



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

CONTENTS

- A. General description of the small-scale project activity.
- B. Baseline methodology
- C. Duration of the project activity / Crediting period
- D. Monitoring methodology and plan
- E. Calculation of GHG emission reductions by sources
- F. Environmental impacts
- G. Stakeholders comments

Annexes

Annex 1: Information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

**Revision history of this document**

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	<ul style="list-style-type: none">• 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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CAMIL Itaqui Biomass Electricity Generation Project**A.2. Description of the small-scale project activity:**

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Purpose

The CAMIL Itaqui Biomass Electricity Generation Project developed by CAMIL is a biomass electricity generation in Itaqui city, Rio Grande do Sul state, Brazil, which is operational since 2001. The electricity consumption from the grid was totally displaced by the power plant. In addition, the CAMIL biomass plant in Itaqui has potential to produce a surplus of energy that can be sold to the grid. 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

CAMIL is a rice mill company, with the production of paddy rice and rice oil to the internal market as its core business. CAMIL is the biggest rice company in Brazil (Brazilian Rice Year Book 2005, pg. 59)¹.

The main activity in the region where the project will be located is rice production and processing. The rice mills generate huge amounts of biomass residues (mainly rice husks). Brazilian and local state legislation prohibits the unlicensed displacement and/or uncontrolled burning of that rice husks, as well as it restricts the land filling of rice husks, allowing the displacement in previously licensed areas. As result, huge amount of rice husks were left to decay in these licensed areas.

The CAMIL project consists in a biomass electricity unit with 4.2 MWe of installed capacity using rice husks residues as fuel. Currently, CAMIL demands a maximum of 3.5 MWe resulting in an amount of 0.7 MWe to be sold to the grid. Despite the fact of CAMIL possess the necessary biomass to reach the 4.2 MWe, only recently the company is licensed to sell its electricity surplus to the grid.

The only kind of biomass that CAMIL uses is its own rice mill residue as fuel for the boiler. The amount of biomass used by third suppliers is null, so the company does not depend on external sources of biomass to maintain the power plant fully operational. Internal transportation of fuel is fully attended with electrical screws, conveyors and elevators.

Like all big rice processing units, CAMIL generates a substantial amount of rice husks that is disposed in lands located in the rural area of the city. Before the power plant installation, 81% of rice husks produced were disposed in legal landfills outside the site of CAMIL-Itaqui rice processing plant.

After the project implementation, 70% of total rice husks production is used as fuel in the boiler, having a surplus of 30% rice husks that are disposed in legal landfills outside the location where the project

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



activity takes place. After October 2005 surplus electricity can be sold to the grid. This means that from December 2005 93% of all generated rice husks will be utilised in the project activity. The surplus of 7% rice husks is disposed in legal landfills outside the location where the project activity takes place. It is emphasized that the project activity is the combustion of rice husks, thereby replacing electricity from the grid and avoiding the decay of rice husks. Rice husks still left for decay after project implementation are not part of the project activity, and are not part of the project emissions.

Contribution of the project to sustainable development

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

- Increases in employment in the area where the plant is located;
- Diversification in the sources of electricity generation;
- Uses of clean and efficient technologies, and conserving 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)	Camil Alimentos S/A	No
Brazil (host)	PTZ BioEnergy Ltd.	No
The Netherlands	Bioheat International 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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Itaqui

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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CAMIL is a rice mill located in Itaqui City, eastern region of Rio Grande do Sul State, at the address: Rua Dr. Afonso Escobar, 1193 – Estação, CEP 97650-000.

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 06: 30 September 2005 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-SSC-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*

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 4.2 MWe, which is below the limit for type I projects.

Category I.D.

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 or non-renewable biomass 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 non-renewable biomass or 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}.

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

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 electricity distribution system of Rio Grande do Sul. 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 Brazilian grid. Thus the project activity replaces the use of at least one fossil fuel.
2. The unit uses only rice husks, which is a renewable biomass.
3. The plant has a maximum output of heat (7.8 MW_{th}) and power (4.2 MWe). The sum of these outputs is below the limit of 45 MW_{thermal}.

