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-06A.
Version 5, 20th May, 2011, Brazil

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 in São Paulo, Paraná and Minas Gerais states, Brazil, developed by BRASCARBON. In Brazil the agricultural operations related to the confined animals operations are very wide and grow 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 of transporting wastewater, which consists of fresh water mixed with manure and urine that accumulates in pits under or beside the barns, to one open lagoon for evaporation, fed by gravity pipeline systems. The organic material degraded in the primary treatment lagoon is digested, thereby producing significant amounts of methane.

These systems emit methane (CH_4) resulting from anaerobic decomposition process. The swine livestock operations create profound environmental consequences, such as greenhouse gas emissions, odour, and water/land contamination that result from storing animal waste. Therefore 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, from the confined animal operations to produce biogas. All manure will be sent daily directly to digester not exceeding 24 hours in the barns.

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, to swine confined feed operations located in 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 promotion of sustainable swine production farms, bringing environmental and social benefits, moving from a high-GHG animal waste management system practice to 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 consist of open tanks, open digesting and ponds (anaerobic lagoons)

[1] http://www.ambientebrasil.com.br

once they are the most economic and viable system approved to manage the manure in confined animals feed operations. Economic barriers are very common because producers invest in the confined feed operations only and not in the waste management systems. Financial resources are always used to maintain the confined feed operation in operation. Also less technology for waste treatment is involved, as open lagoons need less employees and technicians for operation and maintenance. For these reasons the project is additional and more details can be found in the section B.5.

Very few bio-digesters exist or the producer invests 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 stimulated by the Expansion and Waste Treatment Program of the State of Santa Catarina[2] published a Good Practices manual with instructions and publications to help the producers and agro-industries implementing projects or systems to control the animal waste and therefore protecting the eco-system[3].

Failure to do so will increase existing problems (such as increased (insect pest populations) and also problems with allergies and livestock disease. To this end, Brazil has in recent years, required all confined animals feed operations to change from single to multi-lagoon systems, introducing 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.

In 2005, the swine population in Minas Gerais state was 3.793.000[4] [5], in São Paulo State was 1.707.000[4,5] and Paraná State was 4.707.000[4,5]. Considering that a typical hog produces 4.9 kilograms of effluent daily (Table A1), annually some 8.4 million metric tons of hog waste was produced in São Paulo state alone. Introducing a progressive animal waste management practices throughout this region of Brazil could result in an annual reduction of approximately 655 thousand tonnes[6] of carbon dioxide equivalent (CO_2e/year).

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 – Projecto de Controlo da Degradação Ambiental Decorrente da Suinocultura em Santa Catarina, 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

[2] PNMA-II – Projecto de Controlo da Degradação Ambiental Decorrente da Suinocultura em Santa Catarina, 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] Boas Práticas de Produção de Suínos: http://www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_k5u59t7m.pdf

[4] IBGE – Pesquisa Pecuária Municipal (www.ibge.gov.br).

[5] www.agricultura.gov.br

[6] Approximate calculation using IPCC model and emission factors

Socio-Economic Sustainability

• Improvement in air quality (e.g. – reduction of Volatile Organic Compounds [VOCs]) and worker safety;

• Elimination of odors in surrounding areas, which will improve living standards of neighbors communities;

• Proper handling of the 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 promote 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 S/A (private entity)	No
Portugal	Luso Carbon Fund – Fundo Especial de Investimento Fechado	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

A.4. Technical description of the 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 volume and mass reduction 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 replace 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. Afterwards, acetogenic bacteria 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 in one 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 biogas collector piping, from the digester to the flare system.

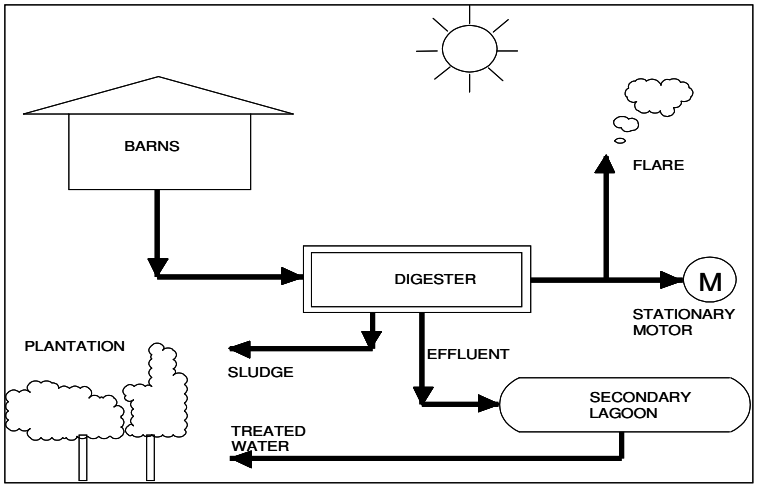
The flare is enclosed and controlled by a data logger CLP –Controller Logic Programmable – where the combustion temperature is stored every one minute in the system. This system will record every each minute the combustion temperature to determinate the flare efficiency. A thermocouple installed in the flare is connected to the PLC to register 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 where 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 derivation pipe will be installed before the flare and after the flow meter, for future proposals, to supply biogas to the electricity generators, for in site electricity supply where **no claims for emissions reductions by the electricity generation will be requested** during the entire project activity but by the emissions reductions of the biogas destroyed in the generators..

The treated effluent is discharged to the open lagoons where 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 proposals, or used for irrigation by the use of biogas pumps or electrical stationary pumps supplied by the biogas electricity generator farmer. No electricity will be consumed from the grid. The technical parts that will be powered by energy will be supplied by solar cells. 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 Southeast/ South Brazil, at the provinces of São Paulo, Minas Gerais and Paraná states.

A.4.1.1. Host Party(ies):

The host party for this project activity is Brazil.

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

Southeast and South Brazil region. States of São Paulo, Minas Gerais and Paraná.

A.4.1.3. City/Town/Community etc:

Cities of Araguari, Carmo do Rio Claro, Guimarânea, Pará de Minas, Santa Juliana and Oliveira at Minas Gerais state.
Cities of Bauru, Fartura, Porto Feliz and Rafard at São Paulo state.
Cities of Ponta Grossa and Pinhalão at Paraná 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 the Figures A3, A4 and A5, with specifics detailed in Table A2.

Table A2. Detailed physical location and identification of project site

Farm/Site	Brascarbon ID	Address	Town/State	Contact	Phone	GPS Coord
Fazenda São Francisco	BCA-094MG1-06	Rod. MG 050, Km 5	Carmo do Rio Claro- MG	Moacyr Mendes Galvão	+ 55 35 3561-1298	20.9525 S 46.2047 W
Fazenda Rancho da Paz	BCA-095MG1-06	Estrada do Morro Vermelho	Oliveira - MG	Marcio Eugenio Leite de Castro	+55 31 3335-0713	20.6842 S 47.7961 W
Fazenda Caixetas (Elite Swine)	BCA-106MG1-06	BR 354, Km 443	Guimarânea - MG	Willian Gomes Eugenio	+55 34 3814-1337	18.7464 S 46.7844 W
Fazenda Boa Vista	BCA-131MG1-06	Estrada Borá, Km 0,5 – Zona Rural	Santa Juliana - MG	Jandira Roman Robel	+55 34 3354-0880	19.2975 S 47.5311 W
Fazenda Boa Vista (Terminação)	BCA-131MG2-06	Estrada Borá, Km 4 – Zona Rural	Santa Juliana - MG	Jandira Roman Robel	+55 34 3354-0880	19.2708 S 47.5578 W
Sitio Bela Vista	BCA-160MG1-06	Rod. Pará de Minas à Pitangui Km 498	Pará de Minas - MG	Hélio José Martins	+55 37 3259-0404	19.7908 S 44.7467 W
Fazenda Cachoeirinha	BCA-169MG1-06	Linha Barreirão – Jateí	Araguari - MG	Livio Rinziler	+55 34 3242 6611	18.6417 S 48.2442 W
Sitio Ana Paula	BCA-009SP1-06	Estrada Velha Capivari/Porto Feliz - KM 08	Porto Feliz - SP	Vagner Carlini	+55 19 3492-9393	23.1597 S 47.4530 W
Fazenda Taquara Branca	BCA-099SP1-06	Bairro Lageado	Fartura - SP	José Carlos Ribeiro	+55 14 3386-1106	23.4694 S 49.4842 W
Fazenda Santana do Matão	BCA-100SP1-06	Fartura	Fartura – SP	Pedro Alcantara Ribeiro Neto	+55 14 3382-1093	23.3847 S 49.5675 W
Fazenda Suinolândia	BCA-101SP1-06	Rod. Marechal Rondon KM 360	Bauru - SP	Paulo Pereira Rangel Filho	+55 14 3279-1112	22.2117 S 49.1960 W
Granja Lago Azul	BCA-081PR1-06	BR 372 - KM 472 - Uvaia	Ponta Grossa – PR	Daniel Dantas Ribeiro	+55 42 3228-9434	24.9151 S 50.3310 W
Granja Herval	BCA-080PR1-06	Estrada da Serrinha S/N - Bairro Herval	Pinhalão – PR	Pedro Alcantara Ribeiro Neto	+55 14 3382-1093	23.7675 S 50.0514 W
Granja São João	BCA-210MG1-06	Rodovia Jaguara Km 5 - Zona Rural	Pará de Minas - MG	João Gabriel Sobrinho	+55 37 3235 3144	19.8019 S 44.6369 W

Moacyr Mendes Galvão has one site in Carmo do Rio Claro city:

- Fazenda São Francisco is a farrow-to-finish swine operation. The site uses three primaries 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.

