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:

Project title: CDM Project Paragominas (hereafter referred to as "Paragominas Project").

PDD Version number: 2.

Date: November 18th, 2008.

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

The project activity consists on the (i) supply of clean electricity to the Brazilian National Interconnected System (SIN) through the implantation and operation of wood waste Paragominas Thermo electrical Plant, located in the city of Paragominas, state of Pará, North Region of Brazil, with an installed capacity of 8.0 MW and (ii) on the avoidance of methane production through the use of the wastes which would have been be disposed in the sawmills yards of the region.

In order to reach its average capacity of energy generation, Paragominas Project will consume about 86,400 tons of wood residues a year, which will be provided by sawmills and companies in the furniture production pole of the region.

The city of Paragominas is one of the main producers of wood in the state of Pará. According to the Plan of Development of the Local Productive Arrangement – LPA – of Wood and Furniture of Paragominas, in 2005 the number of wood producers installed in the city was of 68. Paragominas' City Hall has carried out a technical research in September 2007, along with 60 wood industries present in the city, aiming at quantifying the monthly volume of wood residue and the volume of wood residue stocked in sawmills throughout the city. This studied pointed out an annual residue production of 94,662.41 tons.

It is important to highlight that in the current public and company infrastructure situation of local agents, all the residues generated from activities of sawmills in Paragominas are (i) either deposited open skies in the yards of wood industries, or (ii) clandestinely thrown on vacant lots or (iii) sent to charcoal and lime kilns, the latter being rudimentary ovens to the production of coal.

All the possible destinies that have been given to residues originated of sawmills in the city present great potential of aggression to the environmental and health of local population. The negative effects of the bad management of wood residues have already been felt by the population. The pollution present in the city leads to and exposes the local community to a series of diseases, such as Acute Respiratory Infection, allergies, asthma, and eyeball irritation, among others. According to IBGE, Brazilian Institute of Geography and Statistics, in 2007, diseases related to the respiratory system were responsible for 16.27% of hospital casualties in the city of Paragominas.

Moreover, the lack of an adequate destination to the residues has propitiated the emergence of many charcoal and lime kilns, with the objective of producing coal. The operation of this kind of entrepreneurships without the necessary and sufficient conditions of safety and environmental protection exposes the population to several risks. Many are the cases of burns and even mutilations, especially among children, due to accidents resulting of involuntary contact with residues in combustion. Some pictures of this reality are presented **in annex 6** of this PDD.

The implantation of Project Paragominas will provide, thus, a new alternative in relation to the destiny of residues from sawmills of the region, which will attenuate and may even solve part of the environmental and social problems resulting from the lack of management of the residues.

Paragominas Project has, therefore, as its main objective to solve the environmental and social problems deriving from the bad management of wood residues from sawmills, besides attending to the growing demand for energy in Brazil, due to economical and population growth, supplying clean and renewable energy, contributing, thus, to environmental, social and economical sustainability through the increase in participation of clean and renewable energy in relation to the country's total capacity of energy generation.

Through the implantation of the Paragominas Plant, the production of methane originated from the decomposition of wood residues deposited open skies will be avoided and, besides that, emissions of CO_2 will also be prevented, once the project will avoid the generation of electricity via sources of fossil fuels, with consequent emissions, that would be generated if the project did not exist. This supply of clean and renewable energy will bring an important contribution to environmental sustainability, reducing the emissions of carbon dioxide and of methane that would occur in the absence of the project.

Paragominas Project contributes to the sustainable development of the country once contributing to the economic growth without compromising the future generations, respecting the concept of Sustainable Development, established by Brundtland Report, elaborated by the World Commission on Environment and Development, which defines the term "sustainable development" as "the development that satisfies the present necessities, without compromising the capacity of future generations of supplying their own necessities"[1].

Through the following actions, Paragominas Project for the sustainable development of its region and of the country:

(a) Through Paragominas Project, clean and renewable energy will be dispatched to the Brazilian National Interconnected System, displacing entrepreneurships that would generate energy through the burning of fossil fuels, avoiding, thus, the emission of pollutant gases to the atmosphere and preserving the environment to future generations.

(b) Through the generation of 49 direct jobs and indirect jobs and through the boosting of economics activities aggregated to the implementation of entrepreneurship, Paragominas Project will promote the region economic development, which happens through the generation of income to the community of the municipalities involved and to its collaborators. Through the taxes and tributes generated by its activities to the cities involved and to the Union, Paragominas Project provides financial resources which will be reverted into benefits to the region's population and for the country as a whole.

[1] WCED [CMMAD], 1987. Our Commom Future [Nosso Futuro Comum]. The World Commission on Environment and Development [Comissão Mundial sobre Meio Ambiente e Desenvolvimento]. Oxford University Press.

(c) The construction of biomass power plants similar to Paragominas Plant boosts the local economy, once it provides a technological chain that influences the social-economical activities of the region where the project is located. The operation and the maintenance of the Project require the support of the region's service providers, working in the most diverse areas such as: engineers, professionals related to the environment, professionals in the area of health, administrative and juridical area, mechanics, vise operators, technicians, etc. It is fomented, therefore, the economy related to the third sector, contributing once more to the generation of jobs, collection of taxes and economic growth of the region.

(d) The implantation of Paragominas Project will be configured as the main alternative of destiny of wood residues to the proprietors of sawmills in the city. The utilization of residues in the generation of energy will reduce social problems, such as mutilations and deformities in children burned by the region's charcoal and lime kilns activities, and the environmental problems generated by its lack of management. It is expected that the number of occurrences of health problems related to respiratory diseases due to the pollution caused either by the disposition of residues open skies, either by the production of coal through charcoal and lime kilns, will be reduced considerably after the beginning of the project. Moreover, from the success of Paragominas Project, it is possible that other similar initiatives may arise in the region.

(e) Uaná Energias Renováveis believes that the implementation of the entrepreneurship will lead a considerable improvement in the air quality of the region. It is expected that the pollution levels and the pollutants gases concentration in the city decreases in the medium term after the project implementation. To monitor this improvement, Uaná is willing to hire specializing companies to make the issues of monitoring and control of pollutants gases in the city. Through this action, the company aims to decrease considerably the social and public healthy problems mentioned previously.

(f) The implantation of the entrepreneurship presupposes the acquisition of high-technology equipment, which will be acquired through the manufacturers settled in the national territory. The use of this equipment demands training and capacity for the local workers, coming from the manufacturers themselves. With this, the companies obtain more experience and the technology becomes more widely divulged and consolidated in the region and in the country as a whole.

A.3. Project participants:

Uaná Energias Renováveis S.A. is the owner of Paragominas Thermo electrical Plant and it is responsible for all activities related to the implementation and operation of the plants.

Enerbio Consultoria Ltda advises Uaná Energias Renováveis S.A. to develop CDM Project and to monitor the CERs to be generated from the Paragominas Project.

The table below presents the parties and entities involved in the Paragominas Project.

Table 1 – Private and public parties and entities involved in the activity

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)	Private Entity: Uaná Energias Renováveis S/A.	No
	Private Entity: Enerbio Consultoria Ltda	
(*) 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.		

Detailed information for contact with the party (ies) and with the public/private entities involved in the project activity are related in Annex 1.

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

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

A.4.1.1. Host Party(ies):

Brazil

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

Region: North of Brazil

State: Pará.

A.4.1.3. City/Town/Community etc:

Paragominas City.

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

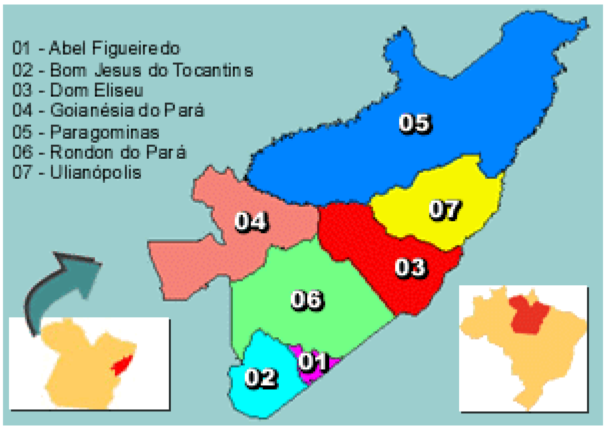
The municipality of Paragominas is situated in the northeast mesoregion of Pará, microregion Paragominas, 310 km from the capital of the state, Belém. The city is limited to the North with the municipality of Ipixiuna do Paráh; the municipalities of Dom Eliseu, Ulianópolis and Goianésia do Pará to the South. Ipixiuna do Pará to the West; and with the state of Maranhão to the East.

Paragominas has a population of 90,819 inhabitants (source: IBGE, 2007), a total area of 19,331 km², located in a medium altitude of 90 meters. The GIP (Gross Internal Product) of the city was, according to IBGE, of approximately R$ 516 million in 2005.

The climate of Paragominas is of a mesothermic and humid kind. The average annual temperature is high, around 25ºC. The pluviometric regimen is usually between 2,250mm and 2,500mm annually. Rains, despite regular, are not equally distributed throughout the year, having its higher concentration between January and June (around 80%), which implicates great hydric surplus and, consequently, great superficial draining and high tides. Relative humidity of air is around 85% (source: Paragominas City Hall - http://www.paragominas.pa.gov.br).

The maps below show the location of the state of Pará in Brazilian territory and the location of Paragominas City in its region. Besides, the figure 1 presents the Global Positioning System of the Paragominas Thermo Electrical Plant.

Map 1 – Location of Paragominas City



The geographical coordinates of the Paragominas Thermo Electrical Plant are South 02º 59’03,6’’ and West 047º 22’18,1”.

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

According to the Appendix B of the Simplified Modalities and Procedures for small scale CDM project activities, the project activity of CDM Project Paragominas can be classified in two categories:

- **Type I: Category I.D.** – Grid connected renewable electricity generation; and
- **Type III: Category III.E.:** Avoidance of methane production from decay of biomass through controlled combustion.

Project activities of Type I are defined as renewable energy project activities with maximum output capacity equivalent of 15 MW (or appropriate equivalent). The installed capacity of Paragominas Plant will be 8 MW, therefore, smaller than 15 MW, limit defined by UNFCCC for classifying CDM Projects as Small Scale Projects Activities.

Furthermore, once Paragominas Project will implant a power plant that will generate energy from wood residues (biomass), the limit of thermal energy generation should also be inferior to 45 thermal MW for fitting a small scale project, which also happens in this project.

ICP (Internal Calorific Power) of the wood residues is 11,635 kJ/kg and the specific consume of the fuel of the plant is 1.5 kg/kWh. With these characteristics, the thermal production of the plant will be 17,452 KJ/Kwh which corresponds to 12 MW Thermal (1.5 kg/kWh x 8 MW = 12 Thermal MW).

The project will make use of renowned and environmentally safe technologies that lead to the use of wood residues, which otherwise would be left open skies to be decomposed and still generates energy from renewable sources. This way, it can be affirmed that the two components of the project are eligible for the simplified procedures for activities of a small scale CDM.

The use of the biomass can be done through direct combustion (with or without physical processes of drying classification, compression, fissure, etc). Thermal chemical processes (gasification, pyrolysis, liquefication and transesterification) or biological processes (anaerobic digestion and fermentation).

Paragominas Project will use one of the main and most renowned technologies of biomass energetic profiting, which is direct combustion. Combustion is the transformation of chemical energy from fuels in heat through the reaction of its composing elements with the oxygen provided. For energetic purposes, direct combustion occurs essentially in stoves, ovens and boilers. In the case of Paragominas Project, a boiler model TH40/42 will be used, with a capacity of production of 40 ton.v/h, work pressure of 42 kgf/cm² and steam temperature of 400ºC. The power plant will also have some other equipment with the following characteristics:

- **Boiler**
    - Furnace in tubes ASTM A-178 Gr. A with nominal thickness of 4.2 mm;
    - Tubular bundle in tubes ASTM A-178 Gr.A with nominal thickness of 3.40mm;
    - Superheater in tubes ASTM A-178 Gr.A with nominal thickness of 4.2mm;
    - Furnace collectors in tubes ASTM A-160 Gr. B;
    - The combustion system will have feeders of rotative-valve kind.
- **Turbine**
    - Capacity of 8000 KW;
    - Rotation of 3600 RPM;
    - Live steam pressure of 42 kg/cm²;
    - Steam temperature of 420º C;
    - Regulation system with three automatic valves;
    - Forced lubrication system with 2 oil bombs, heat changer and double filter;
    - Security system with three disarm devices;
    - Speed regulator Woodward UG40;
    - Specific consumption without extraction of 4.2 kg/KWH

- **Generator**

  - Brand Westinghouse;
  - Potency of 10,000 KVA;
  - Rotation of 3600 RPM;
  - Tension of 6600 Volts;
  - Frequency of 60 Hz.

- **System of supervision**

  - Two computers will execute the software of supervision INDUSOFT OPERATOR WORKSTATION for Windows 2000 – MS Office;
  - The supervising computers will communicate with the programmable controller via Ethernet network of communication. The computers will be interconnected via Ethernet network in a way that only one computer will be able to assume the total system operation.

The technology and equipments used in the project will be probably developed and produced in Brazil and have already been successfully applied to similar projects in the country and in the world. As the project has been yet under conception, some characteristics of these equipments still can be changed.

This initiative in Paragominas Project may be applied to other regions and cities of the state of Pará and of Brazil, reducing social and environmental problems deriving from the bad (or lack of) management of wood residues in the region.