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

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

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:

Technology/measure

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 as a result of anthropogenic activity. Due to the project activity, decay is prevented through controlled combustion and less methane is produced and emitted to the atmosphere. The project activity does not recover or combust methane (unlike III D). Measures shall both reduce anthropogenic emissions by sources, and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually.

Decay is prevented through controlled combustion of rice husks and less methane is produced and emitted to the atmosphere. The direct carbon emissions are related to the emission of methane and nitrous oxide by combustion of the rice husks, which is maximally 5,179 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. The rice husks that are not combusted are not part of the project activity and are sent to legal landfills outside the project boundary.

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

**Use of environmentally sound technologies and transfer of know how**

The CAMIL project has been operational since 2001 using state of art of conventional Rankine steam cycle. The combustion of the fuel has been performed with proven technologies like a medium pressured boiler (22 bar). The power plant control is supervised by a high standard automation set of LPCs and computers. A condensing steam turbine drives an electrical generator. The energy is managed by control panels and devices that keep a steady condition of voltage, frequency and load. Under currently operational conditions, the boiler produces 35,000 kg/h of steam at 22 bar and 350°C while it consumes 7,500 kg/h of rice husks. The steam feeds a multistage steam condensing turbine at 0.09 bar. Before the turbine inlet, 28% of total steam generated is deviated to process heat. The steam turbine drives a 3 phase synchronous generator producing up to 3,800 kWe at 13,800 V and 60 Hz.

An integration panel allows synchronicity and full load control for the auxiliary power plant services, rice mill and export to the grid. Electricity is sent to the utility distribution lines through a transformer of 13.8 kV. The project has obtained all necessary licenses and complies with the Brazilian and State environmental standards, mainly regarding the control of flue gas emissions and wastes. The ash from the plant is 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. The plant has a demonstration function in the region and attracts the interest of many rice mill owners. Also capacity building for operation and maintenance of the plant is being promoted. Specialized service companies are introduced and act as carriers of know how; performing training of plant operators, specialized maintenance and tuning of the equipment. Knowledge is transferred in the region, thereby developing the use of this technology in Brazil.

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 that use coal fired thermal power plants complementing the energy 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 ONS², Eletrobrás³ and ANEEL⁴ corresponding to the south-southeast-midwest Brazilian interconnected Electrical System. The carbon emission factor obtained was 0,463 tonnes of CO₂/MWh. Full details about calculation methods are presented in the confidential PTZ's

² Operador Nacional do Sistema Elétrico - Dados Relevantes do Ano de 2003 (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)



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

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 project emissions (tonnes CO₂ equivalent per year)

Year ^{a)}	Type I.D grid connected electricity generation			Type III.E Avoidance of methane production			Total net emission reduction (A-B) + (C-D)
	Baseline emissions (A)	Project emissions (B)	Net emission reduction (A-B)	Baseline emissions (C)	Project emissions (D)	Net emission reduction (C-D)	
2001 - 2002	7,217	0	7,217	32,227	2,513	29,714	36,932
2002 - 2003	8,614	0	8,614	39,929	3,113	36,816	45,430
2003 - 2004	8,183	0	8,183	48,102	3,750	44,352	52,534
2004 - 2005	8,041	0	8,041	53,315	4,157	49,158	57,199
2005 - 2006	9,634	0	9,634	60,253	4,698	55,556	65,189
2006 - 2007	10,806	0	10,806	66,424	5,179	61,245	72,052
2007 - 2008	10,806	0	10,806	66,424	5,179	61,245	72,052
Total estimated reductions	63,301	0	63,301	366,674	28,588	338,087	401,388
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)	9,043	0	9,043	52,382	4,084	48,298	57,341

^{a)} Years from 01 July until 31 June of the subsequent year.**A.4.4. Public funding of the small-scale project activity:**

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There has been 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 06: 30 September 2005).

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 or non-renewable biomass 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 non-renewable biomass or 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}.

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

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 electricity distribution system of Rio Grande do Sul. 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 Brazilian grid. Thus the project activity replaces the use of at least one fossil fuel.



2. The unit uses only rice husks, which is renewable biomass.
3. The plant has a maximum output of heat (7.8 MW_{th}) and power (4.2 MWe). The sum of these outputs is below the limit of 45 MW_{thermal}.

