



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

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**Revision history of this document**

<b>Version Number</b>	<b>Date</b>	<b>Description and reason of revision</b>
01	21 January 2003	Initial adoption
02	8 July 2005	<ul style="list-style-type: none"><li>• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document.</li><li>• As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <a href="http://cdm.unfccc.int/Reference/Documents">http://cdm.unfccc.int/Reference/Documents</a>.</li></ul>

**SECTION A. General description of the small-scale project activity****A.1. Title of the small-scale project activity:**

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**JOSAPAR Itaqui Biomass Co-generation project****A.2. Description of the small-scale project activity:**

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**Purpose**

The Josapar Itaqui Biomass Co-generation Project developed by JOSAPAR is a project for installation in the Itaqui city, Rio Grande do Sul state, Brazil. Josapar is a rice mill company, of which the core business is the production of paddy and parboiled rice to internal and exporting markets. Josapar is placed 2<sup>nd</sup> company in the ranking of rice companies 2005 (Brazilian Rice Year Book 2005, pg. 59)<sup>1</sup>.

The project eliminates Josapar's electricity demand from the grid, will sell the small surplus generated electricity to the grid and provide process steam to the rice mill.

**Project description**

The main activity in the region where the project will be located is rice production and industrialization. Rice mills 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, and restricts the land filling of it, allowing the displacement only in previously licensed areas. As a result, the rice mills have huge amounts of biomass that are left for decay.

The Josapar project will be the solution for the high costs associated to electricity consumption in rice production. A better quality and control of the steam supplied to the process is targeted with the project implementation.

The Josapar's project consists of a turn-key biomass electricity co-generation unit, with 6 MWe and 15.5 MW<sub>thermal</sub> of installed capacity using only rice husks as fuel, complying with all the Josapar's demand and exporting the surplus power to the grid. With this new thermal power plant, Josapar will deactivate the old boiler used only to produce process steam. This old boiler already uses biomass as fuel but it does not generate electricity.

The only biomass that Josapar 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, once 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.

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



At the present time a considerable amount of rice husks, around 30,000 t/years, is generated in the Josapar rice mills. The amount of biomass produced is disposed in legal landfills outside the location where the project activity will be placed.

### **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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<b>Name of Party involved (*) ((host) indicates a host Party)</b>	<b>Private and/or public entity(ies) project participants (*) (as applicable)</b>	<b>Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)</b>
Brazil (host)	JOSAPAR – Joaquim Oliveira Participações 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:**

&gt;&gt;

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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JOSAPAR-Itaqui rice mill is located in Itaqui City, in the western region of Rio Grande do Sul State. Address: Rua Sesmaria Rocha, s/nº, 720 Km from Porto Alegre, the capital city of the state.

**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 07: 28 November 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-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***

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 6,0 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<sub>thermal</sub>. E.g., for a biomass based co-generating system the rating for all the boilers combined shall not exceed 45 MW<sub>thermal</sub>.

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 (15.5 MW<sub>th</sub>) and power (6.0 MWe). The sum of these outputs is below the limit of 45 MW<sub>thermal</sub>.

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 3,026 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 JOSAPAR project will operate using state of art conventional Rankine steam cycle technology. The combustion of the fuel will be performed with proven technologies like a high pressured boiler (65 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 system is managed by control panels and devices that keep a steady condition of voltage, frequency and load. Under current operational conditions, the boiler produces up to 35,000 kg/h of steam at 65 bar and 520°C while it consumes 10.5 t/h of rice husks. The steam feeds a multistage steam condensing turbine at 0.09 bar. Before the turbine inlet, up to 50% of total steam generated is deviated to process heat. The steam turbine drives a 3 phase synchronous generator producing up to 6,000 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 already will obtain all necessary licences to be installed and complies with the Brazilian 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 that use coal fired thermal power plants complementing the electricity demand in the integrated electrical grid. By the replacement of power from the grid and by supply of electricity to the grid, carbon emissions 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<sup>2</sup>, Eletrobrás<sup>3</sup> and ANEEL<sup>4</sup> corresponding to the south-southeast-midwest Brazilian interconnected Electrical System. The carbon emission factor obtained was 0,463 tonnes of CO<sub>2</sub>/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**

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)<sup>5</sup>. Table 1 shows the amount of rice husks produced in Brazil and Rio Grande do Sul state in 2004. Every tonne of rice production leads to the supply of 0.22 tonne of rice husks. (CIENTEC, 1986)<sup>6</sup>.