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

The complete implementation of the Paragominas Project, connected to the Brazilian Interconnected System, will generate a yearly average estimated reduction of **37,509 tCO_{2e}** and a total reduction of **262,568 tCO_{2e}** during the first 7-year-period, described in the table below:

Table 2: Estimation of emissions reduction of the Paragominas Project

Year	Annual estimation of emission reductions (tCO_2e)
2009 (September to December)	6,005
2010	20,089
2011	26,236
2012	32,172
2013	37,904
2014	43,439
2015	48,783
2016 (January to August)	47,938
Total Estimated Reductions (tCO_2e)	**262,568**
Total Number of Crediting Years	**7**
Annual average over the crediting period of estimated reductions (tCO2e)	**37,509**

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

No public funding for the CDM's project activities was solicited by parties involved in Annex I.

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

According to Appendix C of the simplified modalities and procedures for small-scale CDM project activities, a small scale project is considered part of a large project if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

In relation to the Paragominas Project, there is no other small scale project activity which fits the criteria mentioned above; therefore, the proposed project activity is not a debundled component of a large project activity.

SECTION B. Application of a baseline and monitoring methodology

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

Type I: Category I.D. – Grid connected renewable electricity generation (Version 13);
Type III: Category III.E.: Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment. (Version 15.1)

It will be also used the version 04 of methodological tool "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" and the version 01 of "Tool to calculate an emission factor for an electricity system".

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

Once Paragominas Project fits two categories and methodologies approved by the CDM Executive Board, it is necessary to describe justifications for the choice of such classifications.

For being assigned to a category Type I, it is necessary to demonstrate that the capacity of the project activity of Paragominas Project will not exceed 15 MW. The installed capacity of the project will be of 8 MW and there is no forecast for additions to this capacity of energy generation, configuring, this way, the classification of this project as a small scale in a Type I Category.

The methodology I.D. "Grid connected renewable electricity generation" is applicable to projects upon the following conditions:

- Projects which comprise renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit;

- If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW;

- In the case of project activities that involve the addition of renewable energy generation units at na existing renewable power generation facility, the added capacity of the units added by the project should be lower that 15MW and should be physically distinct from the existing units;

- Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.

Paragominas Project can be classified in the methodology I.D. “Grid connected renewable electricity generation” for the following aspects:

- It consists on the construction and operation of renewable biomass energy generation unit, with installed capacity of 8MW, which will be connected to the grid displacing the electricity generation from fossil fuel fired units connected to the Brazilian Electrical Interconnected System.

- The Biomass Plant of Paragominas Project is a new installation of electricity generation with installed capacity smaller than 15MW, fitting, therefore, the criteria established by Decision 17/CP.7, to classify CDM project in the Simplified Modalities and Procedures for small-scale CDM project activities

- Paragominas Project will use just renewable biomass to generate electricity, once the waste of the activities of sawmill of the Paragominas city would be left in the yards of these sawmill in the absence of the project, respecting the concept of renewable biomass, according to defined in the Annex 18 of the report of the twentieth meeting of CDM Executive Board (available at the site: http://cdm.unfccc.int/EB/Meetings/023/eb23_repan18.pdf).

It is concluded, therefore, that the Paragominas Project fits in the Category I of small scale projects and that it must apply the methodology I.D. “Grid connected renewable electricity generation” to quantify the emission reduction obtained from the clean energy generation which will be supplied by the project.

Regarding to its classification as small scale project of Type III, it is necessary to evidence the criteria which define this category. According to Decision 17/CP.7 (paragraph 6 (c) (iii)) the activities of Type III are defined as others project activities that both reduce anthropogenic emissions by sources and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually.

According to established in the item B.6.3, the emissions of the Paragominas project activity consists just on the (i) transportation of the biomass to the plant which will make the controlled combustion and the generation of electricity and (ii) on the ashes transportation resulted from the combustion process, in an medium volume of 42.1 tonnes of CO_2 equivalent, being, therefore, smaller than the limit of 15 kilotonnes of carbon dioxide equivalent annually. (Decision 17/CP.7, (paragraph 6 (c) (iii))).

Paragominas Project will avoid the methane production of the biomass that would have otherwise been left to decay under clearly anaerobic conditions throughout the credit period in a solid waste disposal site without methane recovery, once the Project will use the future waste which will be generate.

To avoid the biomass decay Paragominas Project will use the mechanism of controlled combustion in the electricity generation.

B.3. Description of the project boundary:

According to the category I.D., the project boundary encompasses the physical and geographical site of the renewable generation source that, in this case, it is the own location of the waste wood plant of Paragominas Project.

While the category III.E. establishes that the project boundary is the physical and geographical site:

- Where the solid waste would have been disposed or is already deposited and the avoided methane emission occurs in absence of the proposed project activity;
- Where the treatment of biomass through controlled combustion, gasification or mechanical/thermal treatment takes place;
- Where the final residues of the combustion process will be deposited;
- And in the itineraries between them, where the transportation of wastes and combustion residues occurs.

In the absence of the project activity, the residues would be disposed in sawmills of the Paragominas City which are located according table below:

Table 3 – Location of Wood Residues to be used by Paragominas Project

Location	nº	Sawmills	Distance to the Plant (km)
Setor Industrial	1	DALSAM	4.91
Setor Industrial	2	SOMAPAL	4.91
Setor Industrial	3	SOUZA	4.7
Setor Industrial	4	MONTE HOREBE	4.6
Setor Industrial	5	SOUZA	4.5
Setor Industrial	6	ANGELIM	4.41
Setor Industrial	7	PARAJÚ	4.3
Setor Industrial	8	SÃO GABRIEL	4.2
Setor Industrial	9	FLORIMA	4.2
Setor Industrial	10	ITUMBIARA	4.1
Setor Industrial	11	BALESTRERI	4.98
Setor Industrial	12	NEGREIROS	4.98
Setor Industrial	13	BALLA	5.05
Setor Industrial	14	IMAZON	5.15
Setor Industrial	15	CEDROLÂNDIA	5.25
Setor Industrial	16	SERMASA	5.31
Setor Industrial	17	PARAMADEL	5.51
Rodovia dos Pioneiros	18	CARUÓ	3.32
Rodovia dos Pioneiros	19	PIONEIRO EPP	3.49
Rodovia dos Pioneiros	20	PIONEIRO LTDA	3.69
Rodovia dos Pioneiros	21	SEMADAL	4.42
Rodovia dos Pioneiros	22	TRÊS IRMÃOS	4.57
Rodovia dos Pioneiros	23	HORATÓRIO	4.7
Rodovia dos Pioneiros	24	JAE	5.16
Rodovia dos Pioneiros	25	MADEIL	4.98
Rodovia dos Pioneiros	26	CICOMAL	4.98
Rodovia dos Pioneiros	27	COMAL	5.44
Rodovia dos Pioneiros	28	REGIÃO DOS LAGOS	5.26
Rodovia dos Pioneiros	29	GP	5.73
Rodovia dos Pioneiros	30	WVP	5.91
Rodovia dos Pioneiros	31	MADESMA	6.01
Rodovia dos Pioneiros	32	IMAPAL	6.11

Location	nº	Sawmills	Distance to the Plant (km)
Setor PA 125	33	DALMAD	0.88
Setor PA 125	34	SANTA JOANA	1.5
Setor PA 125	35	IPÊ	4.97
Setor PA 125	36	SELECTAS	5.05
Setor PA 125	37	TIMBORANA	7.21
Setor PA 256	38	AMAZONIA	3.07
Setor PA 256	39	SEMPLAI	3.07
Setor KM 11	40	GIMASA	12.81
Setor KM 11	41	IMASEL	13.01
Setor KM 11	42	SÃO FRANCISCO	13.21
Setor KM 11	43	MAVIL	13.41
Setor KM 11	44	KR	13.61
Setor KM 11	45	SÃO JOSÉ	13.81
Setor BR 010 Sentido Norte	46	SENHOR PASSOS	15.3
Setor BR 010 Sentido Norte	47	MADECALI	16.9
Setor BR 010 Sentido Norte	48	MADEPARÁ	17.3
Setor BR 010 Sentido Sul	49	MONTE ALEGRE	14.3
Setor BR 010 Sentido Sul	50	FLORESTA	14.8
Setor BR 010 Sentido Sul	51	CL	15.2
Setor BR 010 Sentido Sul	52	ROSA MADEIREIRA	15.3
Setor BR 010 Sentido Sul	53	DUNORTE	15.3
Setor BR 010 Sentido Sul	54	MADEFAT	15.4
Setor BR 010 Sentido Sul	55	BRIMAD	15.5
Setor BR 010 Sentido Sul	56	MONTE HOREBE	-
Setor BR 010 Sentido Sul	57	LUMAPAL	15.5
Setor BR 010 Sentido Sul	58	JANAINA	15.6
Setor BR 010 Sentido Sul	59	TAROBEX	16.3
Setor BR 010 Sentido Sul	60	PRESERVA	16.4

The wood residues will be combusted to generate electricity in the location of Paragominas Plant. It is still not defined by the project participants which treatment will be given to the ashes resulted of the combustion process. One of the alternatives which are being considered is the use of the ashes by the ceramics industry in the region. With that, the destiny of the ashes might be the city of São Miguel do Guamá, 60km of Paragominas (and of the Plant) where is located the ceramic industry of the region.

This way, the project boundary are located in the sawmills where the residues of wood will be collected, in the itineraries between the residues collection local and the location of the Paragominas Plant, in the location where the residues of the combustion process will be deposited, and in the own location of the plant where will occur the biomass combustion and the generation of electricity.

B.4. Description of baseline and its development:

In the absence of the project activity, organic residues of wood would be left to decay in the project boundary and methane would be left to the atmosphere. Through Paragominas Project, the emission of methane will be avoided and the organic waste in question will be used to generation of electricity to the connected grid, displacing possible more pollutant energy sources. This is the baseline scenario for the project activity which can be divided according to the two categories of the project:

Category I.D.

The baseline of the project component related to the generation of renewable energy connected to the grid is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh) calculated in a transparent and conservative manner according to a combined margin (CM), resulted of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system".

The baseline emission (BEy) resulted from the electricity supplied and/or not consumed by the grid is calculated, as follows:

BEy = EGy* EFgrid,CM,y **Equation 1**

Where:

BEy = Baseline emissions in year y (t CO_2e/yr)
EGy = Electricity supplied by the project activity to the grid (MWh)
$EF_{grid,CM,y}$ = Baseline Emission Factor calculated using the "Tool to calculate the emission factor for an electricity system"

The baseline emission factor (EFgrid,CM,y) is calculated with an weighted average of operating margin emission factor and build margin emission factor, as described below:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Equation 2

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2e/ MWh)
$EF_{grid,OM,y}$ = Operating Margin CO_2 emission in year *y* (tCO_2e/ MWh)
W_{OM} = Weighting of operating margin emissions factor (%)
W_{BM} = Weighting of build margin emissions factor (%)

Category III.E.

The baseline scenario is the situation where, in the absence of the project activity, wood waste is left to decay within the project boundary and methane is emitted to the atmosphere. The yearly baseline emissions are the amount of methane that would have been emitted from the decay of the cumulative quantity of the waste diverted or removed from the disposal site, to date, by the project activity, calculated as the methane generation potential using the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"

The baseline emissions (BEy) represent the amount of methane which, in the absence of the project activity, would be generated through disposal at a solid waste disposal site ($BE_{CH4,SWDS,y}$) and its calculation is based in a first order decay model (FOD). The model differentiates between the different types of waste ***j*** with respectively different decay rates ***kj*** and differente fractions of degradable organic carbon (DOC_j). The model calculates the methane generation based on the actual waste streams $W_{j,x}$ disposed in each year x, starting with the first year after the start of the project activity until the end of the year y, for which baseline emissions are calculated (years ***x***, with x = 1 to x = y).

In the case of project activities combusting only freshly generated wastes, the baseline emissions at any year "y" during the crediting period are calculated using the amount and compositions of wastes combusted since the beginning of the project activity project (year "x=1") up to the year "y", using the first order decay model as referred to in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site".

In the case of Paragominas Project, it will be used only freshly generated wastes and none methane is captured for legal or security measures or combusted in another manner.

The baseline emissions are therefore calculated in the following manner:

$BE_y = BE_{CH4,SWDS,y}$ **Equation 3**

Where:

BE_y = Baseline emissions at year "y" during crediting period;
$BE_{CH4,SWDS,y}$= Yearly Methane Generation Potential of the wastes diverted to be disposed in the landfill from the beggining of the project (x=1) up to the year "y, calculated according to the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"(tCO_2e).

O $BE_{CH4,SWDS,y}$ is calculated as follows:

Equation 4:

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot \left(1-e^{-k_j}\right)$$

Where:

$BE_{CH4,SWDS,y}$ => Methane emissions avoided during the year *y* from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year *y* (tCO2e);
φ => Model correction factor to account for model uncertainties (0.9);
f => Fraction of methane captured at the SWDS and flared, combusted or used in another manner;
$GWP_{CH4\,y}$ => Global Warming Potential (GWP) of methane, valid for the relevant commitment;
OX => Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste);
F => Fraction of methane in the SWDS gas (volume fraction) (0.5);
DOCf => Fraction of degradable organic carbon (DOC) that can decompose;
MCF => Methane correction factor;
Wj,x => Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x* (tonnes);
DOCj => Fraction of degradable organic carbon (by weight) in the waste type *j;*
k_j => Decay rate for the waste type *j;*
j => Waste type category (index);
x => Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year *y* for which avoided emissions are calculated (x = y);
y = Year for which methane emissions are calculated;

According to the described on the methodology III.E, in determining the amount of waste prevented from disposal in the solid waste disposal site, the percentage of the biomass that is combusted in the project activity and which would have been dumped in a stockpile in the baseline situation and also would have remained in the stockpile for a sufficient period of time to decay shall be determined. A quantitative analysis shall, according to the methodology, be carried out using the following options:

1) Project specific waste disposal data from at least 3 years prior to the implementation of the project activity;
2) A control group;
3) Official data sources.

In the case of Paragominas Project, it will be used official data source. It will be used the Quantitative Census on Wood Residues elaborated by Paragominas City Hall on September 2007.

