CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

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>.

SECTION A. General description of the small-scale project activity

A.1. Title of the small-scale project activity:
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CAAL Biomass Electricity Generation Project

Version 2
Date: 07/06/2006

A.2. Description of the small-scale project activity:
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Purpose
The CAAL Biomass Electricity Generation Project developed by CAAL is a project for installation in Alegrete city, Rio Grande do Sul state, Brazil. CAAL is a rice mill company, of which the core business is the production of paddy rice for the market in Brazil. CAAL is ranked 6th rice company of Brazil and the biggest rice cooperative in Rio Grande do Sul state (Brazilian Rice Year Book 2005)[1]. The purpose of the project is to avoid methane emissions due to the decay of unutilised rice husks and to avoid carbon emissions related to electricity generation for the grid.

Project description
The project will eliminate CAAL's electricity demand from the grid, will sell the small surplus generated electricity to the grid and provide small amount of process steam to the rice drying and conditioning along the harvest season.

The main activity in the region where the project will be located is rice production and industrialization. The rice mill of CAAL generate huge amounts of biomass residues (rice husks), and the Brazilian and local state legislation prohibits the unlicensed displacement and/or uncontrolled burning of rice husks, as well as, restricts the land filling of it, allowing the disposal only in licensed areas. As a result, the rice mills have huge amount of rice husks left for decay. In the present baseline situation, only a furnace conjunct consumes 2,156 tonnes biomass per year, or 7 % of the total rice husk production. After full implementation of the project 29,631 tonnes of rice husks are consumed, so the project activity prevents annually net 27,475 tonnes of rice husks from decay, avoiding the associated methane emissions.

The CAAL project will be the solution for the high costs associated with electricity consumption in rice production, and will improve the quality of electricity at the CAAL's plant, once the region presents repressed power demand.

The CAAL's project covers the construction of a new biomass co-generation unit of 3.8 MWe and seasonally 7,7 $MW_{thermal}$ of installed capacity, using only rice husks as fuel, complying with CAAL's energy demand and exporting surplus power to the grid.

[1] Rosa, Gilson R. Da Et. Al., Anuário Brasileiro do Arroz 2005, Gazeta Santa Cruz, Santa Cruz do Sul, Brasil, 2005, pg 59

With the new thermal power plant, CAAL will start drying the rice grains during harvest season with heat instead of the direct combustion, practice used currently.

The only biomass that CAAL is going to use are its own rice mill residues as fuel for the boiler. The amount of biomass used by third suppliers is null, therefore the company doesn't depend on external sources of biomass to maintain the power plant fully operational. Internal transportation of the fuel is facilitated by electrical screws, conveyors and elevators.

Like all big rice mills, CAAL generates a substantial amount of rice husks that is disposed on lands located in the rural areas. The project activity avoids the emissions related to the transport of 17 trucks of rice husks per day, but causes emissions related to a much smaller number of trucks for ash removal.

Contribution of the project to sustainable development

The project is promoting sustainable development to the Host Country, providing:

- Increases in employment opportunities in the area where the plant is located;
- Diversification in the sources of electricity generation;
- Uses of clean and efficient technologies, and conserves natural resources, thus the project will be meeting the Agenda 21 and Sustainable Development Criteria of Brazil;
- Actions as a clean technology demonstration project, encouraging development of modern and more efficient generation of electricity and thermal energy using biomass fuel throughout the Country;
- Optimisation in the use of natural resources, avoid new uncontrolled waste disposal places, using a large amount of rice residues from region.

A.3. Project participants:

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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)	CAAL – Cooperativa Agroindustrial Alegrete Ltda	No
Brazil (host)	PTZ BioEnergy Ltd.	No
The Netherlands	Bioheat International B.V.	No
The Netherlands	Essent Energy Trading B.V.	No

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

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

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

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A.4.1.1. Host Party(ies):

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Brazil

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

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Rio Grande do Sul State

A.4.1.3. City/Town/Community etc:

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Alegrete

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

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CAAL is a rice mill located in Alegrete City, in the western region of Rio Grande do Sul State. Address: BR 290, km 583. CEP: 97541-500. Alegrete is 489 km near from Porto Alegre, the capital city of Rio Grande do Sul.

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

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As per appendix B of the simplified modalities and procedures for small-scale CDM project activities, the project activity falls under the following two categories:

Type I; Category I.D.: Grid connected renewable electricity generation

Type III; Category III.E.: Avoidance of methane production from biomass decay through controlled combustion.

Reference: version 08: 03 March 2006 of Appendix B of the simplified modalities and procedures for small scale CDM project activities.

A bundle is formed of small-scale project activities of different types (type I and type III) as to both reduce carbon emissions by replacement of electricity from the grid and to avoid the decay of rice husks through controlled combustion, thereby following the rules and principles as indicated 'EB 21 Report, annex 21, general principles for bundling' and 'Guidelines for completing the simplified project design document (CDM-SCC-PDD) and the form for submissions on methodologies for small-scale CDM project activities (F-CDM-SSC-Subm) (version 01)'.

Justification of how the proposed CDM project adheres to the applicability criteria of the selected project categories.

Type I; Category I.D.: Grid connected renewable electricity generation

Type I project activities are defined as renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts (or an appropriate equivalent) (decision 17/CP.7, paragraph 6 (c) (i)). The project comprises combustion of renewable rice husks in a biomass boiler for electricity generation. The nominal capacity of the installation is 3.8 MWe, which is below the limit of 15 MW for type I projects.

<u>Type III; Category III.E.: Avoidance of methane production from biomass decay through controlled combustion.</u>
Type III project activities are defined as other project activities that both reduce anthropogenic emissions by sources and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually (decision 17/CP.7, paragraph 6 (c) (iii) over the entire crediting period.

The project activity emissions of category III.E. consist of:
a. CO2 emissions related to the combustion of the non-biomass carbon content of the waste (plastics, rubber and fossil derived carbon) and auxiliary fuels used in the combustion facility.
b. Incremental CO2 emissions due to incremental distances between the collection points to the controlled combustion site and to the baseline disposal site as well as transportation of combustion residues and final waste from controlled burning site to disposal site.
c. CO2 emissions related to the power used by the project activity facilities, including the equipments for air pollution control required by regulations. In case the project activity consumes grid based electricity, the grid emission factor (kg CO2e / kWh is used, or it is assumed that diesel generatore would have provided a similar amount of electric power, calculated as described in category I.D.

Ad a. Emissions through combustion of non-biomass carbon are null once the waste composition is 100% rice husks.
Ad. b. The emissions related to the biomass transportation are zero because all the rice husks are generated in the rice mill, where the project will be implemented. The project emissions will result just from the ash transportation, which is maximally 22 tonnes of carbon dioxide equivalent annually.
Ad c. The emissions through electricity or diesel consumption are zero, once the Biomass Power Plant will be fully supplied by a renewable source.
Therefore, project emissions leads to direct carbon emissions of less than 15 kilo tonnes of carbon dioxide equivalent annually.

It is concluded that the project is eligible as small-scale and that it will remain under the limits for small-scale project activities types every year over the crediting period.

Use of environmentally sound technologies and transfer of know how
Commercially state of art of conventional Rankine steam cycle will be used. The combustion of the fuel will be performed with proven technologies as a medium pressured boiler (42 bar) as well as the power plant control will be supervised by a high standard set of LPCs and computers, composing the automation system.

A condensing steam turbine with controlled extraction of steam for process heating (co-generation), driving an electrical generator will be used. Under these characteristics and the concept of co-generation, the total efficiency of the process will reach up to 30% (power +heat) and 17% net electrical efficiency.

Control panels and devices that keep a steady condition of voltage, frequency and load will manage the energy production and supply.

Under fully operational conditions, the boiler will produce approximately 24 t/h of steam at 42 bar and 400°C while consuming 7 t/h of rice husks. The steam will be fed to a multistage steam condensing turbine at 0.09 bar with extraction. A controlled steam extraction will provide up to 15 t/hr of low-pressure steam for general processes. The steam turbine will drive a 3 phase synchronous generator producing up to 3.8 MWe at 13.8 kV and 60 Hz.

