, as it is only viable with the revenues of the carbon credits.

Table B 2.4. NPV and IRR results for the lifetime of the project: 21 years

ID	FARM/SITE	NPV (1st SCENARIO) DIGESTER + FLARE	NPV (2nd SCENARIO) DIGESTER + FLARE + CO-GENERATION	NPV (3rd SCENARIO) ANAEROBIC OPEN LAGOON	IRR(%)
1	Aropec Sitio Herlu	-137.412	-107.419	-20.058	UNDEFINED
2	Fazenda São Carlos	-191.635	-161.642	-33.361	UNDEFINED
3	Faz. Sta Elisa - Site 1	-138.215	-108.222	-18.066	UNDEFINED
4	Faz. Sta Elisa - Site 2	-166.753	-136.760	-22.949	UNDEFINED
5	Faz. Esmeralda	-146.955	-116.962	-20.534	UNDEFINED
6	Sitio Cotovia	-130.902	-100.909	-22.022	UNDEFINED
7	Sitio Sto Antonio - Site 1	-171.480	-141.487	-21.439	UNDEFINED
8	Sitio Sto Antonio - Site 2	-160.689	-130.696	-15.660	UNDEFINED
9	Granja Lajeado	-141.782	-111.789	-23.135	UNDEFINED
10	Faz. São José Nápoles	-169.161	-139.168	-27.861	UNDEFINED
11	Sitio Santa Cruz	-220.352	-190.359	-28.299	UNDEFINED
12	Faz. Analia Franco	-208.936	-178.943	-18.078	UNDEFINED
13	Sitio São João - site 1	-137.412	-107.419	-22.029	UNDEFINED
14	Sitio São João - site 2	-130.724	-100.731	-22.029	UNDEFINED
15	Sitio São Thiago	-212.504	-182.511	-22.029	UNDEFINED

Taking into account the investment sensitive analysis, the project activity still presents negatives NPV where the IRR can't be calculated. The table B2.5 indicates the sensitive analysis for the option where it is considered the installation of the digester, flare and co-generation system, since this option is the unique alternative where revenues can be obtained in the project activity by avoiding costs from the electricity purchase from the grid. The table shows 2 alternatives, A and B, where the alternative A considers the equipment cost reduction and the alternative B considers the increase of the energy price.
The column A considers the equipment cost reduction of 10% since the costs of this project activity was estimated based in the registered project design document in 16 March 2009 – BRASCARBON Methane Recovery Project BCA-BRA-01, ref number 2318.

The column B considers the increase of the energy price in 10% since Brazilians electricity price is adjusted according to the IGPM – Indice Geral de Preços do Mercado (Brazil´s Market Price Index). It was around 5,38% in the last 12 months (from April 2008 to April 2009)(http://www.portalbrasil.net/igpm.htm) but Brascarbon considered 10% as a sever tariff adjustment simulation. The energy tariffs can be obtained by the following web site: http://www.aneel.gov.br/area.cfm?idArea=550; Rural consumption class (where the project activity is installed), southwest region.
Conclusion: the project activity is "additional" from an economic perspective, as it is only viable with the revenues of the carbon credits.

Table B 2.5. NPV and IRR calculation summary , operation lifetime of the project: 21 years

ID	FARM/SITE	A - CONSIDERING 10% EQUIPMENT COST REDUCTION	B - CONSIDERING 10% INCREASE OF THE ENERGY PRICE	IRR(%)
		NPV (2nd SCENARIO) DIGESTER + FLARE + CO-GENERATION	NPV (2nd SCENARIO) DIGESTER + FLARE + CO-GENERATION	
1	Aropec Sitio Herlu	-98.635	-95.765	UNDEFINED
2	Fazenda São Carlos	-147.435	-149.988	UNDEFINED
3	Fazenda Sta Elisa - Site 1	-99.357	-96.568	UNDEFINED
4	Fazenda Sta Elisa - Site 2	-125.042	-125.106	UNDEFINED
5	Faz. Esmeralda	-107.223	-105.308	UNDEFINED
6	Sitio Cotovia	-92.776	-89.255	UNDEFINED
7	Sitio Sto Antonio - Site 1	-129.296	-129.833	UNDEFINED
8	Sitio Sto Antonio Site 2	-119.584	-119.042	UNDEFINED
9	Granja Lajeado	-102.568	-100.135	UNDEFINED
10	Faz. São José Nápoles	-127.209	-127.514	UNDEFINED
11	Sitio Santa Cruz	-173.280	-178.705	UNDEFINED
12	Faz. Analia Franco	-163.007	-167.289	UNDEFINED
13	Sitio São João - site 1	-98.635	-95.765	UNDEFINED
14	Sitio São João - site 2	-92.615	-89.077	UNDEFINED
15	Sitio São Thiago	-166.217	-170.857	UNDEFINED

Premises adopted for the investment analysis calculation

UNIT PRICE OF ELECTRICITY (*)	(in US$ /MWh)	111,86	US$/MWh
	(in BRR$ / MWh)	181,99	BRR$/MWh
EXCHANGE RATE (**)	BRR$/US$	1.627	BRR$/US$
Total energy produced / farm/year	(in MWh / year)	157,68	MWh/y
Brazilian bonds (taxa SELIC) (***)		12,13	%

(*) http://aneel.gov.br/area.cfm?idArea=550 (FOR SUDESTE REGION- may/2008)
(**) 1,627 in 20/may/2008
(***) http://www.bcb.gov.br/ (average last 12 months from July/2007 to June/2008)

Technological Barrier:
Anaerobic digester systems must have size to handle projected animal/effluent volumes with a Hydraulic Retention Time (HRT) consistent with extracting most/all CH_4 from the manure. Those systems become progressively more expensive on a 'per animal' basis in farm animal population distribution, mainly when the animal production decreases.

Moreover, operations and maintenance requirements involved with this technology, including a detailed monitoring program to maintain system performance levels, must also be considered. To the adequate operation of the digesters, certain procedures have to be followed and managed by an expertise technician and, in this case, Brascarbon will be responsible for implementing an external support without interfering in the confined animal feed operation. Variables such as temperature, pressure, methane concentration and density of the biogas have to be determinate or calculated to maintain the lifecycle of the project.
Worldwide, few anaerobic digesters have achieved long-term operations, due primarily to inappropriate operations and maintenance.
The proposed animal waste management system represents the most advanced technology in the farm. The proposed project activity mitigates GHG emissions with associated environmental co-benefits.

Barrier Due to Prevailing Practice (National Policies and Circumstances)
In order to clarify the current circumstances regarding to confined animal operations in Brazil and the serious environmental problems can be occurred due the bad animal waste management system, the state of Santa Catarina, together with EMBRAPA (Brazilian Agricultural Research Corporation), developed an official term[8], dedicated to producers and agro-industries willing to reduce the environmental impact, adopting safety measures to control the waste where the major concentration of it is drained directly into the soil, rivers etc.

According to Mr. Everton Vargas, General Subsecretary of Ministerio das Relações Exteriores do Brasil, during the Major Economies Meeting on Energy Security and Climate Change, in Washington Sptember 27th of 2007, "*…Brasil is ready to contribute and make global efforts to reduce the emissions, under the Kyoto Protocol, …*"[9]

According to researchers of EMBRAPA Swine and Poultry (CNPSA), swine waste storage and treatment systems in the South of Brazil consist of open tanks (esterqueiras), open digesting (bioesterqueiras), ponds (anaerobic, variable and aerobic), cesspit, storage or treatment of compost (in solid form). Just a few bio-digesters exist. The material is normally distributed by pumps or gravity and applied to crops and pastures.

EMBRAPA stimulated by the Expansion and Waste Treatment Program of the State of Santa Catarina with instructions and publications[10], to help the producers and agro-industries to implement projects or systems to control the animal waste management protecting the eco-system. This sentiment was shared by representatives of Brazilian Agricultural Research Corporation (EMBRAPA) as well as officers of national swine producers association (ABCS) and Santa Catarina swine producer association (ACCS). The proposed practice change will afford these farms the financial means (via CER revenues) to adopt and maintain an advanced animal waste management system with reductions in GHG emissions and associated environmental co-benefits (including reduced water contamination).