The Census elaborated by Paragominas City Hall points out for the following results:

- Quantity of stocked residues – 388,542 tonnes;
- Annual Production of Residues – 94,662 tonnes, with firewood representing 72% of the residues and sawdust, 28%.
- It is common in the region the selling of part of the firewood residues from sawmills to the Charcoal producers. This fact worsens the pollution present in the city, providing greater emissions of pollutants of the atmosphere and causing numerous social disorders, as can be seen in the pictures presented in the Annex 6.
- Part of sawmills residue is donated to the pottery of the region (around 10%).

The project activity will avoid methane emission caused by the disposal of waste open skies in the yards of the sawmills, as well as the atmosphere pollution and the social problems caused by the activities of coal industries and lime kilns, giving a more “noble” destiny to the residue.

It is described the main parameters which will be used in the application of equation 4 of this PDD, supplied by "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site":

According to the methodological tool, in the application of equation 4 of this PDD, some parameters must be used according to the residue type, temperature and the pluviometric regimen of the region.

To determine the "DOC_j", which corresponds to the Fraction of degradable organic carbon by weight, methodological tool is based on "IPCC 2006 Guidelines for National Greenhouse Gas Inventories" which gives the following instructions:

Table 4 – Fraction of degradable organic carbon (by weigth) in the residue type *j*

Residue type j	**DOC_j (% wet wasteo)**	**DOC_j (% dry waste)**
A. Wood and wood products	**43**	50
B. Pulp, paper and cardboard (other than sludge)	40	44
C. Food, food waste, beverages and tobacco (other than sludge)	15	38
D. Textiles	24	30
E. Garden, yard and park waste	20	49
F. Glass, plastic, metal, other inert waste	0	0

As Paragominas Project will make use of wood residues and it is located in a region considered wet (Mean Annual precipitation higher than 1000mm), with mean pluviometric regimen varying between 2,250mm to 2,500mm, it will be used the value of 43% for the parameter DOC_j".

The "IPCC 2006 Guidelines for National Greenhouse Gas Inventories" indicates that the parameter "k_j" applies the following default values:

Table 5 – Decay rate for the waste type j

Waste type j		Boreal and Temperate (MAT ≤ 20º C)		Tropical (MAT>20º C)	
		Dry (MAP/PET<1)	Wet (MAP/PET>1)	Dry (MAP <1000 mm)	Wet (MAP >1000 mm)
Slowly degrading	Pulp, paper,cardboard, textiles.	0.04	0.06	0.045	0.07
	Wood, wood products and straw	0.02	0.03	0.025	**0.035**
Moderately degrading	Other(non-food) organic putrescible garden and park waste	0.05	0.10	0.065	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40

Note: MAT – Mean Annual Temperature; MAP – Mean Annual Precipitationo, PET – Potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration..

As mentioned before, Paragominas Project will make use of wood residues to the generation of energy and it is located in a region whose average annual temperature is around 25º C and that presents an average annual precipitation that ranges from 2,250mm to 2,500mm, therefore, it will be used the value of 0.035 for the parameter k_j.

It will be used an methane correction factor, MCF, of 0.8; once the residues will be located in unmanaged SWDS with depths greater than or equal to 5 meters.

Project Participants estimate that Paragominas Project will use approximately 86,400 tons of wood residue a year for the generation of electricity expected for the project, a number which is still below the expected annual production of residues in the region and correspondent to approximately 90% of the annual production of wood residues, and to approximately 21% of the total amount stocked in the sawmills present in the census carried upon the Paragominas City Hall in September 2007.

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:

The baseline scenario of Paragominas Project is the reference scenario where the wood residues would be stacked in the yards of the sawmills and the electricity generation would continue to be supplied by the composition of generation of the National Interconnected System, with CO_2 emissions which would reflect the combined margin emission factor.

The Annex A of the Appendix B of the Simplified Modalities and Procedures to Small Scale CDM Project Activities establishes that the project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment Barrier: a financially more viable alternative to the project activity would have led to higher emissions;
(b) Technological Barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new techology adopted for the project activity and so would have led to higher emissions;
(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) Other Barriers: Without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Before analyzing the barriers faced by Paragominas Project, it is necessary to describe the alternative scenarios that would probable take place in the absence of this project's activity.

- The continuity of the current situation, with electricity being generated by the current composition of generation of the National Interconnected System, more specifically Subsystem North and with wood residues from the region's sawmills' activities being deposited open skies in the yards of these establishments;
- The construction of new diesel power plants in the state of Pará with wood residues from the region's sawmills' activities being deposited open skies in the yards of these establishments;
- The implementation of project without incentives from CDM.

In order to provide an ample view on the alternative scenarios, it is valid to sketch a panorama of the current Brazilian electrical sector, its projection for the future and a brief analysis of the energetic matrix in the state of Pará, where Project Paragominas is located.

According to ANEEL, the installed capacity existent in Brazil in July 2008 was as presented in the table below:

Table 6: Brazilian Installed Capacity in Brazil in July/2008

Type	Quantity	Installed Capacity (MW)	% Installed Capacity
CGH	220	115,302	0.11
EOL	16	247,050	0.24
PCH	304	2,098,933	2.07
SOL	1	20	0.00
UHE	159	75,066,931	74.07
UTE	1,015	21,805,506	21.52
UTN	2	2,007,000	1.98
Total	**1,717**	**101,340,742**	**100**

Caption for Table 6:

- *CHG: Hydro Power Plant Central Generation (Installed capacity minor than 1 MW)*
- *EOL: Wind Power Plant*
- *PCH: Small Hydro Power Plant (Installed capacity greater than 1 MW and less than 30 MW)*
- *UHE: Hydro Power Plant (Installed capacity greater than 30 MW)*
- *UTE: Thermal Power Plant*
- *UTN: Nuclear Thermal Plant*
- *SOL: Solar Power Plant*

It is noticed that the Brazilian energetic matrix presents hydro electrical entrepreneurships (responsible for 74.07% of the country's installed potency) and thermo electrical (responsible for 21.52% of the country's installed capacity) as the main responsible of supplying energy to the Interconnected System and that, in terms of entrepreneurships, thermo electrical power plants are the most common kind in the country.

When analyzing the fuel class used in thermo electrical projects in the country, it is noticed that fossil fuels (75.79% of the installed thermo electrical capacity of the country) and biomass (20.09% of the installed thermoelectrical capacity of the country) constitute the main classes of national fuels (source: ANEEL - *http://www.aneel.gov.br/area.cfm?idArea=15&idPerfil=2)* , with diesel and combustive oil representing the source of fuel used by approximately 59% of the thermo electrical entrepreneurships in operation in the country until July 2008 (source: *http://www.aneel.gov.br/area.cfm?idArea=15&idPerfil=2)*.

Analyzing the kind of fuel most used in Brazilian biomass thermo electrical projects, it can be noticed that only 25 projects in the whole country make use of wood residue to generate energy and that the installed capacity of these projects constitute only 4.93% of the capacity of Brazilian thermo electrical projects, representing an even smaller figure in the total energetic matrix in the country. The table below presents the fuels used in the projects that generate energy from biomass in the country:

Table 7: Fuel used by the Biomass Generation Electricity Plants in operation in Brazil in July/2008

Type	Quantity	Installed capacity (MW)	% Installed capacity
Bagasse of Sugar Cane	249	3,229,663	73,73
Black Liquor	13	859,217	19,61
Residues of Wood	25	216,007	4,93
Biogas	3	41,590	0,95
Rice Husk	3	18,920	0,43
Vegetal Coal	2	15,200	0,35
Total	**295**	**4,380,597**	**100**

It is seen that generating electricity from wood residues is not a current practice in the country, once the power plants with this kind of fuel represent a very small percentage among the national thermo electrical entrepreneurships.

In 2006, the Ministry of Mines and Energy (MME) elaborated the Decennial Plan for Electric Energy Expansion to the period of 2006-2015, establishing three possible scenarios, based on the growth projection of the Gross Domestic Product (GDP) of the country. We adopted to this analysis the scenario pointed out by the MME as the most likely to happen, called reference scenario. This reference scenario estimates the necessity of expansion of the Brazilian electrical sector.

From the MME projection, t was traced a plan for the generation expansion based on the energetic offer from the implantation of hydroelectric and thermoelectric generation entrepreneurships.

Table 8: Estimation of Increase in Offer of Energy to 2006-2015 Period by Source of Energy

Source of Energy	Additional Energy Offer (MW)
Hydroelectric	31,144.5
Thermoelectric	10,486
Total	**41,630.5**

The additional offer of 10,486 MW from thermo electrical power plants in the whole country is predicted according to the program of thermo electrical power plant generation described below:

Table 9: Program of Thermo Electrical Generation Construction – Brazil

Plant	Subsystem	Fuel	Capacity (MW)
Termorio	SE/CO/RO*	Natural Gas	670 123 370
Camaçari	NE	Diesel Oil Natural Gas	347 3
Santa Cruz Nova	SE/CO/RO	Diesel Oil	166 316
Vale do Açu	NE	Natural Gas	340
Três Lagoas	SE/CO/RO	Natural Gas	240 110
Canoas	S	Natural Gas	160 90
Cubatão	SE/CO/RO	Natural Gas	216
Goiânia II – BR	SE/CO/RO	Diesel Oil	140
Biomassa – LEN 2005	SE/CO/RO	Biomass	267
Araucária	S	Natural Gas	469
Jacuí	S	Mineral Coal	350
Candiota III	S	Mineral Coal	350
Carvão Indic. S	S	Mineral Coal	350
Biomassa Indic. SE	SE/CO/RO	Biomass	450 400 450
Biomassa Indic. NE	NE	Biomass	250
Gás NE	NE	Natural Gas	2,450 100
Angra III	SE/CO/RO	Uranium	1,309
Total			**10,486**

*SE/CO/RO – The trajectory of reference scenario considers the interconnection of the state of Rondonia and the Southeast/Midwest Subsystem;

From the table above, the following forecast can be summarized for energetic source:

Table 10: Capacity to be installed by Energetic Source

Fuel	Capacity (MW)	%
Natural Gás	5,341	50.93%
Biomass	1,817	17.33%
Uranium	1,309	12.48%
Mineral Coal	1,050	10.01%
Diesel Oil	969	9.24%
Total	**10,486**	**100%**

The tables above indicate there is no expectation to the installation of biomass power plants in Subsystem North (and in the state of Pará) and that the addition in the energy capacity from biomass in the country corresponds to approximately 17% of the total thermo electrical generation to be made available in the following years, not being the main component in the thermo electrical capacity to be installed in the country in a near future.

Data presented in the Decennial Plan for the Expansion of Electrical Power, elaborated by the Ministry of Mines and Energy, predicts the additional energy capacity according to the necessity of expansion of the electric sector in Brazil.

When analyzing the data of the energetic matrix in Pará, where Paragominas Projectis located, the following characteristics are noticed:

Table 11: Entrepreneurships in operation in State of Pará

Entrepreneurships in operation in State of Pará			
Type	**Number**	**Capacity (kW)**	**% Total Capacity**
CGH	2	690	0.01
UHE	2	8,400,300	96.47
UTE	54	306,780	3.52
Total	**58**	**8,707,770**	**100**

Source: http://www.aneel.gov.br/area.cfm?idArea=15&idPerfil=2
Access in July/2008

Caption:

- CHG: Hydro Power Plant Central Generation (Installed capacity minor than 1 MW)
- UHE: Hydro Power Plant (Installed capacity greater than 30 MW)
- UTE: Thermal Power Plant

Through table 11, it is possible to notice that in terms of numbers of entrepreneurships, the thermo electrical power plants are configured as a type of energy generation activity more predominantly developed in the state of Pará. Whereas in relation to the installed capacity, it is observed that the state's main source of energetic capacity is the hydro electrical generation produced by two hydro electrical power plants, runned by a state company (Centrais Elétricas do Norte do Brasil S. A).

Among the 54 thermoelectric power plants in operation in Pará, only two make use of wood residues to the generation of energy, and they are not located in the municipality of Paragominas. They are the power plant Tramontina, located in the state's capital, Belém do Pará, with an installed capacity of 1.5 MW and the power plant of Pampa, with 0.4 MW of installed capacity, located in the same city.

Table 12 below presents the number of power plants and the installed capacity for each type of fuel in operation in July/2008 in the state of Pará:

Table 12: Number of Plants and Installed Capacity of Entrepreneurships of Electricity Generation in the State of Pará.

Fuel	Fuel Class	Installed Capacity (MW)	Number of Plants
Diesel Oil	Fossil	127,734	46
Fuel Oil	Fossil	70,792	2
Mineral Coal	Fossil	40,104	1
Black Liquor	Biomass	55,500	1
Wood Residue	Biomass	1,900	2
Bagasse of Sugar Cane	Biomass	1,250	1
Gás de Alto Forno	Others	10,000	1
Total		**306,780**	**54**

Source:Adapted Information from the website http://www.aneel.gov.br/area.cfm?idArea=15&idPerfil=2
Access in July/2008

It is concluded that thermo electrical energy generation in the state of Pará is mainly based (approximately 77.8% of the total installed capacity) on fossil fuels, chiefly in diesel/combustive oil and that the generation of electricity from the wood residues is not an activity commonly practiced in the region, once the installed capacity of this kind of entrepreneurship does not composed not even 1% of the total thermo electrical energy generation of the state's matrix.

Barriers

The first barrier faced by the project is the financial one. The implementation of the project activity without CDM is not financially feasible; once the Equity IRR without revenues from CDM is too small and it is less than market benchmark.

The project generates financial and economics benefits, other than CDM related income, then, it will be used the benchmark analysis to analyse the project activity.