An integration panel will allow synchronicity and full load control for the auxiliary power plant services, rice mill and the exportation to the grid. Electricity will be sent to the utility distribution lines through a transformer of 13.8 kV. The project already has obtained all necessary licences to be installed and complies with the Brazilians and State environmental standards, mainly regarding to the control flue gas emissions and wastes. The ash from the plant will be sold as a beneficial by-product.

The project uses the above described environmentally safe and sound technology, which leads to utilization of husks otherwise left for decay and replacement of carbon based electricity generation. PTZ Bioenergy Ltd already has accumulated a large experience in engineering, projecting and constructing power plants at rice industries with conventional high pressure boilers in co-generation, with a similar concept of process engineering. Similar technology has been used by PTZ to combust rice husks at the CAMIL rice mill project (2001), a 4.2 MWe power plant in Itaqui-RS, Brazil, and a 3.0 MWe project at the URBANO rice mill Project (1999) in Jaraguá do Sul city, Santa Catarina State, Brazil, differing only in the equipment's scale.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

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The proposed small-scale project activity reduces carbon emissions by replacement of fossil fuel based electricity generation, and prevents rice husks to be left to decay.

In absence of the project activity, carbon emissions from fossil fuel based electricity generation would have occurred.

Rio Grande do Sul and Santa Catarina States are the only two states in Brazil who presents coal fired thermal power plants complementing the electricity demand in the integrated electrical south Brazilian grid. By the replacement of power from the grid and by supply of electricity to the grid, carbon from the coal combustion in electricity plants is avoided. The grid emission factor was calculated in a transparent way, using the most recent data from ONS[2], Eletrobrás[3] and ANEEL[4] corresponding to the south-southeast-midwest Brazilian interconnected Electrical System. The carbon emission factor obtained was 0.462 tonnes of CO_2/MWh. Full details about calculation methods are presented in the confidential PTZ's document: "Fator de Redução de Emissões no Grid Interconectado do Sistema Sul-Sudeste-Centro-Oeste".

In absence of the project activity the rice husks would have been left to decay

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[2] Operador Nacional do Sistema Elétrico - Dados Relevantes do Ano de 2004 (www.ons.org.br)

[3] Eletrobrás – Sistemas Interligados, Acompanhamento de Combustíveis; (www.eletrobras.gov.br)

[4] Agência Nacional de Energia Elétrica - Banco de Informações de Geração (www.aneel.gov.br)

The production of rice and consequently the supply of rice husks in Rio Grande do Sul is very large, and consequently a large part of the rice husks are left to decay. During the harvest of 2003/2004, Rio Grande do Sul produced around 7 millions tonnes of rice, corresponding to 53% of total rice production of Brazil and 90% in the south region of the country (IRGA, 2004)[5]. Table 1 shows the amount of rice husks produced in Brazil and Rio Grande do Sul state through 2004. Every tonne of rice production leads to the supply of 0.22 tonne of rice husks. (CIENTEC, 1986)[6] .

Table 1: Production of rice and rice husks in 2004 (millions of tonnes)

	Rice	Rice husk
Brasil	11.78	2.59
Rio Grande do Sul	6.31	1.39

Source: IRGA (2004) .

Table 2 shows the proportions and amounts of rice husks used for different purposes. The information is based upon a survey done in 1986 by CIENTEC, taking in account almost one hundred mills, corresponding to 57 up to 60% of the rice production, in cities that presented productions up to 100,000 rice bags per year. The latest CIENTEC's data updates and publications still keep the same ratio between the use and sources of rice husks in the Rio Grande do Sul State. The rice husk surplus of 59.60% is considerable. The project activity aims to prevent part of this surplus not to be left for decay, avoiding the emission of methane.

Table 2: Application and uses relations for the rice husks in Rio Grande do Sul State

Application	Production (tonnes)	Percentage (%)
1.Destined to grain drying	87,000	15.20
2.Destined to steam generation	80,000	14.00
3. Used as cement additive	40,000	7.00
4. Used for motor power generation	24,000	4.20
5. Rice husks Surplus	340,000	59.60
Total	571,000	100.00

[5] RUCATTI, Evely Gischkow, KAYSER, Victor Hugo, 2004. Produção e Disponibilidade de Arroz por Região Brasileira Instituto Riograndense do Arroz. Rio Grande do Sul, Brasil.

[6] CIENTEC, 1986. Programa Energia: Aproveitamento Energético da Casca de Arroz. Relatório do Projeto de Pesquisa. Porto Alegre, Fundação de Ciência e Tecnologia.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

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Table 3: Net emission reduction by the bundle of projects (tonnes CO2 equivalent per year)

Year	Type I.D grid connected electricity generation	Type III.E Avoidance of methane production	Total net emission reduction
	Net emission reduction (A)	Net emission reduction (B)	(A) + (B)
1 Nov - 31 Dec 2007	**2,068**	**1,932**	**4,000**
2008	**12,407**	**9,187**	**21,594**
2009	**12,407**	**14,960**	**27,368**
2010	**12,407**	**19,543**	**31,950**
2011	**12,407**	**23,180**	**35,587**
2012	**12,407**	**26,067**	**38,475**
2013	**12,407**	**28,359**	**40,766**
1 Jan - 31 Out 2014	**10,340**	**25,148**	**35,487**
Total estimated reductions	**86,852**	**148,376**	**235,228**
Total number of crediting years	**7**	**7**	**7**
Annual average over the first crediting period of estimated reductions (tonnes of CO_2 e)	**12,407**	**21,197**	**33,604**

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

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There will be no public funding to the project.

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

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According to paragraph 2 of Appendix C to the Simplified Modalities and Procedures for Small-Scale CDM project activities, a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale 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.

There is no other small-scale activity that meets the above mentioned criteria. Accordingly, the proposed project activity is not a debundled component of a larger project activity.

SECTION B. Application of a baseline methodology:

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

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Type I; Category I.D.: Grid connected renewable electricity generation

Type III; Category III.E.: Avoidance of methane production from biomass decay through controlled combustion.

Reference: Appendix B of the simplified modalities and procedures for small-scale CDM project activities (version 08: 03 March 2006).

B.2 Project category applicable to the small-scale project activity:

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The applicability criteria of the Category I.D. 'Grid connected renewable electricity generation' are:
Technology/measure
1. This category comprises 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.
2. 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.
3. Biomass combined heat and power (co-generation) systems that supply electricity to and/or displace electricity from a grid are included in this category. To qualify under this category, the sum of all forms of energy output shall not exceed 45 $MW_{thermal}$. E.g., for a biomass based co-generating system the rating for all the boilers combined shall not exceed 45 $MW_{thermal}$.
4. Project activities adding renewable energy capacity should consider the following cases:
1) Adding new units;
2) Replacing old units for more efficient units.
To qualify as a small scale CDM project activity, the aggregate installed capacity after adding the new units (case 1) or of the more efficient units (case 2) should be lower than 15 MW[1].
5. 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

[1] Ex: 5 MW of new capacity is added to existing 9 MW to make the aggregate capacity of 14 MW which is within the allowed limits for capacity

The project conforms to the above mentioned conditions in the following ways:

Ad. 1. The project comprises the use of rice husks, which is a renewable biomass to be used to supply electricity to and/or displace electricity from the south-southeast Brazilian electricity distribution system. Rio Grande do Sul and Santa Catarina States are the only two states in Brazil who presents coal fired power plants complementing the energy demand in the integrated electrical south-southeast Brazilian grid. Thus the project activity replaces the use of at least one fossil fuel.
Ad. 2. The unit uses only rice husks, which is renewable biomass.
Ad. 3. The plant has a maximum output of heat (7.7 MWth) and power (3.8 MWe). The sum of these outputs is below the limit of 45 MWthermal.
Ad. 4. The biomass power plant is the first one to be installed in CAAL. The maximum output power of 3.8 MWe is below the limit of 15 MW established to be qualified as a small scale CDM project activity.
Ad. 5. The project is not a retrofitted or modified facility. The biomass power plant will be a new facility that will produce a maximum of 3.8 MWe that is below the limit of 15 MW.

It is concluded that category AMS I.D. is applicable to the small-scale project activity.

<u>Type III; Category III.E.: Avoidance of methane production from biomass decay through controlled combustion.</u>
Type III project activities are defined as other project activities that both reduce anthropogenic emissions by sources and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually (decision 17/CP.7, paragraph 6 (c) (iii).