**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)

<sup>2</sup> Operador Nacional do Sistema Elétrico - Dados Relevantes do Ano de 2003 ([www.ons.org.br](http://www.ons.org.br))

<sup>3</sup> Eletrobrás – Sistemas Interligados, Acompanhamento de Combustíveis; ([www.eletrobras.gov.br](http://www.eletrobras.gov.br))

<sup>4</sup> Agência Nacional de Energia Elétrica - Banco de Informações de Geração ([www.aneel.gov.br](http://www.aneel.gov.br))

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

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



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

**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 CO<sub>2</sub> equivalent per year)**

Year	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)	
1 Sep - 31 Dec 2008	5,041	0	5,041	12,936	1,009	11,927	16,968
2009	15,123	0	15,123	38,808	3,026	35,782	50,905
2010	15,123	0	15,123	38,808	3,026	35,782	50,905
2011	15,123	0	15,123	38,808	3,026	35,782	50,905
2012	15,123	0	15,123	38,808	3,026	35,782	50,905
2013	15,123	0	15,123	38,808	3,026	35,782	50,905
2014	15,123	0	15,123	38,808	3,026	35,782	50,905
1 Jan - 31 Aug 2015	10,082	0	10,082	25,872	2,017	23,855	33,937
<b>Total estimated reductions</b>	<b>105,861</b>	<b>0</b>	<b>105,861</b>	<b>271,656</b>	<b>21,180</b>	<b>250,476</b>	<b>356,337</b>
<b>Total number of crediting years</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>
<b>Annual average over the first crediting period of estimated reductions (tonnes of CO<sub>2</sub> e)</b>	<b>15,123</b>	<b>0</b>	<b>15,123</b>	<b>38,808</b>	<b>3,026</b>	<b>35,782</b>	<b>50,905</b>

**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 07: 28 November 2005).**B.2 Project category applicable to the small-scale project activity:**

&gt;&gt;

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<sub>thermal</sub>. E.g., for a biomass based co-generating system the rating for all the boilers combined shall not exceed 45 MW<sub>thermal</sub>.

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 (15.5 MW<sub>th</sub>) and power (6.0 MWe). The sum of these outputs is below the limit of 45 MW<sub>thermal</sub>.

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 3,026 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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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 - Continuation of current activities

This scenario represents continuation of the current practices. 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 - Construction of a renewable energy plant

In this scenario, the JOSAPAR 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 **financial** barrier:

- The continuation of current practices (Scenario 1) does not pose any financial/economical barrier to the project developer, and requires no further financing.
- The construction of a renewable energy plant (Scenario 2) faces specific financial/economic barriers due to the fact that the capital costs related to biomass 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.

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 financial agents.

**Table 4: Financial Analysis Results**

	With Carbon	Without Carbon
Net Present Value (\$)	9,449.44	-2,341,392.93
IRR	9.81%	-2,23%
Discount Rate	13.75%	
Present Value of carbon sold (21 years) \$	3,242,648.50	

With respect to the **technological** barrier:

- In the case of Scenario 1 (continuation), there are no technical/technological issues as this simply represents a continuation of current practices and does not involve any new technology or



innovation. Indeed, in this scenario there are 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 proven, and have been used effectively in the Host Country.

With respect to the analysis of **prevailing business 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, and as mentioned in section A.4.4, Brazil has a huge rice industry, with more than 350 rice mills. A considerable fraction, about 60%, of rice production is located in the south region (IRGA 2004)<sup>5</sup>. 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<sup>6</sup> more than 59,60 % of residues are not used or sold. **Currently** only 6 small-scale power plants operate at the south region of Brazil. From 2002, no new 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 utilized to sell benefited rice for a lower price or to increment the profit margin of the product. Therefore, the steam generated by the boiler will be used to achieve a higher quality in the rice process. Currently JOSAPAR 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 the financial/economic 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<sub>2</sub> emissions, as shown in the following analysis:

- The Baseline Scenario presents the massive discharge of all rice husks produced in the landfills. This amount represents around 30,000 tonnes of rice husks per year. All electricity is delivered by the grid, which is partly based on fossil fuels, mainly in the south region that has a considerable concentration of coal thermo power plants, and consequently has associated CO<sub>2</sub> emission.
- The Project Scenario is represented by the construction of a new renewable energy plant of 6,0 MW. This implementation will provide steam for the drying rice process, process heat and electricity. The amount of rice husks consumed will be 30,000 tonnes per year. The methane emissions due to biomass decay will be eliminated. The electricity imported from the grid, which is partly generated by fossil fuel, will be displaced, contributing to GHG emission reductions.