Marcio Eugenio Leite de Castro has one site in Oliveira city:

- Fazenda Rancho da Paz 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.

Willian Gomes Eugenio has one site in Guimarânea city:

- Fazenda Caixetas (Elite Swine) is a finishing swine operation. The site uses two primaries 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.

Jandira Roman Robel has two sites in Santa Juliana city:

- Fazenda Boa Vista is a breeding 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 Boa Vista (terminação) is a nursery and finishing swine operation. The site uses two primaries 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.

Helio José Martins has one site in Para de Minas city:

- Sitio Bela Vista is a finishing swine operation. The site uses two primaries 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.

Livio Rinziler has one site in Araguari city:

- Fazenda Cachoeirinha is a farrow-to-finish swine operation. The site uses two primaries 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.

Vagner Carlini has one site in Porto Feliz city:

- Sítio Ana Paula is a farrow-to-finish swine operation. The site uses two primaries 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.

Jose Carlos Ribeiro has one site in Fartura city:

- Fazenda Taquara Branca is a farrow-to-finish swine operation. The site uses two primaries 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.

Pedro Alcantara Ribeiro Neto has one site in Fartura city:

- Fazenda Santana do Matão is a finishing swine 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.

Paulo Pereira Rangel Filho has one site in Bauru city:

- Fazenda Suinolândia is a farrow-to-finish swine 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.

Daniel Dantas Ribeiro has one site in Ponta Grossa city:

- Granja Lago Azul is a farrow-to-finish swine 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.

Pedro Alcântara Ribeiro Neto has one site in Pinhalão city:

- Granja Herval is a breeding and nursery swine 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.

João Gabriel Sobrinho has one site in Para de Minas city:

- Granja São João is a farrow-to-finish swine operation. The site uses two primaries 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.

Figure A3 State of São Paulo, Brazil - Location of project sites

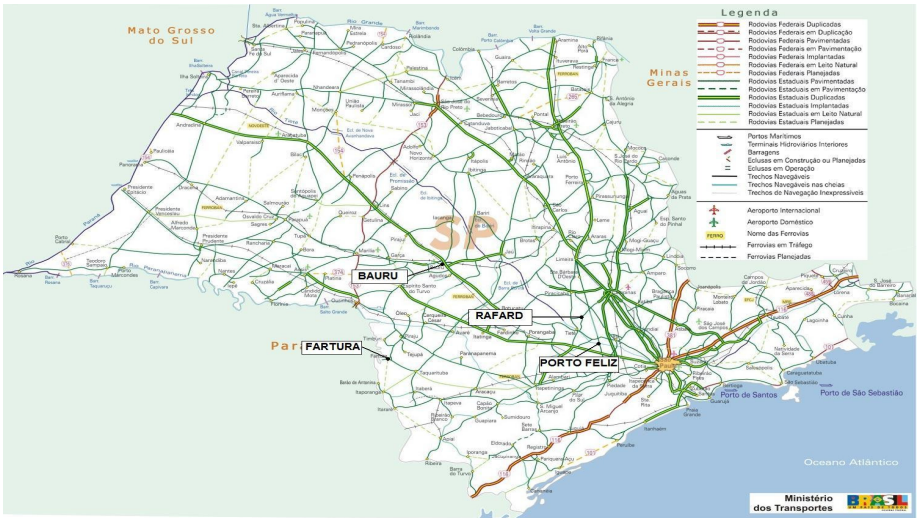


Figure A4 State of Minas Gerais, Brazil - Location of project sites

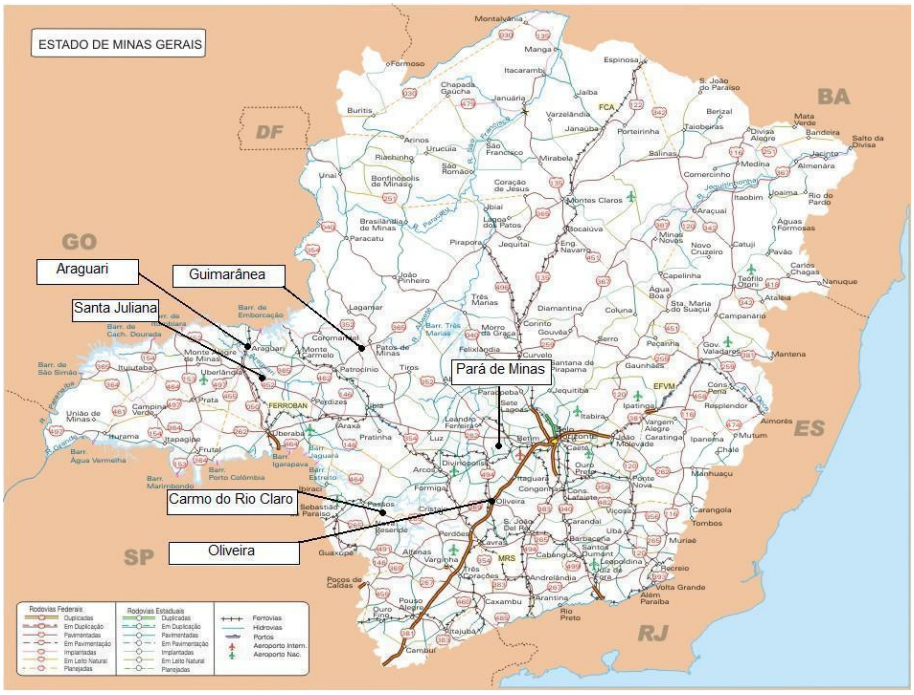
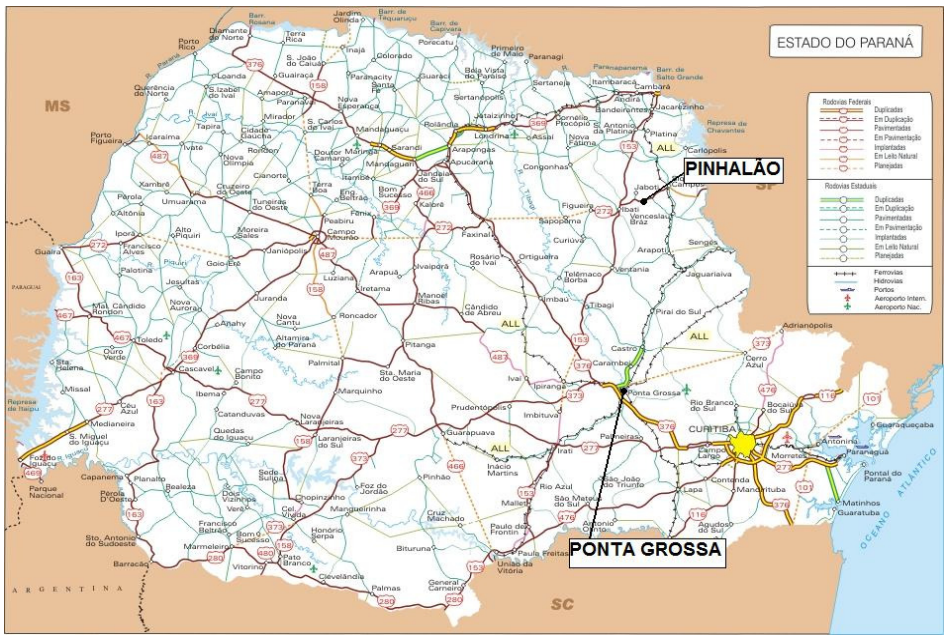


Figure A5 State of Paraná, Brazil - Location of project sites



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 a small scale project because it comprises methane recovery from agro-industries, and project emissions are less than 60 kt CO_2eq.

• Type III.D (reference AMS-III.D) / Version 17 – *"**Methane recovery in animal manure management systems** "*.

The simplified methodology is appropriate because the project activity site is considered an agro-industry and GHG emissions calculations can be estimated using internationally accepted IPCC 2006 guidance.

The project activity will capture and combust methane gas produced from the decomposing manure at swine confined animal feed operation located in Minas Gerais, São Paulo and Paraná states, 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.

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 – Total estimated reductions per year.

Years	Annual estimation of emission reductions in tonnes of CO2e
2012	**47,687**
2013	**47,687**
2014	**47,687**
2015	**47,687**
2016	**47,687**
2017	**47,687**
2018	**47,687**
Total estimated reductions (tonnes of CO2e)	**333,809**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions **(tonnes of CO2e)**	**47,687**

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

There is no public funding in 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, registered within the previous 2 years and whose project boundary is within 1 km of another proposed small-scale activity.