The applicability criteria of the Category III.E. 'Avoidance of methane production from biomass decay through controlled combustion' are:
<u>Technology/measure</u>
1. This project category comprises measures that avoid the production of methane from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site without methane recovery. Due to the project activity, decay is prevented through controlled combustion. The project activity does not recover or combust methane (unlike III G). Measures shall both reduce anthropogenic emissions by sources, and directly emit less than 15 kilo tonnes of carbon dioxide equivalent annually.
2. If the combustion facility is used for heat and electricity generation the project can use a corresponding methodology under type I project activities.

Decay is prevented through controlled combustion of rice husks and less methane is produced and emitted to the atmosphere. Emissions through combustion of non-biomass carbon are null once the waste composition is 100% rice husks. The emissions through electricity or diesel consumption are zero, once the Biomass Power Plant will be fully supplied by a renewable source. The emissions related to the biomass transportation are zero because all the rice husks are generated in the rice mill, where the project will be implemented. The project emissions will result just from the ash transportation, which is maximally 22 tonnes of carbon dioxide equivalent annually. Therefore, project emissions leads to direct carbon emissions of less than 15 kilo tonnes of carbon dioxide equivalent annually..

It is concluded that category AMS III.E. is applicable to the small scale project activity.

Assumptions of the baseline methodology
To estimate the baseline emissions related to grid connected renewable electricity generation the baseline calculations as indicated under category I.D. of Appendix B are applied. This methodology allows to calculate the baseline emissions by four different methods (a, b, c and d). It was decided to calculate the baseline emissions by using the average of the approximate "operating margin" and the "build margin".

To estimate the baseline emissions related to the avoidance of methane production from biomass decay through controlled combustion, the baseline is calculated using the first order decay model based on the discrete time estimate method of the IPCC Guidelines, as referred to in category AMS IIIE and described in category AMS III-G.

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:
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Attachment A to Appendix B indicates that 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 technology 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.

The first step in the process is to list the likely future scenarios. Two scenarios were considered:

Scenario 1 - Continuation of current activities
This scenario represents continuation of the current practices in which a furnace conjunct that provides gases for the drying rice process, using only a very small part of the rice husks, 3,078 tonnes, or 8.7% of the total rice husk production. A large surplus of rice husks are left for decay, and because no electricity is produced with rice husks, all needed -fossil fuel based- electricity is delivered by the grid.

Scenario 2 - The construction of a renewable energy plant
In this scenario, the CAAL Alegrete biomass electricity generation plant is established. Rice husks will be used to produce heat and power. The power replaces fossil fuel based power formerly delivered by the grid. In addition surplus power will be delivered to the grid, thereby replacing fossil fuel based electricity. Methane emissions from the decay of biomass residues will be interrupted.

With respect to the **investment** barrier:

- The continuation of current practices (Scenario 1) does not pose any investment barrier to the project developer, and requires no further financing.
- The construction of a renewable energy plant (Scenario 2) faces specific investment barriers due to the fact that the capital costs related to biomass CHP units are very high. The capital costs involved in the project pose a barrier, especially considering the high interest rates prevalent in developing countries. It is worth noting that there are no direct subsidies or promotional support for the implementation of independent renewable energy plants.

  Besides, almost all energy will be reserved to internal consumption and another part will be delivered to MAE (Wholesale Energy Market). The financial barrier is demonstrated through a financial analysis, which the results are presented in Table 4 below. The carbon revenues increase the returns of the project transforming this into an attractive investment for the company and to the financial agents.

Table 4: Financial Analysis Results

	With Carbon	Without Carbon
Net Present Value (US$)	463,678.69	-866,992.59
IRR	14%	2.3%
Discount Rate	9.75%	
Present Value of carbon sold (7 years) US$	2,275,982.80	

With respect to the **technological** barrier:

- In the case of Scenario 1, there are no technical/technological issues as this simply represents a continuation of current practices and did not involve any new technology or innovation. Indeed, in this scenario there were no technical/technological implications as the scenario calls for continued use of electricity from the grid.
- In the case of Scenario 2, there are no significant technical/technological barriers. All the technologies involved in this scenario are available in the market and commercially, and have been used effectively in the Host Country.

With respect to the analysis of **prevailing practice**:

- The continuation of current practices (Scenario 1) presents no particular obstacles. This practice has been used effectively in the past with good results, and the continued operation of existing facilities and actual practices presents no real barriers. Moreover, Brazil has a huge rice industry, with more than 350 rice mills. A considerable fraction, about 60%, of rice production corresponds to the south region (IRGA 2004). The south Brazilian region, i.e the states of Rio Grande do Sul, Santa Catarina and Paraná, have no recorded problems with power supply, even along the electricity crisis observed at 2001. Environmental agencies have been approving new areas for disposing the industrial residues, as rice husks, with clear and effective rules, in such a way that only the distance, and by consequence the costs, will represent obstacles for taking the residues into consideration as a pressure to perform future projects.
- The Brazilian technologies in rice mills are very updated with global technologies employed, representing the state of art on rice mills technology. The efficiency of the process reaches around 98% of the commercial matter in the grain. Usually 78% of the rice is transformed in products. The other 22-23% are rice residues. Given the large number of rice mills in the south region the biomass residue generation is concentrated in the south region, creating an excess of biomass residues that the market cannot absorb. According to CIENTEC[6] more than 59,60 % of residues are not used or sold. From 2002, zero plants were build, mainly due to the lack of feasibility. Thus, there are many large biomass piles that are left for decay, generating methane during this process.
- The construction of a new renewable energy plant (Scenario 2) doesn’t represent a deviation from the company’s core business (rice production) once the energy costs avoided will be utilised to sell beneficed rice for a lower price or to increment the profit margin of the product. The steam generated by the boiler will be used to achieve a higher quality in the rice process. Currently CAAL has a great amount of rice husks that guaranties the supply for the future plant.

With respect to the analysis of **other barriers**

- In case of scenario 1, no other barriers were identified.
- In case of scenario 2, no other barriers were identified.

Table 5 below summarises the results of the analysis regarding the barriers faced by each of the plausible scenarios. As the table indicates, Scenario 1 faces no barriers, whereas Scenario 2 faces an investment barrier.

Table 5: Summary of Barriers Analysis

Barrier Evaluated	Scenario 1 Continuation of Current Activities	Scenario 2 Construction of a new plant
1. Investment barrier	No	Yes
2. Technological barrier	No	No
3. Prevailing practice	No	No
4. Other barriers	No	No

Because the investment barrier would prevent that the project would have occurred anyway, it is concluded that the project is additional.

The implementation of the project will eliminate the amount of biomass disposed in the landfills as well as the energy consumed from the grid, consequently reducing the CO_2 emissions, as showed in the following analysis:

- The Baseline Scenario corresponds to a furnace conjunct that provides gases for the drying rice process. This furnaces consumes 2,156 tonnes of rice husks per year, or 7 % of the total production. The surplus of biomass is left to decay in open fields licensed areas, generating a considerable amount of methane. The industry will continue to use energy from the grid that has a production of CO_2 associated to the MWh produced.

- The Project Scenario is represented by the construction of a new renewable energy plant of 3.8 MW. This implementation will imply in substitution of the furnaces by steam heat exchangers for the drying rice process, process heat and power generation. The amount of rice husks consumed will be 29,631 tonnes per year, avoiding methane generation caused by biomass decay. The energy imported from the grid, which is partly generated by fossil fuels, will be displaced, contributing to GHG emission reductions. The rice husks transportation will be decreased as well as ash generation will be increased, resulting in a final balance where the diesel consumption is reduced and, consequently, the CO_2 emissions.

The Project Scenario is environmentally additional in comparison to the baseline scenario, and therefore eligible to receive Certified Emission Reductions (CERs) under the CDM.

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

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According to category I.D. the project boundary encompasses the physical, geographical site of the renewable generation source.
According to category III.E. the project boundary is the physical, geographical sites where:

a. where the solid waste would have been disposed and the avoided methane emission occurs in absence of the proposed project activity,

b. where the treatment of biomass through controlled combustion takes place,

c. and in the itineraries between them, where the transportation of wastes and combustion residues occurs.