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:**

&gt;&gt;

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 07: 28 November 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 07: 28 November 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

20/01/2006

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:**

>>

01/07/2007

**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:**

>>

01/09/2008

**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:**

&gt;&gt;

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

&gt;&gt;

Monitoring methodology of category I.D. as described in 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities' (Version 07: 28 November 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 07: 28 November 2005)

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

&gt;&gt;

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 ( $Q_{\text{biomass}}$ ) by the project activity in a year shall be monitored.
- Emissions of CH<sub>4</sub> and N<sub>2</sub>O 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 CO<sub>2</sub> 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:

$$PE_y = Q_{\text{biomass}} * E_{\text{biomass}} (\text{CH}_4_{\text{bio\_comb}} * \text{CH}_4\_GWP + \text{N}_2\text{O}_{\text{bio\_comb}} * \text{N}_2\text{O\_GWP})/10^6$$



where,

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

As indicated before, Q<sub>biomass</sub> can be measured accurately; because rice husks are a homogeneous biomass feedstock E<sub>biomass</sub> 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 kt of CO<sub>2</sub> 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 07: 28 November 2005).

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

&gt;&gt;

<b>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':</b>								
<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	ONS , Eletrobrás and ANEEL	tonnes CO <sub>2</sub> / 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	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	Rice production and documentation on transportation transactions	tonne/month	m	Monthly	100%	Electronic and paper	Value calculated as generated rice husks (D 3.5) minus removed rice husks (D. 3.6) from the year before the project implementation.
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 $Q_{\text{biomass}}$ in the formulae in section E
D 3.10	MC: Moisture content of the biomass	Literature	wt % (wet basis)	m	Yearly	Sample	Paper	The moisture content of rice husks does practically not vary. Therefore a literature value is used.
D 3.11	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 3.12	E <sub>biomass</sub> : Energy content of the biomass (as received)	D. 3.10 and D 3.11	GJ/tonne	C	Yearly	n.a.	Paper	The energy content is determined by the following equation: $E_{\text{biomass}} = E_{\text{dry}} * (1 - MC)$
D.3.13	CH <sub>4</sub> bio_comb	Most recent IPCC 1996 default value		E	Once	n.a.	Paper	
D. 3.14	CH <sub>4</sub> _GWP	Most recent IPCC 1996 default value		E	Once	n.a.	Paper	
D. 3.15	N <sub>2</sub> O <sub>bio</sub> _comb	Most recent IPCC 1996 default value		E	Once	n.a.	Paper	
D 3.16	N <sub>2</sub> O_GWP	Most recent IPCC 1996 default value		E	Once	n.a.	Paper	



D. 3.17	PEy	D. 3.9 D. 3.12 D. 3.13 D. 3.14 D. 3.15 D. 3.16	ktonnes of CO <sub>2</sub> equi- valent	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.
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**D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:**

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**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.3.1.
D.3.4	Low	Values based on info provided by ONS , Eletrobrás and ANEEL. All calculations are internally double-checked.



<b>Table 9: D. 4.2 Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored, related to category III.E.</b>		
<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	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: $Q_{\text{biomass}} = (H_{\text{steam}} / \eta_{\text{BOILER}}) / LHV_{\text{RICE HUSK}}$
D. 3.8	Low	See D.3.5 and D.3.6
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 condition of the stored rice, including rice 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. Therefore it is sufficient to use relevant literature values. 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. 3.11	Low	The HHV of rice husks hardly varies. No additional QC and QA procedures are necessary.
D. 3.12	Low	It is a calculated value based on D.3.10 and D.3.11, so no additional QC and QA procedures will be applied.
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	Most recent IPPC default values will be used as appropriate for small scale projects
D. 3.16	Low	Most recent IPPC default values will be used as appropriate for small scale projects
D. 3.17	Low	It is a calculated value based on D.3.9, D.3.12, D.3.13, D.3.14, D.15 and D.3.16 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:**

>>

JOSAPAR – Joaquim Oliveira S.A. Participações (JOSAPAR), PTZ Bioenergy Ltda (fully and exclusively authorized to act on the behalf of JOSAPAR regarding this CDM project) and BioHeat International (exclusively authorized to sell the carbon credits from the JOSAPAR Pelotas project) are all project participants.