[8] http://www.cnpsa.embrapa.br/pnma/pdf_doc/tac.pdf
[9] http://www.mct.gov.br/index.php/content/view/62460.html
[10] http://www.cnpsa.embrapa.br/index.php?ids=Sn6l70p1l&idl=&pg=1&area=21

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

This section is based on the equations used on the approved methodology AMS.III.D – Version 14 – ***"Methane recovery in animal manure management systems"*** and IPCC 2006.

This baseline methodology was chosen because:

1. This project category comprises methane recovery and destruction from manure and wastes from agricultural or agro-industrial activities that would be decaying anaerobically in the absence of the project activity by:
(a) Installing methane recovery and combustion system to an existing source of methane emissions, or
(b) Changing the management practice of a biogenic waste or raw material in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system.

2. The project activity satisfies the following conditions:
(a) The sludge will be handled aerobically.
(b) Technical measures will be used (e.g. flared, combusted) to ensure that all biogas produced by the digester is used or flared.

3. The annual average temperature of baseline site is higher than 5^{o}C.

4. The depth of the baseline anaerobic lagoon is at least 1 meter.

5. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually.

For baseline emissions calculation see section B.4 and all data is summarised in the section B.6.3, Table B.3 and Table B.4.

The project activity emissions are defined as the amount of methane that would be emitted to the atmosphere during the crediting period due to the project activity. In this case an anaerobic digester is considered the project activity and estimated emissions are determined as follows

Step 1: Emission Reductions.

Equation B4

$$ER_{y,estimated} = BE_y - PE_y$$

Where:

ER_y = emission reductions in t CO_2e/year
BE_Y = the annual baseline methane emissions in t CO2e/year
PE_Y = project emissions in t CO2e/year

Step 2: Baseline Emissions.

According to the Equation B1 section B.4

$$BE_y = GWP_{CH4} * D_{CH4} * UFB * \sum MCF_J * B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{Bl,j}$$

Where:

BE_y	Baseline emissions in year "y" (tCO_2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (21)
D_{CH4}	CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure).
LT	Index for all types of livestock
J	Index for animal waste management system
MCF_j	Annual methane conversion factor (MCF) for the baseline animal waste management system "j"
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m^3 CH_4/kg dm)
$N_{LT,y}$	Annual average number of animals of type "LT" in year "y" (numbers)
$VS_{LT,y}$	Volatile solids for livestock "LT" entering the animal manure management system in year "y" (on a dry matter weight basis, kg dm/animal/year)
$MS\%_{Bl,j}$	Fraction of manure handled in baseline animal manure management system "j"
UF_b	Model correction factor to account for model uncertainties $(0.94)_1$

Step 3: Project Emissions.

According to the simplified baseline and monitoring methodology for a small-scale CDM project Type-III (AMS.III.D – version 14), project emissions consist of:

(a) Physical leakage of biogas in the manure management systems which includes production, collection and transport of biogas to the point of flaring/combustion or gainful use (*PEPL,y*);
(b) Emissions from flaring or combustion of the gas stream (*PEflare,y*);
(c) CO2 emissions using fossil fuels or electricity for the operation of all the installed facilities (*PEpower,y*).

Equation B5

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y}$$

Where:

PE_y	Project emissions in year "y" (tCO_2e)
$PE_{PL,y}$	Emissions due to physical leakage of biogas in year "y" (tCO_2e)
$PE_{flare,y}$	Emissions from flaring or combustion of the biogas stream in the year "y" (tCO_2e)
$PE_{power,y}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year "y" (tCO_2e)

Where:

(A) Emissions due to physical leakage of biogas can be determinate as follows:

Equation B6

$$PE_{PL,y} = 0{,}10 * GWP_{CH4} * D_{CH4} * \sum B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{i,y}$$

Where:

$PE_{PL,y}$	Emissions due to physical leakage of biogas in year "y" (tCO_2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (21)
D_{CH4}	CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure).
LT	Index for all types of livestock
J	Index for animal waste management system
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m^3 CH_4/kg dm)
$N_{LT,y}$	Annual average number of animals of type "LT" in year "y" (numbers)
$VS_{LT,y}$	Volatile solids for livestock "LT" entering the animal manure management system in year "y" (on a dry matter weight basis, kg dm/animal/year)
$MS\%_{i,y}$	Fraction of manure handled in system "i" in year "y"

(B) Emissions from flaring determinated as follows:

Equation B7

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{flare,y} * (1 - \eta_{flare,h}) * GWP_{CH4} / 1000$$

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y, tCO2e
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h , kg/h
$\eta_{flare,h}$	Flare efficiency in an hour h
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period , tCO2e/tCH4
$\eta_{flare,h}$	Flare efficiency in the hour h

(C) Emissions from use of fossil fuels or electricity for the operation:

No fossil fuel or electricity will be used in the project, therefore, $PEpower,y$ = zero.

Step 4: Leakage.

According to the simplified baseline and monitoring methodology AMS.III.D / version 14, no leakage calculation is required.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	*VS default*
Data unit:	kg dry matter/animal/day
Description:	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population
Source of data used:	Obtained from IPCC2006, vol 4, chapter 10, Tables 10A-7 and 10A-8.
Value applied:	0.3 for Market Swine 0.46 for Breeding Swine 0.46 for Guilts
Justification of the choice of data or description of measurement methods and procedures actually applied :	Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association). http://www.abcs.org.br/portal/index2.jsp The genetic source of production operation is originated from Annex I; The farm uses formulated feed rations optimized for the various stage of growth and animals category; The formulated feed rations can be validated through on farm record keeping. Used of factors as defined in IPCC2006, chapter 10, volume 4, since that there is no national data for gross energy calculation.
Any comment:	

Data / Parameter:	MCFj
Data unit:	%
Description:	Annual methane conversion factor for the baseline animal waste management system “j”.
Source of data used:	Obtained from IPCC2006, vol 4, chapter 10, Tables 10.17.
Value applied:	78%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Average temperature of southwest region, mainly where the project sites are located is 23 to 25 Celsius during the year, according to CPTEC/INPE/EMBRAPA http://satelite.cptec.inpe.br/PCD/
Any comment:	

Data / Parameter: Data unit:	MS%Bl,j Fraction
Description:	Fraction of manure handled in baseline animal manure management system "j".
Source of data used:	Project proponents
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	100% of the manure will be handled per category T, system S and climate region k.
Any comment:	

Data / Parameter:	**GWP**CH4
Data unit:	tCO2e/tCH4
Description:	Global warming potential of CH4
Source of data used:	IPCC 2006
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Conversion factor for metric tones of CH4 to metric tones of CO2 equivalent.
Any comment:	

Data / Parameter:	$\mathbf{B_{0,LT}}$
Data unit:	m^3 CH_4/kg dm
Description:	Maximum methane producing potential of the volatile solid generated for animal type "LT".
Source of data used:	IPCC 2006, Tables 10-A7 and 10-A8.
Value applied:	Sows(breeding swine more than 200 kg mass): 0.45 Finishers(market swine more than 50 Kg mass): 0.45 Nursery: 0.45 Boars and Gilts (market swine more than 100 Kg mass): 0.45
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value according to IPCC 2006 in western Europe region. Genetics and nutrition adopted for these farms are the same as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association).http://www.abcs.org.br/portal/index2.jsp The genetic source of production operation is originated from Annex I party; The farm uses formulated feed rations optimized for the various stage of growth and animals category; The formulated feed rations can be validated through on farm record keeping.
Any comment:	

Data / Parameter:	W default
Data unit:	Kg
Description:	Deafult average animal weight of a defined population at the project site.
Source of data:	IPCC 2006, Tables 10-A7 and 10-A8.
Value applied:	Sows(breeding swine): 198 kg Finishers(market swine): 50 kg Nursery (market swine): 50 kg Boars (market swine): 50 kg Gilts (breeding swine): 198 kg
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value according to IPCC 2006 in western Europe region. Genetics and nutrition adopted for these farms as so as in Western Europe. More details and information on genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association). http://www.abcs.org.br/portal/index2.jsp
Any comment:	

B.6.3. Ex-ante calculation of emission reductions:

(i) According to the baseline description in the section B.4, the results from the equations are summarized in the following table B3:

Table B3 – Baseline emissions for the first year – from 1st Feb to 31st Dec 2010

ID	Farm/Site	Baseline Emissions per Annual Average Number of Aniamls Type "LT", in ton CO2e/year					Total
		Sows	Finishers	Nursery / Weaners	Boars	Gilts	
1	Agropecuaria Sitio Herlu	-	1.858	-	-	-	**1.858**
2	Fazenda São Carlos	951	6.872	1.188	27	348	**9.385**
3	Fazenda Sta Elisa - Site 1	199	1.432	247	6	57	**1.941**
4	Fazenda Sta Elisa - Site 2	428	3.093	534	11	123	**4.189**
5	Fazenda Esmeralda	317	2.043	347	11	151	**2.869**
6	Sitio Cotovia	396	3.066	-	18	164	**3.645**
7	Sitio Sto Antonio - Site 1	476	2.091	594	31	28	**3.220**
8	Sitio Sto Antonio Site 2	-	2.091	-	-	-	**2.091**
9	Granja Lajeado	381	2.749	475	14	38	**3.656**
10	Faz. São José Nápoles	792	5.727	990	22	227	**7.759**
11	Sitio Santa Cruz	436	4.645	549	18	151	**5.799**
12	Fazenda Anália Franco	-	1.858	-	-	-	**1.858**
13	Sitio São João - site 1	-	2.787	-	-	-	**2.787**
14	Sitio São João - site 2	792	-	1.060	27	227	**2.106**
15	Sitio São Thiago	-	2.787	-	-	-	**2.787**
TOTAL		**5.167**	**43.100**	**5.984**	**185**	**1.513**	**55.948**

Table B4 – Total baseline emission per year – (starts 1st Feb and ends 31st Jan)

ID	Farm Name/Site	Expected growth %	Baseline Emissions in t CO2e / year							
			2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	Total
1	Agropecuaria Sitio Herlu	0%	2.030	2.030	2.030	2.030	2.030	2.030	2.030	14.210
2	Fazenda São Carlos	0%	10.256	10.256	10.256	10.256	10.256	10.256	10.256	71.792
3	Fazenda Sta Elisa - Site 1	0%	2.121	2.121	2.121	2.121	2.121	2.121	2.121	14.847
4	Fazenda Sta Elisa - Site 2	0%	4.578	4.578	4.578	4.578	4.578	4.578	4.578	32.046
5	Faz. Esmeralda	0%	3.135	3.135	3.135	3.135	3.135	3.135	3.135	21.945
6	Sitio Cotovia	0%	3.983	3.983	3.983	3.983	3.983	3.983	3.983	27.881
7	Sitio Sto Antonio - Site 1	0%	3.519	3.519	3.519	3.519	3.519	3.519	3.519	24.633
8	Sitio Sto Antonio Site 2	0%	2.285	2.285	2.285	2.285	2.285	2.285	2.285	15.995
9	Granja Lajeado	0%	3.995	3.995	3.995	3.995	3.995	3.995	3.995	27.965
10	Faz. São José Nápoles	0%	8.479	8.479	8.479	8.479	8.479	8.479	8.479	59.353
11	Sitio Santa Cruz	0%	6.337	6.337	6.337	6.337	6.337	6.337	6.337	44.359
12	Faz. Analia Franco	0%	2.030	2.030	2.030	2.030	2.030	2.030	2.030	14.210
13	Sitio São João - site 1	0%	3.046	3.046	3.046	3.046	3.046	3.046	3.046	21.322
14	Sitio São João - site 2	0%	2.301	2.301	2.301	2.301	2.301	2.301	2.301	16.107
15	Sitio São Thiago	0%	3.046	3.046	3.046	3.046	3.046	3.046	3.046	21.322
									Total baseline baseline emissions in 7 years, in t CO_2e/year =	427.987

(ii) According to the project emissions description in the section B.6 and equation B5:

Table B5 – Total project activity emissions for the first year – (from 1st Feb to 31st Dec 2010)

ID	Farm/Site	Project Emissions per Annual Average Number of Animals Type "LT", in ton CO2e/year					Total
		Sows	Finishers	Nursery / Weaners	Boars	Gilts	
1	Agrope. Sitio Herlu	-	439	-	-	-	**439**
2	Fazenda São Carlos	225	1.624	281	6	82	**2.219**
3	Fazenda Sta Elisa - Site 1	48	339	59	2	13	**459**
4	Fazenda Sta Elisa - Site 2	102	731	126	3	28	**990**
5	Faz. Esmeralda	75	483	82	3	37	**680**
6	Sitio Cotovia	93	725	-	5	38	**861**
7	Sitio Sto Antonio - Site 1	113	495	141	7	6	**762**
8	Sitio Sto Antonio Site 2	-	495	-	-	-	**495**
9	Granja Lajeado	91	650	113	4	9	**866**
10	Faz. São José Nápoles	188	1.354	234	5	54	**1.835**
11	Sitio Santa Cruz	103	1.098	130	5	37	**1.373**
12	Faz. Analia Franco	-	439	-	-	-	**439**
13	Sitio São João - site 1	-	659	-	-	-	**659**
14	Sitio São João - site 2	188	-	251	6	54	**499**
15	Sitio São Thiago	-	659	-	-	-	**659**
TOTAL		**1.224**	**10.190**	**1.417**	**45**	**359**	**13.235**

Table B6 – Total project activity emissions per year- the year starts on 1st Feb and ends on 31th Jan

ID	Farm Name/Site	Expected growth %	Project Activity Emissions in t CO2e / year							
			2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	Total
1	Agrope. Sitio Herlu	0%	480	480	480	480	480	480	480	**3.360**
2	Fazenda São Carlos	0%	2.425	2.425	2.425	2.425	2.425	2.425	2.425	**16.975**
3	Faz. Sta Elisa - Site 1	0%	502	502	502	502	502	502	502	**3.514**
4	Faz. Sta Elisa - Site 2	0%	1.082	1.082	1.082	1.082	1.082	1.082	1.082	**7.574**
5	Faz. Esmeralda	0%	743	743	743	743	743	743	743	**5.201**
6	Sitio Cotovia	0%	941	941	941	941	941	941	941	**6.587**
7	Sitio Sto Antonio- Site 1	0%	833	833	833	833	833	833	833	**5.831**
8	Sitio Sto Antonio Site 2	0%	541	541	541	541	541	541	541	**3.787**
9	Granja Lajeado	0%	946	946	946	946	946	946	946	**6.622**
10	Faz. São José Nápoles	0%	2.005	2.005	2.005	2.005	2.005	2.005	2.005	**14.035**
11	Sitio Santa Cruz	0%	1.500	1.500	1.500	1.500	1.500	1.500	1.500	**10.500**
12	Faz. Analia Franco	0%	480	480	480	480	480	480	480	**3.360**
13	Sitio São João - site 1	0%	720	720	720	720	720	720	720	**5.040**
14	Sitio São João - site 2	0%	545	545	545	545	545	545	545	**3.815**
15	Sitio São Thiago	0%	720	720	720	720	720	720	720	**5.040**
Total project activity emissions in 7 years, in t CO_2e/year =										**101.241**

(iii) According to the project emissions reduction in the section B.6, the results of the estimation of the emissions reduction, equation B4 are summarized in the following table B7:

Table B7 – Total Emission Reductions

Description	Period (year)						
	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
Total Baseline Emissions – $BE_{y,}$,in ton CO2e/year	61.141	61.141	61.141	61.141	61.141	61.141	61.141
Total Project Emissions – $PE_{y,}$ in ton CO2e/year	14.463	14.463	14.463	14.463	14.463	14.463	14.463
Total Emission Reductions $ER_y = BE_y – PE_y$ (in ton CO2e/year)	46.678	46.678	46.678	46.678	46.678	46.678	46.678

B.6.4 Summary of the ex-ante estimation of emission reductions:

Table B8 – Summary of the Total Ex-ante Emissions Reductions

Year	Estimation of project activity emissions (tCO2 e)	Estimation of baseline emissions (tCO2 e)	Estimation of leakage (tCO2 e)	Estimation of overall emission reductions (tCO2 e)
2010- from 1st Feb to 31st Dec	13.235	55.948	0	42.713
2011	14.463	61.141	0	46.678
2012	14.463	61.141	0	46.678
2013	14.463	61.141	0	46.678
2014	14.463	61.141	0	46.678
2015	14.463	61.141	0	46.678
2016	14.463	61.141	0	46.678
2017 – from 1st Jan to 31st Jan	1.228	5.193		3.965
Total (ton of CO2 e)	**101.241**	**427.987**	**0**	**326.746**

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

The methodology applied to this project activity is AMS-III.D/version 14, ***Methane recovery in animal manure management systems***. The simplified monitoring methodology is applicable to this project activity because they provide a method to accurately measure and record the GHG emissions that will be captured and combusted by the project activity.