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

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 17 – **"Methane recovery in animal manure management systems".**

• EB 28 Meeting Report – Annex 13 **"Tool to determine project emissions from flaring gases containing methane".**

• If in the future an electricity generator for in site electricity supply is installed, methodology Type III. H (reference AMS-III.H) / version 16 – "**Methane recovery in wastewater treatment**" will also be applied.

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, Paraná and Minas Gerais states states, Brazil. This simplified baseline methodology is applicable to this project activity because:

a) **The livestock population in the farm is managed under confined conditions:**
All farms included in this project activity are managed under confined conditions confirmed by the obligatory environmental licenses whose document releases the Confined Animals Feed Operation business. The environmental licenses can be found at Brascarbon and it´s available for validation and verification.

b) **The manure, after treatment, will not be discharged into natural water resources:**
The environmental legislation does not approve any manure or manure after treatment discharging into the natural water resources. Before releasing the environmental licenses by the Environmental Department, the Confined Animal Feed Operation activity is checked to confirm that all effluent after treatment is not discharged into the natural water resources. According item a) above, the environmental licenses can be found at Brascarbon an available for validation and verification.

c) **The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C:**
The annual average temperature verified in city of reference to the São Paulo state is 23-25 ° C, Paraná state is 23-25 ° C, and Minas Gerais state is 23-25 ° C, so higher than what the methodology states as a minimum: 5°C. This information can be verified through on INPE (National Institute of Space Research) web site.

d) In the baseline scenario the anaerobic lagoons have depths which are at least 1 m:
The retention time of waste in open anaerobic open lagoons has proven to be more than 1 month as recommended by EMBRAPA (from 30 to 40 days)[8]. The depth was higher than 1 meter, and has been verified by measurements taken on each farm. This information is available for validation and verification.

e) No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario;
The baseline scenario for all farms in this PDD is a Confined Animal Feed Operation with open anaerobic lagoons for the manure treatment system. No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario, which can be verified in each farm during validation. The project is new and does not involve capacity additions to the baseline scenario. This complies with para 5 and 6 of AMS-III.D version 17.

The project will also satisfy the following conditions:

a) The residual waste from the animal manure management system shall be handled aerobically, otherwise the related emissions shall be taken into account as per relevant procedures of AMS-III.AO "Methane recovery through controlled anaerobic digestion". In case of soil application, proper conditions and procedures (not resulting in methane emissions) must be ensured;

The final sludge will be handled aerobically. It will be applied in the soil, according with the proper conditions and procedures, being assured that no methane emissions are resulting from this application. The project involves the use of treated effluent for irrigation in farms and application of stabilized sludge on crops irrigation in farms, without any anaerobic conditions. The practice is to distribute the sludge over the field according the usual practice to improve the field fertilization. This complies with para 2(a) of AMS-III.D version 17

b) Technical measures will be used ensuring that all biogas produced by the digester is used or flared:

The project involves facilities to burn (flaring) the biogas generated by the digester. This complies with para 2(b) of AMS-III.D version 17. An enclosed flare will be used in the project and also sized to support high temperatures. A continuous sparkling system is installed in the combustion chamber of the flare. In adequate conditions, the project activity will install electricity generator for in site electricity supply of farm needs according to conditions established on para 3 of AMS-III.H version 16, although no claims for emissions reductions by the electricity generation will be requested during the entire project activity, only by the emissions reductions of the biogas destroyed in the generators. This comply with para 4 of AMS-III.D version 17.

[8] http://www.cnpsa.embrapa.br/down.php?tipo=publicacoes&cod_publicacao=186

c) **The storage time of the manure after removal from the animal barns, including transportation, will not exceed 45 days before being fed into the anaerobic digester:**

This situation is assured due to the fact that the barns are directly connected to the biodigesters and considering the common farms practices where each day the barn is washed and all waste is removed by the water flushing system sent to the digester. This complies with para 2(c) of AMS-III.D version 17. The Confined Animal Feed Operation Practices follows recommendations from EMBRAPA (Empresa Brasileira de Agricultura e Agropecuária) to get high standards of sanitary conditions in the confined operations. These recommendations can be found at EMBRAPA web site where all producers use as a guideline.

Finally, the project doesn't involve any landfill activity. The project activity recovers methane generated in the treatment of swine manure by installing methane recovery and combustion systems (biodigester). This complies with para 3 of AMS-III.D version 17.

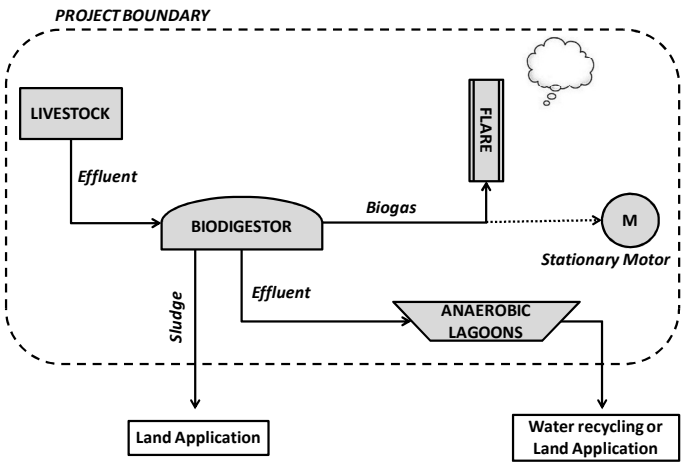
Also, the project is a small scale project because it comprises methane recovery from agro-industries, and project emissions are less than 60 kt CO_2eq.

The starting date for this activity is expected to be on 15/06/2011 where Brascarbon will sign the construction contract of the sites. The project activity schedule was prepared considering all steps of the project development and construction and it´s available for review.

B.3. Description of the project boundary:

According to version 17 of the AMS-III.D methodology, the project boundary is defined as the physical, geographical site of the livestock, of the manure generation and management systems and of the equipment installed which recover and flare the methane. Thus, the project boundary is defined as the livestock, the biodigestor and anaerobic lagoons and the biogas flare system. Figure B1, below, shows the boundary of the project activities schematically: As there is the future possibility to install electricity generator for in site electricity supply, this component is also included (dotted) within the project boundary.

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 17 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 17.

The final draft of this baseline section was completed on 31/03/2009 (updated as to April 2011 on the investment analysis). The name of entity determining the baseline is Brascarbon. Brascarbon 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 as 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.

Baseline emissions (BEy) are calculated by using one of the following two options:

(a) Using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (VS) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure (B_o);

(b) Using the amount of manure that would decay anaerobically in the absence of the project activity based on direct measurement of the quantity of manure treated together with its specific volatile solids (SVS) content.

Option a) was chosen.

Equation B1

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

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 determinated 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
$VS_{default}$	Annex 3	Obtained from IPCC 2006, 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	79%	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	Fazenda São Francisco	300	1,881	1,277	7	90	**3,555**
2	Fazenda Rancho da Paz	250	1,596	1,182	3	75	**3,106**
3	Fazenda Caixetas (Elite)	-	4,438	-	-	-	**4,438**
4	Fazenda Boa Vista	1,000	-	-	10	300	**1,310**
5	Fazenda Boa Vista (term)	-	6,840	4,729	-	-	**11,569**
6	Sitio Bela Vista	-	3,356	-	-	-	**3,356**
7	Fazenda Cachoeirinha	550	4,237	2,601	6	165	**7,558**
8	Sitio Ana Paula	562	3,523	2,658	8	63	**6,814**
9	Fazenda Taquara Branca	200	1,254	946	2	60	**2,462**
10	Faz. Santana do Matão	-	5,085	-	-	-	**5,085**
11	Fazenda Suinolandia	500	3,440	2,416	8	200	**6,564**
12	Granja Lago Azul	750	4,702	3,546	23	456	**9,477**
13	Granja Herval	1,000	-	4,729	14	-	**5,743**
14	Granja São João	2,600	9,320	11,830	25	450	**24,225**
TOTAL		**7.712**	**49.671**	**35.915**	**106**	**1.859**	**95.262**

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 the absence of the project activity the methane resulting from the decomposition of animal wastes in the anaerobic lagoons is released into the atmosphere. Proof of an early consideration of CDM is available since:

- In September 2009 the PDD has been published for global stakeholder consultation;
- In March 2010 the Emission Reduction Purchase Agreement (ERPA) was signed between the Project Developer (Brascarbon) and the carbon credit Buyer (Luso Carbon Fund);
- The contracts between the project developer and the owner of the pig farms especially mention the project implementation under the context of CDM.

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 lagoons), due to the most economic and viable system approved to manage the manure in confined animal feed operations. Also, the approved waste treatment used in the farms involves less technology, as open lagoons, and need less employees and technicians for operation and maintenance.

Economic barriers are very common in the confined animals feed operations because producers invest only in the confined feed operations to be more competitive in the market. Financial resources are always used to maintain the confined feed operation working. This is one of the reasons of the additionality of the project activity.

The proposed project activity intends to improve current animal waste management system practices. These changes will result in the mitigation of anthropogenic GHG emissions by controlling the lagoon's decomposition processes and collecting and combusting the biogas. Also the proposed project activity will be sized to accommodate each farm's maximum expected animal capacity.