It will be used the equity internal rate of return (IRR) as a project financial indicator, due to it is one of the most commonly and appropriate indicator used to infrastructure projects` investment analysis. As a benchmark, it was used the yield of a 21 years Brazilian Governmental Bond[2] - BRL 2008 - plus a conservative estimation of risk premium for the project. This Bond was emitted in 2007 and its yield was 10.68%.

As an electricity project presents higher risks than a Governmental Bond, it is appropriate to add a risk premium in the bond yield. The BNDES, National Bank of Social and Economic Development is the main and the cheapest source for Brazilian Loans for infrastructure projects. According BNDES website, the direct spread required by BNDES for investments related to renewable energy is 0.9% per year (source: http://www.bndes.gov.br/infraestrutura/default.asp). Besides that, BNDES estimates that the

[2] http://www.tesouro.fazenda.gov.br/english/public_debt/downloads/informes/Emissao_Global_BRL2028_eng.pdf

Credit Risk Tax for entrepreneurships related to environmental programs can be until 3.57% per year[3]. This tax is established according the risk profile of each company that will receive the investment.

Therefore, in a conservative manner, project participants adopted just the direct spread required by BNDES as the risk premium. With that, the benchmark for Paragominas Project is 11.58% (10.68% + 0.9%).

Without Revenues from Carbon Credits, Equity IRR is 2.83%. With Revenues from Carbon Credits during all project lifetime (20 years), equity IRR becomes 15.36% and it makes the project feasible.

Some assumptions in the investment analysis are described below:

Revenues

The price of electricity was established according the First Brazilian Auction of Renewable Electricity which happened in June 2007. In this auction, the electricity price varied between R$ 134.97 and R$ 139.12. (Evidences about this price were provided to DOE). Project participants expect to sell electricity from this project with a higher price of R$ 150.00.

The capacity factor of this plant will be 90%. Therefore, the amount of electricity is obtained multiplying 8 MW by 90% and by the number of the hours in the year, 8,760.

Investments

The amount of total investment was established based on commercial proposal sent by potential service suppliers – Kroma Energia. This proposal was provided to DOE that execute the validation process.

Loan Costs

The lending rates of BNDES loans contracts are usually indexed to TJLP and the cost of debt is formed by TJLP plus spread. Usually, it is difficult to small companies get loans directly from BNDES and the transaction cost is very high. Therefore, usually a commercial bank intermediates the transaction, bringing more costs to the transaction.

According BNDES site, the direct spread for thermal generation entrepreneurships is formed by TJLP plus 0.9% per year (source: http://www.bndes.gov.br/infraestrutura/default.asp). In the time of elaboration of this PDD, TJLP is 6.25% per year, forming, therefore, a cost of 7.15%. Project Participants estimate a minimum spread of commercial banks of 2.1% per year, being conservative. In general, this spread is higher.

Operational Expenses

- Operation - The cost with operation was based projecting an necessity of 40 employees working at the plant;

3 http://www.bndes.gov.br/ambiente/meio_ambiente.asp

- Maintenance: The plant need to stop working to perform periodic maintenance. Besides that, it is necessary to buy equipments to replace some pieces and equipments. Cost of maintenance covers all these expenses;
- Fuel Transport: The plant need 1.5 ton. of biomass per hour to operate its capacity. Project participants estimate a cost R$ 20.00 per hour based on experiences of others companies with this kind of entrepreneurship.
- Biomass Cost: The biomass cost is estimated based on the negotiation established between Uaná Energias Renováveis and the biomass suppliers.

The Project's cash flow and the main assumptions used in the financial projection are shown in Annex 5 of this PDD. The equity Internal Rate of Return resulting from the cash flow presented without revenues from carbon credits is 2.83% As it was said previously, the revenues from selling Certified Emission Reduction are fundamental to improve the financial attractiveness of the project.

This way, an alternative financially more viable alternative to the project activity which would be do not develop the project activity would have led to higher emissions through (i) the continuity of the current situation, with electricity being generated by the current composition of generation of the National Interconnected System, more specifically Subsystem North and with wood residues from the region's sawmills' activities being deposited open skies in the yards of these establishments or (ii) the construction of new diesel power plants in the state of Pará with wood residues from the region's sawmills' activities being deposited open skies in the yards of these establishments.

To confirm how solid the investment analysis is, project participants elaborated one sensitivity analysis, varying the main parameters that can affect project cash flow: (i) Amount of Investment; (ii) Price of Electricity and (iii) the O&M Cost. Table below provides the results and it shows that the Equity IRR is less than the benchmark in all scenarios analyzed.

Table 13: Sensitivity Analysis

VARIATION ON ELECTRICITY PRICE		
Projected Situation	MWh Price	Equity IRR
0%	R$ 150.00	2.83%
5%	R$ 157.50	6.95%
10%	R$ 165.00	10.83%
VARIATION ON INVESTMENT TOTAL AMOUNT		
Projected Situation	Investment	Equity IRR
0%	R$ 17.897.697	2.83%
-10%	R$ 16.107.927	4.93%
-5%	R$ 17.002.812	3.85%
VARIATION ON O&M COST		
Projected Situation	O&M Cost	Equity IRR
0%	R$ 6,909,880	2.83%
-10%	R$ 6,218,891	9.33%
-5%	R$ 6,564,386	6.17%

Financial Analysis shows that the project needs revenues from carbon credits to exist and that it is additional and it brings emission reductions that will not happen in the absence of the project.

Barrier due to prevailing practice

As presented previously, oil-based thermo electrical power plants are the kind of entrepreneurship of energy generation more commonly implemented in the state of Pará. The projection elaborated by the Brazilian Ministry of Mines and Energy does not predict the construction of any power plant moved by wood residues in the state and there is not, up to the elaboration of this PDD, any power plant that makes use of such residues in operation or being constructed in the city of Paragominas, proving that this kind of entrepreneurship is not common in the region.

The common practice for the thermo electrical entrepreneurships in Pará and in the country as a whole is the installation of oil-based power plants that emit greenhouse gases to the atmosphere, among them CO_2 and CH_4. The continuation of these current practices and the establishment of entrepreneurships projected by the Ministry of Mines and Energy point to a higher emission of green house gases in the absence of the project activity.

The generation of electricity from fossil fuels occurs through their burning in boilers, turbines and motors of internal combustion. This technology is dominated in the state and in the region, and has more accessible raw material than the power plant moved by wood residue.

It is worth to highlight that until the present there is not, neither in the state of Pará or in the state of Paragominas, a specific legislation that obliges the sawmills of the region to provide a specific destiny to the residues from their activities and, as mentioned previously, there are two destinies that have been usually given to them: the accumulation of a great part of these residues in the sawmills' yards, and the sending of a part of them to the production of vegetable coal or to lime kilns, rudimentary ovens to the production of coal.

The predominant practice in the region points, once more, thus, to the occurrence of two alternative scenarios that provide a greater emission of green house gases: (i) the continuation of the current situation, with electricity being generated by the current composition of generation of the National Interconnected System, more specifically of the North Subsystem with residues of wood from activities in sawmills of the region being deposited open skies in the yards of these establishments or (ii) the construction of new oil-based power plants in the state of Pará with wood residues from the region's sawmills' activities being deposited open skies in the yards of these establishments.

The revenue from the sales of CERs is a key point to stimulate that the common practice be overcome and that new alternatives of energy generation, disposition and use of residues from wood-related activities been developed in the region.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

As Paragominas Project fits two categories, the explanation of the choices for each of them will be carried out separately.

The project emission reduction will be the result of the sum of the emission reductions of the two components present in the categories in which the project fits: the component of renewable energy generation connected to the grid (ER_{ID}) and the component of avoided methane (ER_{IIIE}). Emission reductions are calculated according to the following equation:

$$ER_{total} = ER_{ID} + ER_{IIIE}$$ **Equation 5**

<u>Category I.D</u>

Project Emission

Paragominas Project does not present any significant emission for this category.

Leakage

In the renewable energy generation connected to the grid, category I.D., the project does not present any Leakage, once no equipment is being transferred from another activity or to another activity.

Emissions Reduction

As for the category I.D., the project presents neither significant emission nor leakage, the emissions reduction (ER_{ID}) corresponds the own baseline emissions which in the category I.D., are the kWh produced by the renewable generating units multiplied by an emission coefficient (measured in kg CO_2e/kWh) in a transparent and conservative manner.

In the case of Paragominas Project, the emission coefficient will be calculated through the combined margin (CM), which consists on the combination of operating margin (OM) and build margin (BM) according to the procedures described in the "Tool to calculate the emission factor for an electricity system".

The baseline emissions (BEy) resulted from the electricity supplied and/or not consumed by the grid is calculated according the equation 1, described on item B.4, as follows:

BEy = EGy* EFgrid,CM,y **Equation 1**

The baseline emission factor (EFgrid,CM,y) is calculated with an weighted average of operating margin emission factor and build margin emission factor, as was also presented on item B.4 and described below:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Equation 2

Where:
$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2e/ MWh)
$EF_{grid,OM,y}$ = Operating Margin CO_2 emission in year *y* (tCO_2e/ MWh)
W_{OM} = Weighting of operating margin emissions factor (%)
W_{BM} = Weighting of build margin emissions factor (%)

The tool to calculate the emission factor for an electricity system recommends that the following default values should be used for W_{OM} and W_{BM}:

- Wind and Solar power generation project activities: W_{OM} = 0.75 and W_{BM} = 0.25 for the first crediting period and for subsequent crediting periods.
- All other projects: W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period, and W_{OM} = 0.25 and W_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

This way, for Paragominas Project, it was adopted the following weights: W_{OM} = 0.50 and W_{BM} = 0.50.

Calculation of EFgrid, OM,y and EFgrid, BM,y

According to the "Tool to calculate the emission factor for an electricity system", if the DNA of the Host Country has published a delineation of the project electricity system and connected electricity system, these delineations should be used.

This way, in May 2008, through the Resolution nº 8, the Brazilian DNA defined that the National Interconnected System must be considered as a unique System and that this configuration will be valid for calculating the emission factor of CO_2 used to calculate the emission reduction of greenhouse gases in CDM Projects which supply electricity generation connected to the national grid.

From this moment, the Designated National Authority started to make available the operating margin emission factor through the dispatch data analysis and the build margin emission factor for the Brazilian Electrical System, following the methodological tool to calculate the emission factor for an electricity system, approved by Executive Board and published in the Annex 12 of the EB 35 Report.

The CO_2 emission factors for power generation in the Brazilian National Interconnected System (SIN) are calculated based on the generation record of plants centrally dispatched by ONS (National Operator of the National Electric System). The procedures for calculation were elaborated in cooperation between ONS, Ministry of Mines and Energy (MME) and the Ministry of Science and Technology (MCT).

As for the calculation of operating margin through the dispatch data analysis, the Designated National Authority uses the generation dispatch data centrally dispatched by ONS, this data must be updated annually during the monitoring.

This way, it will be used in Paragominas Project, the operating margin emission factor through the dispatch data analysis, calculated according the methodological Tool to calculate the emission factor for an electricity system and made available for the Brazilian Designated National Authority.

The build margin emission factor must be updated annually, *ex-post*, using **the option 2** suggested by the Tool, including those plants built in the year of the project activity registration or, if the information of the registration year is not available, including those plants built in the most recent year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex-ante*, as described in option above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

With operating margin emission factor through dispatch data analysis with the build margin data, made available by the Brazilian DNA, applying weights of 50% for each margin, the equation 1 will be applied to obtain the emission reduction in this category.

Category III.E

According to the methodology III.E, the emissions reduction hit by the project will be measured as the difference between the baseline emissions and the sum of the project emissions and the leakage, according equation below:

$$ER_y = BE_y - \left(PE_y + Leakage_y\right)$$

Equation 6

Where:

ER_y = Emission Reduction in the year “y” (tCO_2e);
BEy = Baseline Emissions in the year y (tCO_2e/ano);
PE_y = Direct Emission of the project activity in the year y (tCO_2e)
$Leakage_y$ = Leakage of the project in the year y (tCO_2e)

Project Activity Emissions (PEy)

The project activity emissions, under the category III.E., are calculated in the following way:

$$PE_y = PE_{y,comb} + PE_{y,transp} + PE_{y,power}$$

Equation 7

Where:

PE_y = Project activity direct emissions in the year "y" (tCO_2e)
$PEy,_{comb}$ = Emissions through combustion and gasification of non-biomass carbon of waste in the year y (tCO_2e)
$PEy,_{transp}$ = Emissions through incremental transportation in the year y (tCO_2e)
$PEy,_{power}$ = Emissions through electricity or diesel consumption in the year y (tCO_2e)

As in the Paragominas Project, the fuel to be used is 100% biomass, and no non-biomass carbon combustion will be used, the $PE_{y,comb}$ is zero, and once the electricity consumed by the project will be generated by the plant itself present in the Paragominas Project which generates electricity from renewable fuel, $PEy,_{power}$ is also zero.

Therefore, the project activity emission under the category consists just on the emissions related to transportation, calculated in the following manner:

$$PE_{y,transp} = (Q_y / CT_y) * DAF_w * EF_{CO2} + (Q_{y,ash} / CT_{y,ash}) * DAF_{ash} * EF_{CO2} + (Q_{y,RDF/SB} / CT_{y,RDF/SB}) * DAF_{RDF/SB} * EF_{CO2}$$

Equation 8

Where:

$PEy,_{transp}$ = Emissions through incremental transportation in the year y (tCO_2e)
Q_y = Quantity of waste combusted, gasified or mechanically/thermally treated in the year "y" (tonnes)
CT_y = Average truck capacity for waste transportation (tonnes/truck);
DAF_w = Average incremental distance for waste transportation (km/truck);
EF_{CO2} = CO_2 emission factor from fuel use due to transportation (tCO2/km)
$Q_{y,ash}$ = Quantity of combustion and gasification residues and residues from mechanical/thermal treatment produced in the year "y"(tonnes);
CT_{ash} = Average truck capacity for waste transportation (tonnes/truck);
DAF_{ash} = Average Distance for residues transportation (km/truck);
$Q_{y,RDF/SB}$ = Quantity of RDF/SB produced in the year "y" (tonnes);
$CT_{RDF/SB}$ = Average truck capacity for RDF/SB transportation (tonnes/truck);
$DAF_{RDF/SB}$ = Aggregate average distance for RDF/SB transportation to the storage in the production site as well as to the end user sites (km/truck);

As there will not be RDF/SB to be produced by the project, the emissions of the project can be summarized to the following simplification of the equation 8:

$PEy_{,transp} = (Q_y / CT_y)*DAF_w*EF_{CO2} + (Q_{y,ash} / CT_{ash})*DAF_{ash}*EF_{CO2}$

Leakage$_y$

In the component of the project related to the avoided methane for the combustion of the residue, category III.E, the project does not present Leakage, once no equipment is being transferred from another activity or to another activity.