The rice husks are combusted for electricity generation at the site of the rice mill. This is also the location where the rice husks are produced from the rice milling process. So, there will be no itinerary between the biomass landfill and where combustion of the residues occur .The physical, geographical site of the rice mill is indicated in paragraph A.4.1.The solid waste would have been disposed in a legalized landfill by the local Environmental Authority in the absence of the proposed project activity.

Landfill Location:

#1
Rio Grande do Sul State
Alegrete City
Locality: Pinheiros
Access: Municipal Road
Manoel de Assis rural propriety
8 km far from CAAL

#2
Rio Grande do Sul State
Alegrete City
Locality: Poço de Bombas
Access: Municipal Road
Hélio Vieira Rocha rural propriety
3 km far from CAAL

#3
Rio Grande do Sul State
Alegrete City
Locality: Caverá
Access: State Highway
Vanderlei Coelho rural propriety
15 km far from CAAL

#4
Rio Grande do Sul State
Alegrete City
Locality: Caverá
Access: BR 290 Highway
Cláudio Klug Thurow rural propriety
6 km far from CAAL

B.5. Details of the baseline and its development:

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The baseline for grid connected renewable electricity generation is based on methodology AMS I.D. of annex B of the simplified modalities and procedures for small-scale CDM project activities (Version 08:

03 March 2006). The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient, calculated in a transparent and conservative manner as the average of the approximate operating margin and the build margin.

The baseline for avoidance of methane production from biomass decay through controlled combustion is based on methodology AMS III.E. of annex B of the simplified modalities and procedures for small-scale CDM project activities (Version 08: 03 March 2006). The baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter is left to decay within the project boundary and methane is emitted to the atmosphere. The baseline emissions are the amount of methane from the decay of the biomass or organic waste treated in the project activity.

Date of completion
18/05/2006

Name of person/entity determining the baseline:

- Ricardo Pretz and Ronaldo Hoffmann from PTZ Bioenegy Ltda and;
- Martijn Vis from BTG biomass technology group B.V.

Contact details are listed in annex I.

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:
>>

C.1.1. Starting date of the small-scale project activity:
>>

01/09/2006

C.1.2. Expected operational lifetime of the small-scale project activity:
>>

30 years

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

C.2.1. Renewable crediting period:
>>

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

01/11/2007

C.2.1.2. Length of the first crediting period:
>>

7 years, 0 months

C.2.2. Fixed crediting period:
>>

C.2.2.1. Starting date:
>>

C.2.2.2. Length:
>>

SECTION D. Application of a monitoring methodology and plan:

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

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Monitoring methodology of category I.D. as described in 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities' (Version 08: 03 March 2006)

Monitoring methodology of category III.E. as described in 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities' (Version 08: 03 March 2006)

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

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The monitoring methodology of category I.D. describes that: *Monitoring shall consist of metering the electricity generated by the renewable technology. In the case of co-fired plants, the amount of biomass and fossil fuel input shall be monitored.*

Conform the monitoring methodology, the monitoring plan foresees in the metering of electricity generated by the rice husk combustion installation. It is an effective and reliable way to measure the replaced electricity from the grid.

The monitoring methodology belonging to category III.E. describes that:

- The emission reduction achieved by the project activity will be measured as the difference between the baseline emission and the sum of the project emission and leakage.

$ER_y = BE_y – (PE_y + Leakage_y)$

where:
ER_y Emission reduction in the year "y" (tonnes of CO_2 eq.)

- The amount of waste combusted in the project activity in each year (Q_y) shall be measured and recorded, as well as its composition through representative sampling, to provide information for estimating the baseline emissions . The auxiliary fuel used ($Q_{y,fuel}$) will be measured and registered, and the non-biomass carbon in the waste combusted ($Q_{y,C,non\text{-}biomass}$) will be measured by sampling, to yield the project activity emission through combustion. The total quantity of waste combusted (Q_y) and the average truck capacity (CT_y) will be measured to yield the project activity emission through transportation. The power consumption and/or generation will be measured and registered. The monitoring will also record the distance for transporting the waste in baseline and the project scenario.

- The project participants will demonstrate annually that the amount of waste combusted in the project activity facilities would have been disposed in a solid waste disposal site without methane recovery in the absence of the project activity.

In the project activity, rice husks are collected from at the plant location and combusted in the rice husk combustion and electricity generation installation. The biomass (rice husks) are produced at the rice processing plant, and will be either combusted in the biomass electricity plant or transported outside the plant to be left for decay. The amount of biomass combusted is monitored by calculation of the rice husk production and monitoring the rice husks leaving the factory. The biomass composition will be 100% rice husks.
It won't be necessary to calculate emissions from auxiliary fuels once all electricity needed to run the rice husk power plant produced by the same power plant. So the used electricity is renewable and the emission factor is zero.
The emissions related to combustion of non-biomass carbon content are zero because the project will only combust rice husks, which is 100% biomass.
The truck capacity and the distance for transporting the ash outside the power plant will be obtained by truck bills.
The solid waste disposal site where the biomass would have been disposed in the absence of the project activity can be determined by the local Environmental Authority in the environmental permit for biomass disposal. It can be demonstrated that the biomass disposal place doesn't have a recovery methane system.

Project activity emissions consist of:

a. CO2 emissions related to the combustion of the non-biomass carbon content of the waste (plastics, rubber and fossil derived carbon) and auxiliary fuels used in the combustion facility,
b. Incremental CO2 emissions due to incremental distances between the collection points to the controlled combustion site and to the baseline disposal site as well as transportation of combustion residues and final waste from controlled burning site to disposal site,
c. CO2 emissions related to the power used by the project activity facilities, including the equipments for air pollution control required by regulations. In case the project activity consumes grid-based electricity, the grid emission factor (kgCO2e/kWh) is used, or it is assumed that diesel generators would have provided a similar amount of electric power, calculated as described in category I.D.

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

where:

PE_y	project activity direct emissions in the year "y" (tonnes of CO2 equivalent)
$PE_{y,comb}$	emissions through combustion of non-biomass carbon in the year "y"
$PE_{y,transp}$	emissions through incremental transportation in the year "y"
$PE_{y,power}$	emissions through electricity or diesel consumption in the year "y"

The CO_2 emissions related to combustion of non-biomass carbon content of the waste are zero because the project only combust rice husks, which is 100% biomass.
Only ash is transported as a result of the project activity.
All electricity needed to run the rice husk power plant produced by the same power plant. So the used electricity is renewable and the emissions through electricity or diesel consumption are zero.

The formulae used to calculate the project emissions will only consider the parcel related to the ash transportation emissions as follows:

$PE_{y,transp} = (Q_{y,ash}/CT_{y,ash}) * DAF_{ash} * EF_{CO2}$

where:

EF_{CO2}	CO_2 emission factor from fuel use due to transportation (kgCO_2/km, IPCC default values or local values can be used.
$Q_{y,ash}$	quantity of combustion residues produced in the year "y" (tonnes)
$CT_{y,ash}$	average truck capacity for combustion residues transportation (tonnes/truck)
DAF_{ash}	average distance for combustion residues transportation (km/truck)

The quantity of combustion residues produced can be determined by a weight measuring system or estimating by a literature value about the ash content in the biomass. The truck capacity is determined once a standard truck with a fixed volume is used. The average distance between the project and the ash displacement can be registered with the kilometer counter of a truck or car.

It is justified to apply monitoring methodology belonging to category III E as described in 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities' (Version 08: 03 March 2006).

D.3 Data to be monitored:

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Table 6: D 3.1 Data to be collected necessary for determining the baseline of anthropogenic emissions and the project emissions and how this data will be archived, related to project category I.D. ' grid connected electricity generation':

ID-number	*Data variable*	*Source of data*	*Data unit*	*Measured (m), calculated (c) or estimated (e)*	*Recording frequency*	*Proportion of data to be monitored*	*How will the data be archived? (Electronic/ paper)*	*Comment*
D.3.1	Electricity imported from the grid	Electricity ingress register and electricity bills	KWh	m	Continuous and monthly	100%	Electronic and paper	The electricity imported from the grid is monitored by an energy ingress register and by the energy bills expedited monthly by the electricity concessionary
D.3.2	Gross electricity generated by the project	Electronic supervisory system of the biomass power plant.	KWh	m	Continuous	100%	Electronic and paper	The gross electricity generated by the project activity (electricity delivered to the grid and delivered to the own rice mill) is recorded in the electronic supervisory system of the power plant.
D.3.3	Net electricity delivered to the grid	Electronic supervisory system of the biomass power plant.	KWh	m	Continuous	100%	Electronic and paper	The net electricity delivered to the grid is recorded in the electronic supervisory system of the power plant.