Each individual farm will be monitored independently according with the parameters described in the following section B.7.1 and monitored according with the monitoring plan described in the section B.7.2.

All parameters are deeply controlled by operational procedures developed by Brascarbon. A list and the procedures contained in the Brascarbon Operational Procedures Manual are mentioned in the PDD in the Annex 4.

Brascarbon trained several regional technicians who will be responsible to the maintenance and the monitoring system based in ISO 9000 (Brascarbon Operational Procedure Manual).

Details of the monitoring system can be found in the section B.7.2.

B.7.1 Data and parameters monitored:

Data / Parameter:	T f
Data unit:	^{o}C
Description:	Combustion temperature of the flare
Source of data:	Brascarbon Monitoring Report System
Value of data:	Above 500^{o}C
Measurement procedures (if any):	According to the Monitoring Operational Procedure POP-01
Monitoring frequency	Every 3 minutes measurement and registration by a Control Logic Program (CLP)
QA/QC procedures	Check the data for more accurate information.
Any comment:	Monitoring operational procedure POP-01 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	SITE INSPECTION
Data unit:	------
Description:	Inspection on the site considering relevant regulation and the infra-structure of the site
Source of data:	Brascarbon Monitoring Report System
Value of data:	Documents
Measurement procedures (if any):	Annual follow-up of the documentation to check the expiration date, changes in the production lay-out and surroundings of the digester. Use of the annex attached at the operational procedure POP-02
Monitoring frequency	Annually
QA/QC procedures	Check of the confined animal production official documents
Any comment:	Monitoring operational procedure POP-02 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$N_{LT,y}$
Data unit:	Number
Description:	Annual average number of animals of type “LT” in year “y”
Source of data:	Brascarbon Monitoring Report System
Value of data:	Number of heads
Measurement procedures (if any):	Checking of the documentation located at the confined animal production and use of the table annexed at the operational procedure POP-03. Use of the Equation B3 established in the section B4 step 2 item B – determination of the annual average number of animals.
Monitoring frequency	Monthly
QA/QC procedures	Check of the site records and documents.
Any comment:	Monitoring operational procedure POP-03 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	W_{site}
Data unit:	Kg
Description:	Average animal weight of a defined livestock population at the project site in year
Source of data:	Brascarbon Monitoring Report System
Value of data:	Defaulf value 198 kg (breeding) and 50 kg (market) See table B1
Measurement procedures (if any):	Checking data and records in the confined feed animal operation
Monitoring frequency	Quarterlly
QA/QC procedures	Check of the site records and documents,
Any comment:	Monitoring operational procedure POP-016

Data / Parameter:	$BG_{burnt,y}$
Data unit:	m^3
Description:	Biogas flared or used as a fuel in the year y.
Source of data:	Brascarbon Monitoring Report System
Value of data:	to be measured during the monitoring period
Measurement procedures (if any):	Reading of the volume in the local flow gear and register in the table annexed in the operational procedure POP-04
Monitoring frequency	Monthly
QA/QC procedures	Check the registers sent from the field. Control and assure the calibration program of the flow meter.
Any comment:	Monitoring operational procedure POP-04 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$W_{CH4,y}$
Data unit:	Fraction
Description:	Methane content in biogas in the year “y”
Source of data:	Brascarbon Monitoring Report System
Value of data:	---
Measurement procedures (if any):	Use of methane concentration analysis instrument or ORSAT.
Monitoring frequency	Periodical. To assure that the monitoring frequency provides a 95% confidence level, the adequate frequency will be determined through a statistical analysis of the methane fraction variation, based on methane fraction data gathered on a group of farms per region during a certain period time.
QA/QC procedures	Check the registers in the generated documents. Control and assure the calibration program of the instrument.
Any comment:	Monitoring operational procedure POP-05 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	T_{biogas}
Data unit:	^{o}C
Description:	Temperature of the biogas at ambient conditions
Source of data:	Brascarbon Monitoring Report System Official data from CPTEC/INPE http://satelite.cptec.inpe.br/PCD/metadados.jsp?uf=12&id=32334&tipo=MET
Value of data:	According to the ambient conditions
Measurement procedures (if any):	Measurement with a local thermometer. Measurement according Operational Procedure POP-06
Monitoring frequency	Monthly
QA/QC procedures	Check the registers in the generated documents and thermometer calibration
Any comment:	Monitoring operational procedure POP-06 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	P biogas
Data unit:	mbar
Description:	Pressure of the biogas at atmospheric conditions
Source of data:	Brascarbon Monitoring Report System Official data from CPTEC/INPE http://satelite.cptec.inpe.br/PCD/metadados.jsp?uf=12&id=32334&tipo=MET
Value of data:	1013 mbar (or 1 atm)
Measurement procedures (if any):	Measurement with portable local pressure gauge. Measurement according to the Operational Procedure POP-06
Monitoring frequency	Monthly
QA/QC procedures	Check the registers in the generated documents and thermometer calibration
Any comment:	Monitoring operational procedure POP-06 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$D_{CH4,y}$
Data unit:	tones / m^3
Description:	Density of the methane combusted at room temperature and 1013 mbar pressure
Source of data:	Brascarbon Monitoring Report System
Value of data:	Determinated according the ambient temperature variation
Measurement procedures (if any):	Calculation According to the Operational Procedure POP-07. Use of the formula considering pressure, temperature and molecular mass of methane
Monitoring frequency	Montlhy
QA/QC procedures	Check and approve the density value calculation.
Any comment:	Monitoring operational procedure POP-07 can be found at the Brascarbon Operational Procedure Manual. Reference: Annex 13-Tool to determine project emissions from flaring gases containing methane.

Data / Parameter:	Q_{DM}
Data unit:	-----
Description:	Sludge soil application
Source of data:	Brascarbon Monitoring Report System
Value of data:	------
Measurement procedures (if any):	Supervision in the field
Monitoring frequency	Defined according to the digester performance
QA/QC procedures	Check the registers in the generated documents.
Any comment:	Monitoring operational procedure POP-09 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	FE or $\eta_{flare,h}$
Data unit:	%
Description:	Flare Efficiency
Source of data:	Brascarbon Monitoring Report System
Value of data:	If exhaust gas hourly temperature >=500°C than 90% efficiency If exhaust gas hourly temperature < 500°C than 50% efficiency
Measurement procedures (if any):	Enclosed flare. Continuously temperature measurement and registration in the programmable logic controller system (PLC).
Monitoring frequency	Continuously
QA/QC procedures	Check the registers in the generated documents.
Any comment:	Continuous monitoring of the flare efficiency according to Monitoring Operational Procedure POP-08 can be found at the Brascarbon Operational Procedure Manual.

Data / Parameter:	$ER_{y,ex\text{-}post}$
Data unit:	Ton CO2 e
Description:	Ex-post emission reductions achieved by the project activity based on monitored values for the year “y”.
Source of data:	Brascarbon Monitoring Report System
Value of data:	to be determinate according to the measured data
Measurement procedures (if any):	Comparison of the baseline with the actual measured data according to the operational procedure POP-17
Monitoring frequency	Yearly
QA/QC procedures	Check the ER calculation and the registers in the generated documents.
Any comment:	Used to cap the maximal emission reduction in any year. Monitoring Operational Procedure POP-17 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	FFR
Data unit:	-----
Description:	Formulated Feed Rations
Source of data:	Brascarbon Monitoring Report System
Value of data:	------
Measurement procedures (if any):	According to the Operational Procedure POP-14
Monitoring frequency	Monthly
QA/QC procedures	Check the registers and/or food purchases records on the farm.
Any comment:	Monitoring operational procedure POP-14 can be found at the Brascarbon Operational Procedure Manual.