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

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

The applicability criteria of the Category III.E. 'Avoidance of methane production from biomass decay through controlled combustion' are:

Technology/measure

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 as a result of anthropogenic activity. Due to the project activity, decay is prevented through controlled combustion and less methane is produced and emitted to the atmosphere. The project activity does not recover or combust methane (unlike III D). Measures shall both reduce anthropogenic emissions by sources, and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually.

Decay is prevented through controlled combustion of rice husks and less methane is produced and emitted to the atmosphere. The direct carbon emissions are related to the emission of methane and nitrous oxide by combustion of the rice husks, which is maximally 5,179 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. The rice husks that are not combusted are not part of the project activity and are sent to legal landfills outside the project boundary.

It is concluded that project category 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 either using *the average of the approximate "operating margin" and the "build margin"* or taking *the weighted average emissions of the current generation mix*. 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 calculations as described under category III.E. of Appendix B are used. This methodology allows to calculate the Degradable organic carbon (DOC), by taking either the default value (0.3) , or by making use of the equation $DOC = 0.4 (A) + 0.17 (B) + 0.15 (C) + 0.30 (D)$ where, A: per cent waste that is paper and textiles, B: per cent waste that is garden waste, park waste or non-food organic putrescibles, C: per cent waste that is food waste; D: per cent waste that is wood or straw. Because rice husks are a homogeneous feedstock, not consisting of the factors A, B, C, or D, it is decided to use the default value of DOC of 0.3.

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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The Marrakesh Accords and decision 18/CP.9 provide guidance on the eligibility of a proposed CDM project activity which started before registration. If project participants wish to have the crediting period starting prior to the registration of their project activity, they shall:

- (a) Provide evidence that the starting date of the CDM project activity falls between 1 January 2000 and the date of the registration of a first CDM project activity, bearing in mind that only CDM project activities submitted for registration before 31 December 2005 may claim for a crediting period starting before the date of registration; and
- (b) Provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity. This evidence shall be based on (preferably official, legal and/or other corporate) documentation that was available to third parties at, or prior to, the start of the project activity.

Ad a. The plant was commissioned on 01/04/2001, which is the starting date of the project. The permit for construction of the renewable energy plant is dated from 2000. See License ANEEL n°361, published in the Brazilian Official Diary, August, 28th 2000. The time schedule in the final version of the feasibility study 'Implantacao de uma central termoeletrica de 4.2 MW na Camil Alimentos S.A. - Itaquí-RS', of 08/03/2000 prepared by PTZ confirms the commissioning date.

Ad. b. In the decision to proceed with the project activity, i.e. to invest in a combined heat and power plant, fuelled by rice husks, the incentive from CDM was seriously considered. Documented discussions held before project implementation during meetings at Camil have been provided to the validator.

Attachment A to Appendix B indicated 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 - Situation before implementation of the project activities

This scenario represents the situation before implementation of grid connected renewable electricity production facility, like the case in 2000. In this situation rice husks are left for decay, and because no electricity was produced with rice husks, all needed electricity was delivered by the grid.

Scenario 2 - The construction of a renewable energy plant

In this scenario, the Itaquí biomass electricity generation plant is established. Rice husks will be used to produce heat and power. Methane emissions from the decay of biomass residues will be interrupted.

With respect to the **investment** barrier:



- The continuation of current practices (Scenario 1) did not pose any investment barrier to the project developer, and required no further financing.
- The construction of a renewable energy plant (Scenario 2) faced specific investment barriers due to the fact that the capital costs related to biomass CHP units were very high. The capital costs involved in the project posed a barrier, especially considering the high interest rates prevalent in developing countries like Brazil. It is worth noting that there were 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 (\$)	1,155,482.26	393,701.31
IRR	38,04%	13,78%
Discount Rate		13,48%
Present Value of carbon sold (7 years) \$	2,753,541.00	

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 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 modern 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 80% of the rice is transformed into products. The other 20-22% 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 more than 59,60 % of residues are not used or sold.