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 increased worldwide pork production and low operating margins. Farm owners focus on the production, and odour benefits and water quality enhancements are rarely enough to compel an upgrade to an expensive advanced animal waste management system. Also, in the producer´s point of view the animal waste is outside of the production process and has difficult financing challenges that should be considered. Even banks have been unwilling to finance such activities without government guarantees or other incentives. The anaerobic digester requires a much higher investment than an anaerobic lagoon. Therefore this last one is the most likely alternative and can be considered as the baseline scenario.

To demonstrate the existence of an investment barrier, that prevents the implementation of the project without the revenue of the carbon credits, the project proponent has undertaken an investment analysis of the project activity (without the revenue of the carbon credits), considering three scenarios:

- **I: Baseline Scenario**: the installation of an anaerobic lagoon;
- **II: Project Scenario**: the installation of the anaerobic digester with flare.
- **III: Project Scenario + Generator**: the installation of the anaerobic digester with flare and a generator, which assumes that all the farms will install standard generators with a capacity of 40kW, to produce energy during 12 hours/day and will consume 100% of the energy produced for farm activities proposals. This scenario does not involve any connection to the grid for further energy commercialization. It is considered that the revenues associated with this scenario are the avoided costs with electricity purchase

Although in the initial version of the PDD the investment analysis has been referenced to March 2009, the data has been further updated to take into account the effective date on which the investment decision was made, which was 12th of April 2011. The following assumptions were considered (Table B.2.0):

Table B.2.0 – Assumptions for the Investment Analysis

Parameter	Assumption / Value	Comments / Source
Date for the Investiment Analysis	12th of April 2011	Investment Decision date Approval of the investment by the board of Luso Carbon Fund, the carbon credit buyer which is going to fully finance the project
Period	21 years	Maximum period of the Small Scale project life cycle
Discount rate	11.67	Brazilian Selic Tax for the 12th of April 2011 http://www.bcb.gov.br/?SELICDIA SELIC Tax is the main index rate used by the Market in Brazil
Exchange rate R$/USD	1.5870	Exchange rate for 12th of April 2011 http://www4.bcb.gov.br/pec/taxas/port/ptaxnpesq.asp?id=txcotacao
Electricity tariff R$/MWh	203.23 (SE) 178.68 (S)	Data for Southeast Region (São Paulo – SP and Minas Gerais - MG) and South Region (Paraná-PR); Rural consumption http://www.aneel.gov.br/
Total electricity produced per farm (MWh)	175.2	Assuming farmers will produce energy during 12 hours/day during 365days a year
Investment cost Project Scenario	Variable according to size of farm	According to budget provided by supplier
Maintenance cost Project Scenario	R$ 8.784	According to budget provided by supplier Does not vary per farm size (equipment replacement + transport costs)
Investment cost Baseline Scenario	Variable according to size of farm	According to budget provided by supplier
Maintenance cost Baseline Scenario	R$ 1.587	According to budget provided by supplier Does not vary per farm size (equipment replacement + transport costs)
Investment cost Generator 40kW	R$ 128.560	According to budget provided by supplier
Maintenance cost Generator 40kW	R$ 10.285	According to budget provided by supplier

The results of the financial analysis for the three scenarios are presented in tables B 2.1, B.2.2. and B.2.3.

In the Baseline scenario (Table B 2.1) and in the Project scenario (Table B.2.2) there are only negatives cash flows, as no revenue will be expected from the implementation of the project activity.

In the Project + Generator scenario, table B 2.3, although the project activity generates positive returns from the avoided costs of the electricity purchase and this is enough to offset the maintenance costs of the anaerobic digester and the generator, the yearly cash-flows are not

enough to recover the initial amount which is necessary to investment in the digester plus flare and generator. The NPV of this scenario is still negative, lower than in the baseline scenario.

Table B.2.1. Financial Analysis for Baseline Scenario (Anaerobic Lagoon) (US$)

ID	FARM/SITE	Equipment costs	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from the sale of electricity or other project related products, when applicable			NPV (US$) (11,67% discount rate)	IRR (%)
					2012	year n	year n+1	2012	year n	year n+1		
1	Fazenda São Francisco	-7.070	-13.724	0	-1.000	-1.000	-1.000	0	0	0	-28.421	UNDEFINED
2	Fazenda Rancho da Paz	-7.070	-13.724	0	-1.000	-1.000	-1.000	0	0	0	-28.421	UNDEFINED
3	Fazenda Caixetas (Elite)	-7.070	-13.724	0	-1.000	-1.000	-1.000	0	0	0	-28.421	UNDEFINED
4	Fazenda Boa Vista	-5.656	-10.979	0	-1.000	-1.000	-1.000	0	0	0	-24.262	UNDEFINED
5	Fazenda Boa Vista (Term)	-8.484	-16.469	0	-1.000	-1.000	-1.000	0	0	0	-32.579	UNDEFINED
6	Sitio Bela Vista	-7.070	-13.724	0	-1.000	-1.000	-1.000	0	0	0	-28.421	UNDEFINED
7	Fazenda Cachoeirinha	-7.777	-15.096	0	-1.000	-1.000	-1.000	0	0	0	-30.500	UNDEFINED
8	Sitio Ana Paula	-7.777	-15.096	0	-1.000	-1.000	-1.000	0	0	0	-30.500	UNDEFINED
9	Fazenda Taquara Branca	-5.656	-10.979	0	-1.000	-1.000	-1.000	0	0	0	-24.262	UNDEFINED
10	Faz. Santana do Matão	-7.777	-15.096	0	-1.000	-1.000	-1.000	0	0	0	-30.500	UNDEFINED
11	Fazenda Suinolandia	-7.777	-15.096	0	-1.000	-1.000	-1.000	0	0	0	-30.500	UNDEFINED
12	Granja Lago Azul	-7.777	-15.096	0	-1.000	-1.000	-1.000	0	0	0	-30.500	UNDEFINED
13	Granja Herval	-7.777	-15.096	0	-1.000	-1.000	-1.000	0	0	0	-30.500	UNDEFINED
14	Granja São João	-9.191	-17.841	0	-1.000	-1.000	-1.000	0	0	0	-34.659	UNDEFINED

Table B.2.2 – Financial Analysis for Project Scenario (digester + flare) (US$)

ID	FARM/SITE	Equipment costs	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from electricity savings due the onsite energy production (during 12 hours/day in year)			NPV (US$) (11,67% discount rate)	IRR (%)
					2012	year n	year n+1	2012	year n	year n+1		
1	Fazenda São Francisco	-45.747	-23.566	0	-5.535	-5.535	-5.535	0	0	0	-111.527	UNDEFINED
2	Fazenda Rancho da Paz	-45.747	-23.566	0	-5.535	-5.535	-5.535	0	0	0	-111.527	UNDEFINED
3	Fazenda Caixetas (Elite)	-45.747	-23.566	0	-5.535	-5.535	-5.535	0	0	0	-111.527	UNDEFINED
4	Fazenda Boa Vista	-36.597	-18.853	0	-5.535	-5.535	-5.535	0	0	0	-97.664	UNDEFINED
5	Fazenda Boa Vista (Term)	-54.896	-28.280	0	-5.535	-5.535	-5.535	0	0	0	-125.389	UNDEFINED
6	Sitio Bela Vista	-45.747	-23.566	0	-5.535	-5.535	-5.535	0	0	0	-111.527	UNDEFINED
7	Fazenda Cachoeirinha	-50.321	-25.923	0	-5.535	-5.535	-5.535	0	0	0	-118.458	UNDEFINED
8	Sitio Ana Paula	-50.321	-25.923	0	-5.535	-5.535	-5.535	0	0	0	-118.458	UNDEFINED
9	Fazenda Taquara Branca	-36.597	-18.853	0	-5.535	-5.535	-5.535	0	0	0	-97.664	UNDEFINED
10	Faz. Santana do Matão	-50.321	-25.923	0	-5.535	-5.535	-5.535	0	0	0	-118.458	UNDEFINED
11	Fazenda Suinolandia	-50.321	-25.923	0	-5.535	-5.535	-5.535	0	0	0	-118.458	UNDEFINED
12	Granja Lago Azul	-50.321	-25.923	0	-5.535	-5.535	-5.535	0	0	0	-118.458	UNDEFINED
13	Granja Herval	-50.321	-25.923	0	-5.535	-5.535	-5.535	0	0	0	-118.458	UNDEFINED
14	Granja São João	-59.471	-30.636	0	-5.535	-5.535	-5.535	0	0	0	-132.320	UNDEFINED

Table B.2.3 – Financial Analysis for Project Scenario + Generator (digester + flare + generator) (US$)

ID	FARM/SITE	Equipment costs	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from the sale of electricity or other project related products, when applicable (*)			NPV (US$) (10,77% discount rate)	IRR (%)
					2012	year n	year n+1	2012	year n	year n+1		
1	Fazenda São Francisco	-119.004	-31.317	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-70.849	UNDEFINED
2	Fazenda Rancho da Paz	-119.004	-31.317	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-70.849	UNDEFINED
3	Fazenda Caixetas (Elite)	-119.004	-31.317	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-70.849	UNDEFINED
4	Fazenda Boa Vista	-109.855	-26.604	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-56.986	UNDEFINED
5	Fazenda Boa Vista (Term)	-128.154	-36.030	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-84.712	UNDEFINED
6	Sitio Bela Vista	-119.004	-31.317	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-70.849	UNDEFINED
7	Fazenda Cachoeirinha	-123.579	-33.674	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-77.780	UNDEFINED
8	Sitio Ana Paula	-123.579	-33.674	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-77.780	UNDEFINED
9	Fazenda Taquara Branca	-109.855	-26.604	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-56.986	UNDEFINED
10	Faz. Santana do Matão	-123.579	-33.674	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-77.780	UNDEFINED
11	Fazenda Suinolandia	-123.579	-33.674	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-77.780	UNDEFINED
12	Granja Lago Azul	-123.579	-33.674	0	-12.016	-12.016	-12.016	19.726	19.726	19.726	-98.450	UNDEFINED
13	Granja Herval	-123.579	-33.674	0	-12.016	-12.016	-12.016	19.726	19.726	19.726	-98.450	UNDEFINED
14	Granja São João	-132.728	-38.387	0	-12.016	-12.016	-12.016	22.436	22.436	22.436	-91.643	UNDEFINED

In the table B 2.4 the summary of the investment analysis for each farm is presented and it can be seen that the Baseline scenario (anaerobic lagoon) appears as the most attractive option.