Data / Parameter:	GENETIC SOURCE
Data unit: Description:	----- Genetic source from annex I party
Source of data:	Brascarbon Monitoring Report System
Value of data:	Western Europe
Measurement procedures (if any): Monitoring frequency	Data and records from the confined feed animal operation. According Operational Procedure POP-15 Annually
QA/QC procedures	Check data and records from the farm operation
Any comment:	Monitoring operational procedure POP-15 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	MS% i,y
Data unit:	Fraction
Description:	Fraction of manure handled in project emissions in system “i”, year “y”.
Source of data:	Brascarbon Monitoring Report System
Value of data:	
Measurement procedures (if any):	During the site inspection, check if changes in the adopted waste management system and if the surround of the digester was modified from the original proposal project activity. Use of the annex attached at the operational procedure POP-02
Monitoring frequency	Annually
QA/QC procedures	Check of the confined animal production official documents
Any comment:	Monitoring operational procedure POP-02 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$FV_{RG,h}$
Data unit:	m^3/h
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in an hour h
Source of data:	Brascarbon Monitoring Report System
Value of data:	to be measured during the monitoring period
Measurement procedures (if any):	Recover the hourly data registered in the data logger (CLP) of the volume in the local control panel according to the operational procedure POP-04
Monitoring frequency	Monthly
QA/QC procedures	Check the registers sent from the field. Control and assure the calibration program of the flow meter.
Any comment:	Monitoring operational procedure POP-04 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$TM_{RG,h}$
Data unit:	Kg/h
Description:	Mass flow rate of methane in the residual gas in the hour h
Source of data:	Brascarbon Monitoring Report System
Value of data:	to be measured during the monitoring period
Measurement procedures (if any):	To be calculated according to the "Tool to determine project emissions frm flaring gases containing methane". A operational procedure POP 17 includes the instruction to the calculation
Monitoring frequency	Monthly
QA/QC procedures	Check the registers sent from the field. Calculation of the parameter according to the procedures mentioned above.
Any comment:	Monitoring operational procedure POP-17 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$fv_{CH4,RG}$
Data unit:	Fraction
Description:	Volumetric fraction of methane content in the residual gas on dry basis measured as 95% confidence level
Source of data:	Brascarbon Monitoring Report System
Value of data:	
Measurement procedures (if any):	Use of methane concentration analysis instrument on dry basis in the sampling point at piping to the flare.
Monitoring frequency	Periodical. Assures that the monitoring frequency provides a 95% confidence level, the adequate frequency will be determined through a statistical analysis of the methane fraction variation, based on methane fraction data gathered on a group of farms per region during a certain period time.
QA/QC procedures	Check the registers in the generated documents. Control and assure the calibration program of the instrument.
Any comment:	Monitoring operational procedure POP-05 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$N_{day,y}$
Data unit:	Number
Description:	Number of days animal is alive in the farm, in year "y"
Source of data:	Brascarbon Monitoring Report System
Value of data:	Number of days
Measurement procedures (if any):	Checking of the documentation located at the confined animal production and use of the operational procedure POP-03
Monitoring frequency	Monthly
QA/QC procedures	Check of the site records and documents.
Any comment:	Monitoring operational procedure POP-03 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$N_{p,y}$
Data unit:	Number
Description:	Number of animals produced annually of type "LT" in year "y"
Source of data:	Brascarbon Monitoring Report System
Value of data:	Number of heads
Measurement procedures (if any):	Checking of the documentation located at the confined animal production and use of the table annexed at the operational procedure POP-03
Monitoring frequency	annually
QA/QC procedures Any comment:	Check of the site records and documents. Monitoring operational procedure POP-03 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	E
Data unit:	kwh
Description:	Electricity consumed from the grid by the project
Source of data:	Brascarbon
Value applied:	0 kwh
Measurement procedures (if any):	POP 22 - Eventual energy used to determinate project emissions
QA/QC procedures	Check of the site records and documents.
Monitoring frequency	annually
Any comment:	All energy demand consumed in the project is supplied by batteries charged by solar cells which is an advantage for sunny countries, like Brazil. The energy for the temperature controlling system PLC (Programmable Logic Controller) and the sparkling system is supplied by a 12 volts battery. The autonomy for the batteries is of 240 hours and each system works independently (PLC and sparkling system). There are no blowers, pneumatic or electric valves, pumps, compressors, etc, in the project. The flow system is operated by gravity and atmospherically. Although the application of the treated water from the lagoons in the field irrigation was outside of boundary of project and this activity was carried out into baseline, with the project, in a normal situation this water will be sent to the pasture by gravity. In the second best choice it can be used water biogas pumps and the third option is the use of electrical pump powered by a biogas generator. In either situation, no energy is consumed in the process.

B.7.2 Description of the monitoring plan:

The following table, Table B9, presents the monitoring plan followed by Brascarbon in order to achieve certified emissions reductions, after each validation and verification process. Other information of monitoring plan and system can be found in the Annex 4.

Table B9 – Monitoring Plan

ID	DATA	Data Type	Data Unit	Data Variable	Frequency	Measured(m) Calculated(c) Estimated(e) Documented(d)	Proportion of the data to be monitored	How will the data be archived?	For how long is archived data to be kept?	Comment
1	T f	Temp	°C	Flare Temperature	Every 1 minute	M	100%	electronic	Duration of the project +5years	Use for flare efficiency
2	Site Inspection	Document	----	----	Annually	D	100%	electronic	Duration of the project +5years	General Site Inspection
3	$N_{LT,y}$	Number	-	Nr, Of heads	Monthly	M	100%	electronic	Duration of the project +5years	Used to quantify the methane generation potential
4	$BG_{burnt,y}$	Volume	m^3	Biogas produced	Monthly	M	100%	electronic	Duration of the project +5years	Cumulative biogas production
5	$w_{CH4,y}$	Fraction	%	Methane content	TBD(*)	M	100%	electronic	Duration of the project +5years	Concentration in wet basis
6	T_{biogas}	Temp	°C	Biogas Temperature	Monthly	M	100%	electronic	Duration of the project +5years	Use to biogas density calculation
7	D_{CH4}	Mass	Ton/m^3	Density	Monthly	C	100%	electronic	Duration of the project +5years	Density
8	FE	Efficiency	%	Temperature	Monthly	C	100%	electronic	Duration of the project +5years	Efficiency determinate by the burning temp.
9	QDM	Supervision	--	---	Every Batch Disposed	E	100%	electronic	Duration of the project +5years	Sludge disposed outside project boundary
10	W site	Mass	kg	Average Animal weight	Quarterly	D	100%	electronic	Duration of the project +5years	Yearly methane potential generation
11	$ER_{y,estimated}$	Mass	Ton	CO_2e	Annually	C	100%	electronic	Duration of the project +5years	Yearly methane potential generation
12	FFR	------	---	Feed Formulation	Monthly	D	100%	electronic	Duration of the project +5years	Feed Formulation Rations
13	P biogas	Pressure	mbar	Biogas Pressure	Monthly	M	100%	electronic	Duration of the project +5years	Feed Formulation Rations
14	Genetic Source	Document	-------	genetic	Annually	D	100%	electronic	Duration of the project +5years	Genetic Source
15	MS% i,y	fraction	%	Manure handled	Annually	E	100%	electronic	Duration of the project +5years	General Site Inspection
16	$FV_{RG,h}$	volume	m^3/h	volume	Monthly	M	100%	electronic	Duration of the project +5years	Volume of residual gas
17	$fv_{CH4,RG}$	fraction	%	Methane content	TBD(*)	M	100%	electronic	Duration of the project +5years	Volumetric methane fraction of the residual gas
18	$TM_{RG,h}$	mass	Kg/h	Mass flow rate	Monthly	M	100%	electronic	Duration of the project +5years	Total mass flow rate of the residual gas
19	N day,y	number	days	days	Monthly	M	100%	electronic	Duration of the project +5years	Nr. Of days animal is alive
20	N p,y	number	heads	Nr of heads	Monthly	M	100%	electronic	Duration of the project +5years	Nr. Of heads per category annually
21	E	KWh	Kw	power	When consumed	M	100%	electronic	Duration of the project +5years	Electricity consumed in the project activity

(*) TBD: to be determinate to attend 95% confidence level

The monitoring plan will concentrate on ensuring the emission reductions are accurately accounted within the project boundary.