D 3.4	Baseline emission factor	ONS , Eletrobrás and ANEEL	tonnes CO_2/ MWh	c	Yearly	100%	Electronic and paper	Baseline emission factor consists of Operating Margin emission factor and Build Margin emission factor, and calculated from the installed capacity, carbon emission factor , electricity production and fuel consumption of the electricity generation plants connected to the south-southeast-midwest interconnected grid.

Table 7: D 3.2 Data to be collected necessary for determining the baseline of anthropogenic emissions and the project emissions and how this data will be archived, related to project category III.E. ' Avoidance of methane production from biomass decay through controlled combustion':

ID-number	*Data variable*	*Source of data*	*Data unit*	*Measured (m), calculated (c) or estimated (e)*	*Recording frequency*	*Proportion of data to be monitored*	*How will the data be archived? (Electronic/ paper)*	*Comment*
D.3.5	Amount of rice husks generated	Rice production	tonne / month	m	Monthly	100%	Electronic and paper	The monthly rice production times the rice to husk factor (22%) indicates the amount of rice husks generated.
D. 3.6	Amount or rice husks removed by truck	Documentation on transportation transactions	tonne/ month	m	Monthly	100%	Electronic and paper	The weight of the empty truck and the loaded truck are measured by a weight measure system at the rice mill. The resulting amounts of rice husks removed by truck are registered on truck bills and archived.
D. 3.7	Amount of biomass consumed by the project	D 3.5 D 3.6	tonne / month	c	Monthly	100%	Electronic and paper	Value calculated as generated rice husks (D 3.5) minus removed rice husks (D. 3.6)

D 3.8	Amount of biomass that would have been consumed in baseline scenario	Data from experienced Industrial Managers from CAAL	tonne/ day	m	Daily	100%	paper	
D 3.9	Net amount of biomass prevented from being left to decay	D. 3.7 D. 3.8	tonne/ month	c	Monthly	100%	Electronic and paper	D.3.7 - D.3 8. This value equals $Q_{biomass}$ in the formulae in section E
3.10	AC: Ash content in the rice husks	Literature	% wt.	M	Once	Sample	Paper	The ash content of rice husks does practically not vary. Therefore a literature value is used.
D 3.11	$Q_{y,ash}$: quantity of combustion residues produced in the year "y"	Weight measuring system	Tonne/ month	M	Monthly	100%	Paper	Before the project implementation this amount will be estimated trough the ash content in the rice husks (18%) times the amount of rice husks combusted ($Q_{biomass}$). During the project this value will be weighted in a flux balance.
D 3.12	$CT_{y,ash:}$ average truck capacity for combustion residues transportation	Documentation on transportation transactions	tonnes/ truck	M	Once	Sample	Paper	Each truck bill registers the truck ID. For this operation is used a standard truck with a fixed volume capacity (23 m^3). With the specific mass of the ash can be determined the truck capacity in tonnes/truck.
D 3.13	DAF_{ash}: average distance for combustion residues transportation	Length measuring system	km/ truck	M	Once	n.a.	Paper	The length can be measured once the truck itinerary is registered with the kilometer counter of the vehicle.
D 3.14	EF_{CO2}: CO_2 emission factor from fuel use due to transportation	IPCC default values	$kgCO_2$/ km	E	Once	n.a	Paper	
D. 3.15	PEy	D. 3.11 D. 3.12 D. 3.13 D. 3.14	ktonnes of CO_2 equi-valent	C	Monthly	n.a.	Electronic and paper	Using the formula as indicated in the monitoring methodology of category III.E. of the simplified modalities and procedures for small-scale CDM project activities.

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

>>

Table 8: D. 4.1 Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored, related to category I.D.

ID number	*Uncertainty level of data (High/Medium/Low)*	*Explain QA/QC procedures planned for these data, or why such procedures are not necessary.*
D.3.1	Low	The information read by the electricity ingress register will be double checked with the monthly electricity bill expedited monthly by the electricity concessionary.
D.3.2	Low	The electric measurement equipment will comply with Standards for Electricity NBR 5410, Grid proceedings from Brazilian ONS. Standards for connection are established by grid companies during licensing. According to the Brazilian Regulations on electrical Grid, additional measurements are demanded by the ANEEL (National Electric Energy Agency) and the company that owns the rights of grid distribution, in such a way at least two supplementary conventional electronic measurers should be installed at the outlet cabin. The 3 systems will be checked in a monthly basis.
D.3.3	Low	See D.3.1.
D.3.4	Low	Values based on info provided by ONS , Eletrobrás and ANEEL. All calculations are internally double-checked.

Table 9: D. 4.2 Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored, related to category III.E.		
ID number	*Uncertainty level of data (High/Medium/Low)*	*Explain QA/QC procedures planned for these data, or why such procedures are not necessary.*
D.3.5	Low	Rice is the main product of the factory and its production volumes known in detail. Production of rice husks is directly related to the production of rice and can be derived from rice production numbers.
D. 3.6	Low	The amount of rice husks removed by truck is monitored accurately, as all truck loads are registered.
D. 3.7	Low	The rice husk consumption is measured by the difference between the produced rice husks and the rice husks removed by truck. This data can be double-checked in two ways: 1. By measuring the ash production. The ash production is directly related to the quantity of rice husks consumed. The average ash content of rice husks can be obtained from literature or lab analysis. Truck bills provide the mass of the removed ash, thereby taking into account that a slight percentage of the flying ashes are not captured in the cyclones. 2. By determination of the steam enthalpy. Temperature, pressure and flow of the boiler outlet steam are constantly monitored by the supervisory system. This information can give the steam enthalpy. With the steam enthalpy and the boiler efficiency, the amount of rice husks demanded can be determined. Formulae: Qbiomass = (Hsteam/ η_{BOILER})/$LHV_{RICE\ HUSK}$
D. 3.8	Low	The value is estimated through the analysis of the rice production by experienced Industrial Managers from CAAL
D.3.9	Low	It is a calculated value based on D 3.7-D 3.8, so no additional QC and QA procedures will be applied.
D. 3.10	Low	The ash content of rice husks hardly varies. No additional QC and QA procedures are necessary.
D. 3.11	Low	The ash removal is measured in a flux balance. This data can be double-checked in two ways: 1.By the weight registered in the truck bills for the trucks removing the ash from the industry. 2. Multiplying the biomass combusted (D.3.9) by the ash content in the rice husk (18%).
D. 3.12	Low	A standard truck with a constant volume is used. This value can be double-checked by ash quantity generated in a given period divided by the amount of trucks with ash leaving the industry, which is registered in the truck bill, in a given period.
D. 3.13	Low	It can be easily determined running the truck itinerary and registering the distance in the kilometer counting system of the vehicle. It can be double-checked establishing the starting and the ending point of the trajectory and than measuring the distance in the map.
D. 3.14	Low	Most recent IPPC default values
D. 3.15	Low	It is a calculated value based on D.3.11, D.3.12, D.3.13, D.3.14 so besides QC and QA of these separate values (as described elsewhere in this table), no additional QC and QA procedures need to be applied.

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

>>

CAAL – Cooperativa Agroindustrial Alegrete Ltda (CAAL), PTZ Bioenergy Ltda (fully and exclusively authorized to act on the behalf of CAAL regarding this CDM project), BioHeat International (exclusively authorized to sell the carbon credits from the CAAL project) and Essent Energy Trading B.V. are all project participants.

CAAL operates the plant that is part of the project and will measure the required monitoring data related to the project and is qualified to do so. PTZ is responsible for interpretation of the monitoring data, and leakage effects, preparation of the monitoring reports and quality assurance. If required, PTZ will provide instructions and training to operators of CAAL.

Additional information regarding project management planning i.e. project organization, communication, data processing & quality management, calibration of monitoring equipment and troubleshooting procedures are provided to the DOE.