JOSAPAR 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 JOSAPAR.

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:**

&gt;&gt;

**E.1.1 Selected formulae as provided in appendix B:**

&gt;&gt;

**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<sub>2</sub>equ/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 CO<sub>2</sub>equ/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 CO<sub>2</sub>equ/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 CO<sub>2</sub>equ/kWh) of the current generation mix.

**Category III.E.***Baseline emissions*

$$CH_4\_IPCC_{decay} = (MCF * DOC * DOC_F * F * 16/12)$$

where,

CH<sub>4</sub>\_IPCC<sub>decay</sub> IPCC CH<sub>4</sub> emission factor for decaying biomass in the region of the project activity (tonnes of CH<sub>4</sub>/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<sub>F</sub> fraction DOC dissimilated to landfill gas (default is 0.77)

F fraction of CH<sub>4</sub> in landfill gas (default is 0.5)

$$BE_y = Q_{biomass} * CH_4\_IPCC_{decay} * GWP_{CH_4}$$

where,

BE<sub>y</sub> = Baseline methane emissions from biomass decay (tonnes of CO<sub>2</sub> equivalent)

Q<sub>biomass</sub> = Quantity of biomass treated under the project activity (tonnes)

CH<sub>4</sub>\_GWP = GWP for CH<sub>4</sub> (tonnes of CO<sub>2</sub> equivalent/tonne of CH<sub>4</sub>)

*Project emissions*

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

$$PE_y = Q_{\text{biomass}} * E_{\text{biomass}} (CH_{4\text{bio\_comb}} * CH_4\_GWP + N_2O_{\text{bio\_comb}} * N_2O\_GWP) / 10^6$$

where,

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

<b>E.1.2 Description of formulae when not provided in <u>appendix B</u>:</b>
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>>

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

**The baseline emissions (BE<sub>y</sub>)** resulting from the electricity supplied and/or not consumed from the grid is calculated as follows, where EG<sub>y</sub> is the annual net electricity generated from the Project.

$$BE_y = EG_y * EF_y$$

**The baseline emissions factor (EF<sub>y</sub>)** is a weighted average of the EF<sub>OMy</sub> and EF<sub>BM<sub>y</sub></sub>:

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

where the weights  $\omega_{OM}$  and  $\omega_{BM}$  are by default 0.5.

**The Operating Margin emission factor (EF<sub>OMy</sub>)** 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<sub>2</sub>/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:

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

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.

$$PE_y = Q_{biomass} * E_{biomass} (CH_{4bio\_comb} * CH_4\_GWP + N_2Obio\_comb * N_2O\_GWP) / 10^3$$

where,

$PE_y$	Project activity emissions (ktonnes of CO <sub>2</sub> equivalent)
$Q_{biomass}$	Quantity of biomass treated under the project activity (tonnes)
$E_{biomass}$	Energy content of biomass (TJ/tonne)
$CH_{4bio\_comb}$	CH <sub>4</sub> emission factor for biomass and waste (which includes dung and agricultural, municipal and industrial wastes) combustion (kg of CH <sub>4</sub> /TJ, default value is 300)
$CH_4\_GWP$	GWP for CH <sub>4</sub> (tonnes of CO <sub>2</sub> equivalent/tonne of CH <sub>4</sub> )
$N_2Obio\_comb$	N <sub>2</sub> O emission factor for biomass and waste (which includes dung and agricultural, municipal and industrial wastes) combustion (kg/TJ, default value is 4)
$N_2O\_GWP$	GWP for N <sub>2</sub> O (tonnes of CO <sub>2</sub> equivalent/tonne of NO <sub>2</sub> )



**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 emissions are zero.

**Category III.E.**

The total small scale project activity emissions consists of PE<sub>y</sub>: 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:

$$BE_{el} = EG_y * EF_y$$

where,

BE<sub>el</sub> = Baseline Emissions of electricity generation (tonnes CO<sub>2</sub>equ)

EG<sub>y</sub> = Electricity production by project activity (MWh).