Brascarbon introduce de operational procedures, from the Brascarbon Operational Procedures Manual, to facilitate the monitoring system of the parameters described in the Table B9 – Monitoring Plan.
A list of the operational procedures can be found in the annex 4, at the end of this project document design.
The summary of the operational procedures with the main activities is described below:

Monitoring of the Flare Temperature
The temperature of the flare will be controlled by a logic system, able to store the flare temperature continuously. The sensor - thermo coupling - is installed in the flare body.
The signal from the thermocouple is sent to the PLC where the information of the temperature is recorded every each minute.
The file information from the logic system will be recovered monthly, by using a pen drive and the file will be sent to the QA/QC officer to manage the information for further verification. Then, a spreadsheet in excel will be available from the system to show the temperature per minute per day.
The system CLP and the thermocouple will be powered by solar cell – no use of energy from the grid. A 12 volts battery is also included in the system to save energy to be used during the night or days lack of sun. The battery capacity is for 240 hours.
The flare system will operate according to the flare manufacturer specification where the flare is operational from temperatures above 100 ^{o}C.

According to the Tool to determine project emissions from flaring gases containing methane and the specification of the flare, the temperature of the flare will be separated in 3 groups, to determine the flare efficiency, as follows:

a) Total hours when the exhaust gas temperature is ≥ 500 ^{o}C for more than 40 minutes.
b) Total hours when the exhaust gas temperature is ≤ 500 ^{o}C and ≥ 100 ^{o}C for more than 40 minutes.
c) Total hours when the exhaust gas temperature is < 100 ^{o}C or without registers in any hour.

In the operational procedure POP 1 is the form 01.001 where the temperature information is managed according to the specification above mentioned.
All QA/QC procedures are described in the operational procedure related to the maintenance and/or calibration of the equipment.

PEN DRIVE

CLP

Site Inspection
A check list included in the procedure POP 2 – Site Inspection - number 02.001 is the basic guide for the technicians during inspection in the field to follow all items related to the project activity installation.
Attached to it, the MS% i,y - Fraction of manure handled in the system during the year, is included to be inspected during every farm visit.
No changes in the manure managing system will be permitted during the project activity. Variable to be monitored: SITE INSPECTION and MS%i,y.

Average number of animals
To calculate the average number of animals per category LT in the year y ($N_{LT,y}$) the operational procedure has the form 03.002 in the operational procedure POP 3 (average number of animals) where it takes into account of the number of days the animal is alive in the year y ($N_{day,y}$) and the number of animals produced per category LT in the year y ($N_{p,y}$).
The days of animals alive and the total animal produced is also monitored with the same procedure and the form 03.002.
The formula used to the calculation is indicated in the PDD section B.4, step 2 item B, equation B3.
Variables to be monitored: $N_{LT,y}$, $N_{day,y}$ and $N_{p,y.}$

Measurement of the volumetric flow rate of the biogas and residual gas
The operational procedure POP 4- Measurement of the biogas flow rate, is a guide that explains to the technicians how to obtain the biogas flow rate.
The control of the flow rate is by a CLP (see picture in the POP 1 description above) installed in the control panel in the project activity site.
The panel is equipped with solar cells that supply energy to the system. A battery (capacity for 10 days lack of sun) and the flow rate transmitter device to receive information from the thermal mass meter. The flow meter used in the project activity is a thermal mass flow meter.
The system is very reliable and supplied by Endress+hauser, leader of measurement system of liquids and gases. Example of the meter used in the project activity:

The information recorded in the CLP is recovered by the use of a pen drive and the file containing the information will be send to the QA/QC officer to manage information for further verification. A spreadsheet in excel is available from the system to show the flow rate per minute per day.
The variable measured with this procedure are: $BG_{burned,y}$ and $FV_{RG,h}$.
The data monitored is controlled in the form 04.001 attached in the operational procedure POP-04.

Methane content determination
The POP 5- Methane content was prepared to guide the technicians how to obtain the methane content using electronic equipment.
The methane content is obtained by BIOGAS or TESTO electronic equipment.
The concentration of methane is measured in few seconds before starting the measurement button.
The equipment operation and the devices to be used are described in the operational procedure, as well as in the equipment manual.

Both equipments are able to measure the methane concentration in the biogas or in the flare residual gas.
The variables measured with this equipment are: $W_{CH4,y}$ and $fv_{CH4,RG,y}$.
All QA/QC procedures are described in the operational procedure related to the maintenance and/or calibration of the equipment.
The data monitored is controlled in the form 04.001 and 005.001.

Biogas temperature measurement
The biogas temperature is obtained by an electronic equipment BIOGAS.
The methane temperature is measured in few seconds after inserting the thermocouple in the biogas line device.
The equipment operation and the devices to be used are described in the operational procedure, as well as in the equipment manual.
All QA/QC procedures are described in the operational procedure related to the maintenance and/or calibration of the equipment.
The variable measured with this equipment is: T biogas.
The data monitored is controlled in the form 04.001 described in the operational procedure POP 4 – Biogas temperature measurement.

Density of the methane determination
The POP 7- Density of the Methane - is a guide to calculate the methane density. The form 07.001 attached in the operational procedure shows the data to be filled to make the calculation.
The methane density calculation is in accordance with the Tool to determine project emissions from flaring gases containing methane.
The variable monitored with this procedure: D_{CH4}.

Flare efficiency.
The operational procedure POP 8 – Flare efficiency was developed to monitoring and calculation of the flare efficiency.
The flare efficiency is monitored in compliance with manufactures specification.
According to the Tool to determine project emissions from flaring gases containing methane and the specification of the flare, its efficiency is calculated according to the following criteria:

a) If the exhaust gas temperature is $\geq 500\ ^{o}C$ for more than 40 minutes, the flare efficiency is 90% in the respective hour.
b) If the exhaust gas temperature is $\leq 500\ ^{o}C$ and $\geq 100\ ^{o}C$, the flare efficiency is 50% in the respective hour (*).

c) If the exhaust gas temperature is < 100 ^{o}C, or in absence of temperature, the flare efficiency is 0% (zero) in any respective hour (*).

Brascarbon developed the form 08.001 in the operational procedure to monitor the hourly flare efficiency according to the criteria above mentioned.
The variable monitored with this procedure: FE.
(*) according to the manufacturers specification

Biogas pressure
The biogas pressure is obtained by an electronic equipment BIOGAS and procedures described in the operational procedure POP 13- Biogas pressure.
The operating pressure of the biodigestor is atmospherically.
The equipment operation and the devices to be used are described in the operational procedure, as well as in the equipment manual.
All QA/QC procedures are described in the operational procedure related to the maintenance and/or calibration of the equipment.
The variable measured with this equipment is: P biogas.
The data monitored is controlled in the form 04.001.

Formulated feed rations
Monitoring and controlling of the formulated feed rations used per animal category per confined feed animal operation.
The variable monitored: FFR.
Reference of the operational procedure: POP 14 – formulated feed rations monitoring.

Genetic Source
Monitoring and controlling of the genetic source in the project activity per farm.
The variable monitored: GENETIC SOURCE.
Reference of the operational procedure: POP 15 – Genetic Source Monitoring.

Animal weight
The animal weight is monitored and controlled by a form 16.001 where each animal category is monitored during the year, according to the operational procedure POP 16 – Animal Weight Monitoring.
Quarterly the data from the feed operations are checked and transferred to the form.
Records available in the feed operations will be copied and filed at Brascarbon office and attached with the form 16.001.
The variable monitored: W site.

Methane mass flow rate in the residual gas
The residual mass flow rate can be determinate by the POP 17 – Emissions reductions ex-post, which calculates all parameters to determine the emissions reductions ex-post.
The operational procedure is based according to the Annex 13 – Tool to determine project emissions from flaring gases containing methane equation 15 on Step 7 and equation 13 Step 5.

The variables monitored with this procedure:

$TM_{RG,h}$; mass flow rate of the methane in the residual gas in the hour h.
ER y,ex-post; emissions reductions achieved by the project activity based in the monitored values in the year y, in ton CO2e
BEy,ex-post; baseline emissions moniotored ex-post, in ton CO2e..
PEy,ex-post; Project emissions ex-post with monitorated data, in ton CO2e .
MDy; Methane captured and destroyed ex-post.