- 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 utilized to sell benefited 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. The Itaquí plant has a great amount of rice husks available 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, the following other barrier can be identified. The Itaquí rice processing plant of CAMIL has an electricity demand of maximally 3.5 MWe, while the rice husks power plant has a capacity of 4.2 MWe, which means that 0.7 MWe could be sold to the grid. However, in 2001 no regulations were operational to protect self-producers, so it was uncertain whether the surplus electricity could be sold to the grid. Indeed, this barrier proved to be existent, because only recently CAMIL received the Independent producer licence (ANEEL n°75, published in the Brazilian Official Diary, n° 33 section 1, 18th February 2005).

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 the investment, technological and other barriers.

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	Yes

Because the combined investment barrier and other barrier would have prevented 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 CO₂ emissions, as showed in the following analysis:

- The baseline scenario (scenario 1) represents the electricity consumption from the grid by CAMIL. This electricity is provided from a more intensive carbon source, specially in the Rio Grande do Sul state, where it has a more significant contribution from coal fired power plants. Almost all rice husks produced were left to decay, corresponding to 38,704 tCO₂eq emitted per year.
- The Scenario 2 corresponds to the biomass power plant implementation. The boiler consumes 40,205 tonnes of rice husks per year to electricity and process heat generation. After October 2005, CAMIL will start to sell energy to the grid. The biomass consumption necessary to perform this activity corresponds to 11,143 tonnes of rice husks per year. The total amount of biomass that will be consumed is 51,348 tonnes per year, avoiding methane generation caused by biomass decay. The methane decaying avoidance will result in 61,245 tonnes of CO₂eq per year compared to the baseline scenario.



- The Project Scenario is environmentally additional in comparison to the baseline scenario, and therefore eligible to receive Certified Emissions 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:

>>

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 site where the treatment of biomass takes place.

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. Therefore the project boundary of both project activities is the physical, geographical site of the rice mill as indicated in paragraph A 4.1.

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

>>

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 06: 30 September 2005). 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 06: 30 September 2005). 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
31/10/2005

Name of person/entity determining the baseline:

- Ricardo Pretz and Ronaldo Hoffmann from PTZ Bioenergy Ltda and;
- Martijn Vis and René Venendaal 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:



>>

01/04/2001

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:

>>

01/07/2001

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:

>>

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



>>

Monitoring methodology of category I.D. as described in 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities' (version 06: 30 September 2005)

Monitoring methodology of category III.E. as described in 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities' (version 06: 30 September 2005)

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

>>

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 amount of biomass and / or other organic matter combusted (Q_{biomass}) by the project activity in a year shall be monitored.
- Emissions of CH₄ and N₂O will be determined using the most recent IPCC default values
- The total annual project related emissions will be monitored and should be less than or equal to 15 kt of CO₂ equivalent.

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 project related emissions are negligible, except for the emissions of methane and nitrous oxide, due to biomass combustion. The monitoring methodology of category III.E. allows monitoring of the emission of methane and nitrous oxide, due to biomass combustion, by determination of:

$$PE_y = Q_{\text{biomass}} * E_{\text{biomass}} (CH_{4\text{bio_comb}} * CH_4_GWP + N_{2\text{Obio_comb}} * N_2O_GWP) / 10^6$$

where,

PE_y	Project activity emissions (kilotonnes of CO ₂ equivalent)
Q_{biomass}	Quantity of biomass treated under the project activity (tonnes)
E_{biomass}	Energy content of biomass (TJ/tonne)
$CH_{4\text{bio_comb}}$	CH ₄ emission factor for biomass and waste (which includes dung and agricultural, municipal and industrial wastes) combustion (kg of CH ₄ /TJ, default value is 300)
CH_4_GWP	GWP for CH ₄ (tonnes of CO ₂ equivalent/tonne of CH ₄)
$N_{2\text{Obio_comb}}$	N ₂ O emission factor for biomass and waste (which includes dung and agricultural, municipal and industrial wastes) combustion (kg/TJ, default value is 4)



N₂O_GWP GWP for N₂O (tonnes of CO₂ equivalent/tonne of NO₂)

As indicated before, Q_{biomass} can be measured accurately; because rice husks are a homogeneous biomass feedstock E_{biomass} can be determined accurately. The other factors will be determined using the most recent IPCC default values. The project emissions will be monitored and it is proved that they value less than or equal to 15 ktonnes of CO₂ equivalent.