D.6. Name of person/entity determining the monitoring methodology:

>>

- PTZ Bioenergy Ltd. and;
- BTG Biomass Technology Group b.v

The monitoring methodology was prepared by Ricardo Pretz and Ronaldo Hoffmann, of PTZ, as well as Rene Venendaal and Martijn Vis of BTG.

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:
>>

E.1.1 Selected formulae as provided in appendix B:
>>
Category I.D.
No formula is provided to quantify the emission reduction of electricity generation in the Baseline of category I.D. of appendix B. In words it is described that:

Baseline emissions
(…) the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh) calculated in a transparent and conservative manner as:

(a) The average of the "approximate operating margin" and the "build margin", where:
  (i) The "approximate operating margin" is the weighted average emissions (in kg CO2equ/kWh) of all generating sources2 serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;
  (ii) The "build margin" is the weighted average emissions (in kg CO2equ/kWh) of recent capacity additions to the system, based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation. Power plant capacity additions registered as CDM project activities should be excluded from the sample group *m*. If 20% falls on part capacity of a plant, that plant is included in the calculation.

Category III.E.

Baseline emissions

$$BEy = MBy * GWP\_CH_4 – MD_{y,reg} * GWP\_CH_4$$

where,

MB_y	methane generation potential in the year "y" (tonnes of CH4), estimated as in AMS III-G
$MD_{y,reg}$	methane that would be destroyed or removed in the year "y" for safety or legal regulation
GWP_CH_4	GWP for CH4 (value of 21 is used for the first commitment period)

The Yearly Methane Generation Potential is calculated using the first order decay model based on the discrete time estimate method of the IPCC Guidelines, as described in category AMS III-G.

$$MB_y = \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j=A}^{D} A_{j,x} \cdot DOC_j \cdot \left(1 - e^{-k_j}\right) \cdot e^{-k_j \cdot (y-x)}$$

where:

F	is fraction of methane in the landfill gas (default 0.5)
DOCj	is per cent of degradable organic carbon (by weight) in the waste type j
DOCf	is fraction of DOC dissimilated to landfill gas (IPCC default 0.77)
MCF	is Methane Correction Factor (fraction, IPCC default 1.0)
Aj,x	is amount of organic waste type j landfilled in the year x (tonnes/year)
kj	is decay rate for the waste stream type j
J	is waste type distinguished into the waste categories (from A to D), as illustrated in the table below
x	is year since the landfill started receiving wastes: x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)
y	is year for which LFG emissions are calculated

Waste stream A to E	Per cent DOC_j (by weight)	Decay-rate (k_j)
A. Paper and textiles	40	0,023
B. Garden and park waste and other (non-food) putrescibles	17	0,023
C. Food waste	15	0,231
D. Wood and straw waste [1)]	30	0,023
E. Inert material	0	0

[1)] Excluding lignin-C

As the biomass combust in the project is 100% rice husks, the following parameters are chosen:

$DOC = DOC_C = 15\%$
$k = k_c = 0,231$

Project emissions
According to the same guidelines for type III. E., the project emissions are calculated using the following formula:

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

where:

PE_y	project activity direct emissions in the year “y” (tonnes of CO2 equivalent)
$PE_{y,comb}$	emissions through combustion of non-biomass carbon in the year “y”
$PE_{y,transp}$	emissions through incremental transportation in the year “y”
$PE_{y,power}$	emissions through electricity or diesel consumption in the year “y”

(i) Emissions through combustion of non-biomass carbon in the year “y”:

$$PE_{y,comb} = Q_{y,non\text{-}biomass} * 44/12 + Q_{y,fuel} * E_{y,fuel}$$

where:

$Q_{y,non-biomass}$	Non-biomass carbon of the waste combusted in the year "y" (tonnes of Carbon)
$Q_{y,fuel}$	Quantity of auxiliary fuel used in the year "y" (tonnes)
$E_{y,fuel}$	CO_2 emission factor for the combustion of the auxiliary fuel (tonnes CO2 per tonne fuel, according to IPCC Guidelines)

(ii) Emissions through incremental transportation in the year "y":

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

where:

Q_y	quantity of waste combusted 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}	CO2 emission factor from fuel use due to transportation (kgCO2/km, IPCC default values or local values can be used.
$Q_{y,ash}$	quantity of combustion residues produced in the year "y" (tonnes)
$CT_{y,ash}$	average truck capacity for combustion residues transportation (tonnes/truck)
DAF_{ash}	average distance for combustion residues transportation (km/truck)

(iii) Emissions through electricity or diesel consumption in the year "y":

In case the project activity consumes grid-based electricity, the grid emission factor (kg_{CO2e}/kWh) is used, or it is assumed that diesel generators would have provided a similar amount of electric power, calculated as described in category I.D.

E.1.2 Description of formulae when not provided in appendix B:

>>

Formulae not provided in appendix B, related to the methodology described in category I.D.

The baseline emissions (*BEy*) resulting from the electricity supplied and/or not consumed from the grid is calculated as follows, where *EGy* is the annual net electricity generated from the Project.

$$BEy = EGy * EFy$$

The baseline emissions factor (*EFy)* is a weighted average of the *EF_OMy* and *EF_BMy:*

$$EFy = (\omega_{OM} * EF\_OMy) + (\omega_{BM} * EF\_BMy)$$

where the weights ω_{OM} and ω_{BM} are by default 0.5.

The Operating Margin emission factor (*EF_OMy*) is calculated using the following equation:

$$EF\_OM_y(tCO_2/MWh) = \frac{\left[\sum_{i,j} F_{i,j,y} * COEF_{i,j}\right]}{\left[\sum_j GEN_{j,y}\right]}$$

Where:
$F_{i,j,y}$ is the amount of fuel *i* (in GJ) consumed by power source *j* in year *y*;
j is the set of plants delivering electricity to the grid, not including low-cost or mustrun plants and carbon financed plants;
$COEF_{i,j,y}$ is the carbon coefficient of fuel *i* (tCO_2/GJ);
$GEN_{j.y}$ is the electricity (MWh) delivered to the grid by source *j*.

The Build Margin emission factor (EF_BM_y) is the weighted average emission factor of a sample of power plants *m*. This sample includes either the last five plants built or the most recent plants that combined account for 20% of the total generation, whichever is greater (in MWh). The equation for the build margin emission factor is:

$$EF\_BM_y(tCO_2/MWh) = \frac{\left[\sum_{i,m} F_{i,m,y} * COEF_{i,m}\right]}{\left[\sum_m GEN_{m,y}\right]}$$

where $F_{i.m,y}$, $COEF_{i,m}$ *and* GEN_m are analogous to the *OM* calculation above.

Formulae to supplement equations presented in category III.E of annex B.
The ash content of the used rice husks - quantity of combustion residues produced - is determined in the following way:

$Q_{ash} = AC*Q_{biomass}$

Where,
Q_{ash} quantity of combustion residues produced
AC ash content weight %
$Q_{biomass}$ Quantity of biomass treated under the project activity (tonnes)

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:
>>

Category I.D.

The project emissions are negligible.

Category III.E.

According to the same guidelines for type III. E., the project emissions are calculated using the following formula:

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

where:
PE_y project activity direct emissions in the year “y” (tonnes of CO2 equivalent)
$PE_{y,comb}$ emissions through combustion of non-biomass carbon in the year “y”
$PE_{y,transp}$ emissions through incremental transportation in the year “y”

$PE_{y,power}$ emissions through electricity or diesel consumption in the year "y"

(i) Emissions through combustion of non-biomass carbon in the year "y":

$$PE_{y,comb} = Q_{y,non\text{-}biomass} * 44/12 + Q_{y,fuel} * E_{y,fuel}$$

where:

$Q_{y,non\text{-}biomass}$ Non-biomass carbon of the waste combusted in the year "y" (tonnes of Carbon)

$Q_{y,fuel}$ Quantity of auxiliary fuel used in the year "y" (tonnes)

$E_{y,fuel}$ CO_2 emission factor for the combustion of the auxiliary fuel (tonnes CO2 per tonne fuel, according to IPCC Guidelines)

(ii) Emissions through incremental transportation in the year "y":

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

where:

Q_y quantity of waste combusted 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} CO2 emission factor from fuel use due to transportation (kgCO2/km, IPCC default values or local values can be used.