Baseline Emissions (BE_y)

In the category III.E., the baseline emissions is the amount of methane that would have been emitted from the decay of the cumulative quantity of the waste diverted or removed from the residue disposal site by the project activity. According to the described on item B.4, the baseline emissions are calculated according to the equation 3, as follows

$BE_y = BE_{CH4,SWDS,y}$ **Equation 3**

Where:

BE_y = Baseline emissions at year "y" during crediting period;
$BE_{CH4,SWDS,y}$ = Yearly Methane Generation Potential of the wastes diverted to be disposed in the landfill from the beginning of the project activity (x = 1) up to the year "y, calculated according to the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"(tCO_2e).

$BE_{CH4,SWDS,y}$ is calculated according equation 4:

Equation 4:

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot (1-e^{-k_j})$$

Where:

$BE_{CH4,SWDS,y}$ => Methane emissions avoided during the year *y* from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year *y* y (tCO2e);
φ => Model correction factor to account for model uncertainties (0.9);
f => Fraction of methane captured at the SWDS and flared, combusted or used in another manner;
$GWP_{CH4\,y}$ => Global Warming Potential (GWP) of methane, valid for the relevant commitment;
OX => Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste);
F => Fraction of methane in the SWDS gas (volume fraction) (0.5);
DOCf => Fraction of degradable organic carbon (DOC) that can decompose;
MCF => Methane correction factor;
Wj,x => Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x* (tons);
DOCj => Fraction of degradable organic carbon (by weight) in the waste type *j;*
k_j => Decay rate for the waste type *j;*

j => Waste type category (index);
x => Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year *y* for which avoided emissions are calculated (x = y);
y = Year for which methane emissions are calculated;

Paragominas Project will use just freshly generated wastes and the project participants estimate that approximately 86,400 tons of wood residues will be used annually by the project. As mentioned previously, Quantitative Census on Wood Residues, carried out by Paragominas' City Hall on September 19th, 2007, points there were 60 sawmills in the region an estimated annual production of 94,662 tons of residues per year.

As Paragominas Project will make use of wood residues and it is located in a region whose average annual temperature is around 25º C, it will be used the value of 0.035 for the parameter k_j.

In the case of Paragominas City, no methane is captured due to legal or safety regulations or combusted in another manner; therefore, "f" is zero.

It will be used the Methane correction Factor, MCF, of 0.8, once the residues will be located in unmanaged SWDS with depths higher than or equal to 5 meters.

As described in item B.4., the project will use wood residues and is located in a region considered humid (average annual precipitation of over 1000mm), with an average annual pluviometric regimen ranging from 2,250mm and 2,500mm, therefore, "DOC_j", used to the calculation of the emission reductions is 43%.

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

Data / Parameter:	**Φ**
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste a solid waste disposal site"
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Oonk et el. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.
Any comment:	

Data / Parameter:	**OX**
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories

Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The residues that will be used are disposed in sawmills yards without any management, therefore, the value to be applied according to the methodology is zero.
Any comment:	

Data / Parameter:	**F**
Data unit:	-
Description:	Fraction of methane in the SWDS gás (volume fraction)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.
Any comment:	

Data / Parameter:	**DOC_f**
Data unit:	-
Description:	Fraction of degradable organic carbon that can decompose
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value used according indicated in "Tool to determine methane emissions avoided from disposal of waste a solid waste disposal site"
Any comment:	

Data / Parameter:	**MCF**
Data unit:	-
Description:	Methane correction factor
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	It will be used the value specified in the methodology III.E./Version 15.1.for freshly generated residues located on unmanaged SWDS with depth greater than or equal to 5 meters.
Any comment:	

Data / Parameter:	**DOC_j**
Data unit:	-
Description:	Fraction of degradable organic carbon (by weight) of the wood residue
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	43%
Justification of the choice of data or description of measurement methods and procedures actually applied :	It will be applied the DOCj for wet wood residues due to the characteristics of the city where the project will happen, as described in item B.4 of this PDD.
Any comment:	

Data / Parameter:	**k_j**
Data unit:	-
Description:	Decay rate for wood residue
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.035
Justification of the choice of data or description of measurement methods and procedures actually applied :	It will be applied the k_j for wood residues located in wet tropical climate zone, according to the characteristics of the city where will happen the project, as described in item B.4 of this PDD.
Any comment:	

Data / Parameter:	**EF_{CO2}**
Data unit:	tCO2/km
Description:	CO_2 emission factor from fuel use due to transportation
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.001097
Justification of the choice of data or description of measurement methods and procedures actually applied :	It will be used the emission factor recommended by IPCC. This value is a default value for Diesel heavy truck without a pollutants control system. This value is conservative and it was used for two similar Biomass Brazilian Projects registered by CDM EB: http://cdm.unfccc.int/Projects/DB/DNV-CUK1176960362.6/view and http://cdm.unfccc.int/Projects/DB/DNV-CUK1140180495.84/view
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

The ex-ante calculation of emission reduction was done, considering the emission reductions from the two categories of the project, as the equation below:

$ER_{total} = ER_{ID} + ER_{IIIE}$ **Equation 5**

ER_{total} = Total Emissions Reduction of the Project (tCO_2e)
ER_{ID} = Emissions Reduction of Electricity Generation Connected to the Grid - Category I.D.
ER_{IIIE} = Emissions Reduction of Avoided Methane Component - Category III.E

It follows below the detail of the Paragominas Project emission reduction calculation.

Ex-ante Calculation of Emissions Reduction - Category I.D (ER_{ID})

As Paragominas Project in its component of renewable electricity generation neither presents significant emission nor leakage, the emissions reductions (ER_{ID}) are the own baseline emissions and are calculated through the direct application of equation 1 below:

ER_{ID} = BEy = EGy* EFgrid,CM,y **Equation 1**

Where:

ER_{ID} = Emissions Reductions of Category I.D (t CO_2e/yr);
BEy = Baseline emissions in year y (t CO_2e/yr);
EGy = Electricity supplied by the project activity to the grid (MWh);
$EF_{grid,CM,y}$ = Baseline emission factor calculated using the "Tool to calculate the emission factor for an electricity system".

<u>EGy (Electricity supplied by the project activity to the grid (MWh))</u>

For EGy estimation, it was considered the following assumptions:

- Installed capacity of the plant of 8 MW;
- Capacity factor of 90%. This capacity factor includes the necessity of hours per year for machinery setup and non-operation. Losses with transmission are also included in this capacity factor.
- The power plant will generate 63.072 MW per year;

Once the first and last year of the credit period do not consider all the months in the year, the calculation of EG_y will be proportional to the quantity of months in each year.

The table below summarizes the parameters used for obtaining the EG_y:

Table 14 – Parameters used in the ex-ante EGy calculation

Installed Capacity (MWh)	Time of Plant Operation (Hours/year)	Capacity Factor	EGy (MW/year)
8.0	8,760	90%	**63,072**

<u>EFgrid, CM,y Calculation</u>

For the estimation of baseline emission factor calculation were used operating margin and build margin data made available by Brazilian Designated National Authority, considering the weight of 50% for each margin, as described in the item B.6.1. The table below shows the data made available by Brazilian DNA and the $EF_{grid,CM}$ for each month of the year 2007.

Table 15 – EFgrid,CM, 2007 Calculation

Emission Factor	January-07	February-07	March-07	April-07	May-07	June-07	July-07	August-07	September-07	October-07	November-07	December-07
$EFgrid_{OM*}$	0.2292	0.1954	0.1948	0.1965	0.1606	0.2559	0.3096	0.3240	0.3550	0.3774	0.4059	0.4865
$EFgrid_{BM*}$	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775
W_{OM}	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
W_{BM}	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
$EFgrid_{CM*}$	**0.1533**	**0.1365**	**0.1361**	**0.1370**	**0.1190**	**0.1667**	**0.1935**	**0.2008**	**0.2163**	**0.2275**	**0.2417**	**0.2820**

Observations:

- The most recent information available by Brazilian Designated National Authority for complete years refers to the year 2007;
- The daily data for Operating Margin Emission Factor is available on Annex 3;
- The hourly data for Operating Margin Emission Factor are available on the links: http://www.mct.gov.br/index.php/content/view/74691.html

The emission factor which will be used for ex-ante estimation of emission reduction of Paragominas Project is 0.1842 which was obtained from simple arithmetic average of National Interconnected System monthly EFgrid,CM, 2007.

With that, the ex-ante estimation of certified emission reduction of component I.D. can be viewed through the table below:

Table 16 – Ex-ante estimation of Emissions Reduction (tCO_2 e) of Paragominas Project – Component Renewable Electricity Generation (ER_{ID})

Period	EGy (MW)	$EF_{grid,\ CM}$ (ton. CO_2e/MWh)	ER_{ID} (ton. CO2e)
2009 (September - December)	21,024	0.1842	3,873
2010	63,072	0.1842	11,618
2011	63,072	0.1842	11,618
2012	63,072	0.1842	11,618
2013	63,072	0.1842	11,618
2014	63,072	0.1842	11,618
2015	63,072	0.1842	11,618
2016 (until August)	42,048	0.1842	7,745
Total	**441,504**		**81,326**

Ex-ante **calculation of Emissions Reduction - Category III.E** (ER_{IIIE})

As mentioned before, according to the methodology III.E., the emissions reductions achieved by the project activity will be measured as equation below:

$$ER_y = BE_y - \left(PE_y + Leakage_y\right)$$

Equation 6

ER_y = Emission Reduction in the year "y" (tCO_2e);
BEy = Baseline Emissions in the year y during the crediting period (tCO_2e/ano);
PE_y = Direct Emission of the project activity in the year y (tCO_2e)
$Leakage_y$ = Leakage of the project in the year y (tCO_2e)

Ex-ante **calculation of the emission of the project activity (PEy)**

As mentioned previously, as in Paragominas Project the fuel to be used is 100% biomass, and there will not be combustion of non-biomass carbon, the $PE_{y,comb}$ is zero, and once the energy consumed by the project will be generated by the plant itself from renewable fuels, the $PE_{y,power}$ is also zero. Therefore, the emissions of Paragominas Project are reduced to transport emissions that will be calculated according to the simplification of equation 8:

$$PEy,_{transp} = (Q_y / CT_y)*DAF_w*EF_{CO2} + (Q_{y,ash} / CT_{ash})*DAF_{ash}*EF_{CO2}$$

For the ex-ante calculation of the Paragominas Project emissions, it was adopted the following parameters:

Q_y = 86,400 tonnes per year (project participants estimation for the annual biomass consume)
CT_y = 20 tonnes/truck;
DAF_w = 8.2 km/truck (Medium Distance from the 60 sawmills to the plant);
EF_{CO2} = 0.001097 tCO2/km (IPCC Default Value);
$Q_{y,ash}$ = Quantity of combustion residues produced in the year "y"(tonnes). The quantity of combustions residues was calculated based on the ash content of the biomass used (1.26% according Certificate emitted by SGS);
CT_{ash} = 20 tonnes/truck;
DAF_{ash} = 60 km/truck (Medium Distance from the plant to the residue disposal location).

Table 17 –E*x-ante* Estimation of Paragominas Project Emissions (tCO_2 e) – Category III.E.

Year	PEy,transp ($tCO2_e$)	Qy (ton)	CTy (ton/truck)	DAFw (km)	$EFCo_2$	$Q_{y,ash}$ (ton)	$CT_{y,ash}$ (ton/truck)	DAF_{ash} (km)
2009 (Sep-Dez)	14.03	28,800	20.00	8.13	0.001097	362.88	20.00	60.00
2010	42.10	86,400	20.00	8.13	0.001097	1,088	20.00	60.00
2011	42.10	86,400	20.00	8.13	0.001097	1,088	20.00	60.00
2012	42.10	86,400	20.00	8.13	0.001097	1,088	20.00	60.00
2013	42.10	86,400	20.00	8.13	0.001097	1,088	20.00	60.00
2014	42.10	86,400	20.00	8.13	0.001097	1,088	20.00	60.00
2015	42.10	86,400	20.00	8.13	0.001097	1,088	20.00	60.00
2016 (Until Aug)	28.07	57,600	20.00	8.13	0.001097	725.76	20.00	60.00
Total	294.7							

$\mathbf{Leakage_y}$

In the component of the project related to the avoided methane production through the combustion, category III.E, the project does not present any Leakage, once no equipment is being transferred from another activity or to another activity.

Baseline Emissions (BE_y)

In the category III.E, the baseline emissions is the amount of methane that would have been emitted from the decay of the cumulative quantity of the waste diverted or removed from the residue disposal site by the project activity. According to the described on item B.4, the baseline emissions are calculated according to the equation 3, as follows

$BE_y = BE_{CH4,SWDS,y}$ **Equation 3**

As it was also described previously, $BE_{CH4,SWDS,y}$ is calculated according equation 4:

Equation 4:

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot \left(1-e^{-k_j}\right)$$

It follows below, therefore, the table of the main parameters used on the calculation of the methane emissions avoided by Paragominas Project.