It is justified to apply monitoring methodology belonging to category E.III as described in 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities' (version 06: 30 September 2005).

**D.3 Data to be monitored:**

>>

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':								
<i>ID-number</i>	<i>Data variable</i>	<i>Source of data</i>	<i>Data unit</i>	<i>Measured (m), calculated (c) or estimated (e)</i>	<i>Recording frequency</i>	<i>Proportion of data to be monitored</i>	<i>How will the data be archived? (Electronic/ paper)</i>	<i>Comment</i>
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	D. 3.4 and D. 3.5	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.
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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':

<i>ID-number</i>	<i>Data variable</i>	<i>Source of data</i>	<i>Data unit</i>	<i>Measured (m), calculated (c) or estimated (e)</i>	<i>Recording frequency</i>	<i>Proportion of data to be monitored</i>	<i>How will the data be archived? (Electronic/ paper)</i>	<i>Comment</i>
D.3.5	Amount of rice husks generated by CAMIL	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 by CAMIL
D. 3.6	Amount of rice husks removed by truck	Documentation on transportation transactions	tonne/ month	m	Monthly	100%	Electronic and paper	
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 3.4) minus removed rice husks (D. 3.5)



D 3.8	MC: Moisture content of the biomass	Determination of moisture content	wt % (wet basis)	m	Yearly	Sample	Paper	<p>The moisture content of the rice - and consequently in the husks - are monitored daily by a local lab.</p> <p>Because moisture content of rice husks is nearly constant, the analysis of the moisture content is performed once a year, on basis of daily measurements.</p>
D 3.9	Edry: Energy content of the biomass (dry basis)	Literature	GJ/tonne dry	M	Once	Sample	Paper	The energy content of rice husks on dry basis, does practically not vary. Therefore a literature value is used.
D 3.10	E _{biomass} : Energy content of the biomass (as received)	D. 3.5 and D 3.6	GJ/tonne	C	Yearly	n.a.	Paper	The energy content is determined by the following equation: E _{biomass} = Edry* (1-MC)
D.3.11	CH ₄ bio_comb	Most recent IPCC 1996 default value		E	Once	n.a.	Paper	
D. 3.12	CH ₄ _GWP	Most recent IPCC 1996 default value		E	Once	n.a	Paper	
D. 3.13	N ₂ O _{bio} _comb	Most recent IPCC 1996 default value		E	Once	n.a	Paper	
D 3.14	N ₂ O_GWP	Most recent IPCC 1996 default value		E	Once	n.a	Paper	
D. 3.15	PEy	D. 3.7 D. 3.10 D. 3.11 D. 3.12 D. 3.13 D. 3.14	ktonnes of CO ₂ equivalent	C	Monthly	n.a.	Electronic and paper	Using the formula are 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.

<i>ID number</i>	<i>Uncertainty level of data (High/Medium/Low)</i>	<i>Explain QA/QC procedures planned for these data, or why such procedures are not necessary.</i>
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.3.2.
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.		
<i>ID number</i>	<i>Uncertainty level of data (High/Medium/Low)</i>	<i>Explain QA/QC procedures planned for these data, or why such procedures are not necessary.</i>
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	All produced rice husks that do not leave the factory site, are combusted in the CHP plant. This data can be double-checked by comparison with the net electricity production of the rice husk plant, taking average numbers of the electric efficiency and the energy density of the rice husks.
D. 3.8	Low	The moisture content of the rice, and consequently of the husks is monitored on a daily base. The moisture content of the husks is fairly constant, once the rice (and husks) are conditioned and stored at well known conditions, according to the health procedures for storage of grains. The daily data on the moisture content of rice and rice husks will therefore be analysed on a yearly base. In case of substantial changes in the process that could have an effect on the moisture content of the husks, additional analyses of moisture content will be performed. The moisture content is determined according to Brazilian Standard NBR 8289.
D.3.9	Low	The HHV of rice husks hardly varies. No additional QC and QA procedures are necessary.
D. 3.10	Low	It is a calculated value based on D. 3.8 and D. 3.9, so no additional QC and QA procedures will be applied.
D. 3.11	Low	Most recent IPPC default values will be used as appropriate for small scale projects
D. 3.12	Low	Most recent IPPC default values will be used as appropriate for small scale projects
D. 3.13	Low	Most recent IPPC default values will be used as appropriate for small scale projects
D. 3.14	Low	Most recent IPPC default values will be used as appropriate for small scale projects
D. 3.15	Low	It is a calculated value based on D.3.7, D.3.10, D.3.11, D.3.12, D.3.13 and 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:

>>

CAMIL Alimentos S/A (CAMIL), PTZ Bioenergy Ltda (fully and exclusively authorized to act on the behalf of CAMIL regarding this CDM project) and BioHeat International (exclusively authorized to sell the carbon credits from the CAMIL project) are all project participants.

CAMIL 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 CAMIL.

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, from PTZ, as well as René Venendaal and Martijn Vis from 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 CO₂equ/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 sources 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, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants.”;

OR,

- (b) The weighted average emissions (in kg CO₂equ/kWh) of the current generation mix.

Category III.E.

Baseline emissions

$$CH_4_IPCC_{decay} = (MCF * DOC * DOC_F * F * 16/12)$$

where,

CH ₄ _IPCC _{decay}	IPCC CH ₄ emission factor for decaying biomass in the region of the project activity tonnes of CH ₄ /tonne of biomass or organic waste)
MCF	methane correction factor (fraction) (default is 0.4)
DOC	degradable organic carbon (fraction) (default is 0.3)
DOC _F	fraction DOC dissimilated to landfill gas (default is 0.77)
F	fraction of CH ₄ in landfill gas (default is 0.5)

$$BE_y = Q_{biomass} * CH_4_IPCC_{decay} * GWP_CH_4$$

where,

BE _y	Baseline methane emissions from biomass decay (tonnes of CO ₂ equivalent)
Q _{biomass}	Quantity of biomass treated under the project activity (tonnes)
CH ₄ _GWP	GWP for CH ₄ (tonnes of CO ₂ equivalent/tonne of CH ₄)

Project emissions

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

$$PE_y = Q_{biomass} * E_{biomass} (CH_{4bio_comb} * CH_4_GWP + N_{2Obio_comb} * N_2O_GWP) / 10^6$$

where,

PE _y	Project activity emissions (kilotonnes of CO ₂ equivalent)
Q _{biomass}	Quantity of biomass treated under the project activity (tonnes)
E _{biomass}	Energy content of biomass (TJ/tonne)
CH _{4bio_comb}	CH ₄ emission factor for biomass and waste (which includes dung and agricultural, municipal and industrial wastes) combustion (kg of CH ₄ /TJ, default value is 300)
CH ₄ _GWP	GWP for CH ₄ (tonnes of CO ₂ equivalent/tonne of CH ₄)
N _{2Obio_comb}	N ₂ O emission factor for biomass and waste (which includes dung and agricultural, municipal and industrial wastes) combustion (kg/TJ, default value is 4)
N ₂ O_GWP	GWP for N ₂ O (tonnes of CO ₂ equivalent/tonne of NO ₂)

**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** (BE_y) resulting from the electricity supplied and/or not consumed from the grid is calculated as follows, where EG_y is the annual net electricity generated from the Project.

$$BE_y = EG_y * EF_y$$

The **baseline emissions factor** (EF_y) is a weighted average of the EF_{OMy} and EF_{BM_y} :

$$EF_y = (\omega_{OM} * EF_{OMy}) + (\omega_{BM} * EF_{BM_y})$$

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 (tCO₂/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 energy content of the used rice husks -needed to estimate the project emissions- is determined in the following way:

$$E_{biomass} = Edry * (1-MC) * 10^{-3}$$

where,



E_{biomass} = Energy content of biomass in TJ/tonne

E_{dry} = Energy content of dry biomass (HHV dry) in GJ/tonne

MC = moisture content of rice husks weight % wet basis.

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.

Except methane and nitrous oxide emissions because of combustion of biomass (to be determined under category III.E. project activity), the project emissions are negligible.