The formularies 17.001 and 17.002 as well as 10.001 are used to determine the variables above mentioned.

Monitoring System
The monitoring system will be followed according to the Brascarbon Operations Procedures Manual, detailed to attend all necessary controls in the site.

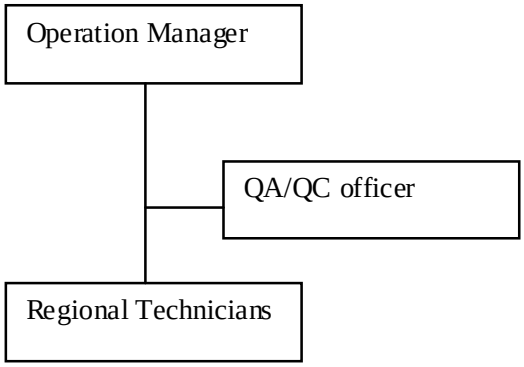
Operational / Monitoring Procedures
Operational / Monitoring procedures listed in the Annex 4.

Quality Assurance/Control: QA/QC
The measuring instruments will be calibrated by the manufacturers' representatives on a manufacturer recommendation basis. The certification of calibration will be controlled by QA/QC officer. Also, the QA/QC officer will be responsible to assure that all Brascarbon Operations Procedures will be executed based in the Iso9000.

Training
The training of the technicians and all employees is provided by the Operations Manager. The topics of the training are as below:
1. General explanation of the project.
2. Explanation of the procedures of the Operations Procedure Manual.
3. Procedures and preparations for the star-up.
4. Maintenance procedures.
5. Biogas safety instructions.
6. Biogas measurement.
7. Safety Issues.

The training document and the equipment manuals are stored for easy reference in the Brascarbon office.

Organization



Operation Manager
Engineer, responsible for the project operations (maintenance and monitoring).

Regional Technicians
Technician, responsible for the monitoring and maintenance of the site projects according to the procedures in the Operations Procedure Manual.

QA/QC officer
Responsible for assure the quality control of the information and the CDM project documents.

Maintenance
For maintenance of the equipment and to attend the monitoring system, BRASCARBON will use the practices recommended by the equipment supplier for repairs, calibration, etc. The regular maintenance in the site project boundary will be according to the Brascarbon Operation Procedures Manual for all items considered in the project such as the digester, flare, measuring systems, piping, electrical parts and others.

B.8. Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity (ies)

The methodology applied to this project activity is AMS-III, D Version 14, ***Methane recovery in animal manure management systems.***
The simplified monitoring methodologies are applicable to this project activity because they provide a method to accurately measure and record the GHG emissions that will be captured and combusted by the project activity.
The completion date of the application of the baseline is 04 JULY 2008.

The entity determining this monitoring methodology is Brascarbon Consultoria, Projetos e Representação Ltda, who is the project developer listed in Annex 1 of this document.

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:

The starting date for this activity is **20/05/2008**.
This date corresponds to the first construction started on 20/05/2008 according to the contract signed between Brascarbon and Selzio Pezzato ME (construction company) for the farm Agropecuária Sitio Herlu.

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

The expected life for this project is **21 years and 0 months**.

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:

The starting date of the crediting period is: **01/02/2010 or the registration date of the project activity.**

C.2.1.2. Length of the first crediting period:

The lenght of the crediting period is **7 years and 0 months**.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

The project activity will not use a fixed period.

C.2.2.2. Length:

The project activity will not use a fixed period.

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

An environmental impact analysis is not required for this type of GHG project activity. Beyond the principal environmental benefits of the project includes:

- reducing atmospheric emissions of volatile solids causing odour
- reducing the population of flies
- best control on the bio-security system
- reducing the possible spread of disease

D.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:

Digesters, to reduce GHG emissions in the confined animals operations, are not pre-requisite to get the environmental licenses. The environmental impacts concerning the project activity is very significant because this project activity can contribute for the local and global sustainable development.
www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_l4l77t4r.PDF
www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_q9m29k2j.pdf
www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_b889i6r.pdf
www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_f6c34f6j.pdf

SECTION E. Stakeholders' comments

The Brascarbon presentation of the MDL project for the stakeholders was held twice in Boituva city 2008 at the Sindicato dos Produtores Rurais de Boituva, Sao Paulo. The first presentation for the community was in 21st December 2007 and the second was in 2rd July 2008, where the community involved as swine producers, unions, etc. could receive all information about de CDM projects proposal based on UNFCCC methodologies. At the end of the presentation Brascarbon introduced a section of questions and answers for clarifications.

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

The invitation for the stakeholders' consultation for the project activity was done by personal mail asking for comments of the PDD attached to the Brascarbon site and also in the UNFCCC site, according to the Resolution 7 of the Brazilian DNA.

The following stakeholders were invited to comment on the project activity according to the Resolution 7 of the Brazilian DNA:

- City Hall and Chamber of Councilors.
- Departments and Secretaries: municipal, state and federal.
- ONG´s
- Unions.
- Ministry Public – State
- Ministry Public – Federal
- State
- Legislative Assembly

E.2. Summary of the comments received:

No comments were received from stakeholders.

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

No comments were received from stakeholders.

During the presentations sections, Brascarbon explained all concerns and questions raised about the CDM projects and the minutes of the section can be found at Brascarbon.

Annex 1

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Mobile:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no official development assistance being provided for this project.

ANNEX 3 - BASELINE INFORMATION

ID	Farm/Site	Animal Category	$N_{LT,y}$	$W_{default}$	W_{site}	$VS_{default}$	VS_{LT}	nd_y	$VS_{(LT,y)}$	UF b	$B_{0(T)}$	GWP_{CH4}	D_{CH4}	MCF	$MS_{(T,S,k)}$	MS% i,y	BE_y	$PE_{PL,y}$	$PE_{flare,y}$	PE y	ER y
1	Aropec Sitio Herlu	Sows	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Finishers	2.219	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	2.030	277	203	480	1.550
		Nursery/Weaners	-	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Boars	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Gilts	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		total	2.219														2.030	277	203	480	1.550
2	Fazenda São Carlos	Sows	1.200	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	1.039	142	104	246	793
		Finishers	8.208	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	7.510	1.024	751	1.775	5.735
		Nursery/Weaners	4.729	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	1.298	177	130	307	991
		Boars	12	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	29	4	3	7	22
		Gilts	460	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	380	52	38	90	290
		total	14.609														10.256	1.399	1.026	2.425	7.831
3	Fazenda Sta Elisa - Site 1	Sows	250	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	217	30	22	52	165
		Finishers	1.710	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	1.565	213	157	370	1.195
		Nursery/Weaners	985	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	270	37	27	64	206
		Boars	3	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	7	1	1	2	5
		Gilts	75	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	62	8	6	14	48
		total	3.023														2.121	289	213	502	1.619
4	Fazenda Sta Elisa - Site 2	Sows	540	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	468	64	47	111	357
		Finishers	3.694	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	3.380	461	338	799	2.581
		Nursery/Weaners	2.128	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	584	80	58	138	446
		Boars	5	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	12	2	1	3	9
		Gilts	162	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	134	18	13	31	103
		total	6.529														4.578	625	457	1.082	3.496
5	Faz. Esmeralda	Sows	400	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	346	47	35	82	264
		Finishers	2.441	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	2.233	305	223	528	1.705
		Nursery/Weaners	1.381	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	379	52	38	90	289
		Boars	5	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	12	2	1	3	9
		Gilts	200	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	165	23	17	40	125
		total	4.427														3.135	429	314	743	2.392

ANNEX 3 - BASELINE INFORMATION (CONTINUATION)