Table 18 – Main parameters used on the methane emissions avoided calculation

Description	Parameter	Value	Unit	Source
Model correction factor to account for modelo uncertainties.	φ	0.9	Without Unit Measure	Methodological Tool *
Oxidation Factor.	OX	0	Without Unit Measure	IPCC (2006)**
Fraction of Methane captured at the SWDS and flared, combusted or used in another manner	f	0	Without Unit Measure l	Calculated Anually
Global Warming Potential of Methane	GWP_{CH4}	21	tCO_2e/ t CH_4	UNFCCC/Kyoto Protocol
Fraction of methane in the SWDS gas	F	0.5	Without Unit Measure	IPCC (2006)**
Fraction of degradable organic carbon that can decompose	DOC_f	0.5	Without Unit Measure	IPCC (2006)**
Methane Correction Factor	MCF	0.8	Without Unit Measure	Methodological Tool /IPCC (2006)**
Fraction of degradable organic carbon (by weight) of wood residues	DOC_j	43%	%	IPCC (2006)**
Decay Rate of Wood Residue	k_j	0.035	Without Unit Measure	IPCC (2006)**
Quantity of Residues *j* prevented to be disposed in the SWDS in year *x*	Wj,x	86,400	Tonnes	Project Participants.

* Methodological Tool – "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site";
** IPCC (2006) - IPCC 2006 Guidelines for National Greenhouse Gas Inventories

The table below shows the results of baseline emissions of Paragominas Project, applying the equation 4 and data present on table 18.

Table 19 – Baseline Emissions (BEy) of Avoided Methane Production Component of Paragominas Project

Period	BEy (ton. CO2e)
2009 (September - December)	2,147
2010	8,513
2011	14,661
2012	20,597
2013	26,328
2014	31,863
2015	37,207
2016 (until August)	40,221
Total	**181,537**

Emissions Reductions - Category III.E. (ER_{IIIE})

Applying, therefore, the equation 6, the emissions reductions from the avoided methane component, category III, are summarized, according table below:

Table 20 – Emissions Reductions (ER_{IIIE}) of Avoided Methane Production component (Category III.E.) of Paragominas Project

Period	BEy (ton. CO2e)	PE_y (ton. CO_2e)	$Leakage_y$ (ton. CO2e)	ER_{IIIE} (ton. CO2e)
2009 (September - December)	2,147	14	0	2,133
2010	8,513	42	0	8,471
2011	14,661	42	0	14,619
2012	20,597	42	0	20,555
2013	26,328	42	0	26,286
2014	31,863	42	0	31,821
2015	37,207	42	0	37,165
2016 (until August)	40,221	28	0	40,193
Total	**181,537**	**295**	-	**181,243**

Total Emissions Reductions of Paragominas Project

As described previously, the emissions reductions of Paragominas Project are calculated according equation 5 below:

$$ER_{total} = ER_{ID} + ER_{IIIE}$$ **Equation 5**

ER_{total} = Total Emissions Reduction of the project (tCO_2e)
ER_{ID} = Emissions Reduction of Electricity Generation Connected to the Grid - Category I.D.
ER_{IIIE} = Emissions Reduction of Avoided Methane Component - Category III.E

Table 21 shows the ex-ante estimation of total emissions reductions provided by Paragominas Project.

Table 21 – Ex-ante Estimation of Total Emissions Reductions (ER_{total}) of Paragominas Project

Period	ER_{ID} (ton. CO2e)	ER_{IIIE} (ton. CO2e)	Total
2009 (September - December)	3,873	2,133	6,005
2010	11,618	8,471	20,089
2011	11,618	14,619	26,236
2012	11,618	20,555	32,172
2013	11,618	26,286	37,904
2014	11,618	31,821	43,439
2015	11,618	37,165	48,783
2016 (until August)	7.745	40,193	47,938
Total	81,326	181,243	262,568

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

Table 22 – Summary of the ex-ante estimation of Emission Reductions – Category I.D.

Year	Estimation of project activity emissions (tonnes of CO2 e)	Estimation of baseline emissions (tonnes of CO2 e)	Estimation of Leakage (tonnes of CO2 e)	Estimation of overall emission reductions (tonnes of CO2 e)
2009 (September - December)	0	3,873	0	3,873
2010	0	11,618	0	11,618
2011	0	11,618	0	11,618
2012	0	11,618	0	11,618
2013	0	11,618	0	11,618
2014	0	11,618	0	11,618
2015	0	11,618	0	11,618
2016 (until August)	0	7,745	0	7,745
Total	0	81,326	0	81,326

Table 23 – Summary of the ex-ante estimation of Emission Reductions – Category III.E.

Year	Estimation of project activity emissions (tonnes of CO2 e)	Estimation of baseline emissions (tonnes of CO2 e)	Estimation of Leakage (tonnes of CO2 e)	Estimation of overall emission reductions (tonnes of CO2 e)
2009 (September - December)	14	2,147	0	2,133
2010	42	8,513	0	8,471
2011	42	14,661	0	14,619
2012	42	20,597	0	20,555
2013	42	26,328	0	26,286
2014	42	31,863	0	31,821
2015	42	37,207	0	37,165
2016 (until August)	28	40,221	0	40,193
Total	295	181,537	0	181,243

Table 24 – Summary of the ex-ante estimation of Total Emission Reductions of Paragominas Project

Year	Estimation of project activity emissions (tonnes of CO2 e)	Estimation of baseline emissions (tonnes of CO2 e)	Estimation of Leakage (tonnes of CO2 e)	Estimation of overall emission reductions (tonnes of CO2 e)
2009	14	6,019	0	6,005
2010	42	20,131	0	20,089
2011	42	26,278	0	26,236
2012	42	32,214	0	32,172
2013	42	37,946	0	37,904
2014	42	43,481	0	43,439
2015	42	48,825	0	48,783
2016	28	47,966	0	47,938
Total	295	262.863	0	262,568

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

B.7.1 Data and parameters monitored:

Data / Parameter:	***EG_y***
Data unit:	MWh
Description:	Electricity supplied by the project activity to the grid
Source of data to be used:	Project Activity Site (Project Participants)
Value of data	Electricity supplied to the National Interconnected System (The project has a projection of generating 8 MW per hour)
Brief description of measurement methods and procedures to be applied:	Electricity is continually measured and monitored by the System of Supervision of the power plant. The electricity generated by the project will be filed and monitored monthly. The information of generation may be checked (i) through CEEE reports or with (ii) reports provided by the distributing concessionaire of the electricity or (iii) through sales receipts if necessary.
QA/QC procedures to be applied:	The uncertainty level for these data is low. They will be used to calculate the emission reductions. The electricity generated will be monitored by the project participants and it will be checked by reports provided by (1) CCEE or by (2) by the distributing concessionaire of the electricity or (3) by receipt of sales.
Any comment:	Data collected monthly and consolidated annually.

Data / Parameter:	Combined Margin ($EF_{grid,CM,y}$) CO_2 Emission Factor
Data unit:	tCO_2/MWh
Description:	The combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".
Source of data to be used:	Ex-post emission factor will be calculated by MCT with ONS data. The variables $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$, necessary for $EF_{grid,CM,y}$ calculation, will be also monitored and calculated by MCT and ONS, through the Dispatch Data of the National Interconnected System.
Value of data	The values of ($EF_{grid,CM,y}$) Combined Margin CO_2 Emission Factor which were used for ex-ante estimation of emission reduction of Paragominas Project is 0.1842 which was obtained from simple arithmetic average of National Interconnected System monthly EFgrid,CM, 2007.
Brief description of measurement methods and procedures to be applied:	The value will be made available by Brazilian National Authority according data of ONS – National System Operator. The emission factor is calculated as described in the most recent version of the "Tool to calculate the emission factor for an electricity system".
QA/QC procedures to be applied:	As described in the most recent version of the "Tool to calculate the emission factor for an electricity system". The uncertainty level for these data is low.
Any comment:	Data collected monthly and consolidated annually.

Data / Parameter:	F
Data unit:	-
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner.
Source of data to be used:	SWDS visit
Value of data	0 (estimated)
Brief description of measurement methods and procedures to be applied:	It will be carried out periodically (probably with the City Hall of Paragominas together) a research to evaluate if there is any fraction of methane captured at the SWDS and flared, combusted or used in another manner.
QA/QC procedures to be applied:	It will be monitored by Project Participants annually. Probably, project participants will act with the City Hall of Paragominas to monitor this parameter and to assure the data quality.
Any comment:	Presently, there are no sawmills in Paragominas capturing methane gas for burning, combustion or use of any other kind. There is also no prediction for projects of this kind in the region. Data monitored annually.

Data / Parameter:	GWP_{CH4}
Data unit:	$tCO_2e/t\ CH_4$
Description:	Global Warming Potential (GWP) of methane, valid for the relevant commitment period.
Source of data to be used:	Decisions under UNFCCC and Kyoto Protocol

Value of data	21 (for the first commitment period)
Brief description of measurement methods and procedures to be applied:	Not applicable. Value provided by Decisions under UNFCCC and Kyoto Protocol
QA/QC procedures to be applied:	Not applicable. Value provided by Decisions under UNFCCC and Kyoto Protocol
Any comment:	

Data / Parameter:	$\mathbf{W_x}$
Data unit:	Tonnes
Description:	Total Amount of organic waste prevented from disposal in year x
Source of data to be used:	Measured by project participants.
Value of data	It is estimated an annual consume of 86,400 tonnes of wood residues per year.
Brief description of measurement methods and procedures to be applied:	Probably, project participants will use a mechanical scale and internal registration to monitor the biomass quantity that will be used by the project. However, this procedure is not 100% defined yet.
QA/QC procedures to be applied:	Project Participants will use a mechanical scale and internal registration to monitor the quantity of biomass that will be used. The uncertainty level for these data is low, because it is one of the most important parameter for the project and it will be monitored continuously.
Any comment:	Data monitored continuously and aggregated monthly and annually.

Data / Parameter:	$\mathbf{Q_y}$
Data unit:	Tonnes
Description:	Quantity of waste combusted, gasified or mechanically/thermally treated in the year "y".
Source of data to be used:	Measured by project participants.
Value of data	It is estimated an annual consume of 86,400 tonnes of wood residues per year. This data will be probably equal to the Total Amount of organic waste prevented from disposal in year x ($\mathbf{W_x}$)
Brief description of measurement methods and procedures to be applied:	Probably, project participants will use a mechanical scale and internal registration to monitor the biomass quantity that will be used by the project.
QA/QC procedures to be applied:	Project Participants will use a mechanical scale and internal registration to monitor the quantity of biomass that will be used. The uncertainty level for these data is low, because it is one of the most important parameter for the project and it will be monitored continuously.
Any comment:	Data monitored continuously and aggregated monthly and annually.

Data / Parameter:	$\mathbf{CT_y}$
Data unit:	Tonnes/truck

Description:	Average truck capacity for waste transportation
Source of data to be used:	Measured by project participants.
Value of data	It is estimated a medium capacity of 20 tonnes/truck.
Brief description of measurement methods and procedures to be applied:	The average truck capacity will be measured by project participants through the use of internal spreadsheets forms. There will be spreadsheets that will be filled with information by the operators that will work directly in the plant. This data will be monitored continuously and aggregated monthly and annually.
QA/QC procedures to be applied:	Spreadsheets will be filled by operators trained to control this information.
Any comment:	

Data / Parameter:	**DAF_w**
Data unit:	km/truck
Description:	Average incremental distance for waste transportation
Source of data to be used:	Measured by project participants.
Value of data	8.2 km/truck (Medium Distance from the 60 sawmills to the plant);
Brief description of measurement methods and procedures to be applied:	The average incremental distance for waste transportation will be measured by project participants through the use of internal spreadsheets forms (the same spreadsheet form used to monitor CT_y). There will be spreadsheets that will be filled with information by the operators that will work directly in the plant. This data will be monitored continuously and aggregated monthly and annually.
QA/QC procedures to be applied:	Spreadsheets will be filled by operators trained to control this information.
Any comment:	

Data / Parameter:	**$Q_{y,ash}$**
Data unit:	Tonnes
Description:	Quantity of combustion and gasification residues from mechanical/thermal treatment produced in the year “y”
Source of data to be used:	Measured by project participants.
Value of data	The quantity of combustions residues was calculated based on the ash content of the biomass to be used by the project (1.26% according Certificate emitted by SGS)
Brief description of measurement methods and procedures to be applied:	Probably, project participants will use a mechanical scale and internal registration to monitor combustions residues that will be generated by the project.
QA/QC procedures to be applied:	Project Participants will use a mechanical scale and internal registration to monitor the quantity of ashes to be generated by the project. This parameter will be monitored continuously.
Any comment:	Data monitored continuously and aggregated monthly and annually.

Data / Parameter:	**CT_{ash}**
Data unit:	Tonnes/truck
Description:	Average truck capacity for waste transportation (tonnes/truck);
Source of data to be used:	Measured by project participants.
Value of data	It is estimated a medium capacity of 20 tonnes/truck.
Brief description of measurement methods and procedures to be applied:	The average truck capacity will be measured by project participants through the use of internal spreadsheets forms. There will be spreadsheets that will be filled with information by the operators that will work directly in the plant. This data will be monitored continuously and aggregated monthly and annually.
QA/QC procedures to be applied:	Spreadsheets will be filled by operators trained to control this information.
Any comment:	

Data / Parameter:	**DAF_{ash}**
Data unit:	km/truck
Description:	Average distance for residues transportation
Source of data to be used:	Measured by project participants.
Value of data	60 km/truck (Medium Distance from the plant to the residue disposal location that will be probably the city of São Miguel do Guamá);
Brief description of measurement methods and procedures to be applied:	The average incremental distance for waste transportation will be measured by project participants through the use of internal spreadsheets forms (the same spreadsheet form used to monitor CT_{ash}). There will be spreadsheets that will be filled with information by the operators that will work directly in the plant. This data will be monitored continuously and aggregated monthly and annually.
QA/QC procedures to be applied:	Spreadsheets will be filled by operators trained to control this information.
Any comment:	

B.7.2 Description of the monitoring plan:

The monitoring plan described below is elaborated according to the monitoring methodology present in category I.D. and in the category III. E and will be executed through an integrated manner by the project participants:

Responsibilities

- Uaná Energias Renováveis: Operator and Owner of the Thermo Electrical Plant Paragominas. It is responsible for all activities related to the plant's operation and maintenance, as well as for the measurements of the monitored data.