$Q_{y,ash}$ quantity of combustion residues produced in the year "y" (tonnes)

$CT_{y,ash}$ average truck capacity for combustion residues transportation (tonnes/truck)

DAF_{ash} average distance for combustion residues transportation (km/truck)

(iii) Emissions through electricity or diesel consumption in the year "y":

In case the project activity consumes grid-based electricity, the grid emission factor (kg_{CO2e}/kWh) is used, or it is assumed that diesel generators would have provided a similar amount of electric power, calculated as described in category I.D.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

>>

Category I.D.

No leakage calculation is required, as the renewable energy technology used is not equipment transferred from another activity.

Category III.E.

No leakage calculation is required.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

>>

Category I.D.

The small-scale project activities are zero.

Category III.E.
The total small-scale project activity emissions consist of PE_y: emissions through ash transportation.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

>>
Category I.D.
The baseline emissions for grid connected electricity generation are described as follows:

$BE_{el} = EGy * EFy$

where,
BE_{el} = Baseline Emissions of electricity generation (tonnes CO_{2equ})
EGy = Electricity production by project activity (MWh).
EFy = Emission Coefficient (measured in tonnes CO_2equ/MWh)

Category III.E.
Baseline emissions

$BEy = MBy * GWP\_CH_4 – MD_{y,reg} * GWP\_CH_4$

where,

MB_y	methane generation potential in the year "y" (tonnes of CH4), estimated as in AMS III-G
$MD_{y,reg}$	methane that would be destroyed or removed in the year "y" for safety or legal regulation
GWP_CH_4	GWP for CH4 (value of 21 is used for the first commitment period)

The Yearly Methane Generation Potential is calculated using the first order decay model based on the discrete time estimate method of the IPCC Guidelines, as described in category AMS III-G.

$$MB_y = \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j=A}^{D} A_{j,x} \cdot DOC_j \cdot \left(1 - e^{-k_j}\right) \cdot e^{-k_j \cdot (y-x)}$$

where:

F	is fraction of methane in the landfill gas (default 0.5)
DOCj	is per cent of degradable organic carbon (by weight) in the waste type j
DOCf	is fraction of DOC dissimilated to landfill gas (IPCC default 0.77)
MCF	is Methane Correction Factor (fraction, IPCC default 1.0)
Aj,x	is amount of organic waste type j landfilled in the year x (tonnes/year)
kj	is decay rate for the waste stream type j
J	is waste type distinguished into the waste categories (from A to D), as illustrated in the table below
x	is year since the landfill started receiving wastes: x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)
y	is year for which LFG emissions are calculated

Waste stream A to E	Per cent DOC_j (by weight)	Decay-rate (k_j)
A. Paper and textiles	40	0,023
B. Garden and park waste and other (non-food) putrescibles	17	0,023
C. Food waste	15	0,231
D. Wood and straw waste [1)]	30	0,023
E. Inert material	0	0

[1)] Excluding lignin-C

As the biomass combust in the project is 100% rice husks, the following parameters are choose:

$DOC = DOC_c = 15\%$
$k = k_c = 0{,}231$

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

>>

Category I.D.
Emission reduction by grid connected renewable electricity production during a given period equals:

$ER_{ID} = BE_{el}$

where,
ER_{ID} = emission reduction due to grid connected renewable electricity production (tonnes CO_2equ)
BE_{el} = Baseline Emissions of electricity generation (tonnes CO_{2equ})

Category III.E.
Emission reduction by avoidance of methane production from biomass decay through controlled combustion equals:

$ER_{IIIE} = BE_y - PE_y$

where,
ER_{IIIE} Emission reduction by the avoidance of methane production from biomass decay through controlled combustion (tonnes of CO2 equivalent)
PE_y Project activity emissions (tonnes of CO_2 equivalent)
BE_y Baseline methane emissions from biomass decay (tonnes of CO_2 equivalent)

Total
The total combined emission reduction of the bundle of project activities of type I.D. and III.E are:
$ER_{total} = ER_{ID} + ER_{IIIE}$

ER_{total} Total net emission reduction by the bundle of project activities (tonnes CO2 equivalent)
ER_{ID} Emission reduction due to grid connected renewable electricity production (tonnes CO_2equ)

ER_{IIIE} Emission reduction by the avoidance of methane production from biomass decay through controlled combustion (tonnes of CO2 equivalent)

Remark: formulae can be used for any given time period. It should be stated clearly what time period is meant.

E.2 Table providing values obtained when applying formulae above:

>>

Table 10: Emission reduction by grid connected electricity generation

Indicator	Abbreviation	Value	Unit
Operating margin emission factor	EF_OMy	0.822	tonnes CO_2/MWh
Build margin emission factor	EF_BM_y	0.102	tonnes CO_2/MWh
Baseline emission factor	EFy	0.462	tonnes CO_2/MWh
Annual net electricity generated by the Project	EGy	26,856	MWh
Baseline emissions	BE_{el}	12,407	tonnes CO_2/year
Project emissions	n.a.	0	tonnes CO_2/year
Emission reduction from electricity generation	ER_{ID}	12,407	tonnes CO_2/year

Table 11: Emission reduction by avoidance of methane production from biomass decay through controlled combustion

Indicator	Abbreviation	Value	Unit
methane correction factor	MCF	1.0	dimensionless fraction
degradable organic carbon	DOC	0.15	dimensionless fraction
fraction DOC dissimilated to landfill gas	DOC_F	0.77	dimensionless fraction
fraction of CH_4 in landfill gas	F	0.5	dimensionless fraction
decay rate for the rice husk	k	0.231	$year^{-1}$
Quantity of biomass treated under the project activity	$Q_{biomass}$	27,475	tonnes/year
GWP for CH_4	CH_4_GWP	21	tonnes of CO_2 equivalent/tonne of CH_4
Baseline methane emissions from biomass decay	BE_y	21,219	tonnes of CO_2 equivalent/year
Non-biomass carbon of the waste combusted	$Q_{y,non-biomass}$	0	tonnes of Carbon/year
Quantity of auxiliary fuel used	$Q_{y,fuel}$	0	tonnes/year
CO_2 emission factor for the combustion of the auxiliary fuel	$E_{y,fuel}$	n.a.	tonnes CO_2/tonne fuel
Emissions through combustion of non-biomass carbon	$PE_{y,comb}$	0	tonnes of CO_2 equivalent/year
Quantity of waste combusted	Q_y	27,475	tonnes/year
Average truck capacity for waste transportation	CT_y	n.a.	tonnes/truck
Average incremental distance for waste transportation	DAF_w	0	km/truck
CO_2 emission factor from fuel use due to transportation	EF_{CO2}	0.674	$kgCO_2$/km
Ash content in the rice husk	AC	0.18 [a]	dimensionless fraction (%wt)
Quantity of combustion residues produced	$Q_{y,ash}$	4,946	tonnes/year
Average truck capacity for combustion residues transportation	$CT_{y,ash}$	4,5	tonnes/truck

Average distance for combustion residues transportation	DAF_{ash}	30	km/truck
Emissions through incremental transportation	$PE_{y,transp}$	22	tonnes of CO_2 equivalent/year
Emissions through electricity or diesel consumption	$PE_{y,power}$	0	tonnes of CO_2 equivalent/year
Project activity emissions	PE_y	22	tonnes of CO_2 equivalent/year
Emission reduction by avoidance of methane production from biomass decay	ER_{IIIE}	21,197	tonnes of CO_2 equivalent/year

[a] CIENTEC, 1986. Programa Energia: Aproveitamento Energético da Casca de Arroz. Relatório do Projeto de Pesquisa. Porto Alegre, Fundação de Ciência e Tecnologia.