Table B 2.4. NPV Comparison for the three scenarios (US$)

ID	FARM/SITE	NPV (1st SCENARIO) Open Lagoon	NPV (2nd SCENARIO) DIGESTER + FLARE	NPV (3rd SCENARIO) DIGESTER + FLARE+GENERATOR
1	Fazenda São Francisco	-28.421	-111.527	-70.849
2	Fazenda Rancho da Paz	-28.421	-111.527	-70.849
3	Fazenda Caixetas (Elite)	-28.421	-111.527	-70.849
4	Fazenda Boa Vista	-24.262	-97.664	-56.986
5	Fazenda Boa Vista (Term)	-32.579	-125.389	-84.712
6	Sitio Bela Vista	-28.421	-111.527	-70.849
7	Fazenda Cachoeirinha	-30.500	-118.458	-77.780
8	Sitio Ana Paula	-30.500	-118.458	-77.780
9	Fazenda Taquara Branca	-24.262	-97.664	-56.986
10	Faz. Santana do Matão	-30.500	-118.458	-77.780
11	Fazenda Suinolandia	-30.500	-118.458	-77.780
12	Granja Lago Azul	-30.500	-118.458	-98.450
13	Granja Herval	-30.500	-118.458	-98.450
14	Granja São João	-34.659	-132.320	-91.643

A sensitivity analysis of the Scenario Project + Generator (only scenario with revenues) was undertaken, considering the variations of 10% as recommended by the Guidelines on the Assessment of Investment Analysis (Annex 58 of the EB 51):

- Alternative A: Investment Cost: decrease in 10%
- Alternative B: Electricity Tariff: increase in 10%

The results are presented in the table B.2.5 and it can be seen that in both alternatives considered, the project is still not viable and the NPV is negative.

Table B 2.5. Sensitivity analysis summary (US$)

ID	FARM/SITE	A - CONSIDERING 10% INVESTMENT COST REDUCTION	B - CONSIDERING 10% INCREASE OF THE ENERGY PRICE
		NPV (3rd SCENARIO) DIGESTER + FLARE + GENERATOR	NPV (3rd SCENARIO) DIGESTER + FLARE + GENERATOR
1	Fazenda São Francisco	-55.817	-53.738
2	Fazenda Rancho da Paz	-55.817	-53.738
3	Fazenda Caixetas (Elite)	-55.817	-53.738
4	Fazenda Boa Vista	-43.340	-39.875
5	Fazenda Boa Vista (Term)	-68.293	-67.600
6	Sitio Bela Vista	-55.817	-53.738
7	Fazenda Cachoeirinha	-62.055	-60.669
8	Sitio Ana Paula	-62.055	-60.669
9	Fazenda Taquara Branca	-43.340	-39.875
10	Faz. Santana do Matão	-62.055	-60.669
11	Fazenda Suinolandia	-62.055	-60.669
12	Granja Lago Azul	-82.725	-83.406
13	Granja Herval	-82.725	-83.406
14	Granja São João	-74.531	-74.532

From the 3 Scenarios considered, the installation of the open anaerobic lagoon (baseline scenario) is the most economic option to the swine producers. Both the investment and maintenance cost are inferior to the other scenarios considered and this is an option approved by the environment department. The negative cash flows and present value indicate that the farm producers would not engage and invest in any implementation of anaerobic digester plus flare with or without generator. Continuation of the actual practices, anaerobic lagoon, would be the most attractive course of action because it requires less investment (especially since all the producers already have an anaerobic lagoon under place) and this practice is compliant with the environmental legislation. The installation of an anaerobic lagoon is the option with higher GHG emissions.

Technological Barrier:

There is no technology requested for the waste management system, by the environment department, to be implemented in the confined animals feed operations. The actual and approved waste treatment system is open anaerobic lagoons considered also the most economic system to be installed.

The Brascarbon proposal is the installation of the anaerobic digester technology with biogas recovery and destruction.

Anaerobic digester systems must have sized properly to handle the projected animal/effluent volumes with a Hydraulic Retention Time (HRT) consistent with extracting most/all CH_4 from the manure. 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.

Special equipment such a biogas analyzer, to determine the concentration of the methane in the biogas, has to be acquired to verify the performance of the digester. An enclosed flare has also to be installed to capture and destroy the biogas produced in the digester. Many other instruments such thermo coupling, solar cells, batteries, flow meters, programmable logic controller (to save the temperature information) have also to be installed to perform and control the biogas production.

Also to the adequate operation of the digesters operational procedures have to be followed and managed by an expertise technician. Brascarbon will be responsible for implementing an external support without interfering in the confined animal feed operation because the local animal producers does not have staff available to perform these tasks.

Moreover, operations and maintenance requirements involved with this technology, including a detailed monitoring program to maintain system performance levels, must also be considered. 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)

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

In order to clarify the actual circumstances regarding to confined animal operations in Brazil and the serious environmental problems that can occur due the bad animal waste management system, EMBRAPA stimulated by the Expansion and Waste Treatment Program of the State of Santa Catarina published a Good Practices Manual with instructions and publications to help the producers and agro-industries to implement projects or systems to control the animal waste management protecting the eco-system[9]. This idea was supported by officers of national swine producers association (ABCS).

Although the installation of an animal waste management system will, by itself, provide the producers with some external benefits as it was stated before, the project itself could not be developed without the revenues from the CERs. CDM funding will help to alleviate the identified barrier by providing the financial means which are necessary to implement the project activity.

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 17 – *"**Methane recovery in animal manure management systems**"* and data from 2006 IPCC Guidelines for National GHG Inventories, volume 4, chapter 10.

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 emissions for this project activity 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

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

[9] [9] Boas Práticas de Produção de Suínos: http://www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_k5u59t7m.pdf

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

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

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)

Step 3: Project Emissions.

According to the simplified baseline and monitoring methodology for a small-scale CDM project Type-III (AMS.III.D – version 17), 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) CO2emissions from use of fossil fuels or electricity for the operation of all the installed facilities (*PEpower,y*).

(d) CO2 emissions from incremental transportation distances ($PE_{transp,y}$)

(e) Emissions from the storage of manure before being fed into the anaerobic digester ($PE_{storage,y}$)

Equation B5

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

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)
$PE_{transp,y}$	Emissions from incremental transportation in the year y (tCO2e), as per relevant paragraph in AMS-III.F
$PE_{storage,y}$	Emissions from the storage of the manure in the year "y" (tCO_2e)

Where:

(A) Emissions due to physical leakage of biogas can be determinated 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 determinate 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 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.

(D) Emissions from incremental transportation

No incremental transportation will occur in the project activity, and therefore, $PE_{transp,y} = 0$

(E) Emissions from storage of the manure:

The manure will not be stored in the entire project. Each day all the manure is washed and sent to the digester, therefore, *PEstorage,y* = 0.

Step 4: Leakage.

According to the simplified baseline and monitoring methodology AMS.III.D / version 17, no leakage calculation is required.