- Enerbio Consultoria – Responsible for monitoring data interpretation and for project emissions and project emissions reductions calculation. Enerbio Consultoria is also responsible for the development of periodic monitoring reports and will asses in all monitoring of the project during all crediting period.

- Operation and Maintenance Team: responsible for activities related to the plant's operation and maintenance and responsible for collection information directly in the Paragominas Plant meters. The Operation and Maintenance Team is also responsible for consolidation and analysis of monthly generation spreadsheets.

- Measurement Outsourced Agent: Part of the Operation and Maintenance Team responsibility can be outsourced with a Measurement Agent's hiring. In this case, the Operation and Maintenance Team is responsible for supervising the work performed by the Measurement Outsourced Agent.

- Electric Power Commercialization Chamber (CCEE): it is responsible for implantation, operation and maintenance of SCDE, to enable the collection of electric energy's data for the use of Accounting and Settlement System (SCL), aiming at assuring the accuracy of the amounts measured, as well as the meeting of the required deadlines

- Calibration Outsourced Agent: Agent hired according the legal requirements of Brazil to make calibration of the measurement equipments used in the projects.

<u>Process Description</u>

I – Procedure of Generation Data Collection

There are two data collection channels in each measurement points. A channel is used by the company for direct collection and the other one is used by CCEE for data sent validation.

In the company, the Operation and Maintenance Team is responsible for obtaining data directly from the meters and make available in files on xml format. Data obtained by the company are sent daily to CCEE through SCDE system which makes the National Interconnected Grid measurement point generation and consumption data's collection and treatment.

The Operation and Maintenance Team is also responsible for generating, at each month in the first working day, based on consultation from a meters` database, the spreadsheets with the generation data, consolidated hourly, regarding the previous month. These files are sent to CCEE in TXT format.

The procedure quoted above might be outsourced through a Measurement Agent's hiring. In this case, the Special Measurement Area is responsible for supervising the work performed by the Measurement Outsourced Agent

In CCEE, the collected data, through SCDE, are transferred to the software SCL to accounting and financial clearance based on the CCEE's Rules and Procedures for Commercialization

II – Data Consolidation Procedure:

Uaná Energia Renováveis compares data available and if an inconsistency occurs, it will be generated a non-conformity report that will verify with CCEE the cause for the disagreement between the information

III – Data Storage:

The generation information, both the internally generated and the spreadsheets generated through the CCEE website, are electronically stored by the Operation and Maintenance Team.

IV – Confronting of the internal generation data with the third part reports

The internal information might be confronted with (i) data available on CCEE *website* or with (ii) reports supplied by the electricity concessionaire or (iii) with the electricity receipt of sale.

Quantity of biomass used in the project

Uaná Energias Renováveis will be responsible of monitoring the wood residues to be used in the generation of electricity. The measurement should reflect the total amount of biomass fed into the boilers. Data will be obtained though a mechanical scale that will be calibrated periodically, according to the national quality standards. This procedure is not 100% defined yet.

The total quantity of biomass used by the project will be registered and filed daily and the information of this quantity will be sent monthly to Enerbio Consultoria for monitoring and emission reduction calculation.

Meters Calibration

The calibration of meters will follow what was described on the document elaborated by ONS – Sub module 12.3 - Maintenance of the measurement system for billing, which establishes that:

(a) The periodicity for the responsible agent's preventive maintenance for Measurement System for Billing (SMF) is of 2 (two) years at the most. That periodicity can be altered in function of the occurrence history observed for all facilities.

(b) The preventive maintenance can be postponed by the period of up to 2 (two) years, in the case of happening inspection in the measurement point. The postponement of that maintenance starts to apply from the inspection date.

Emission Factor

The emission factors will be calculated each year as described on the item B.6.1. To calculate the emission factors will be used data supplied by Ministry of the Science and Technology (MCT) (www.mct.gov.br), institution which chairs the Brazilian DNA. Enerbio Consultoria will be responsible for obtaining data made available by Brazilian DNA and for calculating the emissions reductions related to the renewable electricity generation.

Emissions of the project

The average capacity of the trucks that will transport the wood residue to be used by the project and the average capacity of the trucks that will transport the residue ashes of the project will be measured by the project participants and the emissions of the project from the transportation will be calculated monthly by Enerbio Consultoria.

Monthly report

Throughout the whole credit period Enerbio Consultoria will elaborate monthly an internal control report with the data provided by Uaná Energias Renováveis, aiming at monitoring the activities and the emission reductions propitiated by the project. The format of this report is to be defined, but will contain, at least, the following information:

- Generation of energy supplied to the network;
- Monthly emission factor (if available through DNA);
- Quantity of biomass monthly used;
- Average capacity of the trucks used;
- Project's emissions;
- Project's emissions reductions.

Period of Archiving

All data collected as part of the monitoring will be archived and be kept for at least 2 years after the end of the last crediting period.

Backup Procedure

Periodically, the Information Technology Area accomplishes an insurance backup for all company's data through a Data Server *backup.*

Census on the biomass of the region

Throughout the crediting period, Uaná Energias Renováveis will carry out an annual census through the data made available by official entities of the region or through data elaborated through studies ordered by it, about the percentage of residues used in Paragominas Project that would have been deposited in another way without recuperation of methane and that would be decomposed in anaerobic conditions in the places of residue disposal.

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 baseline study and monitoring methodology for the project activity were elaborated by Enerbio Consultoria and they were completed on 01/08/2008. Enerbio Consultoria is also a project participant.

Responsible for the project and participant listed on Annex I with the contact information

Eduardo Baltar de Souza Leão
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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:

02/01/2009

Until the starting date of the validation process, Uaná Energias Renováveis did not have any contract signed for equipment supply and it did not start any activity related to the construction of the plant.

The starting date of the project activity was determined according to the entrepreneur expectation about the emission of installation license of the Thermo Electrical Plant of Paragominas Project. The emission of the Installation License will provide to Uaná Energias Renováveis the right to start the entrepreneurship construction. The prevision for the construction beginning was 02/01/2009 at the beginning of the validation process and the prevision for the Installation License emission was 01/12/2008.

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

20 years.

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

The project activity will use renewable crediting period.

C.2.1. Renewable crediting period

7 years and it can be renewed at most two times

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

The date which occurs later between:

- 01/09/2009 (Prevision for Operation Beginning);
- Date of Project Registration in CDM EB.

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

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

According to the law 5,887 of May 9th, 1995, which accounts for the Environment Politics of the State of Pará, the construction, installation, amplification, reform and functioning of entrepreneurships and activities that use and exploit natural resources, considered effective or potentially pollutant, as well as the ones capable of causing significant environmental degradation, in any way, will depend on previous licensing of the environmental organ, that, on its side, will depend on the evaluation of environmental impacts.

The evaluation of environmental impacts is composed by two main instruments. The (1st) Prior Study on Environmental Impact – PSEI (From the Portuguese: EPIA), which is instrument to analysis of processes and methods on the viability of the implantation of the work or activity and (2nd) Report on Environmental Impact – REI (From the Portuguese: RIMA), that will reflect the conclusions of PSEI and aims at transmitting key information of the mentioned study through accessible language to all the segments of the population, so as to render possible the knowledge on the advantages and disadvantages of the project, as well as all the environmental consequences of its implantation.

The environmental organ, having received REI, will establish a deadline for receiving comments from the public organs and other interested parties and whenever judged necessary will promote the realization of public audience. These will be destined to provide information on the project and its environmental impacts and to render possible the discussion and debate on REI.

Both PSEI and REI can be dismissed in case the environmental organ understands the project's activity offers few impacts. However, for the licensing of the construction or activity that dismisses the elaboration of PSEI/REI, the environmental organ may demand other specific instruments to the evaluation of environmental impacts.

Only after the consideration of the Interested Parties the project can begin its licensing phase, which is composed by the following levels:

- Previous License (PL) – emitted in the preliminary phase of activity, resulting from the analysis of the basic requirements to be attended regarding its location, installation and operation, being observed the ecologic-economical zone guidelines, without failure in attendance to what is established in the plans of use and occupation of the soil;
- Installation License (LI) – issued after the previous phase, which authorizes the implantation of the activity, according to the specifications in the executive project approved;
- Operation License (LO) – emitted after the previous phase, which authorizes the operation of the activity and the functioning of its environmental control machinery, according to what is established in the Previous License and License for Installation.

The local environmental organ has understood Paragominas Projectis as one project of low negative environmental impact and with very positive consequences to the region. This way, the elaboration of PSEI was not required; however, it was demanded to the project a description about its activities according to the Term of Reference for Industrial Projects, which will be delivered to EOD for its validation.

Uaná Energias Renováveis has demanded the Previous License for the entrepreneurship in August 2008. Until the elaboration of this PDD, the PL was being analyzed by the Local Environmental Organ.

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:

The environmental impacts of the project activity are not considered significant by the Host Party. The Term of Reference for Industrial Projects elaborated by Uaná Energias Renováveis will be delivered to the EOD which will validate the project.

SECTION E. Stakeholders' comments

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

According to Resolution nº 1 of Brazilian DNA, local stakeholder must be invited to comment the CDM Project.

Therefore, the project proponents sent letters to the local stakeholders inviting them to make comments about the project. The following stakeholders were invited to make comments about the Project:

- City Hall of Paragominas;
- Municipal Assembly of Paragominas;
- Paragominas Secretary of Environment;
- UMAMP (Municipal Union of Residents Association of Paragominas);
- State Secretary of Environment;

- Federal Attorney of Public Interest;
- State of Pará Attorney of Public Interest;
- Brazilian Fórum of NGO's and Social Movements for Environment and Development.

The call-letters were sent before the validation process and a 15 days term was given for the local stakeholders to make some pronunciation and giving opinions about Paragominas Project.

The PDD was available to public comments for the local stakeholders at the website www.enerbio-rs.com.br. It was given the possibility of the receiving of the PDD in written version for reading and comments.

E.2. Summary of the comments received:

So far, the project has not received any comments.

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

It is not applicable, because so far the project has not received any comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding coming from Annex I countries was used in this project.

Annex 3

BASELINE INFORMATION

From 2006, the MCT in cooperation with the MME and ONS, started to make available the calculation methodology for CO_2 emission factor for grid-connected electricity generation in the Brazilian National Interconnected System according to ACM0002 Methodology using dispatch data analysis. The emission factor started to be widespread for each Subsystem of Brazilian Interconnected System.

In May 2008, the Designated National Authority of CDM in Brazil defined that the National Interconnected System must be considered as a unique System and, this way, this configuration started to be valid for calculating the emission factor of CO_2 used to calculate the emission reduction of greenhouse gases for CDM Projects of electricity generation connected to the grid.

The calculation of emission factor of CO_2, published by Brazilian DNA, follows the methodological tool "Tool to calculate the emission factor for an electricity system" approved by the CDM Executive Board and published in the Annex 12 of EB 35 Report.

The tables below present the values considered to calculate the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$) which were used for *ex-ante* estimation of emission reduction of Paragominas Project. All these data were provided by the Brazilian DNA

Table 25 – Monthly Medium Operating Margin Emission Factor of the year of 2007– Brazilian Interconnected System

Medium Emission Factor (tCO2/MWh) - **MONTHLY**													
2007		Month											
		January	February	March	April	May	June	July	August	September	October	November	December
		0,2292	0,1954	0,1948	0,1965	0,1606	0,2559	0,3096	0,3240	0,3550	0,3774	0,4059	0,4865

Table 26 – Daily Medium Operating Margin Emission Factor of the year of 2007– Brazilian Interconnected System