EF<sub>y</sub> = Emission Coefficient (measured in tonnes CO<sub>2</sub>equ/MWh)

**Category III.E.**

*Baseline emissions*

$$CH_4\_IPCC_{decay} = (MCF * DOC * DOC_F * F * 16/12)$$

where,

CH<sub>4</sub>\_IPCC<sub>decay</sub> IPCC CH<sub>4</sub> emission factor for decaying biomass in the region of the project activity (tonnes of CH<sub>4</sub>/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<sub>F</sub> fraction DOC dissimilated to landfill gas (default is 0.77)

F fraction of CH<sub>4</sub> in landfill gas (default is 0.5)



$$BE_y = Q_{\text{biomass}} * CH_4\_IPCC_{\text{decay}} * GWP\_CH_4$$

where,

$BE_y$  Baseline methane emissions from biomass decay (tonnes of CO<sub>2</sub> equivalent)

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

$CH_4\_GWP$  GWP for CH<sub>4</sub> (tonnes of CO<sub>2</sub> equivalent/tonne of CH<sub>4</sub>)

**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<sub>2</sub>equ)

$BE_{el}$  = Baseline Emissions of electricity generation (tonnes CO<sub>2</sub>equ)

#### **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 CO<sub>2</sub> equivalent)

$PE_y$  Project activity emissions (kilotonnes of CO<sub>2</sub> equivalent)

$BE_y$  Baseline methane emissions from biomass decay (tonnes of CO<sub>2</sub> equivalent)

#### **Total**

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

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

$ER_{\text{total}}$  Total net emission reduction by the bundle of project activities (tonnes CO<sub>2</sub> equivalent)

$ER_{ID}$  Emission reduction due to grid connected renewable electricity production (tonnes CO<sub>2</sub>equ)

$ER_{III.E}$  Emission reduction by the avoidance of methane production from biomass decay through controlled combustion (tonnes of CO<sub>2</sub> 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:**

&gt;&gt;

**Table 10: Emission reduction by grid connected electricity generation**

Indicator	Abbreviation	Value	Unit
Operating margin emission factor	EF_OM <sub>y</sub>	0.847	tonnes CO <sub>2</sub> /MWh
Build margin emission factor	EF_BM <sub>y</sub>	0.079	tonnes CO <sub>2</sub> /MWh
Baseline emission factor	EF <sub>y</sub>	0.463	tonnes CO <sub>2</sub> /MWh
Annual net electricity generated by the Project	EG <sub>y</sub>	32,663	MWh
<u>Baseline emissions</u>	BE <sub>el</sub>	<u>15,123</u>	<u>tonnes CO<sub>2</sub>/year</u>
<u>Project emissions</u>	<u>n.a.</u>	<u>0</u>	<u>tonnes CO<sub>2</sub>/year</u>
<u>Emission reduction from electricity generation</u>	ER <sub>ID</sub>	<u>15,123</u>	<u>tonnes CO<sub>2</sub>/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 <sub>F</sub>	0.77	dimensionless fraction
fraction of CH <sub>4</sub> in landfill gas	F	0.5	dimensionless fraction
IPCC CH <sub>4</sub> emission factor for decaying biomass in the region of the project activity	CH <sub>4</sub> _IPCCdecay	0.0616	tonnes of CH <sub>4</sub> /tonne of biomass or organic waste
Quantity of biomass treated under the project activity	Q <sub>biomass</sub>	30,000	tonnes/year
GWP for CH <sub>4</sub>	CH <sub>4</sub> _GWP	21	tonnes of CO <sub>2</sub> equivalent/tonne of CH <sub>4</sub>
<u>Baseline methane emissions from biomass decay</u>	<u>BE<sub>y</sub></u>	<u>38,808</u>	<u>tonnes of CO<sub>2</sub> equivalent/year</u>
Energy content of dry biomass (HHV dry)	E <sub>dry</sub>	15.49 <sup>a)</sup>	GJ/tonne
Moisture content of the biomass	MC	12	weight % wet basis
Energy content of biomass	E <sub>biomass</sub>	0.0133	TJ/tonne
CH <sub>4</sub> emission factor for biomass and waste	CH <sub>4</sub> bio_comb	300	kg of CH <sub>4</sub> /TJ
N <sub>2</sub> O emission factor for biomass and waste	N <sub>2</sub> O <sub>bio_comb</sub>	4	kg/TJ
GWP for N <sub>2</sub> O	N <sub>2</sub> O_GWP	310	tonnes of CO <sub>2</sub> equivalent/tonne of NO <sub>2</sub>
<u>Project activity emissions</u>	<u>PE<sub>y</sub></u>	<u>3,026</u>	<u>tonnes of CO<sub>2</sub> equivalent/year</u>
<u>Emission reduction by avoidance of methane production from biomass decay</u>	<u>ER<sub>III</sub>E</u>	<u>35,782</u>	<u>tonnes of CO<sub>2</sub> equivalent/year</u>