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

Data / Parameter:	MCF_j
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:	79%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Average temperature of the region, mainly where the project sites are located is 23 to 25 Celsius during the year, according to CPTEC/INPE/EMBRAPA and INMET http://bancodedados.cptec.inpe.br http://www.inmet.gov.br/html/clima.php
Any comment:	

Data / Parameter:	$MS\%_{BL,j}$
Data unit:	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:	$VS_{default}$
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 (finishers, nursery/weaners, boars) 0.46 for Breeding Swine (guilts, sows)
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/ 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:	**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 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/ 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 ratings 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 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/
Any comment:	

Data / Parameter:	UF_b
Data unit:	Fraction
Description:	Model correction factor to account for model uncertainties
Source of data:	FCCC/SBSTA/2003/10/Add.2, page 25.
Value applied:	0.94
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value according to methodology AMS-III.D
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 – 2012

ID	Farm/Site	Baseline Emissions per Annual Average Number of Animals Type "LT" in t CO2e/year					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Fazenda São Francisco	275	1,744	263	17	75	**2,374**
2	Fazenda Rancho da Paz	229	1,479	243	7	63	**2,021**
3	Fazenda Caixetas (Elite)	-	4,113	-	-	-	**4,113**
4	Fazenda Boa Vista	917	-	-	25	251	**1,193**
5	Fazenda Boa Vista (term)	-	6,338	974	-	-	**7,312**
6	Sitio Bela Vista	-	3,110	-	-	-	**3,110**
7	Fazenda Cachoeirinha	504	3,926	536	15	138	**5,119**
8	Sitio Ana Paula	515	3,265	547	20	53	**4,400**
9	Fazenda Taquara Branca	183	1,162	195	5	50	**1,595**
10	Faz. Santana do Matão	-	4,712	-	-	-	**4,712**
11	Fazenda Suinolandia	459	3,188	498	20	167	**4,332**
12	Granja Lago Azul	688	4,357	730	57	382	**6,214**
13	Granja Herval	917	-	974	35	-	**1,926**
14	Granja São João	2,384	8,637	2,436	62	377	**13,896**
TOTAL		**7.071**	**46.031**	**7.396**	**263**	**1.556**	**62.317**

Table B4 – Total baseline emission per year

ID	Farm/Site	Baseline Emissions per yera, in t CO2e / year							Total
		2012	2013	2014	2015	2016	2017	2018	
1	Fazenda São Francisco	2,374	2,374	2,374	2,374	2,374	2,374	2,374	**16,618**
2	Fazenda Rancho da Paz	2,021	2,021	2,021	2,021	2,021	2,021	2,021	**14,147**
3	Fazenda Caixetas (Elite)	4,113	4,113	4,113	4,113	4,113	4,113	4,113	**28,791**
4	Fazenda Boa Vista	1,193	1,193	1,193	1,193	1,193	1,193	1,193	**8,351**
5	Fazenda Boa Vista (term)	7,312	7,312	7,312	7,312	7,312	7,312	7,312	**51,184**
6	Sitio Bela Vista	3,110	3,110	3,110	3,110	3,110	3,110	3,110	**21,770**
7	Fazenda Cachoeirinha	5,119	5,119	5,119	5,119	5,119	5,119	5,119	**35,833**
8	Sitio Ana Paula	4,400	4,400	4,400	4,400	4,400	4,400	4,400	**30,800**
9	Fazenda Taquara Branca	1,595	1,595	1,595	1,595	1,595	1,595	1,595	**11,165**
10	Faz. Santana do Matão	4,712	4,712	4,712	4,712	4,712	4,712	4,712	**32,984**
11	Fazenda Suinolandia	4,332	4,332	4,332	4,332	4,332	4,332	4,332	**30,324**
13	Granja Lago Azul	6,214	6,214	6,214	6,214	6,214	6,214	6,214	**43,498**
14	Granja Herval	1,926	1,926	1,926	1,926	1,926	1,926	1,926	**13,482**
15	Granja São João	13,896	13,896	13,896	13,896	13,896	13,896	13,896	**97,272**
TOTAL		**62,317**	**62,317**	**62,317**	**62,317**	**62,317**	**62,317**	**62,317**	**436,219**

(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 – 2012

ID	Farm/Site	Project Emissions per Annual Average Number of Animals Type "LT", in t CO2e/year					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Fazenda São Francisco	65	409	61	4	18	**557**
2	Fazenda Rancho da Paz	54	347	57	2	14	**474**
3	Fazenda Caixetas (Elite)	-	965	-	-	-	**965**
4	Fazenda Boa Vista	215	-	-	6	59	**280**
5	Fazenda Boa Vista (term)	-	1,488	228	-	-	**1,716**
6	Sitio Bela Vista	-	730	-	-	-	**730**
7	Fazenda Cachoeirinha	118	922	126	4	33	**1,203**
8	Sitio Ana Paula	121	767	129	5	12	**1,034**
9	Fazenda Taquara Branca	43	272	46	2	12	**375**
10	Faz. Santana do Matão	-	1,106	-	-	-	**1,106**
11	Fazenda Suinolandia	108	748	117	5	40	**1,018**
13	Granja Lago Azul	162	1,023	171	14	89	**1,459**
14	Granja Herval	215	-	228	9	-	**452**
15	Granja São João	559	2,027	572	14	89	**3,261**
TOTAL		**1,660**	**10,804**	**1,735**	**65**	**366**	**14,630**

Table B6 – Total project activity emissions per year

ID	Farm/Site	Project Emissions in t CO2e/year							Total
		2012	2013	2014	2015	2016	2017	2018	
1	Fazenda São Francisco	557	557	557	557	557	557	557	**3,899**
2	Fazenda Rancho da Paz	474	474	474	474	474	474	474	**3,318**
3	Fazenda Caixetas (Elite)	965	965	965	965	965	965	965	**6,755**
4	Fazenda Boa Vista	280	280	280	280	280	280	280	**1,960**
5	Fazenda Boa Vista (term)	1,716	1,716	1,716	1,716	1,716	1,716	1,716	**12,012**
6	Sitio Bela Vista	730	730	730	730	730	730	730	**5,110**
7	Fazenda Cachoeirinha	1,203	1,203	1,203	1,203	1,203	1,203	1,203	**8,421**
8	Sitio Ana Paula	1,034	1,034	1,034	1,034	1,034	1,034	1,034	**7,238**
9	Fazenda Taquara Branca	375	375	375	375	375	375	375	**2,625**
10	Faz. Santana do Matão	1,106	1,106	1,106	1,106	1,106	1,106	1,106	**7,742**
11	Fazenda Suinolandia	1,018	1,018	1,018	1,018	1,018	1,018	1,018	**7,126**
13	Granja Lago Azul	1,459	1,459	1,459	1,459	1,459	1,459	1,459	**10,213**
14	Granja Herval	452	452	452	452	452	452	452	**3,164**
15	Granja São João	3,261	3,261	3,261	3,261	3,261	3,261	3,261	**22,827**
TOTAL		**14,630**	**14,630**	**14,630**	**14,630**	**14,630**	**14,630**	**14,630**	**102,410**

(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	Year						
	2012	2013	2014	2015	2016	2017	2018
Total Baseline Emissions - $BE_{y,}$,in ton CO2e/year	62,317	62,317	62,317	62,317	62,317	62,317	62,317
Total Project Emissions - $PE_{y,}$ in ton CO2e/year	14,630	14,630	14,630	14,630	14,630	14,630	14,630
Total Emission Reductions - $ER_y = BE_y – PE_y$ (in ton CO2e/year)	47,687	47,687	47,687	47,687	47,687	47,687	47,687

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)
2012	14,630	62,317	0	47,687
2013	14,630	62,317	0	47,687
2014	14,630	62,317	0	47,687
2015	14,630	62,317	0	47,687
2016	14,630	62,317	0	47,687
2017	14,630	62,317	0	47,687
2018	14,630	62,317	0	47,687
Total (ton de CO2 e)	102,410	436,219	0	333,809

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 17, ***Methane recovery in animal manure management systems***. If in the future an electricity generator for in site electricity supply is installed, methodology AMS-III.H /version 16, ***Methane recovery in wastewater treatment***, will also be applied. 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.

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 data monitored and required for verification and issuance is kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later. 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 for 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:	^oC
Description:	Combustion temperature of the flare
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	According to the Monitoring Operational Procedure POP-01
Monitoring frequency	Every 1 minute 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:	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:	Sows: 220 kg Finishers: 90 kg Nursery: 20 kg Boars: 240 kg Gilts: 220 kg
Measurement procedures (if any):	Checking data and records in the confined feed animal operation
Monitoring frequency	Quarterly
QA/QC procedures	Check of the site records and documents,
Any comment:	Monitoring operational procedure POP-016

Data / Parameter:	SITE INSPECTION
Data unit:	n.a.
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:	n.a.
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:	See table B.2 in Section B.4
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:	$BG_{burnt,y}$
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:	n.a.
Measurement procedures (if any):	Recover the 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:	$W_{CH4,y}$
Data unit:	Fraction
Description:	Methane content in biogas in the year "y"
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
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. 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 operation conditions
Source of data:	Brascarbon Monitoring Report System
Value of data:	20.ºC
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:	$D_{CH4,y}$
Data unit:	tones / m^3
Description:	Density of the methane combusted at operation conditions
Source of data:	Brascarbon Monitoring Report System
Value of data:	0.00067
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	Monthly
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:	n.a.
Description:	Sludge soil application
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
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 0% efficiency
Measurement procedures (if any):	Enclosed flare. The temperature measurement and it´s registration in the programmable logic controller system (PLC) is every minute. Brascarbon considers efficiency 90% for the hour with all temperature measurements above or equal to 500º Celsius and 0% efficiency for the hour with any temperature measurements below 500º Celsius
Monitoring frequency	Monthly
QA/QC procedures	Check the registers in the generated documents.
Any comment:	Every minute monitoring of the flare temperature. The efficiency calculation is monthly and according to Monitoring Operational Procedure POP-08 which can be found at the Brascarbon Operational Procedure Manual. According to the manufacture specifications of the enclosed flares the dimension, the combustor, the mixer, the refractory and the continuous sparking system of the enclosed flares were established according to the maximum theoretical flow of biogas for each swine farm. Hence, only the temperature of the enclosed flare must be monitored to ensure adequate combustion of biogas in the flare.