ID	Farm/Site	Animal Category	$N_{LT,y}$	$W_{default}$	W_{site}	$VS_{default}$	VS_{LT}	nd_y	$VS_{(LT,y)}$	UF b	$B_{0(T)}$	GWP_{CH4}	D_{CH4}	MCF	$MS_{(T,S,k)}$	MS% i,y	BE_y	$PE_{PL,y}$	$PE_{flare,y}$	PE y	ER y
6	Sitio Cotovia	Sows	500	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	433	59	43	102	331
		Finishers	3.662	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	3.351	457	335	792	2.559
		Nursery/Weaners	-	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Boars	8	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	20	3	2	5	15
		Gilts	216	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	179	24	18	42	137
		total	4.386														3.983	543	398	941	3.042
7	Sitio Sto Antonio - Site 1	Sows	600	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	520	71	52	123	397
		Finishers	2.497	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	2.285	312	229	541	1.744
		Nursery/Weaners	2.365	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	649	89	65	154	495
		Boars	14	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	34	5	3	8	26
		Gilts	37	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	31	4	3	7	24
		total	5.513														3.519	481	352	833	2.686
8	Sitio Sto Antonio Site 2	Sows	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Finishers	2.497	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	2.285	312	229	541	1.744
		Nursery/Weaners	-	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Boars	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Gilts	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		total	2.497														2.285	312	229	541	1.744
9	Granja Lajeado	Sows	480	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	416	57	42	99	317
		Finishers	3.283	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	3.004	410	300	710	2.294
		Nursery/Weaners	1.892	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	519	71	52	123	396
		Boars	6	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	15	2	2	4	11
		Gilts	50	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	41	6	4	10	31
		total	5.711														3.995	546	400	946	3.049
10	Faz. São José Nápoles	Sows	1.000	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	866	118	87	205	661
		Finishers	6.840	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	6.259	854	626	1.480	4.779
		Nursery/Weaners	3.941	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	1.082	148	108	256	826
		Boars	10	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	24	3	2	5	19
		Gilts	300	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	248	34	25	59	189
		total	12.091														8.479	1.157	848	2.005	6.474

ANNEX 3 - BASELINE INFORMATION (CONTINUATION)

ID	Farm/Site	Animal Category	$N_{LT,y}$	$W_{default}$	W_{site}	$VS_{default}$	VS_{LT}	nd_y	$VS_{(LT,y)}$	UF b	$B_{0(T)}$	GWP_{CH4}	D_{CH4}	MCF	$MS_{(T,S,k)}$	MS% i,y	BE_y	$PE_{PL,y}$	$PE_{flare,y}$	PE y	ER y
11	Sitio Santa Cruz	Sows	550	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	476	65	48	113	363
		Finishers	5.548	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	5.076	692	508	1.200	3.876
		Nursery/Weaners	2.186	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	600	82	60	142	458
		Boars	8	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	20	3	2	5	15
		Gilts	200	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	165	23	17	40	125
		total	8.492														6.337	865	635	1.500	4.837
12	Faz. Analia Franco	Sows	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Finishers	2.219	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	2.030	277	203	480	1.550
		Nursery/Weaners	-	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Boars	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Gilts	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		total	2.219														2.030	277	203	480	1.550
13	Sitio São João - site 1	Sows	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Finishers	3.329	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1	1	3.046	415	305	720	2.326
		Nursery/Weaners	-	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Boars	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		Gilts	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1	1	-	-	-	-	-
		total	3.329														3.046	415	305	720	2.326
14	Sitio São João - site 2	Sows	1.000	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1		866	118	87	205	661
		Finishers	-	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1		-	-	-	-	-
		Nursery/Weaners	4.220	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1		1.158	158	116	274	884
		Boars	12	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1		29	4	3	7	22
		Gilts	300	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1		248	34	25	59	189
		total	5.532														2.301	314	231	545	1.756
15	Sitio São Thiago	Sows	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	78	1		-	-	-	-	-
		Finishers	3.329	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	78	1		3.046	415	305	720	2.326
		Nursery/Weaners	-	50	27	0,3	0,16	365	59	0,94	0,45	21	0,00067	78	1		-	-	-	-	-
		Boars	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	78	1		-	-	-	-	-
		Gilts	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	78	1		-	-	-	-	-
		total	3.329														3.046	415	305	720	2.326

Annex 4

MONITORING INFORMATION

The following table presents the explanation of the QA/QC procedures of the monitoring plan followed by BRASCARBON in order to achieve certified emission reductions, after each validation and verification process:

ID	DATA VARIABLE	UNCERTAINTY LEVEL	DATA UNIT	DATA ORIGIN
1	T f	Low	^{o}C	Register from the measurement system, information managed by Brascarbon,
2	Site Inspection	Low	-----	Register information managed by Brascarbon
3	$N_{LT,y}$	Low	Nr, Of heads by category	Register from the measurement system, information managed by Brascarbon,
4	$BG_{burned,y}$	Low	m^3	Register from the measurement system, information managed by Brascarbon,
5	W_{CH4}	Low	%	Register from the measurement system, information managed by Brascarbon,
6	T_{biogas}	Low	^{o}C	Register from the measurement system, information managed by Brascarbon,
7	D_{CH4}	Low	t/m^3	Register from the measurement system, information managed by Brascarbon,
8	FE	Low	%	Register information managed by Brascarbon,
9	QDM	Low	---	Register from the measurement system, information managed by Brascarbon,
10	W site	Low	Kg	Register from the measurement system, information managed by Brascarbon,
11	ER y,ex-post	Low	Tons CO_2e	Register from the measurement system, information managed by Brascarbon,
12	FFR	Low	-----	Register from the measurement system, information managed by Brascarbon,
13	P biogas	Low	mbar	Register information managed by Brascarbon.
14	Genetic Source	Low	-----	Register information managed by Brascarbon.
15	MS% i,y	Low	%	Register information managed by Brascarbon.
16	$FV_{RG,h}$	Low	m^3/h	Register information managed by Brascarbon.
17	$fv_{CH4,RG}$	Low	%	Register information managed by Brascarbon.
18	$TM_{RG,h}$	Low	Kg/h	Register information managed by Brascarbon.
19	N day,y	Low	days	Register information managed by Brascarbon.
20	N p,y	Low	Nr, Of heads by category	Register information managed by Brascarbon.
21	E	Low	Kw	Register information managed by Brascarbon.

BRASCARBON has implemented the Operation Procedures Manual and forms to capture and report monitored data and maintenance activities throughout the project lifecycle. On-site assessment, supplier production data, task tracking, and post-implementation auditing tools have been developed to ensure accurate, consistent, and complete data gathering and project implementation.

By coupling these capabilities with an ISO-based quality and environmental management system, BRASCARBON enables transparent data collection and verification.

Procedures from Brascarbon Operation Procedures Manual to ensure accurate and consistent data for monitoring system have been developed as indicated in the following table:

ID	DATA /PARAMETERS/TITLE	FREQUENCY	RESPONSIBLE	PROCEDURE	COMENTS
1	T_f	M	TR	POP 1	Flare Temperature
2	SITE INSPECTION MS% i,y	A	TR	POP 2	General site Inspection
3	$N_{LT,y}$ $N_{Day,y}$ $N_{p,y}$	M	TR	POP 3	Number of heads
4	$BG_{burnt,y}$ $FV_{RG,h}$	M	TR	POP 4	Biogas produced and burnt
5	$W_{CH4,y}$ $fv_{CH4,RG}$	TBD	TR	POP 5	Methane content
6	T_{biogas}	M	TR	POP 6	Biogas Temperature
7	D_{CH4}	M	TR	POP 7	Methane Density
8	FE	M	TR	POP 8	Flare Efficiency
9	QDM	Every Batch	TR	POP 9	Sludge Mass
10	ER	A	QC	POP 17	Emission reduction calculation
11	TRAINING	A	OM	POP 11	General training of procedures and safety issues
12	MAINTENANCE	S	OM	POP 12	Up-date of the maintenance activities
13	P biogas	M	TR	POP 13	Biogas pressure
14	FFR	M	TR	POP 14	Formulated Feed Rations
15	GENETIC SOURCE	A	TR	POP 15	Genetic source
16	W site	Q	TR	POP 16	Average animal weight
17	ER ex-post $TM_{RG,h}$	A	QC	POP 17	Yearly emissions reductions ex-post
18	E	When used	TR	POP 22	Eventual energy used to determinate project emissions

Legend:

A: Annually
Q: Quarterly
M: Monthly
S: Semesterlly
TR: Regional Technician
QC: Quality Control
TBD: to be determinate to attend 95% confidence level
OM: Operation Manger