Category III.E.

$$PE_y = Q_{\text{biomass}} * E_{\text{biomass}} (\text{CH}_4_{\text{bio_comb}} * \text{CH}_4_GWP + \text{N}_2\text{O}_{\text{bio_comb}} * \text{N}_2\text{O_GWP}) / 10^3$$

where,

PE_y	Project activity emissions (ktonnes of CO ₂ equivalent)
Q_{biomass}	Quantity of biomass treated under the project activity (tonnes)
E_{biomass}	Energy content of biomass (TJ/tonne)
$\text{CH}_4_{\text{bio_comb}}$	CH ₄ emission factor for biomass and waste (which includes dung and agricultural, municipal and industrial wastes) combustion (kg of CH ₄ /TJ, default value is 300)
CH_4_GWP	GWP for CH ₄ (tonnes of CO ₂ equivalent/tonne of CH ₄)
$\text{N}_2\text{O}_{\text{bio_comb}}$	N ₂ O emission factor for biomass and waste (which includes dung and agricultural, municipal and industrial wastes) combustion (kg/TJ, default value is 4)
$\text{N}_2\text{O_GWP}$	GWP for N ₂ O (tonnes of CO ₂ equivalent/tonne of NO ₂)

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 consists of PE_y: the methane emissions and nitrous oxide emissions due to the combustion of rice husks, and is calculated as described in E. 1.2.1.

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:

$$BE_y = EG_y * EF_y$$

where,

BE_y = Baseline Emissions of electricity generation (tonnes CO₂equ)

EG_y = Electricity production by project activity (MWh).

EF_y = Emission Coefficient (measured in tonnes CO₂equ/MWh)

Category III.E.

Baseline emissions

$$CH_4_IPCC_{decay} = (MCF * DOC * DOC_F * F * 16/12)$$

where,

CH₄_IPCC_{decay} IPCC CH₄ emission factor for decaying biomass in the region of the project activity (tonnes of CH₄/tonne of biomass or organic waste)

MCF methane correction factor (fraction) (default is 0.4)

DOC degradable organic carbon (fraction, see equation below or default is 0.3)

DOC_F fraction DOC dissimilated to landfill gas (default is 0.77)

F fraction of CH₄ in landfill gas (default is 0.5)

$$BE_y = Q_{biomass} * CH_4_IPCC_{decay} * GWP_CH_4$$

where,

BE_y Baseline methane emissions from biomass decay (tonnes of CO₂ equivalent)

Q_{biomass} Quantity of biomass treated under the project activity (tonnes)

CH₄_GWP GWP for CH₄ (tonnes of CO₂ equivalent/tonne of CH₄)

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 CO₂equ)



BE_{el} = Baseline Emissions of electricity generation (tonnes CO_{2equi})

Category III.E.

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

$$ER_{III.E} = BE_y - (PE_y / 10^3)$$

where,

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

PE_y Project activity emissions (kilotonnes of CO₂ equivalent)

BE_y Baseline methane emissions from biomass decay (tonnes of CO₂ equivalent)

Total

The total combined emission reduction of the bundle of project activities of type I.D. and III.E are:

$$ER_{total} = ER_{ID} + ER_{III.E}$$

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_{2equi})

ER_{III.E} 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	0.847	tonnes CO ₂ /MWh
Build margin emission factor	EF_BMy	0.079	tonnes CO ₂ /MWh
Baseline emission factor	EFy	0.463	tonnes CO ₂ /MWh
Annual net electricity generated by the Project	EGy	19,531	MWh
<u>Baseline emissions</u>	BE _{el}	<u>9,043</u>	<u>tonnes CO₂/year</u>
<u>Project emissions</u>	<u>n.a.</u>	<u>0</u>	<u>tonnes CO₂/year</u>
<u>Emission reduction from electricity generation</u>	ER _{ID}	<u>9,043</u>	<u>tonnes CO₂/year</u>