Table 12: Net emission reduction by the bundle of projects (tonnes CO2 equivalent per year)

Year	**Type I.D grid connected electricity generation**			**Type III.E Avoidance of methane production**			**Total net emission reduction**
	Baseline emissions (A)	Project emissions (B)	Net emission reduction (A-B)	Baseline emissions (C)	Project emissions (D)	Net emission reduction (C-D)	(A-B) + (C-D)
1 Nov - 31 Dec 2007	**2,068**	**0**	**2,068**	**1,936**	**4**	**1,932**	**4,000**
2008	**12,407**	**0**	**12,407**	**9,209**	**22**	**9,187**	**21,594**
2009	**12,407**	**0**	**12,407**	**14,982**	**22**	**14,960**	**27,368**
2010	**12,407**	**0**	**12,407**	**19,565**	**22**	**19,543**	**31,950**
2011	**12,407**	**0**	**12,407**	**23,202**	**22**	**23,180**	**35,587**
2012	**12,407**	**0**	**12,407**	**26,089**	**22**	**26,067**	**38,475**
2013	**12,407**	**0**	**12,407**	**28,381**	**22**	**28,359**	**40,766**
1 Jan - 31 Out 2014	**10,340**	**0**	**10,340**	**25,166**	**19**	**25,148**	**35,487**
Total estimated reductions	**86,852**	**0**	**86,852**	**148,531**	**156**	**148,376**	**235,228**
Total number of crediting years	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Annual average over the first crediting period of estimated reductions (tonnes of CO_2 e)	**12,407**	**0**	**12,407**	**21,219**	**22**	**21,197**	**33,604**

SECTION F.: Environmental impacts:

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

>>

Documentation

The renewable energy plant has received permit for construction from ANEEL, the Brazilian electricity energy National Agency (License ANEEL n°75, published in the Brazilian Official Diary, n° 33 section 1, 18th February 2005)

The environmental permit for operation from the Environmental Agency of Rio Grande do Sul State (FEPAM – Fundação Estadual de Proteção Ambiental) has the number 833/2004, and it was issued on 18th November 2004, and is valid until 18th November 2006. The CAAL rice mil is accomplished to local environmental license, in such a way, it has authorization for operation according the law.

Renewable electricity production

The project will contribute to displace more carbon-intensive electricity generation sources from the South-Southeast grid, promoting the use of renewable fuels (biomass) for electricity generation

Rice husks

The project will improve the local environmental condition due to the adequate treatment of rice husks residues. Currently these residues are a problem because they are left decomposing in landfills, releasing methane emissions to the atmosphere.

SECTION G. Stakeholders' comments:

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

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

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

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

G.2. Summary of the comments received:

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1. City Hall of Alegrete.
2. Brazilian Forum of NGOs.
3. District Attorney.

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

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1. The City Hall of Alegrete answered that there is no objection for the project implementation once the environmental permit for operation was already obtained.
2. The letter of invitation sent in march 02 was answered in may 17, after the established period of 30 days for stakeholder comments, by the Brazilian Forum of NGOs. The Brazilian Forum of NGOs suggests the "Gold Standard" methodology as more accurate criteria to evaluate the sustainability impacts of the project implementation.
3. The District Attorney raised questions about the source of the water that will be utilized in the project and the destination of the ashes from the biomass combustion process. PTZ, as the project developer, answered that the water will came from artesian well and the ash will be handled following the local environmental standards established by the Environmental Agency of Rio Grande do Sul State (FEPAM – Fundação Estadual de Proteção Ambiental).

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project participants

Organization:	CAAL – Cooperativa Agroindustrial Alegrete Ltda
Street/P.O.Box:	BR 290, km 583
Building:	
City:	Alegrete
State/Region:	Rio Grande do Sul
Postfix/ZIP:	97541-500
Country:	Brasil
Telephone:	+55 3422 9200
FAX:	+55 3422 4911
E-Mail:	caaladm@caal.com.br
URL:	www.caal.com.br
Represented by:	
Title:	
Salutation:	Mr.
Last Name:	Ramos
Middle Name:	Alberto Pacheco
First Name:	Jose
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	PTZ BioEnergy Ltd.
Street/P.O.Box:	Av. Loureiro da Silva
Building:	2001,Cj. 424
City:	Porto Alegre
State/Region:	Rio Grande do Sul
Postfix/ZIP:	90050-240
Country:	Brazil
Telephone:	+55 51 3028 7858
FAX:	+55 51 3028 7857
E-Mail:	ptz@ptz.com.br
URL:	www.ptz.com.br
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Pretz
Middle Name:	
First Name:	Ricardo
Mobile:	+55 51 9974 5486
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	BioHeat International B.V.
Street/P.O.Box:	Colosseum 11
Building:	
City:	Enschede
State/Region:	
Postfix/ZIP:	7521 PV
Country:	The Netherlands
Telephone:	+31 53 486 1186
FAX:	+31 53 486 1180
E-Mail:	office@bioheat-international.com
URL:	http://www.bioheat-international.com/
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Venendaal
Middle Name:	
First Name:	René
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Essent Energy Trading B.V.
Street/P.O.Box:	P.O. Box 689
Building:	
City:	's-Hertogenbosch
State/Region:	
Postfix/ZIP:	5201 AR
Country:	The Netherlands
Telephone:	+31 73 616 1878
FAX:	
E-Mail:	nyame.degroot@essent.nl
URL:	www.essent.nl
Represented by:	
Title:	Manager Emissions and Weather, Energy Management Group
Salutation:	Mr.
Last Name:	de Groot
Middle Name:	
First Name:	Nyame
Mobile:	+31 627 003 708
Direct FAX:	+31 73 853 1578
Direct tel:	+31 73 6161878
Personal E-Mail:	nyame.degroot@essent.nl

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funds.

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Annex 3

BASELINE INFORMATION

The grid factor calculation was conduced with the following databases:

- Electricity Generated at 2004 (MWh):

Operador Nacional do Sistema Elétrico. Centro Nacional de Operação do Sistema. Acompanhamento Diário da Operação do SIN (www.ons.org.br)

- Efficiency for thermal power plants:

Thermal Power Plant	Efficiency calculation sources
Jorge Lacerda A	Eletrobrás[1] and CIMGC[2]
Jorge Lacerda B	Eletrobrás and CIMGC
Jorge Lacerda C	Eletrobrás and CIMC
Charqueadas	Eletrobrás and CIMGC
P.Medice A	Eletrobrás and CIMGC
P. Medice B	Eletrobrás and CIMGC
P. Medice (A+B)	Eletrobrás and CIMGC
São Jeronimo	Eletrobrás and CIMGC
Figueira	Eletrobrás and CIMGC
Santa Cruz	Eletrobrás and CIMGC
Igarapé	Eletrobrás and CIMGC
Piratininga	Eletrobrás and CIMGC
Nova Piratininga	Eletrobrás and CIMGC

For the other efficiency inputs the Executive Board recommended values were used just for the Build Margin calculation. For the Operating Margin the values adopted were the average as described in the OECD information paper (Bosi, 2002)[3].

The spreadsheets containing the efficiency and the grid factor calculations are confidential files and are available only for authorized persons.

[1] Eletrobrás – http://www.eletrobras.gov.br/EM_atuacao_ccc/default.asp

[2] Comissão Interministerial de Mudança Global do Clima – CIMGC; Análise sobre o Setor Energético na Região Sul: www.mct.gov.br/clima/comunic_old/energi41.htm#index

[3] Bosi, M., A. Laurence, P. Maldonado, R. Schaeffer, A.F. Simoes, H. Winkler and J.M. Lukamba. Road testing baselines for GHG mitigation projects in the electric power sector. OECD/IEA information paper, October 2002.

Biomass and electricity aspects in the CAAL Biomass Electricity Generation Project

Year	Electricity generated/year (MWh)	Amount of rice husks produced (kg/year)	Amount of rice husks consumed (kg/year)	Effective rice husk consume by the project activity (kg/year)	Amount of rice husks to the landfill (kg/year)	% Consumed
2006	-	29,631,000	2,156,000	0	27,475,000	7%
2007	4,476	29,631,000	7,960,000	5,804,000	21,671,000	27%
2008	26,856	29,631,000	29,631,000	27,475,000	0	100%
2009	26,856	29,631,000	29,631,000	27,475,000	0	100%
2010	26,856	29,631,000	29,631,000	27,475,000	0	100%
2011	26,856	29,631,000	29,631,000	27,475,000	0	100%
2012	26,856	29,631,000	29,631,000	27,475,000	0	100%
2013	26,856	29,631,000	29,631,000	27,475,000	0	100%
2014	26,856	29,631,000	29,631,000	27,475,000	0	100%
2015	26,856	29,631,000	29,631,000	27,475,000	0	100%
2016	26,856	29,631,000	29,631,000	27,475,000	0	100%
2017	26,856	29,631,000	29,631,000	27,475,000	0	100%
2018	26,856	29,631,000	29,631,000	27,475,000	0	100%