Medium Emission Factor (tCO_2/MWh) - **DAILY**													
2007		Month											
	Day	January	February	March	April	May	June	July	August	September	October	November	December
	1	0,1989	0,1965	0,2466	0,2204	0,2620	0,1409	0,3254	0,2625	0,3402	0,3753	0,3359	0,3831
	2	0,2314	0,2260	0,2102	0,1929	0,1999	0,1634	0,2933	0,2989	0,3854	0,3700	0,4556	0,4286
	3	0,2270	0,2059	0,1878	0,1957	0,1497	0,1975	0,2692	0,3305	0,2882	0,3753	0,4557	0,3761
	4	0,2322	0,2195	0,2205	0,1960	0,1618	0,1898	0,2790	0,3591	0,3042	0,3731	0,5588	0,3791
	5	0,2146	0,1496	0,2252	0,1982	0,1703	0,2706	0,2833	0,3619	0,3491	0,3296	0,4773	0,3884
	6	0,2758	0,1458	0,2346	0,1951	0,1820	0,2478	0,2928	0,2978	0,3467	0,3683	0,3686	0,3935
	7	0,2812	0,1845	0,2334	0,2124	0,1394	0,2747	0,3280	0,2553	0,4455	0,4927	0,3534	0,4359
	8	0,2579	0,1471	0,1923	0,2353	0,1259	0,2484	0,3944	0,2603	0,4297	0,3922	0,3520	0,4885
	9	0,2592	0,1640	0,2040	0,2223	0,1342	0,2983	0,3491	0,2944	0,4108	0,3679	0,3798	0,5143
	10	0,2179	0,1749	0,1860	0,1958	0,1713	0,3292	0,3201	0,3215	0,2859	0,3799	0,4743	0,3831
	11	0,2232	0,2131	0,2033	0,1861	0,1717	0,2817	0,2915	0,3471	0,2579	0,3793	0,5057	0,3245
	12	0,2254	0,1746	0,1804	0,1600	0,1950	0,2592	0,2809	0,3805	0,2480	0,4448	0,3967	0,3439
	13	0,2627	0,1726	0,1767	0,1614	0,2243	0,2613	0,3009	0,3255	0,2836	0,4945	0,3995	0,4192
	14	0,3102	0,1705	0,2027	0,2150	0,1676	0,2616	0,3263	0,3382	0,2845	0,5172	0,3629	0,4146
	15	0,2554	0,1832	0,2215	0,2264	0,1633	0,3048	0,3395	0,3516	0,3674	0,4061	0,4286	0,4129
	16	0,1978	0,1736	0,2156	0,1922	0,1557	0,2904	0,3307	0,3148	0,4407	0,3679	0,4486	0,4935
	17	0,1988	0,1934	0,2324	0,2236	0,1515	0,3182	0,3214	0,3025	0,3677	0,3552	0,4881	0,4501
	18	0,2114	0,2292	0,2553	0,2256	0,1455	0,2640	0,3245	0,3867	0,3491	0,3640	0,5123	0,4570
	19	0,2213	0,2073	0,2199	0,2072	0,1391	0,2324	0,3133	0,4149	0,3758	0,3606	0,4010	0,4710
	20	0,2253	0,2465	0,1924	0,1767	0,1274	0,2380	0,3050	0,3512	0,3577	0,4013	0,3839	0,5208
	21	0,2478	0,2514	0,1809	0,1849	0,1113	0,2341	0,3359	0,3438	0,3395	0,4714	0,3763	0,5127
	22	0,2107	0,2267	0,1727	0,1905	0,1155	0,2434	0,3229	0,3478	0,4127	0,3727	0,3752	0,6000
	23	0,1816	0,2098	0,1450	0,1789	0,1510	0,2615	0,3005	0,3396	0,4503	0,3465	0,3437	0,6587
	24	0,1727	0,1935	0,1415	0,1931	0,1551	0,3127	0,2856	0,3030	0,3525	0,3353	0,4072	0,6614
	25	0,2158	0,2000	0,1167	0,1789	0,1424	0,2790	0,2958	0,3649	0,3931	0,3273	0,4748	0,6913
	26	0,2155	0,1720	0,1466	0,1649	0,1795	0,2413	0,3037	0,3844	0,3710	0,3159	0,3936	0,5878
	27	0,2411	0,2080	0,1703	0,1643	0,2215	0,2454	0,2951	0,3154	0,2954	0,3433	0,3756	0,5647
	28	0,2521	0,2555	0,1530	0,1552	0,1781	0,2622	0,3188	0,2828	0,3486	0,3641	0,3470	0,5873
	29	0,2273		0,1806	0,2464	0,1442	0,2659	0,3472	0,2889	0,4057	0,3375	0,3140	0,6143
	30	0,2360		0,1844	0,2295	0,1416	0,2840	0,2814	0,2785	0,4581	0,3435	0,3407	0,6485
	31	0,2113		0,2113		0,1453		0,2778	0,2934		0,3136		0,6693

The hourly average emission factors are also available on the link: http://www.mct.gov.br/index.php/content/view/72901.html (accessed in July/2008), respectively. The operating margin emission factor is calculated for Brazilian National Interconnected System for each hour based on the value of energy dispatched by each plant, generation cost of each plant (dispatch priority), hourly exchange with neighboring subsystem and emission factors for thermoelectric plants.

The dispatch order for Brazilian Interconnected System is: hydroelectric power plants, wind, nuclear, imports from other systems in ascending order of cost, thermoelectric power plants in ascending order of generation cost.

The tables below present the data concerned to the build margin emission factor ($EF_{grid,BM,y}$) used for project ex-ante emission reduction estimation.

Table 27 – Build Margin Emission Factor of the year 2007 – National Interconnected System

Medium Emission Factor (tCO_2/MWh) - **ANNUAL**		
2007		
		0,0775

*Source: Designated National Authority (*http://www.mct.gov.br/index.php/content/view/72901.html (accessed in july/2008)

The build emission factor is the average emission factor of the most recent plants of the subsystem. This set should comprise at least 5 plants and its installed capacity should be greater than 20% of installed capacity of the subsystem.

Others information about the baseline scenario and baseline emissions is presented on item B.

Annex 4

MONITORING INFORMATION

All information related to the monitoring of the project are described on item B.7..

Annex 5

CASH FLOW AND FINANCIAL ASSUMPTIONS USED

It follows below in detail the financial assumptions used in the cash flow of the project:

Table 28 – Assumptions used in the Project Cash Flow

	ASSUMPTIONS		
A	**MW Generation**	8,0	
B	**Quantity of Months for New Equipment Implantation**	20	
C	**FUEL PRICE**		
c1	Product Price (R$)	10,00	
c2	Freight Price (R$)	20,00	
D	**Tonnes Hour**	1,5	
	INVESTIMENTS AND CREDITS		
1.1	Total Investment	R$	17.897.696,72
1.2	Equity	R$	8.000.000,00
1.3	Debt	R$	9.897.696,72
1.4	Medium Depreciation (10 years)	R$	1.789.769,67
	ELECTRICITY PRODUCTION		
2.1	Capacity Factor		0,9000
2.2	Total Electricity Generated	MWh/year	63.072
2.3	Fuel Necessary (1,5t/MWh)	t/year	94.608
2.4	Carbon Credits Per Year	t/year	37.509
2	**Net total electricity generated to the grid during the year**	**MWh/year**	**63.072**
	CO2		
3	**Quantity of CO2 replaced (1t dof CO2 / MWh)**	**Ton/year**	
	PRICE		
4.1	Electricity Price	R$ / MWh	150,00
4.2	Carbon Credits Price	R$ / t	
	REVENUES		
5.1	Revenues with Electricity Generation	R$/year	9.460.800,00
5.2	Revenues with Carbon Credits Selling	R$/year	0,00
5.3	Others Revenues	R$/year	0,00
5	**Total Annual Revenue**	**R$/year**	**9.460.800,00**
	EXPENSES AND COSTs WITH OPERATION AND MAINTENANCE (O&M)		
6.1	Operation	R$/year	1.997.280,00
6.2	Consumables	R$/year	323.000,00
6.3	Maintenance	R$/year	846.000,00
6.4	Administratives Expenses	R$/year	240.000,00
6.5	Fuel	R$/year	1.051.200,00
6.6	Fuel Transportation	R$/year	2.102.400,00
6.7	Aneel Supervision Tax	R$/year	50.000,00
6.8	Insurance	R$/year	200.000,00
6.9	Others	R$/year	100.000,00
6	**Total Expenses and O&M Costs**	**R$/year**	**6.909.880,00**

The cash flow which results an Equity Internal Rate of Return of 2.83% is presented below

Table 29 – Cash Flow of Paragominas Project

Description	0	1	2	3	4	5	6	7	8	9
GROSS REVENUE	**0**	**0**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**
Taxes (PIS and COFINS)			(875.124)	(875.124)	(875.124)	(875.124)	(875.124)	(875.124)	(875.124)	(875.124)
NET REVENUE	**0**	**0**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**
Operational Expenses	0	0	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)
GROSS PROFIT	**0**	**0**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**
Loan Interest BNDES	0	0	(677.579)	(677.579)	(677.579)	(677.579)	(677.579)	(677.579)	(677.579)	(677.579)
Loan Amortization	0	0	(1.476.682)	(1.476.682)	(1.476.682)	(1.476.682)	(1.476.682)	(1.476.682)	(1.476.682)	(1.476.682)
Depreciation			(1.789.770)	(1.789.770)	(1.789.770)	(1.789.770)	(1.789.770)	(1.789.770)	(1.789.770)	(1.789.770)
EARNING BEFORE INCOME TAX AND SOCIAL CONTRIBUTIO	**0**	**0**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**
Income Tax and Social Contribution	0	0	0	0	0	0	0	0	0	0
NET PROFIT	**0**	**0**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**	**(2.268.235)**

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
EQUITY CASH FLOW										
Equity Investment	R$ (5.280.000,00)	R$ (2.720.000,00)								
Gross Profit	R$ -	R$ -	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00
Financial Expenses	R$ -	R$ -	R$ (2.154.261,70)	R$ (2.154.261,70)	R$ (2.154.261,70)	R$ (2.154.261,70)	R$ (2.154.261,70)	R$ (2.154.261,70)	R$ (2.154.261,70)	R$ (2.154.261,70)
EQUITY CASH FLOW	**R$ (5.280.000,00)**	**R$ (2.720.000,00)**	**R$ (478.465,70)**	**R$ (478.465,70)**	**R$ (478.465,70)**	**R$ (478.465,70)**	**R$ (478.465,70)**	**R$ (478.465,70)**	**R$ (478.465,70)**	**R$ (478.465,70)**
EQUITY IRR 2,83%										

Description	10	11	12	13	14	15	16	17	18	19
GROSS REVENUE	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**	**9.460.800**
Taxes (PIS and COFINS)	(875.124)	(875.124)	(875.124)	(875.124)	(875.124)	(875.124)	(875.124)	(875.124)	(875.124)	(875.124)
NET REVENUE	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**	**8.585.676**
Operational Expenses	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)	(6.909.880)
GROSS PROFIT	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**
Loan Interest BNDES	0	0	0	0	0	0	0	0	0	0
Loan Amortization	0	0	0	0	0	0	0	0	0	0
Depreciation	(1.789.770)	(1.789.770)	0	0	0	0	0	0	0	0
EARNING BEFORE INCOME TAX AND SOCIAL CONTRIBUTIO	**(113.974)**	**(113.974)**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**	**1.675.796**
Income Tax and Social Contribution	0	0	(569.771)	(569.771)	(569.771)	(569.771)	(569.771)	(569.771)	(569.771)	(569.771)
NET PROFIT	**(113.974)**	**(113.974)**	**1.106.025**	**1.106.025**	**1.106.025**	**1.106.025**	**1.106.025**	**1.106.025**	**1.106.025**	**1.106.025**

	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19
EQUITY CASH FLOW										
Equity Investment										
Gross Profit	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00	R$ 1.675.796,00
Financial Expenses	R$ -	R$ -	R$ -	R$ -	R$ -	R$ -	R$ -	R$ -	R$ -	R$ -
EQUITY CASH FLOW	**R$ 1.675.796,00**	**R$ 1.675.796,00**	**R$ 1.675.796,00**	**R$ 1.675.796,00**	**R$ 1.675.796,00**	**R$ 1.675.796,00**	**R$ 1.675.796,00**	**R$ 1.675.796,00**	**R$ 1.675.796,00**	**R$ 1.675.796,00**
EQUITY IRR 2,83%										

Annex 6

PICTURES OF THE CURRENT SITUATION OF WOOD RESIDUES PRESENT IN THE CITY OF PARAGOMINAS

Picture 1 – Wood residue deposit located in the city of Paragominas (Picture: Paragominas City Hall – Quantitative Census on Wood Residues/2007)

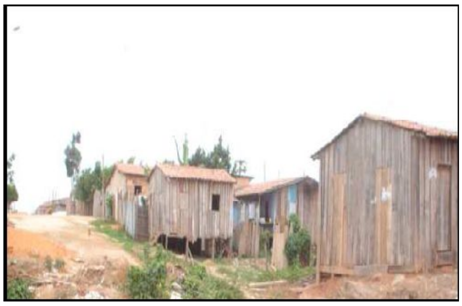
Picture 2 – Production of sawdust (Picture: Paragominas City Hall – Quantitative Census on Wood Residues/2007)

Picture 3 – View from above sawdust mount (Picture: Paragominas City Hall – Quantitative Census on Wood Residues/2007)

Picture 4 – Lateral view of the mount reaching residences **(Picture: Paragominas City Hall – Quantitative Census on Wood Residues/2007)**

Picture 5 – Residences located in Dangerous Zone of Coal Production Rudimentary Activities **(Picture: Emilene Moreira dos Santos – published in Análise de Risco Sócio-Ambiental: Um Enfoque aos Resíduos de Madeira no Perímetro Urbano do Município de Paragominas (Analysis of socio-environmental risks: na overview on wood residues in urban perimeter in the municipality of Paragominas):**

Picture 6 – Houses built over grounds with sawdust **(Picture: Emilene Moreira dos Santos – published in Análise de Risco Sócio-Ambiental: Um Enfoque aos Resíduos de Madeira no Perímetro Urbano do Município de Paragominas)**



Picture 7 – Disposal of sawdust on inappropriate area (Picture: Emilene Moreira dos Santos – published in Análise de Risco Sócio-Ambiental: Um Enfoque aos Resíduos de Madeira no Perímetro Urbano do Município de Paragominas).

Picture 8 – Lime kiln activated (Picture: Emilene Moreira dos Santos – published in Análise de Risco Sócio-Ambiental: Um Enfoque aos Resíduos de Madeira no Perímetro Urbano do Município de Paragominas)

Picture 9 – Child burnt by the activities in lime kilns. (Picture: Folha de São Paulo, 2005)

The child above had her feet and hands burnt and atrophied while playing in a zone where wood residues were illegally burnt. The child has lost a toe in one foot;

Picture 10 – Child burnt by the activities in lime kilns. (Picture: Program of Recovery and Support of Children burnt in lime kilns – From the portuguese: Programa de Recuperação e Apoio às Crianças Queimadas em Caieieras, 2002)

The child above had her right leg amputated and the left one atrophied due to a burn propitiated by the illegal burn of wood residues in lime kilns.