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

Indicator	Abbreviation	Value	Unit
methane correction factor	MCF	0.4	dimensionless fraction
degradable organic carbon	DOC	0.3	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
IPCC CH ₄ emission factor for decaying biomass in the region of the project activity	CH ₄ _IPCCdecay	0.0616	tonnes of CH ₄ /tonne of biomass or organic waste
Quantity of biomass treated under the project activity	Q _{biomass}	40,493	tonnes/year
GWP for CH ₄	CH ₄ _GWP	21	tonnes of CO ₂ equivalent/tonne of CH ₄
<u>Baseline methane emissions from biomass decay</u>	BE _v	<u>52,382</u>	<u>tonnes of CO₂ equivalent/year</u>
Energy content of dry biomass (HHV dry)	E _{dry}	15.49 ^{a)}	GJ/tonne
Moisture content of the biomass	MC	12%	weight % wet basis
Energy content of biomass	E _{biomass}	0.013376	TJ/tonne
CH ₄ emission factor for biomass and waste	CH ₄ bio_comb	300	kg of CH ₄ /TJ
N ₂ O emission factor for biomass and waste	N ₂ O _{bio} _comb	4	kg/TJ
GWP for N ₂ O	N ₂ O_GWP	310	tonnes of CO ₂ equivalent/tonne of NO ₂
<u>Project activity emissions</u>	PE _v	<u>4,084</u>	<u>tonnes of CO₂ equivalent/year</u>
Emission reduction by avoidance of methane production from biomass decay	ER _{IIIIE}	48,298	<u>tonnes of CO₂ equivalent/year</u>



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 calendar year)

Year ^{a)}	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)
2001 - 2002	7,217	0	7,217	32,227	2,513	29,714	36,932
2002 - 2003	8,614	0	8,614	39,929	3,113	36,816	45,430
2003 - 2004	8,183	0	8,183	48,102	3,750	44,352	52,534
2004 - 2005	8,041	0	8,041	53,315	4,157	49,158	57,199
2005 - 2006	9,634	0	9,634	60,253	4,698	55,556	65,189
2006 - 2007	10,806	0	10,806	66,424	5,179	61,245	72,052
2007 - 2008	10,806	0	10,806	66,424	5,179	61,245	72,052
Total estimated reductions	63,301	0	63,301	366,674	28,588	338,087	401,388
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)	9,043	0	9,043	52,382	4,084	48,298	57,341

a) Years from 01 July until 31 June of the subsequent year.

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

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Documentation

The renewable energy plant has received permit for construction from ANEEL, the Brazilian electricity energy National Agency (License ANEEL n°361, published in the Brazilian Official Diary, August, 28th 2000). In 2005, CAMIL reached the Independent producer licence 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 314/2002, and it was emitted in 15th January 2002, valid until 18th November 2006.

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:**

>>

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 Itaqui;
- Chamber of Itaqui;
- 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:

>>

To date, no comments have been received

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

>>

To date, no comments have been received

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY****Project participants**

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project has not received any public funds.

**Annex 3****BASELINE INFORMATION**

The grid factor calculation was conducted with the following databases:

- Electricity Generated at 2003 (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 was used the Executive Board recommended values just for the Build Margin calculation and for the Operating Margin the values adopted was the average 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.

Biomass and electricity aspects in the CAMIL Itaquí Biomass Electricity Generation Project

¹ Eletrobrás – http://www.eletrabras.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.



Year	Electricity generated/year (MWh)	Amount of rice husks produced (kg/year)	Amount of rice husks consumed (kg/year)	Amount of rice husks to the landfill (kg/year)	% Consumed
2000	-	40.081.320	7.631.814	32.449.506	19%
2001	6.429	60.430.934	10.919.658	49.511.276	18%
2002	18.319	64.688.681	27.985.947	36.702.734	43%
2003	18.889	45.524.564	33.747.186	11.777.378	74%
2004	16.457	50.912.682	40.621.619	10.291.063	80%
2005	18.275	47.285.509	41.807.399	5.478.110	88%
2006	23.340	55.216.524	51.348.327	3.868.197	93%
2007	23.340	55.216.524	51.348.327	3.868.197	93%
2008	23.340	55.216.524	51.348.327	3.868.197	93%
2009	23.340	55.216.524	51.348.327	3.868.197	93%
2010	23.340	55.216.524	51.348.327	3.868.197	93%
2011	23.340	55.216.524	51.348.327	3.868.197	93%
2012	23.340	55.216.524	51.348.327	3.868.197	93%