<sup>a)</sup> 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 CO<sub>2</sub> equivalent per calendar 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 Sep - 31 Dec 2008	5,041	0	5,041	12,936	1,009	11,927	16,968
2009	15,123	0	15,123	38,808	3,026	35,782	50,905
2010	15,123	0	15,123	38,808	3,026	35,782	50,905
2011	15,123	0	15,123	38,808	3,026	35,782	50,905
2012	15,123	0	15,123	38,808	3,026	35,782	50,905
2013	15,123	0	15,123	38,808	3,026	35,782	50,905
2014	15,123	0	15,123	38,808	3,026	35,782	50,905
1 Jan - 31 Aug 2015	10,082	0	10,082	25,872	2,017	23,855	33,937
Total estimated reductions	105,861	0	105,861	271,656	21,180	250,476	356,337
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 <sub>2</sub> e)	15,123	0	15,123	38,808	3,026	35,782	50,905

**SECTION F. Environmental impacts****F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:****Documentation**

The renewable energy plant will receive permit for construction from ANEEL, the Brazilian electricity energy National Agency.

The environmental permit for operation from the Environmental Agency of Rio Grande do Sul State (FEPAM – Fundação Estadual de Proteção Ambiental) also will be acquired for the project implementation.

**Renewable electricity generation**

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 2<sup>nd</sup>, 2003, from the Brazilian Inter-Ministerial Commission of Climate Change (Comissão Interministerial de Mudança Global do Clima - CIMGC), decreed on July 7<sup>th</sup>, 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 Itaquí;
- Chamber of Itaquí;
- 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 will not receive any public funds.

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**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](http://www.ons.org.br))

- Efficiency for thermal power plants:

<b>Thermal Power Plant</b>	<b>Efficiency calculation sources</b>
<b>Jorge Lacerda A</b>	Eletrobrás <sup>1</sup> and CIMGC <sup>2</sup>
<b>Jorge Lacerda B</b>	Eletrobrás and CIMGC
<b>Jorge Lacerda C</b>	Eletrobrás and CIMC
<b>Charqueadas</b>	Eletrobrás and CIMGC
<b>P. Medice A</b>	Eletrobrás and CIMGC
<b>P. Medice B</b>	Eletrobrás and CIMGC
<b>P. Medice (A+B)</b>	Eletrobrás and CIMGC
<b>São Jeronimo</b>	Eletrobrás and CIMGC
<b>Figueira</b>	Eletrobrás and CIMGC
<b>Santa Cruz</b>	Eletrobrás and CIMGC
<b>Igarapé</b>	Eletrobrás and CIMGC
<b>Piratininga</b>	Eletrobrás and CIMGC
<b>Nova Piratininga</b>	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)<sup>3</sup>.

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 JOSAPAR Biomass Co-generation Project**

<sup>1</sup> Eletrobrás – [http://www.eletrobras.gov.br/EM\\_atuacao\\_ccc/default.asp](http://www.eletrobras.gov.br/EM_atuacao_ccc/default.asp)

<sup>2</sup> 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](http://www.mct.gov.br/clima/comunic_old/energi41.htm#index)

<sup>3</sup> 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
2007	-	30.000.000	0	30,000,000	0%
2008	10,888	30.000.000	10,000,000	20,000,000	33%
2009	32,663	30.000.000	30,000,000	0	100%
2010	32,663	30.000.000	30,000,000	0	100%
2011	32,663	30.000.000	30,000,000	0	100%
2012	32,663	30.000.000	30,000,000	0	100%
2013	32,663	30.000.000	30,000,000	0	100%
2014	32,663	30.000.000	30,000,000	0	100%
2015	32,663	30.000.000	30,000,000	0	100%
2016	32,663	30.000.000	30,000,000	0	100%
2017	32,663	30.000.000	30,000,000	0	100%
2018	32,663	30.000.000	30,000,000	0	100%
2019	32,663	30.000.000	30,000,000	0	100%