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:	n.a.
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:	n.a.
Description:	Formulated Feed Rations
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
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:	P biogas
Data unit:	mbar
Description:	Pressure of the biogas at operation conditions
Source of data:	Brascarbon Monitoring Report System
Value of data:	1013,25 mbar (or 1 atm)
Measurement procedures (if any):	Measurement with portable local pressure gauge. Measurement according Operational Procedure POP-13
Monitoring frequency	Monthly
QA/QC procedures	Check the registers in the generated documents and equipment for measurement calibration
Any comment:	Monitoring operational procedure POP-13 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	GENETIC SOURCE
Data unit:	n.a.
Description:	Genetic source from annex I party
Source of data:	Brascarbon Monitoring Report System
Value of data:	Western Europe
Measurement procedures (if any):	Data and records from the confined feed animal operation. According Operational Procedure POP-15
Monitoring frequency	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:	1
Measurement procedures (if any):	During the site inspection, checking if changes in the adopted waste management system and surroundings 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 hour h
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	Recover the data registered in the data logger (CLP) of the volume in the local control panel and calculate flow rate 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:	n.a.
Measurement procedures (if any):	To be calculated according to the "Tool to determine project emissions from flaring gases containing methane". An 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:	n.a.
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. 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:	$N_{day,y}$
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:	Sows 365 Finishers 90 Nursery/Weaners 70 Boars 365 Gilts 365
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:	Animal production data (see Annex 3)
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	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:	nd_y
Data unit:	Number
Description:	Number of days in year "y" where the treatment plant was operational
Source of data:	Brascarbon Monitoring Report System
Value of data:	365
Measurement procedures (if any):	According to the operational procedure POP-24
Monitoring frequency	Annually
QA/QC procedures	Check the data for more accurate information.
Any comment:	Monitoring operational procedure POP-24 can be found at the Brascarbon Operational Procedure Manual

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	Until end of CP + 2 years	Use for flare efficiency
2	Site Inspection	Document	----	----	Annually	D	100%	electronic	Until end of CP + 2 years	General Site Inspection
3	$N_{LT,y}$	Number	-	Nr, Of heads	Monthly	C	100%	electronic	Until end of CP + 2 years	Used to quantify the methane generation potential
4	$BG_{burnt,y}$	Volume	m^3	Biogas produced	Monthly	M	100%	electronic	Until end of CP + 2 years	Cumulative biogas production
5	$w_{CH4,y}$	Fraction	%	Methane content	TBD(*)	M	100%	electronic	Until end of CP + 2 years	Concentration in wet basis
6	T_{biogas}	Temp	°C	Biogas Temperature	Monthly	M	100%	electronic	Until end of CP + 2 years	Use to biogas density calculation
7	D_{CH4}	Mass	Ton/^{3}	Density	Monthly	C	100%	electronic	Until end of CP + 2 years	Density
8	FE	Efficiency	%	Temperature	Monthly	C	100%	electronic	Until end of CP + 2 years	Efficiency determinate by the burning temp.
9	QDM	Supervision	--	---	Every Batch Disposed	E	100%	electronic	Until end of CP + 2 years	Sludge disposed outside project boundary
10	W site	Mass	kg	Average Animal weight	Quarterly	D	100%	electronic	Until end of CP + 2 years	Average Animal weight
11	$ER_{y,estimated}$	Mass	Ton	CO_2e	Annually	C	100%	electronic	Until end of CP + 2 years	Yearly methane potential generation
12	FFR	------	---	Feed Formulation	Monthly	D	100%	electronic	Until end of CP + 2 years	Feed Formulation Rations
13	P biogas	Pressure	mbar	Biogas Pressure	Monthly	M	100%	electronic	Until end of CP + 2 years	Biogas pressure
14	Genetic Source	Document	-------	genetic	Annually	D	100%	electronic	Until end of CP + 2 years	Genetic Source
15	MS% i,y	fraction	%	Manure handled	Annually	E	100%	electronic	Until end of CP + 2 years	General Site Inspection
16	$FV_{RG,h}$	volume	m^3/h	Volume	Monthly	M	100%	electronic	Until end of CP + 2 years	Volume of residual gas
17	$fv_{CH4,RG}$	fraction	%	Methane content	TBD(*)	M	100%	electronic	Until end of CP + 2 years	Volumetric methane fraction of the residual gas
18	$TM_{RG,h}$	mass	Kg/h	Mass flow rate	Monthly	C	100%	electronic	Until end of CP + 2 years	Total mass flow rate of the residual gas
19	N day,y	number	days	days	Monthly	M	100%	electronic	Until end of CP + 2 years	Nr. Of days animal is alive
20	N p,y	number	heads	Nr of heads	Monthly	M	100%	electronic	Until end of CP + 2 years	Nr. Of heads per category annually
21	ndy	number	days	days	Annually	M	100%	electronic	Until end of CP + 2 years	Number of days the treatment plant was operational

(*) 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
Temperature of the flare will be controlled by a logic system which will be able to store the burning temperature every minute. The sensor - thermo coupling - is installed in the flare body.
The signal from the thermocouple is sent to the CLP where the information of the temperature is recorded every each minute.
The file information from the logic system will be recovered monthly using a pendrive and the file will be sent to the QA/QC officer to manage the information for further verification. A spreadsheet in excel is 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.

In the operational procedure POP 1 can be found the formulary 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 orientation to guide the technicians during inspection in the field to follow all items related to the project activity installation.
Attached on it, the MS% i,y - Fraction of manure handled in the system during the year, is included to be inspected during the each farm visit.
No changes in the manure managing system will be permitted during the project activity.
Variables 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 formulary 03.003 from 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 formulary 03.003.
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.
The operational procedure POP 4- Measurement of the biogas flow rate, is a guide to explain 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 to 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 confident 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 pendrive and the file containing the information will be sent to the QA/QC officer to manage the information for further verification. A spreadsheet in excel is available from the system to show the flow rate per minute per day.
The variables measured with this procedure are: $BG_{burnt,y}$ and $FV_{RG,h.}$.
The data monitored is controlled in the formulary 04.001 attached in the operational procedure POP 4.

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 electronic equipment BIOGAS or TESTO.
The concentration of methane is measured in a few seconds before starting the measurement button.
The operation of the equipment and the devices to be used is clearly described in the operational procedure as so as in the equipment manual.

Both equipment is 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 formulary 04.001.

Biogas temperature measurement.
The biogas temperature is obtained by electronic equipment BIOGAS.
The methane temperature is measured in a few seconds after inserting the thermocouple in the biogas line device.
The operation of the equipment and the devices to be used is clearly described in the operational procedure as so 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 formulary 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 formulary 07.001 attached in the operational procedure shows the data to be filled to make the calculation.
The methane density calculation is according to 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 manufacturer´s specifications were taken into consideration in the installation of the flares according to the maximum theoretical flow of biogas for each swine farm. Hence, only the temperature of the enclosed flare must be monitored to ensure adequate combustion of the biogas in the flare and the flare efficiency is calculated according to the following criteria::

a) If the exhaust gas temperature is $\geq 500\ ^{o}C$, the flare efficiency is 90% in the respective hour.
b) If the exhaust gas temperature is $< 500\ ^{o}C$, the flare efficiency is 0% in the respective hour.

Brascarbon developed the formulary 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.

Biogas pressure.
The biogas pressure is obtained by electronic equipment BIOGAS and procedures described in the operational procedure POP 13- Biogas pressure.
The operating pressure of the digester is atmospherically.
The operation of the equipment and the devices to be used is clearly described in the operational procedure as so 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 formulary 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 formulary 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 formulary.
Records available in the feed operations will be copied and filed at Brascarbon office and attached with the formulary 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, where it 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 monitored ex-post, in ton CO2e..
- PEy,ex-post; Project emissions ex-post with monitorated data, in ton CO2e .
- MD_y; Methane captured and destroyed ex-post.

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

Number of days the treatment plant was operational
The number of days the treatment plant was operational can be determinate by the POP 24 – days of functioning, where it is monitored the number of days in a year "y" that the treatment plant has operated.
The variables monitored with this procedure: nd_y

Monitoring System
The monitoring system will be followed according to the Brascarbon Operations Procedures Manual, detailed to attend all necessary controls in the site and all monitoring requisites specified in the approved methodology AMS.III.D – Version 17 – *"**Methane recovery in animal manure management systems**"*. If in the future an electricity generator for in site electricity supply is installed, requisites from methodology AMS-III.H /version 16, **Methane recovery in wastewater treatment**, will also be followed.

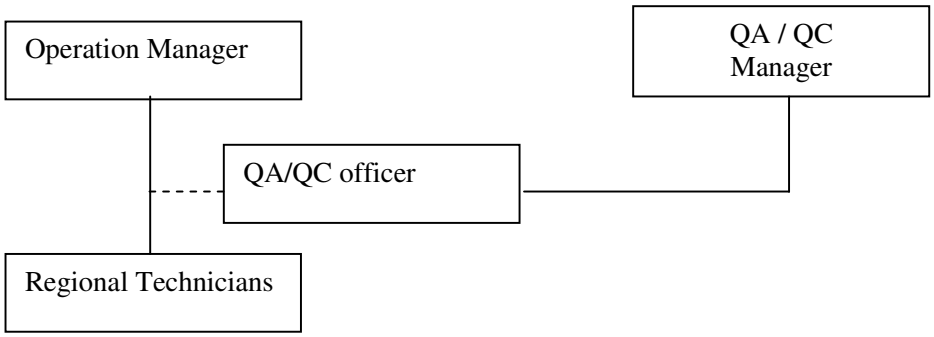
Operational / Monitoring Procedures
Operational / Monitoring procedures listed in the Annex 4.

Quality Assurance/Control: QA/QC
The measuring instruments will be calibrated by the manufacturers' representatives on a manufacturer's recommendation basis. The certification of calibration will be controlled by QA/QC officer. The QA/QC officer will be also 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 maintenance and monitoring data collection.

QA/QC Manager
Engineer, responsible for the monitoring operation and emissions for the project activity.

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 to 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, pipings, 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 17, ***Methane recovery in animal manure management systems.*** If in the future an electricity generator for in site electricity supply is installed, methodology AMS-III.H /version 16, ***Methane recovery in wastewater treatment***, will also be applied.
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 31/03/2009 (updated as to April 2011 on the investment analysis)..

The entity determining this monitoring methodology is BrasCarbon Consultoria, Projetos e Representação S/A, 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 **15/06/2011,** which represents the **expected date** for signature of the construction contract of the sites.

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: **01/01/2012 or the registration date of the project activity**, what happens by last**.**

C.2.1.2. Length of the first crediting period:

The length 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

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 list of the stakeholders was 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 and negative issues were received from the local stakeholders.

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

No comments were received from stakeholders.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding being provided for this project.

ANNEX 3 - BASELINE INFORMATION

ID	Farm/Site	Animal Category	$N_{da,y}$	$N_{p,y}$	$N_{LT,y}$	$W_{default}$	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	$PE_{PL,y}$	$PE_{flare,y}$	$PE_{power,y}$	$PE_{transp,y}$	$PE_{storage,y}$	PE y	ER y
1	Fazenda São Francisco	Sows	365	300	300	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	275	37	28	-	-	-	65	210
		Finishers	116	5.920	1.881	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	1.744	235	174	-	-	-	409	1.335
		Nursery/Weaners	70	6.658	1.277	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	263	35	26	-	-	-	61	202
		Boars	365	7	7	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	17	2	2	-	-	-	4	13
		Gilts	365	90	90	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	75	10	8	-	-	-	18	57
		total			3.555														2.374	319	238	-	-	-	557	1.817
2	Fazenda Rancho da Paz	Sows	365	250	250	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	229	31	23	-	-	-	54	175
		Finishers	90	6.472	1.596	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	1.479	199	148	-	-	-	347	1.132
		Nursery/Weaners	70	6.162	1.182	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	243	33	24	-	-	-	57	186
		Boars	365	3	3	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	7	1	1	-	-	-	2	5
		Gilts	365	75	75	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	63	8	6	-	-	-	14	49
		total			3.106														2.021	272	202	-	-	-	474	1.547
3	Fazenda Caixetas (Elite)	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Finishers	90	18.000	4.438	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.113	554	411	-	-	-	965	3.148
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		total			4.438														4.113	554	411	-	-	-	965	3.148
4	Fazenda Boa Vista	Sows	365	1.000	1.000	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	917	123	92	-	-	-	215	702
		Finishers	90	-	-	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Boars	365	10	10	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	25	3	3	-	-	-	6	19
		Gilts	365	300	300	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	251	34	25	-	-	-	59	192
		total			1.310														1.193	160	120	-	-	-	280	913
5	Fazenda Boa Vista (Term)	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Finishers	90	27.738	6.840	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	6.338	854	634	-	-	-	1.488	4.850
		Nursery/Weaners	70	24.660	4.729	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	974	131	97	-	-	-	228	746
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		total			11.569														7.312	985	731	-	-	-	1.716	5.596
6	Sitio Bela Vista	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Finishers	116	10.560	3.356	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	3.110	419	311	-	-	-	730	2.380
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		total			3.356														3.110	419	311	-	-	-	730	2.380
7	Fazenda Cachoeirinha	Sows	365	550	550	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	504	68	50	-	-	-	118	386
		Finishers	116	13.331	4.237	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	3.926	529	393	-	-	-	922	3.004
		Nursery/Weaners	70	13.560	2.601	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	536	72	54	-	-	-	126	410
		Boars	365	6	6	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	15	2	2	-	-	-	4	11
		Gilts	365	165	165	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	138	19	14	-	-	-	33	105
		total			7.558														5.119	690	513	-	-	-	1.203	3.916

ANNEX 3 - BASELINE INFORMATION (Continuation)

ID	Farm/Site	Animal Category	$N_{da,y}$	$N_{p,y}$	$N_{LT,y}$	$W_{default}$	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	$PE_{PL,y}$	$PE_{flare,y}$	$PE_{power,y}$	$PE_{transp,y}$	$PE_{storage,y}$	PE y	ER y
8	Sitio Ana Paula	Sows	365	562	562	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	515	69	52	-	-	-	121	394
		Finishers	116	11.085	3.523	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	3.265	440	327	-	-	-	767	2.498
		Nursery/Weaners	70	13.860	2.658	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	547	74	55	-	-	-	129	418
		Boars	365	8	8	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	20	3	2	-	-	-	5	15
		Gilts	365	63	63	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	53	7	5	-	-	-	12	41
		total			6.814														4.400	593	441	-	-	-	1.034	3.366
9	Fazenda Taquara Branca	Sows	365	200	200	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	183	25	18	-	-	-	43	140
		Finishers	116	3.946	1.254	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	1.162	156	116	-	-	-	272	890
		Nursery/Weaners	70	4.932	946	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	195	26	20	-	-	-	46	149
		Boars	365	2	2	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	5	1	1	-	-	-	2	3
		Gilts	365	60	60	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	50	7	5	-	-	-	12	38
		total			2.462														1.595	215	160	-	-	-	375	1.220
10	Faz. Santana do Matão	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Finishers	116	16.000	5.085	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.712	635	471	-	-	-	1.106	3.606
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		total			5.085														4.712	635	471	-	-	-	1.106	3.606
11	Fazenda Suinolandia	Sows	365	500	500	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	459	62	46	-	-	-	108	351
		Finishers	90	13.950	3.440	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	3.188	429	319	-	-	-	748	2.440
		Nursery/Weaners	70	12.600	2.416	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	498	67	50	-	-	-	117	381
		Boars	365	8	8	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	20	3	2	-	-	-	5	15
		Gilts	365	200	200	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	167	23	17	-	-	-	40	127
		total			6.564														4.332	584	434	-	-	-	1.018	3.314
12	Granja Lago Azul	Sows	365	750	750	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	688	93	69	-	-	-	162	526
		Finishers	116	14.794	4.702	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.357	587	436	-	-	-	1.023	3.334
		Nursery/Weaners	70	18.492	3.546	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	730	98	73	-	-	-	171	559
		Boars	365	23	23	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	57	8	6	-	-	-	14	43
		Gilts	365	456	456	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	382	51	38	-	-	-	89	293
		total			9.477														6.214	837	622	-	-	-	1.459	4.755
13	Granja Herval	Sows	365	1.000	1.000	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	917	123	92	-	-	-	215	702
		Finishers	116	-	-	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		Nursery/Weaners	70	24.660	4.729	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	974	131	97	-	-	-	228	746
		Boars	365	14	14	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	35	5	4	-	-	-	9	26
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-	-	-	-
		total			5.743														1.926	259	193	-	-	-	452	1.474
14	Granja São João	Sows	365	2.600	2.600	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	2.384	321	238	-	-	-	559	1.825
		Finishers	116	29.325	9.320	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	8.637	1.163	864	-	-	-	2.027	6.610
		Nursery/Weaners	70	61.686	11.830	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	2.436	328	244	-	-	-	572	1.864
		Boars	365	25	25	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	62	8	6	-	-	-	14	48
		Gilts	365	450	450	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	377	51	38	-	-	-	89	288
		total			24.225														13.896	1.871	1.390	-	-	-	3.261	10.635

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	°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	°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	ndy	Low	days	Register information managed by Brascarbon.

BRASCARBON has implemented an Operation Procedures Manual and formularies to capture and report monitoring 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	Every minute	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	QC	POP 3	Number of heads
4	$BG_{burnt,y}$ $FV_{RG,h}$	M	QC	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	QC	POP 7	Methane Density
8	FE	M	QC	POP 8	Flare Efficiency
9	QDM	Every Batch	TR	POP 9	Sludge Mass
10	ER	A	QC	POP 10	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	A	QC	POP 17	Yearly emissions reductions ex-post
18	ndy	A	QC	POP 24	Number of days the treatment plant was operational

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